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CARIBOU

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STATE OF ALASKA
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DEPARTMENT OF FISH AND GAME
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LOCATION

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

HERDS: Kenai Mountains, Kenai Lowlands, Killey River, Twin Lakes 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 and in the extreme western portion of 15B; the herd winters on the lower Moose River to the outlet of Skilak Lake and the area around Brown's Lake in Subunit 15B. The Killey River caribou herd (KRCH) inhabits 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 spring 1998 estimated population sizes of the KMCH, KLCH, KRCH, FRCH and TLCH were 475, 135, 380, 100, and 70 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. 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%. A survey conducted in March 1997 revealed 452 animals, which declined in February 1998 to 419 caribou. During the past 5 years, the mean annual hunter success rate was 22%. 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 4 Kenai Peninsula herds and is currently at its largest population size. 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, 1991 and 1992. 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 instances of wolves killing caribou. As the caribou population builds and the moose population declines, wolf predation on caribou should increase. The Killey River herd has been hunted since 1994 and the Fox River herd since 1995.

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 3 population peaks in its 33-year history and is currently declining. 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. In 1996 the herd increased to 452 animals then declined the following year to 419, postseason (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. In spring of 1994 the herd increased, remained stable for 1 year, and increased again in 1995 and remained stable for another year (Table 2). In spring 1998, 124 caribou was the highest number recorded. 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 then increased to 400

in 1997. The survey conducted by the Fish and Wildlife Service only revealed 380; however, animals were widely scattered and it is believed the count did not accurately assess the herd's size. The Fox River herd's mean annual rate of increase was 29% (range = 14-49%) between fall 1991 and 1994 and only increased 9% by spring 1996. The herd declined by 9% in 1997 then increased by 9% in the since 1998 count. 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. In spring 1997 the herd increased again, followed by a 9% decline in January 1998. 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 1996 and 1997 due to limited budgets. 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). Observations during the 1996 and 1997 surveys indicate the calf to cow ratio was still low.

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 1993 to 1997 indicated the mean June calf percentage was 24%, (range = 17 to 28%) (Table 2). Surveyors counted a low of 16 calves in 1993, compared to a high of 30 young in 1997, as the population increased from 86 to 124 caribou during the same period. Staff conducted surveys in fall, and bull to cow ratios were not available. Incidental observations indicated the bull to cow ratio was probably stable and higher than 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. In 1996 calves comprised 23% of the 376 caribou counted, and the bull to cow ratio remained stable. The January 1998 survey revealed a decline of 36 caribou when compared to the June 1997 count. Although this count may reflect predation and mortality due to hunting, it is believed the 1997 count of 376 and the 1998 counts were low. A count conducted in the fall of 1999 revealed 516 caribou in this herd.

Fox River Caribou Herd. Biologists completed composition surveys on the FRCH in fall of 1993. They counted 57 caribou in 1993 with the following ratios: 23 calves:100 cows and 61 bulls:100 cows; calves composed 22% of the caribou observed (Table 4). Composition surveys were not conducted in 1994 and 1995. In 1996, we counted 81 caribou comprised of 19% calves. Calf percentage of the total observed decreased from 22% in 1993 to 19% by 1996. Only aerial

surveys to assess the herd's population size were completed in 1997. These data indicate the herd increased from 57 caribou in 1993 to 96 in 1997.

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. Seventy-three caribou were counted in 1996, comprising 19% calves. An aerial survey completed in 1997 indicated that the herd declined by 9% to 66 animals.

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 between 1993 and 1996. In 1997 the season was 10 August to 30 September and 10 November to 10 December. 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 the portion of the Kenai National Wildlife Refuge of Subunit 15A was 1 to 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; 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: number of permits available for KMCH was increased from 200 to 250 and a second season, 10 November to 10 December, was approved. The season opened for KRCH in spring of 1994 and 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 1060 applications for 250 permits in 1996 and 876 applications for 250 permits in 1997.

The mean annual harvest for the past 5 years was 25 caribou (range = 18–29), and bulls averaged 55% of the harvest (Tables 6 and 10). Permittees harvested 10 bulls and 13 cows in 1996 and 12 bulls, 14 cows and one caribou of unreported gender during 1997.

Kenai Lowlands Caribou Herd — The season was closed during this reporting period.

Killey River Caribou Herd — The department received 271 applications in 1996 for the 25 permits and 269 applications in 1997 for the 50 permits issued to hunt the KRCH. Permittees harvested 12 bulls in 1996 and 23 bulls in 1997 (Tables 8 and 12).

Fox River Caribou Herd — The department received 204 applications in 1996 and 123 in 1997 for the 10 permits issued to hunt the FRCH. Permittees harvested 2 bulls each in 1996 and 1997 (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-nine percent of permittees reported they did not hunt in 1996, while 52% did not go afield in 1997 (Table 10). Twenty-three (18%) of the 128 hunters in 1996 and 27 (23%) of the 120 hunters in 1997 were successful (Tables 10 and 14). Local residents harvested 2 caribou, and nonlocal residents harvested 20 caribou in 1996 (Table 14). Local residents took 3 caribou, and nonlocal residents harvested 24 animals in 1997. Unsuccessful hunters comprised 16 local residents and 86 nonlocal residents in 1996. One successful and 2 unsuccessful nonresidents hunted this herd in 1996. In 1997 4 nonresidents hunted unsuccessfully, compared to 7 local and 82 nonlocal residents.

Kenai Lowlands Caribou Herd — This herd was not hunted during this reporting period.

Killey River Caribou Herd — The department issued 25 permits in 1996 and 50 in 1997. Thirty-two percent of the permittees in 1996 and 46% in 1997 did not hunt (Table 12). Hunters harvested 12 caribou in 1996 and 23 in 1997. Hunter success rate was 71% in 1996 and 85% in 1997. Seven local, 3 nonlocal residents, and 2 nonresidents were successful in 1996, compared to 17 local, 5 nonlocal residents, and 1 nonresident in 1997 (Table 15).

Fox River Caribou Herd — The department issued 10 permits in 1996 and 1997. Three (30%) permittees hunted in 1996 and harvested 2 bulls. Hunter success rate was 67%. In 1997, 4 permittees hunted and harvested 2 bulls. Hunter success was 50%. All hunters in 1996 and 1997 were local residents (Table 16).

Harvest Chronology.

Kenai Mountains Caribou Herd — The harvest chronology was similar in 1994 and 1995, showing the most effort early in the season. In 1996 hunting pressure was highest during the second hunting periods, with the lowest reported effort between September 1and 15 (Table 17). In the past 5 years, hunters have harvested 50% or more of the harvest before September 1. Permittees took 9 (34%) of the 27 caribou harvested in 1997 during the first 6 days of the season, compared to 8 (35%) of 23 during the same reporting period in 1996. No harvest and little effort was reported during the late season.

Kenai Lowlands Caribou Herd — The Kenai Lowland Caribou herd was not hunted during this reporting period.

Killey River Caribou Herd —Hunting effort in 1996 was distributed over the first, third, and last hunting periods with no harvest during the second period. In 1995 effort was reported during all reporting periods with most effort during the second and third periods (Table 18).

Fox River Caribou Herd —In the second year the FRCH was hunted, 100% of the effort was in the third hunting period. In 1997 the effort was evenly split between the last 2 hunting periods (Table 19).

Transport Methods.

Kenai Mountains Caribou Herd — In 1996 and 1997 most successful hunters (70%) used highway vehicles for access and then hiked into the areas they hunted (Table 20). In 1996 16 (70%) successful hunters walked, while 2 (9%) used horses, 1 used a mountain bike, and 4 failed to report their means of transport into the field. The following year 19 (70%) successful hunters walked, 6 (22%) relied on horses, and 2 (7%) used aircraft. Unsuccessful hunters followed a similar pattern of reliance on foot travel.

Kenai Lowlands Caribou Herd — The Kenai Lowland Caribou herd was not hunted during this reporting period.

Killey River Caribou Herd — In 1996 and 1997 hunters used 2 primary methods to access their hunting areas: boat across Tustumena Lake and walk to the hunting area or boat across the lake and use horses to pack into the hunt area. Sixty-seven percent of the hunters in 1996 used horses, compared to 70% the next year. In 1996 25% of hunters used boats, compared to 22% in 1997. Only 8% in 1996 and 9% in 1997 of the successful hunters used aircraft (Table 21).

Fox River Caribou Herd — All four successful hunters in 1996 and 1997 used a boat to access the hunting area.

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. 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 classified 403. 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 1995. Composition surveys were not completed in 1996 or 1997. The observation of 452 caribou on 14 March 1997 indicates that the herd had reached its highest number and declined to 419 when counted on 27 February 1998. This has been the typical pattern of the Kenai Mountains Caribou herd over the past 2 decades. The KMCH appeared more productive when stabilized around 350 to 400 caribou.

Although the Kenai Lowlands herd has increased steadily this reporting period, hunting is still not justifiable. The opportunity for viewing by locals and tourists is also increasing. Moderate calf mortality during summer and moderate adult mortality in winter were factors in the population increase. The primary predators are wolves during winter and free-ranging domestic dogs and coyotes during summer.

Although some caribou in the KLCH have been observed south and east of Kalifornsky Beach Road in Unit 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 the KLCH. 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 1996 and 1998 female calves were captured in the Killey River and Kenai Mountains Caribou herds in March and April to compare weights as an indicator of range quality. In 1996 the Kenai Mountain mean calf weights were 127 pounds compared to a mean weight of 145 in the Killey River herd. In 1998 Kenai Mountains calves averaged 122 pounds compared to 141 recorded for the Killey River calves. We also recorded morphometric measurements.

A comparison of the mean weights for calves indicates Killey River calves were larger than calves from Kenai Mountains herd in both years. The estimated 475 caribou currently in the Kenai Mountains herd occupy a 1407 km^2 area, a density of 0.3 animals/km^2. The 380 Killey River caribou currently occupy about 371 km^2, a density of 1.0 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. We will assess calf weight again in April 2000.

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 findings applicable to future capture efforts. Calves captured in 1996 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. The winter of 1997/98 was normal for the Kenai. 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 moderately high and habitat has not limited their growth.

CONCLUSIONS AND RECOMMENDATIONS

Recent survey and harvest data indicate the department is exceeding the KMCH post-season population objective of 350 to 400 caribou. Limited habitat, inclement weather, predation, and human harvests are plausible explanations for the herd's decline from 452 in 1996 to 419 animals in 1997. 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 (post-season) until we identify factors influencing calf recruitment.

The KLCH has slowly increased over the past 5 years from 1993 to 1997. 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. Additionally, a limited number of permits should be issued to harvest only cows in the Killey River herd. A decreased rate of growth in this herd 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 1993 and 1996 and decreased its growth in 1997. Because this herd has the habitat potential to increase to about 200 animals, I recommend we monitor the herd to determine if the low 1997 count was a 1-year event or caused by 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.

LITERATURE CITED

PALMER, L. J. 1938. Management of moose herds on the Kenai Peninsula. Restoration Project Reptort March, April, and May 1938. Unpublished manuscript. Kenai National Wildlife Refuge files, Soldotna. AK. 40pp.

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Table 1 Kenai Mountains caribou fall composition counts and estimated population size, 1993–1998

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
1993/94[b]	--	--	--	--	--	--	--	--	--
1994/95[b]	--	--	--	--	--	--	--	--	--
1995/96[c]	41	29	17	59	--	--	--	403	450
1996/97[d]	--	--	--	--	--	--	--	452	500
1997/98e	--	--	--	--	--	--	--	419	475

[a] Estimated herd size postseason.
[b] Surveys were incomplete.
[c] Survey conducted on 14 March 1996.
[d] Survey date 14 March 1997
[e] Survey date 27 February 1998

Table 2 Kenai Lowlands caribou composition counts and estimated population size, 1993 to 1998

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
1993/94[b]	--	--	28	--	--	--	--	86	86-90
1994/95[c]	--	--	22	--	--	--	--	86	86-90
1995/96[d]	--	--	28	--	--	--	--	96	96-100
1996/97[e]	--	--	17	--	--	--	--	98	98-105
1997/98[f]	--	--	24	--	--	--	--	124	124-135

[a] Estimated herd size in June.
[b] Survey date 20 June 1994.
[c] Survey date 21 June 1995.
[d] Survey date 21 June 1996.
[e] Survey date 19 June 1997.
[f] Survey date 16 June 1998.

Table 3 Killey River caribou composition counts and estimated population size, 1993-1998

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
1993/94[b]	56	44	22	50	--	--	--	28	281	290
1994/95[d]	--	--	--	--	--	--	--	--	259[c]	300
1995/96[e]	--	--	--	--	--	--	--	--	261[c]	300
1996/97[f]	--	--	23	--	--	--	--	--	376[c]	400
1997/98[g]	--	--	--	--	--	--	--	--	340[c]	380

[a] Estimated herd sizein fall.
[b] Survey date 15 November 1993.
[c] Aerial survey using fixed-wing aircraft - total count only.
[d] Survey date 31 October 1994
[e] Survey date 28 November 1995.
[f] Survey date 11 June 1997
[g] Survey date 13 January 1998

Table 4 Fox River caribou fall composition counts and estimated population size, 1993-1998

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
1993/94[b]	61	23	22	54	--	--	--	33	57	57
1994/95[d]	--	--	--	--	--	--	--	--	83[c]	85
1995/96[e]	--	--	--	--	--	--	--	--	89[c]	90
1996/97[f]	--	--	19	--	--	--	--		81[c]	85
1997/98[g]	--	--	--	--	--	--	--	--	96[c]	100

a Estimated herd size in fall. Not hunted.
[b] Survey date 15 November 1993.
[c] Aerial survey using fixed-wing aircraft - total count only.
[d] Survey date 31 October 1994.
[e] Survey date 9 April 1996.
[f] Survey date 3 June 1997.
[g] Survey date 11 March 1998.

Table 5 Twin Lakes caribou fall composition counts and estimated population size, 1993–1998

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
1993/94[b]	30	26	17	64	--	--	--	19	36	36
1994/95[d]	--	--	--	--	--	--	--	--	45[c]	45
1995/96[e]	--	--	--	--	--	--	--	--	48[c]	48
1996/97[f]	--	--	19	--	--	--	--	--	73[c]	75
1997/98[g]	--	--	--	--	--	--	--	--	66[c]	70

[a] Estimated herd size in fall.

[b] Survey date 15 November 1993.

[c] Aerial survey using fixed-wing aircraft - total count only.

[d] Survey date 31 October 1994.

[e] Survey date 28 November 1995.

[f] Survey date 11 June 1997.

[g] Survey date 13 January 1998.

Table 6 Kenai Mountains caribou harvest and accidental death, 1993–98

Regulatory year	Hunter Harvest: Reported M	(%)	F	(%)	Unk.	Total	Estimated: Unreported	Illegal	Total	Accidental death	Grand total
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
1996/97	10	(44)	13	(56)	0	23	--	--	--	--	23
1997/98	12	(46)	14	(54)	1	27	--	--	--	--	27

Table 7 Kenai Lowlands caribou harvest and accidental death, 1993–98

Regulatory year	Hunter Harvest: Reported M (%)	F (%)	Unk.	Total[a]	Estimated: Unreported	Illegal	Total	Accidental death	Grand total
1993/94	0	0	0	0	--	--	0	7[b]	7
1994/95	0	0	0	0	--	--	0	2[c]	2
1995/96	0	0	0	0	--	--	0	1[c]	1
1996/97	0	0	0	0	--	--	0	1[c]	1
1997/98	0	0	0	0	--	--	0	1[c]	1

[b] Road-killed; 3 adults & 4 calves.

[c] Road-killed adult.

Table 8 Killey River caribou harvest and accidental death, 1993–98

Regulatory year	Hunter Harvest: Reported M (%)	F (%)	Unk.	Total	Estimated: Unreported	Illegal	Total	Accidental death	Grand total
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
1996/97	12 (100)	0	0	12	--	--	0	0	12
1997/98	23 (100)	0	0	23	--	--	0	0	23

[a] No hunting season.

Table 9 Fox River caribou harvest and accidental death, 1993-98

Regulatory year	Hunter Harvest: Reported M (%)	F (%)	Unk.	Total	Estimated: Unreported	Illegal	Total	Accidental death	Grand total
1993/94[a]	0	0	0	0	--	--	0	0	0
1994/95[a]	0	0	0	0	--	--	0	0	0
1995/96	5 (100)	0	0	5	--	--	0	0	5
1996/97	2 (100)	0	0	2	--	--	0	0	2
1997/98	2 (100)	0	0	2	--	--	0	0	2

[a] No hunting season

Table 10 Kenai Mountains caribou harvest data by permit hunt, 1993-98

Hunt No. /Area	Regulatory year	Permits issued	Percent did not hunt	Percent successful hunters	Percent unsucessful hunters	Bulls (%)	Cows (%)	Unk.	Total harvest
001/Unit 7									
	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
	1996/97	250	49	18	82	44	56	--	23
	1997/98	250	52	23	77	46	54	1	27

Table 11 Kenai Lowlands caribou harvest data by permit hunt, 1993-98

Hunt No. /Area	Regulatory year	Permits issued	Percent did not hunt	Percent successful hunters	Percent unsuccessful hunters	Bulls (%)	Cows (%)	Unk.	Total harvest
506/15A									
	1993/94 [a]			No Season					
	1994/95 [a]			No Season					
	1995/96 [a]			No Season					
	1996/97 [a]			No Season					
	1997/98 [a]			No Season					

[a] No hunting season.

Table 12 Killey River caribou harvest data by permit hunt, 1993-98

Hunt No. /Area	Regulatory year	Permits issued	Percent did not hunt	Percent successful hunters	Percent unsuccessful hunters	Bulls (%)	Cows (%)	Unk.	Total harvest
608/15B	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
	1996/97	25	32	71	29	12 (100)	0	0	12
	1997/98	50	46	85	15	23 (100)	0	0	23

[a] No hunting season.

Table 13 Fox River caribou harvest data by permit hunt, 1993-98

Hunt No. /Area	Regulatory year	Permits issued	Percent did not hunt	Percent successful hunters	Percent unsucessful hunters	Bulls (%)	Cows (%)	Unk.	Total harvest
608/15B	1993/94[a]	0	--	--	--	--	--	--	0
	1994/95[a]	0	--	--	--	--	--	--	0
	1995/96	15	47	63	37	5 (100)	0	0	5
	1996/97	10	70	67	33	2 (100)	0	0	2
	1997/98	10	60	50	50	2 (100)	0	0	2

[a] No hunting season.

Table 14 Kenai Mountains caribou annual hunter residency and success, 1993-98

	Successful					Unsuccessful					
Regulatory year	Local[a] resident	Nonlocal resident	Nonresident	Total[b]	(%)	Local[a] resident	Nonlocal resident	Nonresident	Total[b]	(%)	Total hunters
1993/94	4	25	0	29	(25)	5	78	2	85	(75)	114
1994/95	2	26	0	28	(24)	8	79	0	88	(76)	116
1995/96	9	9	0	18	(17)	2	56	2	85	(83)	103
1996/97	2	20	1	23	(18)	16	86	3	105	(82)	128
1997/98	3	24	0	27	(23)	7	82	4	93	(77)	120

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

Table 15 Killey River caribou annual hunter residency and success, 1993-98

Regulatory year	Successful					Unsuccessful					Total hunters
	Local[a] resident	Nonlocal resident	Nonresident	Total	(%)	Local[a] resident	Nonlocal resident	Nonresident	Total	(%)	
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
1996/97	7	3	2	12	(71)	3	1	0	5	(29)	17
1997/98	17	5	1	23	(86)	3	1	0	4	(14)	27

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

Table 16 Fox River caribou annual hunter residency and success, 1993-98

Regulatory year	Successful					Unsuccessful					Total hunters
	Local[a] resident	Nonlocal resident	Nonresident	Total	(%)	Local[a] resident	Nonlocal resident	Nonresident	Total	(%)	
1993/94[b]	--	--	--	--		--	--	--	--		--
1994/95[b]	--	--	--	--		--	--	--	--		--
1995/96	3	1	1	5	(63)	3	0	0	3	(37)	8
1996/97	2	0	0	2	(67)	1	0	0	1	(33)	3
1997/98	2	0	0	2	(50)	2	0	0	2	(50)	4

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

Table 17 Kenai Mountains caribou annual harvest chronology percent by time period, 1993-98

Regulatory year	Harvest periods 8/10-8/15	8/16-8/31	9/1-9/15	9/16-9/30	*n*
1993/94	38	31	17	14	29[a]
1994/95	46	29	14	11	28
1995/96	11	39	39	11	18
1996/97	35	44	9	13	23
1997/98	34	23	26	19	27

Table 18 Killey River caribou annual harvest chronology percent by harvest period, 1993-98

Regulatory year	Harvest periods 8/10-8/15	8/16-8/31	9/1-9/15	9/16-9/30	*n*
1993/94			No season		
1994/95	36	27	36	--	11
1995/96	--	--	50	50	8
1996/97	25	--	50	25	12
1997/98	13	44	40	5	23

Table 19 Fox River caribou annual harvest chronology percent by harvest period, 1993-98

Regulatory year	Harvest periods 8/10-8/15	8/16-8/31	9/1-9/15	9/16-9/30	*n*
1993/94		No season			
1994/95		No season			
1995/96	40	20	40	--	5
1996/97	--	--	100	--	2
1997/98	--	--	50	50	2

Table 20 Kenai Mountains caribou harvest percent by transport method, 1993-98

Regulatory year	Airplane	Horse	Boat	3- or 4-Wheeler	Snowmachine	ORV	Highway vehicle	Unknown	*n*
1993/94	10	21	--	--	--	--	59	10	29
1994/95	7	14	--	--	--	--	75	4	28
1995/96	6	22	--	6	--	--	67	0	18
1996/97	--	9	--	--	--	4	70	17	23
1997/98	7	22	--	--	--	--	70	--	27

[a] ORV includes mountain bike.

Table 21 Killey River caribou harvest percent by transport method, 1993-98

Regulatory year	Percent of harvest								
	Airplane	Horse	Boat	3- or 4-Wheeler	Snowmachine	ORV	Highway vehicle	Unknown	*n*
1993/94				No season					
1994/95	--	45	55	--	--	--	--	0	11
1995/96	13	75	13	--	--	--	--	0	8
1996/97	8	67	25	--	--	--	--	0	12
1997/98	9	70	22	--	--	--	--	0	23

Table 22 Fox River caribou harvest percent by transport method, 1993-98

Regulatory year	Percent of harvest								
	Airplane	Horse	Boat	3- or 4-Wheeler	Snowmachine	ORV	Highway vehicle	Unknown	*n*
1993/94				No season					
1994/95				No season					
1995/96	--	40	60	--	--	--	--	0	5
1996/97	--	--	100	--	--	--	--	0	2
1997/98	--	--	100	--	--	--	--	0	2

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

There is little objective information 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 (Alaska Game Commission Reports, 1925–39), remaining relatively stable throughout that decade. There were indications that the herd began declining in the late 1930s (Skoog 1968); however, no substantive information was collected between 1940 and 1950 to support this theory.

Reindeer were brought 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.

We used photocensusing 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 providing an extrapolated estimate of 20,618 caribou. Photocensus estimates of the MCH since then have documented a steady rate of increase. The last aerial photocensus, in 1996, provided a minimum estimate of 192,818 caribou in the MCH.

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:

- Manage the MCH for maximum opportunity to hunt caribou
- 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 alternate years, occurring in even years. A photocensus was planned for 1998 but did not occur because of poor weather. 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 (YDNWR). Biologists, using fixed-wing aircraft, radiotrack and survey the herd's range, estimate the number of caribou observed, and photograph discrete groups using hand-held 35-mm cameras. Since 1994 we have 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: 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 and 1998. Helicopter availability and level of funding determines whether composition counts are conducted during a particular year. We have captured and radiocollared MCH caribou in most years from 1980 to 1992. Beginning in 1992, collaring programs were scheduled for alternating years, occurring in even years. Female calf caribou are captured using a helicopter and skid-mounted or hand-held net guns. These are usually cooperative efforts between the department, LACL, and TNWR. During November 1998, YDNWR staff attempted to capture and radio-collar caribou when large numbers of the MCH occupied areas of Unit 18. Nine caribou were radiocollared during those efforts.

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 1997 and 1998. Staff from BLM enter radiotracking data from these flights into a statewide interagency GIS database.

We monitored the harvest and assisted Fish and Wildlife Protection in enforcement 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 prior to the 1998–99 season have not been entered into the statewide harvest information system, and reminder letters have not been routinely 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%. From 1992–1994, the annual rate of increase appeared to be 28%, but this was probably an artifact of more precise survey techniques. No herd size information is available after 1996; however, there is little to suggest that the herd growth rate has markedly declined. The dramatic growth of the herd is attributed to a succession of mild winters, movements on to previously unused range, relatively 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). No aerial photocensus was conducted during the postcalving aggregation in June 1998 because of weather conditions. The MCH has probably continued to increase in size during this reporting period, but the rate of increase during the past few years may be less than in previous years.

Population Composition

We conducted a sex and age composition survey on a small group of caribou near Portage Creek in October 1996 (Table 2). We were uncertain whether these animals were part of the main herd, or a portion of the herd that typically remains near Portage Creek. In October 1998, sex and age composition surveys were conducted on caribou located south of Koliganek and also in the Mosquito river drainage (Table 2). The bull:cow ratio has consistently remained greater than the minimum objective of 35:100 (Table 2). The fall calf:cow ratio has remained consistently greater than 30:100 (Table 2), indicating good production.

Radiotelemetry flights to delineate calving areas provided a subjective estimate of 28.4 calves:100 cows on May 22, 1997. A radiotracking flight on May 19, 1998 revealed that a very low proportion of the cows had calved. Subsequent flights through the summer and fall revealed normal calf numbers.

Distribution and Movements

The MCH has continued to increase its range as it has grown. To follow the movements of the herd, we had 51 caribou with active radio collars in July 1996. These included 22 deployed in range of the Kilbuck caribou herd when large numbers of Mulchatna caribou were in that area.

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 radiotelemetry 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).

The MCH did not move into traditional wintering areas en mass during this reporting period but scattered throughout their range and beyond into previously unused territory. In November 1996, approximately 25,000 Mulchatna caribou traveled north to the McGrath area. Another 30,000 caribou spent most of the winter of 1996/97 in Unit 17A, an area where large numbers of caribou had not been present for many decades.

During the winter of 1997/98, Mulchatna caribou were scattered widely across the northern part of Unit 17B and southern 19B. Large numbers were also near Aniak on the Kuskokwim River. Though no radiocollared Mulchatna caribou were located north of the Kuskokwim River, many caribou from this herd were. This was the farthest northwest that Mulchatna caribou had traveled in recent times. Movement into these nontraditional wintering areas has probably resulted in decreased pressure on the forage supply in the more typical wintering areas.

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 10,000–15,000 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. In 1994 most of the MCH females started using the area between the upper Nushagak River and upper Tikchik lakes for calving. In May 1996, 1997, and 1998, most of the cows from the MCH calved in the drainages of the King Salmon River and Klutuspak Creek of the upper Nushagak River.

Seasonal Movements. The June 1996 postcalving aggregation of the MCH took place on the east side of the Mulchatna River, between Tutna Lake and the Stuyahok River. By August, large numbers had moved into the Nushagak Hills and west to the Holitna River. Throughout midwinter, large numbers of caribou were located near McGrath in Unit 19D, in Unit 17A and eastern Unit 18, and throughout northern Unit 17B. During March 1997, at least 20,000 caribou were located in the Togiak River drainage of Unit 17A, 15,000 in the Aniak river drainage of western Unit 19A and 19B, and 20,000 were between Sparrevohn and the Swift River in eastern Unit 19A and southern Units 19A and 19C. Most of the remainder of the herd was between Swan Lakes and Nikabuna Lakes in Units 17B and 9B. From those far-flung reaches, the majority of

the cow segment of the herd again traveled to the area drained by the King Salmon River and Klutuspak Creek to calve in May 1997.

The late June 1997 postcalving aggregation of the MCH was in the Koktuli River drainage east of the Mulchatna River. By August, large numbers had moved northwest through the Nushagak Hills, then west across the Holitna and Aniak River drainages and into Unit 17A and Unit 18 south of the Yukon River. During late fall, the caribou that had been in Unit 17A left the Togiak drainage and moved east into northern Unit 17B. By early October, there were at least 50,000 caribou near Kemuk Mountain, with many more scattered throughout Unit 17B. In January 1998 there were at least 40,000 Mulchatna caribou between Swan Lakes and Tutna Lake in northwestern Unit 9B, and groups from 3000 to 7000 east of Portage Creek, south of Koliganek, and north of Iliamna Lake. Large numbers of Mulchatna caribou were also in the Aniak area on the Kuskokwim River. Though no radiocollared Mulchatna caribou were located northwest of the Kuskokwim River, caribou trails, cratering, and groups of caribou were found from Aniak, up the Innoko River, throughout the Iditarod River, in the Blackburn Hills, and into the Unalakleet River drainage. Large numbers of wintering Western Arctic Herd Caribou (WACH) have used the Nulato Hills of the Unalakleet River drainage, and this was the first time we had any indication of possible mixing of the herds. This is also the first time we have evidence of caribou using ranges that Skoog (1968) speculated were used by up to a million caribou in the late 1800s.

In May 1998 most of the cows in the MCH had once again returned from being scattered throughout western Alaska to calve in the area drained by the King Salmon River and Klutuspak Creek. By late June, most of the herd had moved eastward through the Nushagak Hills, through the Mosquito River drainage, and northeast up the Mulchatna River to the Bonanza Hills. On July 6, 1998 almost the entire herd was in the Snipe Lake-Twin Lakes–Telaquana Lake area.

Several peripheral groups appear to be independent from the main MCH. A group of about 1300 caribou resides between Portage Creek and Etolin Point. Caribou in the Kilbuck Mountains and in Rainy Pass seem 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. The hunting season for caribou in the area used by the MCH is August 1 through April 15 in Units 9B, 17B, 17C (east of the Wood River and Wood River lakes), 19A (south of the Kuskokwim River), and 19B. The bag limit for resident hunters is 5 caribou; however, no more than 2 can be bulls in Units 19A and 19B, and no more than 2 can be bulls from October 1 through November 30 in Units 9B, 17B, and 17C. The bag limit for nonresidents is 2 caribou. Unit 17A, the western portion of Unit 17C, and Unit 18 south of the Yukon River may be opened by emergency order when sufficient numbers of Mulchatna caribou enter those areas. Hunters may take caribou the same day they have been airborne from January 1 through April 15 in Units 9B, 17B, and that portion of Unit 17C east of the Nushagak River, provided the hunter is 300 feet from the airplane.

Board of Game Actions and Emergency Orders. During their spring 1997 meeting, the Board of Game passed a regulation requiring that edible meat of the front quarters, hindquarters, and ribs of moose and caribou must remain naturally attached to the bone until the meat has been processed for human consumption or transported out of the field. This regulation applied to Units 9B, 17, those portions of Unit 19A within the Holitna/Hoholitna Controlled Use Area, and Unit 19B. The open hunting season for caribou in Unit 17C south and west of the Kokwok River, north and west of the Nushagak River, and north and east of the Wood River was changed to that of the rest of Unit 17C east of the Wood River. Previously this area had been opened for caribou hunting only by emergency order. The bag limit for Mulchatna caribou was changed from 5, of which only 2 could be bulls, to 5, of which only 2 bulls could be taken October 1 through November 30. The Board also granted emergency order authority to the department to announce a caribou season with a bag limit of 5 caribou in Unit 17A, western Unit 17C, and Unit 18 (south of the Yukon River) when large numbers of Mulchatna caribou are in those areas.

During their spring 1998 meeting, the Board of Game changed the "meat on the bone" regulation to only moose and caribou taken before October 1 and deleted the requirement to retain meat on the ribs.

Hunter Harvest. The reported harvest from the MCH was 2366 caribou during the 1996/97 hunting season and 2704 during 1997/98 (Table 3). These totals and the number of hunters reporting hunting Mulchatna caribou indicated a slight decline in effort from the previous several years. Distribution of the caribou during fall of 1996 and 1997 made hunting more difficult than in previous years. Several air taxi operations reported they informed hunters that caribou were not readily accessible from their base of operations and returned deposits. As in previous years, males composed most of the harvest each year (78% and 84%).

Data from harvest reports must be viewed with caution because overlays were not keypunched and there is no way of objectively analyzing the rate of return. The unreported harvest for each year during this reporting period was estimated at an additional 2200 and 2400.

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, Dillingham). The number of caribou harvested by local residents has undoubtedly increased since the Subsistence surveys due to increases in the range of the herd and number of people living in the surrounding villages. Unreported harvest by other Alaska residents is more difficult to quantify.

From the early 1980s through 1995, there was a steady increase in the number of caribou hunters in the range of the MCH during the fall season, yet harvest levels remained less than 5% of the total population. Harvests did not appear to be limiting herd growth or range expansion. Conservative management of areas recently occupied by the MCH is probably contributing to the increased use of new areas by caribou. The decrease in the number of reported hunters the last 2 years is probably a result of the unpredictable movements of the herd and the lag-time experienced by transporters in finding locations to take hunters in the new areas utilized by the herd.

Hunter Residency and Success. Nonresidents made up 51% of the reporting hunters during the 1996/97 season and 62% of the reporting hunters during 1997/98. Nonlocal Alaska residents accounted for 43% and local residents 4% of the hunters who returned harvest reports for 1996/97. Nonlocal Alaska residents accounted for 32%, and local residents 5% of hunters who returned harvest reports for 1997/98. Of the reporting hunters, 85% successfully harvested at least 1 caribou in 1996/97, and 84% were successful in 1997/98 (Table 4).

Harvest Chronology. Most (77%) of the reported harvest in 1996/97 occurred during August and September, as did 86% in 1997/98. March was also an important month for harvesting caribou, accounting for 11% in 1996/97 and 4% in 1997/98 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 means of hunter transport during the 1996/97 (82%) and 1997/98 (86%) hunting seasons (Table 6). Boats and snowmachines were other important means of transportation and were the main transportation methods for local hunters. These transport methods 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. Predation rates still appear to be low but are probably increasing. Many local residents report increasing wolf numbers. An increasing number of hunters along the Nushagak and Mulchatna Rivers reported having encounters with brown bears, including bears on fresh kills, on hunter-killed carcasses, and on raids in 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 that time.

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 trampled and heavily grazed. Traditional winter range on the north and west sides of Iliamna Lake is also showing signs of heavy use. Many of the areas that the MCH is moving into have not been used by caribou for over 100 years, or reindeer for over 50 years, and appear to have vast quantities of essentially virgin lichen communities.

CONCLUSIONS AND RECOMMENDATIONS

Though no population estimation surveys occurred during this reporting period, the MCH appeared to continue growing in size and range. 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. Fall

composition counts in 1996 and 1998 indicate good calf production through this reporting period.

The total reported harvest and the number of hunters afield steadily increased through 1995, while annual harvests remained at less than 5% of the population. Decreases in the reported number of hunters during this reporting period indicate an even smaller percent harvest. 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 made this herd increasingly popular with nonresident hunters. However, the mobility of the herd and the inaccessibility of much of its range to hunters make hunting logistics challenging.

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 more than 60,000 mi.^{2}, and large portions of the herd are pioneering new winter and summer ranges in good to excellent caribou habitat. There is some evidence of localized overuse of habitat in some portions of the range, but most of the areas used by the MCH seem to be 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. Calf production and survival appear to be high, and there is little evidence of disease (although caribou in the adjacent NAPCH had a high incidence of lung worm in 1995 and 1996). Considering the size of the herd, there are relatively low predation rates and the herd continues to extend its range in 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 may be 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, the overall 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 extends its size and range. Since the main portion of the herd is migratory, using areas from the western slopes of the Alaska Range to the 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 the harvest data so that we can better manage the MCH as well as the smaller herds that are 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 include:

1 Conduct a biannual photocensus of the MCH during postcalving aggregations;

2 Conduct composition surveys annually 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 female caribou from the main winter range of the MCH each October or 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;

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 the 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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Table 1 Mulchatna caribou herd estimated population size, 1991/92–1997/98

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
1997/98	--	--	--	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, 1991–1998

Regulatory year	Total bulls: 100 cows	Calves: 100 cows	Calves (%)	Cows (%)	Small bulls (% of bulls)	Medium bulls (% of bulls)	Large bulls (% of bulls)	Total bulls (%)	Composition sample size	Estimate of herd size[a]
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
1997/98	---	---	---	---	---	---	---	---	---	200,000?
1998/99	40.6	33.6	19.3	57.4	27.8	43.7	28.5	23.3	3,086	

[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, 1991–97

	Hunter Harvest								
Regulatory	Reported				Estimated				Total
year	M (%)	F(%)	Unk.	Total	Unreported	Illegal	Total	Accidental death	caribou
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
1996/97	78%	21%	1.0%	2,366	2,200	--	2,200	--	4,566
1997/98	84%	15%	0.6%	2,704	2,400	--	2,400	--	5,104

Table 4 Mulchatna caribou annual hunter residency and success, 1991–97

Regulatory year	Successful				Unsuccessful				Total hunters[a]
	Local resident	Nonlocal resident	Nonresident	Total (%)	Local resident	Nonlocal resident	Nonresident	Total (%)	
1991/92	89[c]	562	599	85%	9	136	69	15%	1,464
1992/93	82[c]	542	651	91%	12	82	26	9%	1,391
1993/94	47[c]	718	725	86%	5	171	77	14%	2,394
1994/95	61[b]	812	896	85%	11	227	124	15%	2,954
1995/96	52[c]	1,035	928	87%	15	188	86	13%	3,127
1996/97	56[c]	647	824	85%	25	139	101	15%	1,822
1997/98	85[c]	564	1,277	84%	33	178	152	16%	2,301

[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 month, 1991–97

Regulatory year	Harvest Periods									Total
	August	September	October	November	December	January	February	March	April	
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
1996/97	25%	52%	5%	1%	1%	1%	2%	11%	2%	2,366
1997/98	33%	53%	4%	0.3%	0.4%	1%	3%	4%	0.3%	2,704

Table 6 Mulchatna caribou harvest percent by transport method, 1991–97

Regulatory year	Percent of harvest								Total caribou
	Airplane	Horse	Boat	3- or 4-Wheeler	Snowmachine	ORV	Highway vehicle	Unknown	
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
1997/98	82%	0.4%	10%	2%	3%	0.3%	0.7%	1%	2,366
1997/98	86%	0.4%	8%	1%	2%	0.1%	0.2%	2%	2,704

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., 2000 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; 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 multiple bag limit, road system hunt. Despite these problems, we viewed the large harvests as beneficial to reduce the NAPCH herd to 15,000 and to utilize the 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.

MANAGEMENT DIRECTION

MANAGEMENT OBJECTIVES

Based on the history of this herd and the long-term objective of trying to maintain the NAPCH at a relatively stable level, we recommend reducing the midsummer population objective of 15,000–20,000 caribou to 10,000–12,000 with an October sex ratio of 40 bulls:100 cows.

METHODS

POPULATION SIZE

In late June 1997, 1998, and 1999 we used an R-22 helicopter and fixed-winged aircraft to conduct radiotelemetry-aided aerial photocensuses on postcalving concentrations. We took

oblique 35mm photos of large groups to allow accurate enumeration. In addition, the Fish and Wildlife Service (FWS) surveyed peripheral areas along the Aleutian Mountains and Pacific coast. We determined the percent calves by direct enumeration or close-up photos of larger herds taken from the helicopter. We weighted the results by herd size to estimate total productivity.

Population Composition

We conducted sex and age composition surveys with a helicopter in October 1996, 1997, and 1998 and classified caribou throughout their entire distribution between the Naknek River and Port Moller. Caribou were classified as calves, cows, small bulls, medium bulls, and large bulls.

Parturition Surveys

During 31 May–1 June 1997 and 1998 and 2–3 June 1999, we used an R-22 or R-44 helicopter to classify caribou on the calving grounds as parturient cow (with calf, hard antlers or distended utter), nonparturient cow, yearling, or bull (Whitten 1995). We also observed radiocollared females to document their age-specific pregnancy rate. During 29 May–30 June 1998, we conducted a study on natality and early calf mortality (Sellers et al. 1998*a*).

Radiotelemetry Data

We scheduled capture operations to maintain 25–30 functioning radio collars in the NAPCH. In April 1997 we used an R-22 helicopter to dart 14 female calves and 4 female yearlings. In October 1998, in a cooperative project with the FWS, we fitted 19 female calves and 2 female yearlings with standard radio collars (Sellers et al. 1998*b*). We also captured 6 adult females just north of Port Moller and fitted them with satellite collars. We recorded standardized measurements, took blood samples, and radiocollared the calves. We periodically conducted radiotelemetry flights to monitor herd movement and survival rates of collared caribou.

Herd Condition

In addition to weights and measurements of captured caribou, we collected 10 female calves in October 1996, 1997, and 1998 to obtain measurements and samples to assess body condition (Valkenburg et al. 1996, Valkenburg et al. in press). We noticed "pinhead" hemoragic lesions on a majority of lungs, so we collected several samples for submittal to a veterinary pathology lab. In late June 1998, we found and dispatched 2 debilitated calves in the Ilnik calving area and found 1 other that had recently died. All 3 were sent to the Washington Animal Disease Diagnostic Laboratory at Washington State University for necropsy.

Harvest

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 through 1996/97 hunting seasons.

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 regarding 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. Since 1996 the herd has continued a gradual decline.

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. Since 1995 staff of the Alaska Peninsula/Becharof Refuge covered portions of the Aleutian Mountains and Pacific drainages. This area had not been counted since the early 1980s, so counts after 1995 represent a more complete "minimum count" than obtained from photocensuses in previous years. The same cooperative counts were conducted in 1997, 1998, and 1999, with total estimates of 10,000, 9,200 (Sellers and Squibb 1998*c*) and 8,600 (Table 1), respectively.

Population Composition

A sample of 2572 caribou was classified in October 1996 and had 48 bulls and 36 calves:100 cows (Table 1). A weighted sample of 3815 caribou classified from the June 1997 photocensus showed 24% calves in the herd. A sample of 1064 caribou classified in October 1997 had 47 bulls and 27 calves:100 cows. Calves made up 16% of the sample (Table 1). In June 1998, there was 24% calves in postcalving aggregations based on a weighted sample of 4461 caribou.

In October 1998 a sample of 1342 had 31 bulls and 30 calves:100 cows (Table 1). In June 1999 there were 19% calves in postcalving aggregations based on a sample of 7378 caribou.

During 1970–80 when the NAPCH was growing, the average fall ratio was 50 calves:100 cows (range = 45–56). During 1981–94, the fall ratio varied from 27 to 52 calves:100 cows and averaged 39. Since 1995 the ratio averaged 30 (range = 24–39) calves:100 cows.

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. After mild winters of 1995–96 and 1996–97, this winter distribution pattern resumed during 1997–98 and 1998–99.

MORTALITY

Harvest

Season and Bag Limits. The 1996–97 and 1997–98 resident seasons in Unit 9C were 10 August to 31 March with a bag limit of 4 caribou, not to include more than 1 cow. Seasonal limits were not more than 2 from 10–31 August, 1 during September–November and only by a hunter who had not previously taken a caribou, and after November 30 not more than 1 caribou could be taken per calendar month. In Unit 9E the resident bag limit was also 4 caribou, not to include more than 1 cow. Within the Pacific drainages of 9E southwest of Seal Cape, which opened on July 1, the bag limit was 2 bulls until August 10, after which either sex could be taken. In all of 9E the bag limit was 1 caribou during September–November. From 1–30 April the limit was 2 caribou. The 1996–97 and 1997–98 nonresident seasons in both 9C and 9E were 10 August to 31 October with a 1 bull limit.

Board of Game Actions and Emergency Orders. In response to the results of the 1998 post-calving census that indicated a continuing decline in the NAPCH, the department and the Naknek/Kvichak Fish and Game Advisory Committee requested an emergency meeting of the Board of Game in August. Other communities in 9E soon joined the call for reductions in the upcoming season. During a teleconference meeting on 11 August 1998, the Board curtailed the seasons and bag limits as follows. The resident bag limit was reduced to bulls only in both 9C and 9E. The nonresident season was closed in both 9C and 9E during 5–20 September, and in 9E the nonresident season was also closed during October.

In March 1999 the Board of Game reviewed the status of the NAPCH and, with considerable public involvement, decided to institute a Tier II hunt until the allowable harvest reached a level of 1200 caribou.

Hunter Harvest. Low reporting rates and the overlapping winter distribution of both NAPCH and Mulchatna animals complicate counting 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 1996–97 reported harvest from the NAPCH was 481 caribou, including 438 males (91%) and 43 females (9%) (Table 2). Most local and some nonlocal hunters did not report their harvested caribou. The nonsubsistence reporting rate was estimated at 60% (Sellers 1989). Nonlocal hunters (nonresidents and Alaskans residing outside of 9C and 9E) reported killing 368 caribou in 1996–97. Correcting this number by the reporting rate provides an estimated kill by nonlocals of 613 caribou. Results from village household surveys estimated that residents of villages in 9C and 9E killed a total of 1047 caribou during the 1996–97season (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 1996–97, leaving approximately 938 caribou unreported on harvest ticket reports, for a reporting rate of 10%. Combining reported harvests, estimates of harvests by village residents, and unreported nonlocal harvests, the best estimate of total kill for 1996–97 is 1660 caribou.

The 1997–98 reported harvest from the NAPCH was 482 caribou, including 446 males (92%) and 36 females (8%) (Table 2). Applying the 60% reporting rate to nonlocal harvest results in an estimate of 673. If the reporting rate for local residents remained similar to that estimated during 1994–97 (i.e., ~9%), approximately 700 caribou were taken by local residents. Combining the estimated village harvest with the adjusted nonlocal harvest (673) yields a total estimate of 1300–1400 caribou (Table 2).

The 1998–99 reported harvest was 490 caribou, comprising 94% males, despite the bull-only bag limit. We believe that the emergency action by the Board of Game to reduce the nonresident harvest (see below) and the extra effort to appraise village residents of the herd's decline increased the level of reporting by all hunters. If correct, this change in reporting compliance makes extrapolating the total harvest problematic. Based on the lower availability of caribou to villages and reduced effort by nonlocal hunters, the harvest probably did not exceed 1000 caribou.

Hunter Residency and Success. Success rates for all hunters reported on harvest tickets averaged 80% for 1996–97 and 97–98 (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 1996–97, approximately 63%, 15% and 22% of the total harvest went to local residents, nonlocal state residents, and nonresidents, respectively. During 1997–98, approximately 51%, 15%, and 34% of the total harvest went to locals, nonlocal state residents, and nonresidents, respectively. In odd-numbered years, the proportion of the harvest taken by nonresidents increased due to more effort in conjunction with the brown bear season. As a result of the Board of Game's emergency action to curtail the nonresident season in 1998, the allocation of reported harvest for 1998–99 was much different than it was in previous years. Nonresidents and nonlocal residents only accounted for 29% and 28% of the reported harvest. When unreported harvest is factored in, it is likely that local residents accounted for 70% of the harvest.

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). Although caribou availability during the winter increased during 1996–97 and 1997–98, reported harvests increased only slightly due to the restrictive winter bag limit. In 1998–99, a higher percentage of the harvest was during winter due to restrictions in the fall nonresident season and favorable travel conditions during that winter.

September is still the most important month, especially for nonresidents, because of the combination of relatively good weather conditions, the best chance to harvest 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 most important method of transportation reported from harvest tickets (Table 5), but emergency curtailment of the fall 1998 season reduced the proportion of reported harvest attributed to aircraft transportation. In 1998–99, the importance of 3- and 4- wheelers and snowmachines reflected less fall hunting effort. The level of snowmachine use varies annually depending on snow conditions.

Other Mortality

The radio collars placed on the NAPCH cows were designed to facilitate annual postcalving photocensuses, so mortality censors were not used in some transmitters. Telemetry flights were sporadic. These 2 factors preclude precise dating of natural mortalities or determining the cause of death. 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 1998 were 29%, 35%, 20%, 19%, 20%, and 24%, respectively. In October 1998, 19 calves and 2 yearlings were collared throughout the range of the NAPCH, and by June 1999 71% were dead. Because radio collars were not retrieved until June 1999, evidence of the cause of death was scant, but most deaths from the NAPCH were on winter range, ruling out bear predation in most cases. Evidence of wolf activity was present at several carcasses, but we could not confirm whether predation or merely scavenging occurred.

We reported the results of a calf mortality study conducted during June 1998 in Sellers et al. 1998*a*. During the first month of life, 35% of radiocollared calves (n = 37) died. Predators, primarily brown bears (*Ursus arctos*), bald eagles (*Haliaeetus leucocephalus*), and wolves (*Canis lupus*) caused most of the mortality of calves <2 weeks old, but disease apparently was an important mortality factor in calves >3 weeks old.

HABITAT AND ANIMAL CONDITION

Assessment

Little quantitative data are available to assess range conditions. Visual assessment of winter range condition based on the abundance of lichens in the early 1980s clearly noted a difference between the traditional range south of the Naknek River and areas between the Naknek River and Lake Iliamna. This difference was confirmed in a reconnaissance survey that compared lichen abundance in several areas on the traditional range with areas close to the King Salmon-Naknek road that still receives minimal use by caribou (R. Squibb, FWS, King Salmon pers commun).

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).

Since 1995 we have captured female calves and collected female calves every October to further assess body condition to allow comparisons with other herds and look for differences over time. Age-specific productivity has also been monitored since 1997. This work has been reported by Valkenburg et al. (1996 and in press) and Sellers et al. (1998*a*, 1998*b*, and in prep). Overall, this work demonstrates that the NAPCH is under moderate nutritional stress. No 2-year-old females have produced calves ($n = 25$) and only 33% of 3-year-olds ($n = 18$) have been pregnant. Overall pregnancy rates are relatively low at less than 80%. Weights of neonate calves in 1998 and 1999 averaged 8.4 and 7.2 kg for males and females, respectively. These weights are intermediate compared to other herds in the state. Weights and percent bone marrow fat of female calves collected in October are also intermediate, but a high percentage of these caribou showed lessions from lungworms.

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.

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 handling 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, pers commun). When we collected calves in October 1995–98, 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 12,000 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.

The NAPCH has been designated a population important for high levels of human consumption, and under the state's Intensive Management law, a review of intensive management options was triggered in March 1999 when the Board of Game significantly reduced harvest under a Tier II permit hunt. This review will occur in October of 1999.

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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
1997/98	47	27	16	57	54	31	14	27	1,064	10,000
1998/99	31	30	19	62	57	28	15	19	1,342	9,200

[a] Composition survey from fixed-wing aircraft

Table 2 NAPCH harvest, 1994–98

Regulatory year	Hunter harvest: Reported M (%)	Reported F (%)	Reported Unk.	Reported Total	Estimated Unreported	Estimated total[a]
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
1996/97	438 (91%)	43 (9%)	0	481	1,100-1,300	1,600-1,700
1997/98	446 (92%)	36 (8%)	0	482	900-1,000	1,300-1,400
1998/99	453 (94%)	31 (6%)	6	490	500	1,000

[a] Estimated total is rounded off.

Table 3 NAP caribou annual hunter residency and success, 1993–97

Regulatory year	Successful: Local[a] resident	Successful: Nonlocal resident	Successful: Nonresident	Successful: Total (%)	Unsuccessful: Local resident	Unsuccessful: Nonlocal resident	Unsuccessful: Nonresident	Unsuccessful: Total (%)	Total hunters
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
1996/97	55	131	222	408 (83%)	13	38	34	85 (17%)	493
1997/98	49	112	277	438 (78 %)	14	57	56	127 (22%)	565

[a] Local residents are residents of Subunits 9A, 9B, 9C and 9E.

Table 4 NAP caribou annual harvest chronology percent by month 1994–98

Regulatory year	Harvest periods									
	August	September	October	November	December	January	February	March	April	*n*
1994/95	13	38	11	3	13	5	8	6	2	564
1995/96	18	43	23	4	4	2	1	1	0	533
1996/97	19	36	21	4	5	6	3	4	0	477
1997/98	11	50	23	1	5	4	4	2	0	454
1998/99	16	31	12	6	8	8	8	6	1	490

Table 5 NAP caribou harvest percent by transport method, 1994–98

Regulatory year	Percent of harvest						
	Airplane	Horse	Boat	3- or 4-Wheeler	Snowmachine	ORV	Highway vehicle
1994/95	44	0	14	23	4	2	12
1995/96	57	0	19	13	0	1	9
1996/97	46	0	22	16	3	3	10
1997/98	53	0	21	15	4	2	5
1998/99	33	0	21	25	10	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 1996. Numbers of caribou on Unimak Island have also varied substantially, ranging from 5000 in 1975 to 300 during the 1980s.

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 have played a major 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 (the Department and the U.S. Fish and Wildlife Service [FWS]) 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 and Klein 1999). Parturition surveys were begun in June 1997. In April 1997 and October 1998, in cooperative projects with the FWS, we captured and radiocollared females calves. In October 1998 we also captured 8 adult females in northeastern 9D and fitted them with satellite radio collars. During 1999, with substantial funding from the FWS, we conducted a study of caribou productivity and calf survival (Sellers et al. in prep.).

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 FWS management plan specified all hunting was to be closed. The population appeared to stabilize briefly in 1994 but then continued to decline through 1996.

Population Size

In February 1995 the FWS 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, FWS staff counted 1403 caribou. No count was made during June 1996. Based on these previous counts by both agencies and poor recruitment in 1995 and 1996, results of FWS surveys from 12–15 April 1997, which totaled 3243 in Unit 9D, were surprising and inexplicable. Given the poor recruitment of the previous 2 years, it seemed implausible that the herd could have doubled in 2 years. If herd growth was ruled out, the results of the April 1997 survey reflected substantial movement of caribou into the SAPCH's core range or that past surveys by both agencies grossly underestimated the herd's size. Two surveys during mid-summer 1997 did little to explain this discrepancy. On June 29, 1997, I conducted a standard postcalving photo count on the SAPCH's core calving areas and counted 1696 caribou. Because of the discrepancy between this count and the FWS April 1997 survey, another expanded survey was conducted during 9–11 July with me as observer and a FWS pilot flying their PA-18 Super Cub. During this 3-day survey, all 22 radiocollared caribou were located, including 3 that were outside the core calving areas and not located on 29 June. These 3 radiocollared caribou were associated with a total of 94 caribou. During this 3-day survey, we visually estimated 1557 caribou. By combining the photos from 29 June of herds in the core calving area with caribou seen in fringe areas, primarily the mountains in extreme northeastern 9D, this cooperative survey tallied 1844 caribou.

In February 1998 the FWS counted 3127 caribou within the core area in Unit 9D. No postcalving count was attempted in summer 1998. During 26–29 June 1999 I completed an expanded postcalving photo count of the SAPCH and counted 3612 caribou in Unit 9D.

On January 17, 1997 the FWS counted 603 caribou on Unimak Island. This has been the only comprehensive survey of Unimak Island in over 2 decades.

Population Composition

During the June 1997 postcalving count, approximately 15% of the 1844 caribou were calves. The fall helicopter survey in 1997 showed 12% (n = 686) calves (Table 1). Ratios were 42 bulls and 19 calves per 100 cows. During June 1998 the FWS classified 518 caribou from a single herd estimated at 900 caribou at Black Hill and found 21% were calves. Considering that typically the caribou using the Caribou River Flats (CRF) are more productive than those near Black Hill/Trader Mountain (BHTM) (Pitcher et. al 1990, Sellers 1993, 1995), calf production in 1998 was higher than in most recent years. This was confirmed in October 1998 when a sample of 987 caribou was classified with ratios of 35 calves and 32 bulls per 100 cows. Calves composed 26% of all caribou seen during the 1999 postcalving count.

On Unimak Island, a sample of 140 caribou counted on 12 July 1997 contained 29% 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 CRF. 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 BHTM 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 CRF.

Since the early 1980s, caribou in Unit 9D have been presumed to be part of the SAPCH, and all caribou in Unit 9E have been counted as part of the Northern Alaska Peninsula caribou herd (NAPCH). 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 claimed that the "missing" caribou simply migrated north into the range of the 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, but empirical evidence of this distinction has been scant because of the difficulty in collaring and following caribou in this remote part of the Alaska Peninsula.

In October 1998, 6 caribou in the extreme southeastern corner of Unit 9E and 8 caribou in the northeastern portion of Unit 9D were fitted with satellite collars to further investigate whether interchange between herds occurred in this area. As of June 1999, none of these caribou has moved from the unit where captured. Further tracking of these caribou is planned. Additionally, genetic testing for interbreeding among caribou in 9E, 9D, and Unimak Island is planned. Exchange of caribou between Unimak Island and the mainland has not been documented in recent years.

MORTALITY

Harvest

Season and Bag Limits. There was no state hunt in Unit 9D or Unimak Island during 1993–98.

Board of Game Actions and Emergency Orders. The Board of Game took no action during 1995–98. At the spring 1999 meeting, they reinstituted a state hunt for the 1999–00 season. The resident season was set as 1–20 September and 15 November–31 March, with a 1 caribou limit. A registration permit hunt was set for nonresident during 5–25 September, with a cap of 50 bulls available.

Federal Subsistence Board Actions. In 1997, following the FWS count of 3243 caribou in Unit 9D and 603 on Unimak Island, the Federal Subsistence Board (FSB) approved a special action request from the Kodiak–Aleutian Federal Regional Subsistence Advisory Council. They established a federal registration permit hunt for bull caribou, with a total of 100 permits distributed among villages in 9D (35 permits to King Cove, 35 to Sand Point, 15 to Cold Bay, and 15 to Nelson Lagoon) and 60 permits available in False Pass on Unimak Island. The 1997 season dates were set as 10 August to 31 March on Unimak Island and 10 November to 31 March. The department supported the hunt on Unimak but opposed the hunt in 9D because of continued low productivity, high natural mortality, the inexplicable jump in counts from 1995 and 1996 to the April 1997 survey, and the discrepancy between the April survey and 2 summer counts in 1997. The hunt proceeded, but due to poor weather and other factors, harvests by some villages were low. On 31 March 1998, King Cove made a Special Action Request to extend the season by an additional month. The FSB approved this request with no objection from the department.

During summer 1998, the FSB again considered and approved a Special Action Request to expand the federal subsistence hunt in 9D and on Unimak Island from 1 August through 31 March. The number of available permits was expanded for 9D and Unimak to 235.

Following the Board of Game's action in March 1999 to establish a general resident state season, the FSB dropped the federal subsistence hunt in 9D and later opened federal lands to nonlocal hunters.

Hunter Harvest. There was no state hunt during 1993–98. The reported harvests from the 1997-98 and 1998-99 federal subsistence registration hunts were 32 and 23, respectively, but the reporting rate averaged 60% for both years.

Other Mortality

Annual survivorship of radiocollared adult females from the SAPCH was estimated at 0.61 from 1987–90, which was extremely low compared to other Alaska caribou herds (Pitcher et al. 1990). Causes of death were not determined, although predation by wolves and bears was suspected. Both predators 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 have reflected 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. The survival rate for 13 calves and 1 yearling from October 1998 through June 1999 was 93%.

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 and Klein (1999) 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. They concluded that earlier spring green-up and more abundant grasses, sedges, and forbs accounted for the higher calf production.

Female calves captured in October 1998 weighed about the same (117.8 lbs, SD = 9.2, n = 13) as calves from the NAPCH (115.8, SD = 12.2, n = 19). During June 1999 we weighed 54 neonatal calves from the SAPCH and 44 from the NAPCH. Male calves from the NAPCH sample were slightly heavier than males from the SAPCH (P = 0.09), but there was no difference for females (P = 0.36). Weights of calves from the SAPCH were significantly heavier (P = 0.09 for males and 0.01 for females) in 1999 than recorded in 1989 (Pitcher et al. 1990). There was no difference in average weights of SAPCH males or females from the CRF and the BHTM calving areas (P = 0.19 for males and 0.47 for females).

During early June 1989, 1997, and 1999, we conducted parturition surveys of the SAPCH. In all 3 years there was no difference in pregnancy rates between caribou located on the CRF and the BHTM areas. However, peak of calving occurred earlier on the CRF, where 30% of the parturient cows were accompanied by calves on 4 June, compared to 21% with calves on the BHTM area. Pregnancy rates were slightly higher in 1997 and 1999 than in 1989 when the herd was declining (Table 2).

Three-year-old radiocollared cows from the SAPCH were significantly more productive in 1999 (11 of 12 were pregnant and 9 were accompanied by calves) than were 3-year-olds from the NAPCH in 1998 and 1999. The high proportion of 3-year-olds in the SAPCH now producing calves is consistent with other indications of better body condition, probably as a result of improving range.

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 manifested 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 have sustained itself.

Based on evidence of improved body condition, higher productivity, and better survival rates of radiocollared females, it appears the SAPCH is beginning a period of recovery. However, high mortality of neonatal calves documented in 1999 indicates herd growth may be somewhat sporadic. Nevertheless, past experience of overpopulation indicates that management actions should ensure that this herd does not exceed 5000 animals.

Close cooperation between the department and the INWR staff is essential for effective management and research. Expanded survey and research efforts made possible from recent cooperative projects have provided essential information on the current condition of this herd. Genetic testing should be used to evaluate the distinctness of the NAPCH, SAPCH, and Unimak Island herds. 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 1995-98 in the NAPCH, it might be worth collecting 5–10 calves during fall composition surveys.

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

Regulatory year	% Calves		Fall composition							Postcalving survey results	INWR[a] counts
	Summer	Fall	Bulls: 100 cows	Calves: 100 cows	Cows (%)	Small bulls (% bulls)	Medium bulls (% bulls)	Large bulls (% 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										1,403
1997	15	12	42	19	62	36	36	27	546	1,844	3,243
1998		21	32	35	60	42	23	36	987		3,127
1999	26									3,612	

[a] Counts by Izembek National Wildlife Refuge staff

[b] Count from Super Cub

Table 2. Parturition rates for caribou in the Black Hill/Trader Mountain (BHTM), Caribou River Flats (CRF), and Unimak areas of the Southern Alaska Peninsula caribou herd, 1989–99

Year	Area (date)	Pregnancy indicator			Percent parturient	Not pregnant (%)	Yearlings	Number classified
		With calf	Distended utter	Hard antlers				
1989[a]	BHTM (9 Jun)	32	152		73	69 (27)		253
	CRF (8 Jun)	38	20		73	21 (27)		79
1997	BHTM (1 Jun)	30	44	156	78	65 (22)	48	343
	CRF (1 Jun)	110	39	76	82	49 (18)	59	333
1999	BHTM	40	20	129	96	7 (4)	57	253
	CRF	39	20	70	88	17 (12)	65	211
	Unimak	17	3	8	67	14 (33)	39	81

[a] Pitcher et al. 1990

LOCATION

GAME MANAGEMENT UNIT: 12 (3300 mi^2) and adjacent Yukon, Canada (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, Canada

BACKGROUND

Historically, the Chisana caribou herd (CCH) has been small and nonmigratory. Skoog (1968) estimated the CCH was about 3000 animals in the early 1960s. By the mid to late 1970s, the herd declined to an estimated 1000 caribou. Similar declining trends were reported in other Interior caribou herds. During the 1980s, environmental conditions were favorable, and the herd increased to about 1900 caribou. Since 1988 the herd has steadily declined. Weather and predation have been the primary causes for the decline. Harvest by humans has had a minor effect on population fluctuations since the 1950s. Between 1979 and 1994, the bag limit was 1 bull caribou, and harvest was limited to 1–2% of the population.

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

In the Chisana area, 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 assists hunters in the Yukon. Few Alaska residents fly into the area to hunt, and Native people now living at Northway and Tetlin rarely hunt in the CCH range. Use of the area by tourists is also minimal.

Before the mid-1980s, the CCH was not a high management priority because of its small size, remoteness, and the light and selective (primarily mature males) hunting pressure it received. In 1980 the Wrangell-St Elias National Park and Preserve was created, and 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 to 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 censuses and composition surveys. Subsequently, between 1990 and 1998 39 adult females

and 17 5-month-old female calves were radiocollared. Radiocollaring and herd monitoring costs are shared between ADF&G, NPS, and YDRR.

Since 1988, study results documented declines in herd size and bull:cow ratio. By 1991, declining bull numbers became a concern, and harvest was reduced through voluntary compliance by guides and local hunters. In 1994 the bull population declined to a level below the management objective and all hunting of Chisana caribou was stopped. Hunting will remain closed until the bull:cow ratio meets the population objective which will require substantial improvement in calf survival.

MANAGEMENT DIRECTION

A cooperative Chisana Caribou Management and Monitoring Plan is being developed to provide management direction that considers the different mandates and philosophies of ADF&G, NPS, and YDRR.

Following are the current Chisana caribou management goals and objectives. Due to the current status of the herd and closed hunting seasons, I have recommended new goals and objectives in the Conclusions and Recommendations section of this report.

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

Since 1986 we have collected annual fall sex and age composition data between late September and early October. A Bellanca Scout was used to locate most of the herd by radiotracking collared animals. Since 1993 we have used a Robinson-22 helicopter to classify each caribou as either a cow, calf, or bull. Bulls were further classified based on antler size as either small, medium, or large. We attempted to classify >90% of the herd.

We conducted surveys to estimate population size during late June 1992, 1993, 1995, and 1997. During these surveys, we located caribou by visually searching the herd's summer range and by locating radiocollared caribou. We used 2 search aircraft (Piper Super Cub and a Bellanca Scout) with a pilot and 1 observer in each. All caribou found were counted by the observation team, and all groups larger than 25 caribou were also photographed using a 35-

mm camera. Prints were then enlarged and the caribou were counted with the aid of a magnifying glass. We also 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 since 1991 to: 1) improve the efficiency of the census and composition surveys; 2) monitor seasonal distribution and movement patterns; 3) determine pregnancy and natality rates and median calving date; 4) evaluate herd condition; 5) estimate annual mortality rates; and 6) obtain blood samples in spring 1994 and 1995 to determine pregnancy rates, herd genetics, and incidence of disease. The number of active collars operating during the report period was 11–23.

We used several indices to evaluate herd condition and range quality. Since 1993, we have estimated annual herd pregnancy rate by monitoring radiocollared cows during late May and 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. During 1993 and 1994 we determined median calving date, which is the date by which 50% of the pregnant radiocollared cows had given birth. We assessed range condition by evaluating the percent lichen versus moss in the herd's winter diet during 1994 and 1995. We plan to evaluate winter range conditions again in winter 1998–1999.

Hunting seasons are based on a regulatory year (RY = 1 July–30 June). Beginning in RY 1993–1994, we monitored the CCH harvest using information from registration permit reports. We implemented a registration permit hunt because the harvest quota was low and we needed the flexibility to require a short report period to prevent overharvest. Since RY 1994–1995, the hunting season was technically open under registration permit, but no registration permits were issued because of herd population 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 about 1900 caribou. Since 1988 the herd has declined by an average of 12.1% annually, and by fall 1998 it included about 500 caribou (Table 1). If recruitment continues at the current low level, the herd may decline more rapidly due to the advanced age of most cows. Many of the small mountain herds in Interior and Southcentral Alaska and western Yukon have experienced low calf survival during the 1990s. However, none was as low as the Chisana Herd. Unreported harvest of primarily cows along the Alaska Highway in Yukon may affect herd growth. The regional biologist and protection officer in Haines Junction, Yukon are working to eliminate this harvest.

Population Composition

Since 1990 the calf:cow ratio in the CCH has been 0–14 ($\bar{x}$ = 5.8/100) and as a result, 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 9 years. Bulls are aging, and unless calves are recruited, the bull:cow ratio will decline further.

Pregnancy and Natality Rates

Pregnancy rates and number of calves on 31 May (estimated by calf:cow ratio) have been inconsistent since 1993. Annual pregnancy rate had little effect on the number of calves by 31 May. Also, the number of calves on 31 May had little effect on the number that were alive by 21 June (Table 2). There was little change between the number of calves alive on 21 June compared to 1 October (Table 1).

Estimated number of calves on 31 May were low (<40:100) in 1993, 1996, and 1998. In 1993 low number of calves were expected because 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. In 1994 the pregnancy rate increased to about 86%, and on 30 May the estimated calf:cow ratio was 73:100. However, by 17 June 1994 the calf:cow ratio had declined to about 11:100. In 1995 and 1996 pregnancy rates increased to >93%, and calf:cow ratios on 30 May were 52:100 in 1995 but only 38:100 in 1996. By 20 June calf:cow ratios were 7:100 in both years. In 1997 the estimated minimum herd pregnancy rate was 82%. The 30 May calf:cow ratio of 64:100 declined to 14:100 by 1 October. Herd pregnancy rate was not estimated in 1998, but the late May calf:cow ratio was 14:100. We do not know if the low number of calves was due to a reduced pregnancy rate or to high early calf mortality. Fall composition data demonstrated that pregnancy rate and the number of calves alive on 31 May had no influence on fall calf:cow ratios, indicating calf mortality is the factor that most influences recruitment (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). Between 1991 and 1996, most of the herd wintered in the eastern end of its range in Canada within the spruce forests along the Beaver Creek drainage. In 1992 snowfall was very early (9 September) and deep. The herd moved further north and wintered in the forested habitats near Wellesley Lake. Before 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 1997 most of the herd wintered in Alaska along Beaver Creek and in the Ptarmigan Lake area. 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 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 occurred in spruce to alpine habitats (3400–6600 ft) during 1994–1998. In 1993 and 1994, we monitored calving behavior and found that parturient Chisana cows sequestered themselves and selected high elevation habitats that offered escape from predators, even though food is scarce there. During

1995 and 1996, more cows calved beneath the trees (30–38%) than in previous years (0–10%); however, they still calved apart. In 1997, 25% of the calving took place below tree line. 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. Between 1996 and 1998, radiotracking surveys conducted 3–5 days after peak calving found only 8% of the calving cows were in a group larger than 4 caribou.

MORTALITY

Harvest

Season and Bag Limit.

Units and Bag Limits	Resident Open Season (Subsistence and General Hunts)	Nonresident Open Season
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 registration 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 an overharvest, the board stipulated a 5-day report period and a harvest quota of up to 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, we decided on a harvest quota of zero and have issued no permits for Chisana caribou since RY 1994–1995.

Human-induced Mortality. There has been no legal harvest of Chisana caribou in Alaska or Yukon since RY 1994–1995 (Table 3). Reports from local residents indicated an illegal harvest in Alaska of 0–3 caribou annually. In theYukon, First Nation band members can hunt Chisana caribou but have said they would stop until the herd recovers. However, between 1996 and 1998, 3–20 Chisana caribou were taken during the winter along the Alaska Highway in the Yukon. Because the herd is inaccessible most of the year in Alaska, illegal or incidental harvest is not a concern. During years that the herd winters along the Alaska Highway in Yukon, harvest can have a large effect on the herd. Most of the harvest comprises cows, and in 1998 we estimated harvest to be 20 animals (4% of the herd).

Other Mortality

During 1996–1998, the annual mortality rate for radiocollared adult females was 8–30%. Since 1994, causes of death have been determined for 14 radiocollared females: predators killed 13, and 1 died in an avalanche. Adult mortality rate is expected to remain high and possibly even increase due to the increasing age structure in the herd.

Insignificant calf recruitment occurred during 1990 through 1998 (0–14 calves:100 cows). Based on percent cows in the herd and on annual herd pregnancy rates, we estimated 325–550 calves were born annually between 1994 and 1998. By 1 October, 83–95% of the calves died each year. Most calf mortality occurred between the end of May and 21 June. Predation was the primary cause of death, based on timing of the mortality and on results from caribou calf mortality studies for adjacent herds.

Each year since 1993, we have witnessed grizzly bears and golden eagles killing calves and observed wolves near cows with calves and postcalving aggregations. Coyote numbers may have increased during 1997 and 1998 and may become an important predator on calves. Between 1990 and 1992 coyotes were abundant within the Chisana range. During those years, coyotes were observed killing calves. Wolf predation was the primary cause of calf mortality in the nearby Aishihik Herd. Spence (1998) estimated that each wolf killed about 8 calves/summer and were the primary limiting factor to Aishihik Herd growth. There were at least 5 wolf packs (35–40 wolves) within the Chisana Herd's summer ranges, so it is therefore likely wolves were the primary cause of calf mortality.

Using calf mortality data from other small herds in a predictive model, Spence (1998) hypothesized that reducing wolf pack size on the calving grounds would significantly increase calf survival. It may be possible that selective wolf trapping by private citizens could benefit the Chisana Herd if they could reduce the 5 primary packs in the herd's summer range to 2 wolves/pack. Trapping is legal throughout the herd's range under state, federal subsistence, or territorial regulations.

During the Chisana Herd's 10-year decline, we were able to estimate overwinter calf mortality only once due to the lack of an adequate calf sample. During winter 1990–1991, 64% of radiocollared female calves died between October 1990 and June 1991. Of the 9 collared caribou that died during this period, all were apparently killed by either bears or wolves, based on the evidence of a violent death (blood on collar) and sign at the death site. At least 3 of these deaths can directly be attributed to wolves based on the timing of death (midwinter).

Summers were significantly warmer and slightly drier during years the herd was declining, and winters 1991 and 1992 were severe in terms of snow depth and late spring snows. Lenart (1997) found that short-term variations in climate will affect nutrient quality in aboveground biomass of caribou forage and possibly adversely affect caribou by increasing insect harassment and decreasing nitrogen content in their forage. A record low number of snow-free days and drought conditions during summer 1992 caused reduced pregnancy rate in 1993 (50%). Similar conditions possibly prevailed in 1991, 1992, and 1998 as pregnancy rates during these years appeared low but unfortunately were not measured. However, even in years with >90% pregnancy, no additional calves survived until fall. Favorable weather conditions

(normal rainfall, low snowfall) persisted during 1995, 1996, and 1997. Pregnancy rates were high but calf survival continued to be very low (4–5:100 cows), indicating that predation was the primary regulating factor. The Chisana Herd grew during the 1980s when climate conditions were favorable and predation levels were comparable to current levels.

HABITAT

Assessment

Before 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 were collected from this area, but it 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. In the vicinity of Wellesley Lake, lichen availability was low (21% lichen and 75% moss and evergreen shrub fragments in samples). In the remaining portion of the winter range, lichen availability was 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 winter ranges of other Interior herds. Nutritionally stressed caribou are presumably more vulnerable to predators, which may explain the high 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, 1992, and 1998. Adverse weather conditions also prevailed during those years. Most years pregnancy rates were high, indicating summer range is adequate except during periods of unfavorable weather.

Enhancement

The entire range of the CCH is located in the Wrangell–St Elias National Park and Preserve or within Yukon, Canada. 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 Yukon.

CONCLUSIONS AND RECOMMENDATIONS

The CCH declined by 72% since 1988 due primarily to poor calf recruitment and, since 1992, due to high adult mortality. Since 1990, recruitment averaged less than 6 calves:100 cows. Causes of low calf numbers are not completely known, but primary factors were low natality rates in 1993 and 1998 and possibly in 1991 and 1992 caused by adverse weather conditions and predation on adults and calves. Predation was the cause of 96% of the mortality among radiocollared cows ≥5 months old in 1991. Hunting during the herd's decline was restricted to

bulls and removed about 2% or less of the population annually. Even this level of harvest slightly accelerated the declining bull:cow ratio. Legal hunting did not limit the herd's ability to grow, but illegal harvest along the Alaska Highway in Yukon may have had some limiting effect. Winter range quality in the eastern portion of the herd's range is below average compared to other Interior herds and probably contributed to higher overwinter adult mortality between 1994 and 1996. For the herd to stabilize, the 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. In order for calf survival to increase, pregnancy and natality rates must remain high and mortality caused by predators must decline. A possible solution may be selective wolf trapping by area residents.

The extremely low recruitment rates experienced by the CCH over the past 9 years have never been documented in any other wild caribou herd. Sufficient funding to determine pregnancy and natality rates, fall composition counts, and winter range use and mortality should be continued. Additional work by YDRR and possibly by a graduate student from the University of Nevada evaluating herd age structure, composition, and range condition may begin next year.

When hunting was allowed, the primary users of the Chisana Herd were nonresidents. Since 1990, 43% of the hunters participating in the Chisana caribou hunt were nonresidents who took 58% of the harvest. Local subsistence users harvested 8 (9% of the harvest) caribou during this time. Once the herd recovers and hunting is allowed, harvest regulations should provide for guided nonresidents.

ADF&G, NPS, and YDRR are developing a Chisana caribou management plan. The completed plan will recommend management and harvest strategies for the Chisana Herd that will meet the mandates of ADF&G and NPS. A final plan is expected by January 2000.

Current goals and the objective are not pertinent because all hunting of the herd has been closed since 1994 and will not reopen until substantial herd recovery has occurred. I recommend that the management goal be changed to: Manage the Chisana Herd for the greatest benefit of the herd and its users under the legal mandates of the managing agency and landowners.

I recommend the management objective be changed to: Develop a management plan that recommends management and harvest strategies designed to meet the management goal by January 2000.

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Table 1 Chisana caribou fall composition counts and estimated population size, 1987–1998

Date	Bulls: 100 Cows	Calves: 100 Cows	% calves	% cows	% small bulls (% of bulls)	% medium bulls (% of bulls	% large bulls (% bulls)	% bulls	Composition sample size	Estimated 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[b]			9						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[c]	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	679
9/30/96	16	5	4	83	40	18	42	13	377	575
10/1/97	24	14	10	72	3	68	28	18	520	541
9/28/98	19	4	3	81	49	14	37	15	231	493

[a] Based on population modeling.

[b] Classification accomplished from fixed-wing aircraft rather than from a helicopter.

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

Table 2 Chisana caribou postcalving composition counts, 1989–1997

Date	% calves (*n*)	% 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
7/10/97[a]	8 (13)	92 (153)	166

[a] Herd was scattered and composition count results are suspect.

Table 3 Chisana caribou harvest and accidental death, regulatory years 1989–1990 through 1997–1998

Regulatory year	Alaska harvest							Yukon harvest		
	Reported				Estimated					
	M	F	Unk	Total	Unreported	Illegal	Total	Reported	Unreported	Total
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
1997–1998	0	0	0	0	0	3	3	0	3–5	6–8

LOCATION

GAME MANAGEMENT UNIT: Portions 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) before 1972 when the herd size was estimated at 350–400 caribou and it received little sport harvest (Jennings 1974). 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 numbered 700–800 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 on the MCH, despite a reduced bag limit and restrictions imposed by the MPMA. In 1975, hunting pressure increased 72% over 1974 levels, and in 1976 there were 70% more hunters than in 1975 (Larson 1977). Despite the larger known herd size, the harvest was equal to or exceeding recruitment.

During the 1977 hunting season, it was necessary to close the season by emergency order on 8 September. Even with the emergency closure, the reported harvest totaled 93 caribou and exceeded recruitment. The large harvest, combined with predation by wolves and bears, led to the determination that harvest must be reduced (Davis 1979). In 1978 the bag limit for 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 that were in effect. 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 upon incomplete data on herd size, movements, and identity of the MCH.

On 29 June 1988, we estimated 800 caribou in the MCH. Historical information from local residents had indicated more caribou between the Robertson and Delta Rivers than we estimated. Therefore, a population objective was established to increase MCH size to 1000 caribou by 1993.

For the 1990–91 hunting season, the hunt was changed from a drawing permit hunt to a registration permit hunt. This change was enacted because customary and traditional use determinations precluded conducting the hunt as a drawing permit hunt.

The hunting season was closed from 1992–1993 through 1996–1997 because the herd was below the population goal. Also, a registration permit hunt did not allow adequate control of harvest because of relatively high hunter interest and low harvest quotas.

In 1995 the Alaska Board of Game adopted a Wolf Predation Control Implementation Plan (5 AAC 92.125) for Unit 20D. It established a new objective to reverse the decline of the MCH and increase the fall population to 600–800 caribou with a harvest of 30–50 caribou annually by the year 2002.

MANAGEMENT DIRECTION

MANAGEMENT OBJECTIVE

Increase the fall population to 600–800 caribou with a sustainable harvest of 30–50 caribou by the year 2002.

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 and groups without radios and to help count total numbers. Caribou were classified according to criteria specified by Eagan (1995).

We radiocollared eight 4-month-old calves in October 1996 and 12 in October 1998. These caribou were immobilized using 1 mg carfentanil citrate (Wildnil®, Wildlife Pharmaceuticals, Fort Collins, Colorado, USA) and 65 mg of xylazine hydrochloride (AnaSed®, Lloyd Laboratories, Shenandoah, Iowa, USA). Caribou were weighed, measured, and subjectively rated for body condition.

Hunting was conducted by registration permit. Hunters were required to report hunt status, kill date and location, transportation mode, and commercial services. Harvest data were summarized by regulatory year (RY = 1 July–30 June).

RESULTS AND DISCUSSION

POPULATION STATUS AND TREND

Population Size

The MCH was slightly below the minimum herd size goal during this reporting period.

RY 1996–1997. In fall 1996 a minimum herd size of 586 caribou was estimated during aerial census and composition surveys (Table 1).

RY 1997–1998. The fall 1997 population estimate was biased low because it occurred late in the season (28 Oct), and only 451 caribou were counted. However, based on computer modeling, the posthunt herd size was estimated at 597 caribou (Table 1). The fall 1998 count was compromised by poor visibility.

Population Composition

Fall calf numbers were chronically low in the Macomb Herd, except in 1996. During the 1995–1996 trapping season, a trapper harvested 9 wolves from a pack that spent a significant amount of time on the Macomb Plateau. Removal of these wolves may have contributed to increased calf survival in fall 1996.

The bull:cow ratio in composition counts has varied more than in most herds (Table 1). The average bull:cow ratio for 1996–1998 was 40:100. Variation in bull:cow ratios is probably due to grouping during fall counts, even though counts are done when mixing is optimal for determining composition.

Distribution and Movements

The MCH occupies the mountains of the eastern Alaska Range from the Delta River to the Mentasta Highway. Their primary range is in Unit 20D between the Robertson River and Jarvis Creek, and the primary calving grounds are on the Macomb Plateau. The MCH also uses the lowlands of the Tanana River valley as winter range.

RY 1996–1997. During the MCH fall 1996 census, 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.

RY 1997–1998. During the MCH fall 1997 census, caribou were distributed from Bear Creek to Sheep Creek, west of the Johnson River. The largest groups of caribou were observed west of the Johnson River, near Sheep Creek.

MORTALITY

Harvest

Season and Bag Limit.

RY 1996–1997 — The 1996–1997 hunting season was canceled because herd size was below the population goal.

RY 1997–1998 — The 1997–1998 hunting season was conducted as registration permit hunt RC835 from 10 to 20 September with a harvest quota of 30 bulls. The hunt opening date was set on 10 September to reduce incidental caribou harvest by moose hunters in the area and to make large, mature bulls more accessible to hunters. This was an attempt to make harvest more compensatory rather than additive.

Board of Game Actions and Emergency Orders. At their March 1998 meeting, the board adopted a proposal to extend the MCH registration permit hunt into that portion of Unit 12 west of the Glen Highway (Tok Cutoff) and south of the Alaska Highway, excluding the Tok River drainage. The purpose of this change was to include Macomb caribou that may be killed in Unit 12 within the harvest quota set for the MCH registration hunt. In the past, Macomb caribou that moved into Unit 12 were taken during a general season and not included in the registration hunt quota.

The Healy Lake Village Council also submitted a proposal to establish a Tier II hunt for the Macomb Herd, but they withdrew their proposal before the board meeting.

Hunter Harvest.

Harvest resumed in 1997–1998 and 22 bulls were taken. Harvest improved slightly in 1998–1999 (Table 2).

Permit Hunts.

RY 1996–1997 — The season was cancelled and no hunt was conducted.

RY 1997–1998 — Registration Permit Hunt RC835 was held during the 1997–1998 hunting season. Permits were issued to 143 hunters (Table 3) and 94 permittees (66%) actually hunted. Significantly fewer permits were issued than during the RY 1990–1991 and RY 1991–1992 registration permit hunts. Hunters probably did not realize the hunt was open after closures during the previous 5 seasons.

Hunter Residency and Success.

RY 1996–1997 — The season was cancelled and no caribou were harvested (Table 4).

RY 1997–1998 — Most hunters (69%) were local residents of Unit 20D. All hunters had a 23% success rate. Local and nonlocal hunters had similar success rates with 23% of local hunters killing caribou, compared to 24% of nonlocal hunters. Hunter success during RY 1997–1998 was very similar to success rates during the previous 2 registration hunts in RY 1990–1991 and RY 1991–1992 (Table 4).

Harvest Chronology.

RY 1996–1997 — The season was cancelled and no caribou were harvested (Table 5).

RY 1997–1998 — The RY 1997–1998 hunting season was only open during 10–20 September (Table 5). Most caribou (10) were killed on opening day, with caribou killed at a steady rate until 15 September. Only 1 caribou was killed during 16–20 September. Harvest probably declined significantly after 15 September because the moose hunting season closed, reducing incidental harvest. The 1998 data were only partially analyzed when this report was written, but chronology was similar to 1997, except the season was closed by emergency order on 16 September.

Transport Methods.

RY 1996–1997 — The season was cancelled and no caribou were harvested (Table 6).

RY 1997–1998 — Horses were the most commonly used mode of transportation for successful hunters. They were used primarily by residents of Dry Creek hunting within the Macomb Plateau Controlled Use Area (MPCUA). Hunters that hunted outside of the MPCUA primarily used ORVs, highway vehicles, and 4-wheelers.

Other Mortality

No other mortality was recorded for the MCH during this reporting period.

HABITAT

Assessment and Enhancement

Mean weights of caribou calves have increased since the early 1990s when they were chronically low throughout the Interior (Table 7). The relatively high mean calf weights during 1996–1998 indicated that the herd is not nutritionally stressed, but the traditional range is small and carrying capacity is unlikely to be greater than 1000 caribou.

The weight of 4-month-old calves captured during radiocollaring increased in fall 1996 to a mean weight of 128.3 lb ($s_{\bar{x}} = 6.0$, $n = 8$), from 118.8 lb in fall 1994 (Table 2). Mean weight of calves in 1998 was 132.8 ($s_{\bar{x}} = 2.1$, $n = 12$).

CONCLUSIONS AND RECOMMENDATIONS

The MCH failed to meet the herd size objective of 600–800 caribou, but at 597 animals it was only slightly below the objective. Radio collars were placed on 20 caribou during this reporting period (including fall 1998) to facilitate monitoring the herd. The first hunt since RY 1992–1993 was conducted as a registration permit hunt in RY 1997–1998. In 1998 the harvest reached the objective of 30–50. A limited harvest may be continued in the future if harvest does not compromise achieving the herd size objective and the bull:cow ratio does not decline below about 30:100. The most significant factor required to achieve population size and

harvest objectives will be improved calf survival. Intensive management efforts will continue in an attempt to meet established objectives.

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Table 1 Macomb caribou fall composition counts and estimated population size, 1982–1998

Survey date	Bulls: 100 cows	Calves: 100 cows	Calves %	Cows %	Small bulls %	Medium bulls %	Large 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
10/28/97	28	18	12	69	40	26	33	19	451	597[c]
9/30/98	50	25	14	57	32	46	22	28	472	600[d]

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

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

[c] Based on population modeling estimate.

[d] Estimated.

Table 2 Macomb caribou harvest[a] and accidental death, regulatory years 1985–1986 through 1998–1999

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
1997–1998	22	0	0	22	0	2	2	0	24
1998–1999	32	0	0	32	0	0	0	0	32

[a] Includes permit hunt harvest.

[b] Hunt canceled.

Table 3 Macomb caribou harvest data by permit hunt, regulatory years 1985–1986 through 1998–1999

Hunt	Regulatory year	Permits issued	Percent did not hunt	Percent successful hunters	Percent unsuccessful hunters	Harvest			Total harvest
						Bulls (%)	Cows (%)	Unk	
530[a]	1985–1986	140	61	22	78	12 (100)	0 (0)	0 (0)	12
	1986–1987	100	62	26	74	10 (100)	0 (0)	0 (0)	10
570[b]	1986–1987	15	53	14	86	1 (100)	0 (0)	0 (0)	1
530[a]	1987–1988	150	53	76	24	53 (100)	0 (0)	0 (0)	53[c]
	1988–1989	150	57	55	45	36 (100)	0 (0)	0 (0)	36[d]
	1989–1990	150	47	55	45	44 (100)	0 (0)	0 (0)	44[d]
535[e]	1990–1991	351	42	21	79	42 (100)	0 (0)	0 (0)	42
	1991–1992	317	33	16	50	48 (96)	0 (0)	2 (4)	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
RC835[e]	1997–1998[g]	143	34	15	50	22 (100)	0 (0)	0 (0)	22
	1998–1999	167	32	19	49	32 (100)	0 (0)	0 (0)	32
Totals for all permit hunts	1985–1986	140	61	22	78	12 (100)	0 (0)	0 (0)	12
	1986–1987	115	61	24	76	11 (100)	0 (0)	0 (0)	11
	1987–1988	150	53	76	24	53 (100)	0 (0)	0 (0)	53[a]
	1988–1989	150	57	55	45	36 (100)	0 (0)	0 (0)	36[b]
	1989–1990	150	47	53	48	44 (100)	0 (0)	0 (0)	44[b]
	1990–1991	351	42	23	77	42 (100)	0 (0)	0 (0)	42
	1991–1992	317	33	16	50	48 (96)	0 (0)	2 (4)	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
	1997–1998[g]	143	34	15	50	22 (100)	0 (0)	0 (0)	22
	1998–1999	167	32	19	49	32 (100)	0 (0)	0 (0)	32

[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] Registration permit hunt.
[f] Hunt canceled.
[g] Hunt closed by emergency order on 16 Sep 1998.

Table 4 Macomb caribou hunter residency and success of permit hunters, regulatory years 1986–1987 through 1998–1999

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]									
1997–1998[c]	15	7	0	22 (23)	50	22	0	72 (77)	94
1998–1999	22	10	0	32 (28)	39	43	0	82 (72)	114

[a] Resident of Unit 20D.

[b] Hunt by drawing permit.

[c] Hunt by registration permit.

[d] Hunt canceled.

Table 5 Macomb caribou harvest by time period, regulatory years 1987–1988 through 1997–1998

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]										
1997–1998					16[c]	6				22

[a] Season closed by emergency order on 4 Sep 1991.
[b] Hunt canceled.
[c] Season dates 10–20 Sep.

Table 6 Macomb caribou harvest percent by transport method, regulatory years 1986–1987 through 1997–1998

Regulatory year	Percent harvest by transport method[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]										
1997–1998	0	32	0	14	0	23	18	0	14	22

[a] Includes permit hunt harvest.

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

[c] Hunt canceled.

Table 7 Macomb caribou female calf weights, 1988–1998

Date	$\bar{x}$ weight (lb)	n
Spring 1988	116.8	4
Spring 1990	107.3	12
Fall 1994	118.8	10
Fall 1996	128.3	8
Fall 1998	132.8	12

LOCATION

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

HERD: Nelchina Caribou Herd

GEOGRAPHICAL DESCRIPTION: Nelchina Basin

BACKGROUND

The Nelchina Caribou Herd (NCH) contained 5000–15,000 caribou in the late 1940s. The herd increased during the early 1950s, aided by intensive predator control conducted by the Federal Government. The NCH 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 numbered between 7000 and 10,000 caribou in 1972. During 1973–74, the NCH began to increase and continued to grow through the mid-1990s, reaching an estimated 50,000 animals in 1995.

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, so the BOG curtailed the season and bag limit. From 1972 through 1976, the bag limit was 1 caribou, and fall seasons varied from 15 to 40 days. Even with a very short season, the reported harvests ranged from 560 to as high as 1200 caribou, which exceeded the desired harvest level. In 1976 the season was closed by emergency order after hunters killed 800 caribou in only 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 permits under sport hunting regulations. Unit residents took a few caribou under a subsistence registration permit hunt. Beginning in 1990 Nelchina permits were only issued for state and federal subsistence hunts except for a very limited drawing hunt in Unit 14. Both the number of permits and the allowable harvest have increased as the herd has grown, and during the last 10 years (1988–97) there have been close to 37,000 caribou harvested from the NCH.

MANAGEMENT DIRECTION

MANAGEMENT OBJECTIVES

- Maintain a fall population of 35,000–40,000 caribou, with a minimum of 40 bulls:100 cows and 40 calves:100 cows.

- Provide for an annual harvest of between 3000–6000 caribou.

METHODS

Biologists conducted yearly censuses and sex and age composition counts. The censuses involve aerial counts of caribou observed during June in postcalving aggregations and are followed immediately by sex and age composition surveys. Count technique includes either a fixed-wing photocensus using aerial photography techniques or a traditional census using hand-held cameras and direct field estimates made from aircraft. Aggregation of caribou and weather conditions determine the census technique; loosely aggregated caribou cannot be photographed effectively. Composition data is collected via helicopter immediately after the census in June to determine productivity and again in October during the rut to determine the bull:cow ratio and calf survival until fall. Extrapolated fall posthunt population estimates are then calculated from the spring counts and fall composition data.

Radiocollared caribou are located seasonally to delineate herd distribution and determine seasonal range use. Between 40 and 60 radiocollared caribou are maintained in the herd each year. Collars are placed on female calves to obtain survival and parturition data on radiocollared females of known age. All radiocollared cows are followed every other day during the calving period to determine pregnancy rates and the mean calving date.

Female calves are collected during the fall and spring to obtain body condition indices. Neonatal calves are captured to obtain estimates of birth weights. Biologists use permit reports, radio telemetry flights, and hunter field checks to monitor hunt conditions and harvests.

RESULTS AND DISCUSSION

POPULATION STATUS AND TREND

Population Size

The NCH fall population estimate declined from 44,273 caribou in 1996 to 31,893 in 1997, then increased to 38,552 in 1998 (Table 1). The estimated density was 0.9 caribou/km^2 in 1998 based on an approximate range of 44,200 km^2 (Lieb et al. 1988). The last Upper Susitna River subherd count was in 1994 with 2014 caribou counted. Because this subherd is only counted every 5 years or so, counts are not added into the NCH estimate.

Population Composition

Herd productivity was low in 1997 with only 39 calves:100 cows observed during the spring postcalving survey. Calf production increased in 1998 with 54 calves:100 cows counted. The drop in calf production during 1997 was attributed to a decline in physical condition of the cows that resulted in a reproductive pause. Lactating cow caribou that are nutritionally stressed because of poor forage conditions during dry summers often skip a breeding season to regain body condition (Whitten 1995). Overall, productivity in the NCH has been high even with yearly fluctuations due to weather during both the 1980s and 1990s, based on June counts averaging 50 calves/100 cows in both decades. Calf mortality is monitored by comparing changes in calf:cow ratios between summer and fall. The 1997 and 1998 fall ratios were 26 and 38 calves:100 cows, respectively. A fall ratio of 38 calves:100 cows has been observed in 3 of the last 4 years. During

the mid-1980s, herd productivity was similar to present-day productivity, but fall calf:cow ratios were somewhat higher, averaging 43:100, indicating a decline in calf survival from June to October in recent years. This coincides with an increase in wolf numbers during the 1990s.

The bull:cow ratio during the 1997 fall composition count was 26:100 and 21:100 in 1998. Fall bull ratios have been declining since 1992. Bull:cow ratios during the 1980s when the herd was increasing were often in the range of 50–60 bulls:100 cow. This reduction in the bull:cow ratio is due to increased bull harvests. Subsistence permittees select for large bulls. As more subsistence permits were issued, not only has the number of bulls declined but the age structure of the bull population has been skewed toward younger animals. Composition data from fall 1998 included 56% small bulls, 28% medium bulls, and only 16% large bulls. In prior years when the bull:cow ratio was higher, the age classes for bulls were more evenly represented.

Distribution and Movements

Calving takes place in the eastern Talkeetna Mountains from Fog Lakes southeast to the Little Nelchina River. The core calving area centers around the Oshetna River and Kosina Creek. This is also the area used during the postcalving and early summer period. Distribution of caribou during late summer and early fall, coinciding with hunting seasons during 1996 and 1997, was mainly in remote portions of the Susitna River drainage, the Lake Louise Flats, or the southern Alphabet Hills. These areas are relatively inaccessible compared to other portions of Unit 13. During the fall of 1998, caribou used more accessible range in the upper Denali Highway country than in the previous 2 years. In 1997 and 1998 the rut occurred in the foothills of the Talkeetna Mountains behind Eureka. Caribou remained in Unit 13 until late October or early November. Then 90% of the herd migrated east into Units 12 and 20E. In 1996 the rut occurred in Unit 12 as caribou migrated out of the unit in late September. There has been little use of traditional wintering areas in Unit 13 since 1995. In recent years, spring migration back to the calving grounds has occurred during late April or early May.

MORTALITY

Harvest

Season and Bag Limit. The 1997 and 1998 season dates for the state Tier I (RC567) and Tier II (TC566) subsistence hunts in Unit 13 were 1 August–20 September and 21 October to 31 March. The fall season for the Tier I hunt was split to reduce crowding, with hunters choosing 1 hunt period; either 10–30 August or 1–20 September. The 1–9 August period for the Tier I hunt was open for all permittees, but they had to use a primitive weapon. There were no weapon restrictions for the Tier II hunters during 1–9 August. The bag limit for the Tier I hunt was 1 cow or antlered bull having 6 or fewer points on 1 side and any bull for the Tier II hunt. There was a state registration subsistence hunt (RC 460) for NCH in Unit 12 during the late fall that was opened and closed by emergency order. The bag limit for this hunt was 1 bull. A state drawing hunt (DC 590) for any caribou with season dates of 10 August–20 September was held in Subunit 14B. The Unit 13 federal subsistence seasons (RC 513) in 1996 and 1997 had similar season dates as the state, except for the fall season that opened 10 August and 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; only residents of Units 11,

13, or 12 along the Nabesna Road were eligible. In 1998 Unit 20 residents from Delta Junction also became eligible. The Unit 12 federal subsistence hunt (RC 512) is by emergency order and has not been held the last 2 years.

Board of Game Actions and Emergency Orders. Sport hunting for NCH was eliminated in 1989 after the McDowell Decision by the Alaska Supreme Court resulted in all Alaskans being eligible for a Nelchina permit, not just rural residents. Only Tier II subsistence hunting was allowed between 1990 and 1995. In 1996 the Board of Game created a subsistence Tier I registration hunt for all state residents, with no limit on the number of permits issued. A harvest quota of up to 10,000 cows was set with the intent of reducing the herd to a level consistent with the management objective. The Tier II hunt was changed to a bulls-only hunt with an allocation of 5000 bulls and 10,000 permits issued. Emergency orders closed the winter caribou season in subunit 13E in both 1996 and 1997. The reason for this closure was to prevent overharvesting the small Upper Susitna subherd that permanently resides in Subunit 13E. The Upper Susitna subherd numbers only 2000 and can not sustain high harvests. The winter 1997 season for the Tier I hunt was closed by emergency order after a decline in herd productivity resulted in a lower than expected population estimate in October 1997. The Federal Government assumed control of wildlife management on federal lands in 1990 following the McDowell decision because federal law includes rural residency as a criterion for subsistence. 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, and this greatly reduces the opportunity to take caribou under a federal permit.

Hunter Harvest. The reported harvest in 1997–98 for the combined state and federal hunts was 4027 caribou, down 28% from the 1996–97 take of 5601 (Table 2). In 1996 both the cow harvest and total harvest were the highest reported from the NCH in 25 years. The cow harvest declined by 54% in 1997 because the Tier I winter season was closed by emergency order. Management efforts in 1996 focused on increasing the cow harvest to reduce the herd, but the objective for cow harvests changed in 1997 after a low spring count indicated an unexpected and unexplained decline in the cow population.

Illegal and unreported harvests of Nelchina caribou are an additional source of mortality. The estimated illegal and unreported take (Table 3) was increased in 1996 and 1997 because of the large increase in hunting pressure under the Tier I registration hunt. Many of the permittees were first time caribou hunters and field observations indicated increased illegal take and wounding loss. 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 validating the permit, there is minimal chance of citing them for taking additional caribou on the same permit. Individuals also transfer permits with family members or friends.

Wounding loss is probably quite high because caribou are a herd animal; an caribou is often shot near other caribou so more than 1 animal can be hit with 1 shot. Also, identifying a specific animal from a group is difficult, especially cows and small bulls. If a caribou is not knocked

down with the first shot, it may be lost in the herd and other caribou shot until one eventually drops.

Permit Hunts. Nelchina caribou were harvested by 5 separate permit hunts. Harvest data are presented in Table 2. During this reporting period the total number of permits issued varied from slightly over 10,000 to 50,000.

A State Tier II subsistence hunt is the primary way of allocating harvests from the NCH and, with the exception of 1996 and 1997, and has accounted for 90% of the harvest. All Alaskan residents may apply for this hunt, and permits are scored according to certain subsistence criteria and issued based on an applicant's rank. This is one of the most popular hunts in the state with over 17,000 applicants for the 10,000 permits issued. The hunt takes place entirely in Unit 13 with both fall and winter seasons. The bag limit between 1990 and 1996 was any caribou, but harvests were predominantly bulls. Cow harvests were not high enough to stabilize or reduce the size of the NCH. In 1996 the bag limit for this hunt was changed to 1 bull and Registration Hunt RC567 was created to provide for increased cow harvests. The Tier II harvest dropped in 1996 and 1997 (Table 2), in part because of this bag limit change but also because caribou were not easily accessible.

A State Tier I registration hunt for cows and small bulls (6 or less points on 1 side) was established in 1996 to increase the cow harvest. Small bulls were also legal because of the possible problem of sex identification by inexperienced hunters. Any state resident could obtain a permit. Hunter response exceeded all predictions as 36,601 permits were issued in 1996, almost 4 permits for every cow that could be taken. The management objective of increasing the cow harvest was met with a record 2519 cows taken in 1996. The 1997 harvest declined to 1151 because the winter season was closed by emergency order. The harvest of cows would have been even higher had the NCH not been dispersed over the most remote portions of the unit during both fall hunts. Problems with managing the Tier I hunt focus around the large number of permits issued. Crowding, competition, and a decline in hunter ethics are important issues associated with increased hunting effort. Another important concern involved the potential for overharvests as the number of permits issued greatly exceeded the cow harvest quota. There is no effective and timely way to monitor harvests in the field and issue an emergency order to prevent overharvesting should caribou become very accessible during the open season.

The Unit 13 federal hunt, Hunt RC513, is a registration hunt for residents of Units 13, 11, and 12 along the Nabesna Road and Delta Junction in Unit 20. The number of participants and harvest have somewhat stabilized the last 2 years after a decline in both participation and harvest that was attributed to a reduction in available federal lands for hunting following state land selections. The state selected most of the federal lands in Units 13B and 13E along the Denali Highway that were previously open to caribou hunting. Under federal regulations, state-selected lands are currently not open to federal subsistence hunting. The 1997 harvest of 164 caribou is well below the 1991 harvest of 647 (Table 2) when this hunt first opened. However, the potential for a high harvest under this hunt still exists because the fall caribou migration route between Paxson and Sourdough along the Richardson Highway is still on federal land that is open to hunting. 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.

The state RC 460 registration hunt in Unit 12 is opened when the NCH migrates into Unit 12 but is not yet mixed with Mentasta Caribou Herd. This hunt allows Alaskan residents, especially Unit 12 residents, the opportunity to harvest a caribou when these animals are available. Season dates and bag limits are controlled by emergency order. Harvests are low and have fluctuated between 155 and 361 bulls (Table 2); however, the hunt is very popular and has the potential for a high harvest if allowed.

The Unit 12 federal hunt, Hunt 512, is a local subsistence hunt 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. The U.S. Fish and Wildlife Service administer this hunt at the Tetlin National Wildlife Refuge. The hunt has not been held in 3 years, and harvests were very low when it was open (Table 2).

The state drawing permit hunt DC590 is for any caribou and is held in Unit 14B. It is the only NCH hunt that is not a subsistence hunt and is open to both residents and nonresidents. Up to 100 permits are issued and bulls predominate in the harvest, but the overall take has been very low, varying from 6–22 animals during this reporting period (Table 2).

Hunter Residency and Success. Only Alaskan residents are allowed to hunt Nelchina caribou in Units 13 and 12. Nonresident hunters are allowed to hunt the NCH only in 14B under a drawing permit hunt, but there were no successful nonresident applicants during this report period. Table 4 lists hunter residency for local (Unit 13) or nonlocal hunters and their success for the state Tier I and II hunts only. Most of the Tier I and II permits were issued to non-local Alaskan residents. Local hunters comprised 5–13% of the total Tier I and Tier II hunters and took 3–6% of the total harvest. Both federal hunts are open only to residents of defined subsistence zones; local rural residents harvest caribou from these federal hunts.

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 3 years, both successful and unsuccessful permittees spent approximately 2 additional days hunting because caribou were in more remote portions of the unit. In 1997 successful and unsuccessful hunters spent 6 and 8 days, respectively, in the field.

Hunter success for all hunts declined from 62% in 1993–94 to 29% in 1996–97. The decline in hunter success was primarily attributable to the large increase in the number of permits issued. Another factor that affects hunter success in the Tier II hunt is the way permits are issued to the same high scoring individuals every year. Because of this, a Nelchina permit is not the valued prize it was under the old drawing system when an individual was fortunate to get drawn for a permit every 3 or 4 years. Because of the way Tier II applications are scored, up to 3 members of the household that apply may receive a permit. Consequently, the number of permits issued in a household may exceed the need for caribou meat for that household, especially if a moose is also taken.

Harvest Chronology. The early fall caribou season occurs in August and September and is the most popular time to hunt caribou. Sixty to 90 percent of the yearly harvest occurred between 1 August and 20 September during this reporting period (Table 5). Harvests are higher in September because of the onset of the rut, when bulls are more vulnerable. Hunting pressure also increases during moose season by hunters on combination hunts. Historically, late fall and winter seasons have been important, with high harvests in those years when caribou remain in Unit 13. During 1997–98, when caribou delayed their migration out of Unit 13 until late October and early November, 34% of the total harvest occurred the last week in October and first week of November. The chronology data for the 2 years of the Tier I hunt showed a similar timing of harvests as observed in the Tier II hunt, except the late fall and winter season was only opened during the 1996–97 season. Chronology data for the federal hunt reflects the timing of caribou movements onto federal land during open season. The harvest in Unit 12 is entirely during early winter, which is the time the season is open.

Transport Methods. For successful Tier I and II subsistence hunters during this report period, 4-wheelers were the predominant transportation, followed by highway vehicles and snowmachines (Table 6). During the early 1990s, highway vehicles were the most important method of transportation, but in 1993 success rates for hunters using 4-wheelers began to climb. The use of snowmachines has fluctuated widely and is dependent on the availability of caribou during the winter hunt. Highway vehicles have been the most important transportation method in the federal subsistence hunt (513) and the Unit 12 state registration hunt RC460, with 60–80% of successful hunters reporting their use. Aircraft were the most important transportation method in the Unit 14B drawing hunt, with 50–80% of successful hunters using aircraft to access the field.

Other Mortality

The mortality rate during 1996–97 for radiocollared cows was estimated at 15%. The 1997–98 mortality declined to 5%, a figure closer to historical observations. Reasons for this high mortality rate in 1996–97 are unknown. Tracking flights are not conducted frequently enough to determine the specific cause of mortality.

Wolves are present throughout the NCH range and predation by wolves is thought to be an important source of mortality that has probably increased during this reporting period. During the early to mid 1980s, the number of wolves occupying both the core Nelchina caribou range and winter range was relatively low because of high human harvests. Since 1988 wolves have increased over most of the Nelchina caribou range, especially in Subunit 13A adjacent to the core calving grounds. The 1998 wolf estimate of 12 wolves/1000 km^2 (Testa, ADF&G files) in 13A is one of the highest for the core calving ground in over 20 years. The fall 1998 population estimate of over 500 wolves unitwide is the highest in over 25 years. Ballard et al. (1987) reported Unit 13 wolves preyed primarily on moose and did not follow migrating caribou out of the pack territory but did utilize caribou whenever easily available. Increased wolf predation on caribou calves is supported by the observed decline in fall calf:cow ratios in recent years. The increase in the NCH may actually be contributing to increased wolf numbers because of a larger prey base available during the critical period when wolves are whelping pups. In recent years caribou have dispersed over large portions of the unit during the summer, becoming available to more packs that are raising pups, allowing higher pup survival.

An important factor limiting winter predation on caribou by wolves in Unit 13 is the migratory pattern of the NCH. A large percentage of the caribou in the NCH leave Unit 13 in October and do not return from wintering areas in Units 12 and 20 until April, and thus are unavailable to Unit 13 wolves. Wolf predation on caribou when they winter out of the unit is unknown; however, wolves are abundant in Units 12 and 20E and caribou are being taken (C. Gardner, pers. commun.). Grizzly bears are present and considered numerous throughout the NCH summer range. Grizzlies are also known to be important predators of caribou (Boertje and Gardner 1998); however, predation rates and their effects on the NCH are unknown.

Winter snow accumulations have been at or below average in Units 13, 12, and 20E during this reporting period and probably have had little influence on overwinter mortality.

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 and the result was an overall 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 resulted in 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 all the preferred lichen species virtually eliminated. In this area caribou have 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.

Initial research in the early 1990s designed to evaluate body condition in various caribou herds led to the conclusion that Nelchina animals were in poorer body condition than animals from the Alaska Peninsula or the Mulchatna Caribou Herds (Pitcher 1991).

Beginning in 1992 management efforts have included an evaluation of body condition of the NCH animals by monitoring fall and spring weights of female calves. Since 1992 weights of female calves have ranged between 103 lbs. and 126 lbs. Overall, female calves from the NCH are the lightest of the interior herds (Valkenburg, ADF&G Files 1998). The lowest weights were obtained in 1996 when summer drought limited forage and resulted in a reduced level of nutrition. The NCH has the genetic potential to produce heavier cows provided adequate nutrition is available. Female calves from the Kenai that are descended from the NCH animals translocated in 1986 and 1987 weighed up to 145 lbs. and were among the heaviest in the state

(T. Spraker, pers. commun.). Analysis of body condition since 1992 leads to the conclusion that the NCH is more nutritionally stressed than other interior herds due to overstocking of the range for a number of years.

Neonatal calf weights were obtained on the calving grounds in Unit 13A during the peak of calving beginning in 1996. Weights have fluctuated lightly between years and are 1–2 lbs. less than those from the adjacent Mentasta herd, but additional data are needed before comparisons and conclusions concerning neonatal calf weights are possible.

Enhancement

Caribou habitat enhancement is dependent on the occurrence of wildfire or controlled burns. The Copper River Basin Fire Management Plan, an interagency plan, designates areas in Unit 13 where wildfires will not necessarily be suppressed. The plan provides for a natural fire regime to benefit wildlife habitat. Wildfire promotes lichen growth, and thus effective long-term 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 the caribou carrying capacity. In spite of the plan and benefits of wild fire, recent wildfire starts in Unit 13 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. Planning is also underway for a controlled burn in the Alphabet Hills and Lake Louise Flats to improve moose and caribou habitat.

NONREGULATORY MANAGEMENT PROBLEMS/NEEDS

Current management needs include (1) monitoring range condition, (2) continued monitoring of body condition parameters, (3) determining sources and rates of natural mortality, and (4) minimizing land use activities that adversely affect the Nelchina range.

The immediate repair and reading of the existing Nelchina range stations is needed if they are to remain a useful tool for evaluating range condition and trend. Additional stations should be added in important habitats such as the Eastern Talkeetna Mountains and wintering grounds in eastern Unit 13 and Units 11 and 12.

The department should continue to monitor the body condition of Nelchina caribou. 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 and grizzly bear predation rates on Nelchina caribou are unknown as are other sources of mortality. To determine sources of mortality, more radio collars are needed and the monitoring intensity should be increased. 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 the use of 4-wheelers for caribou and moose hunting, and snowmachines for winter recreational use may be intense enough to disrupt normal caribou behavior patterns. I recommend the potential impacts of ORV and snowmobile use in Unit 13 be evaluated and a plan for future use of these vehicles be developed. This should entail a joint planning process with landowners, other regulatory agencies, and the public.

CONCLUSIONS AND RECOMMENDATIONS

The 1998 NCH herd estimate indicates the size of the herd has declined and is within the current management objective of 35,000–40,000 caribou. Calf production in the NCH remains high overall. Declines in calf productivity do occur occasionally, such as in 1997 when the calf:cow ratio was the lowest ever observed. Most declines in calf production have been attributed to lower pregnancy rates due to reduced forage production or availability because of severe winter conditions, summer droughts, or cold summers with late spring and early fall snow conditions. Cameron and Ver Hoeff (1994) found that when body condition of cows declined, caribou skipped a calving interval until body condition improved. Calf mortality from spring to fall is reflected by calf/cow ratios obtained during fall composition counts during the rut. The level of summer calf mortality has increased in recent years. Since the fall of 1995, the calf:cow ratio has been below the management objective of 40:100.

Bull:cow ratios in both 1997 and 1998 are the lowest observed and well below the management objective of 40 bulls:100 cows in the NCH. Composition data for the bull segment of the population show most of the decline has occurred in the large bull category. Heavy harvests on the bull segment during the fall seasons by subsistence hunters is the reason for the decline in the bull:cow ratio and the number of large bulls. Subsistence hunters select for older, larger bulls when they are available. Bull:cow ratios should be increased to the management objective of 40:100 as soon as possible to ensure the presence of enough large bulls during the rut. While young bulls are capable of breeding, large bulls are considered essential for an efficient and timely rut. Cows are stimulated and estrus induced by bull physiology and behavior. Synchrony of the rut is important to achieve synchrony in parturition, which provides a survival advantage for calves.

Cow harvests need to be maintained in order to limit the population size within the management objective of 35,000–40,000 caribou. The yearly harvest objective for cows should be based on the annual recruitment as well as overall population size. Because almost all of the NCH has wintered out of Unit 13 in recent years, a substantial portion of the cow and bull harvest must be taken during fall. To accomplish this, regulations requiring hunters to kill cows are necessary, and I am recommending establishing separate cow and bull harvest quotas for the Tier II hunt. When the quota for bulls is reached, the taking of bulls could be closed by emergency order, and the hunt could remain open for harvesting cows. I also recommend eliminating the Tier I hunt. An unlimited registration hunt puts too many hunters in the field, creates unacceptable hunt conditions, and has the potential for overharvests. With predicted harvest quotas of about 1500 cows a year for the next few years, it is unrealistic to continue issuing 30,000 Tier I permits.

The 1998 NCH estimate indicates the size of the herd has declined and is within the current management objective of 35,000–40,000 caribou. I recommend keeping the management objective for the NCH at this level. Between 1989 and 1996 the herd exceeded this stocking level and even reached 50,000 in 1995. Current data indicate NCH animals are born later, are smaller at birth and as yearlings, and produce their first calf a year later than caribou from other interior herds. Currently, the NCH shows signs of a nutritionally stressed herd. In addition to body condition trends, range station studies indicate a decline in forage quality and quantity on the critical calving grounds as the herd increased in size in the mid to late 1980s (Lieb 1994). Messier et al. (1988) reported reduced nutritional levels and productivity in the George River Caribou Herd as the herd size increased. Maintaining between 35,000–40,000 animals in the herd is thought to represent an appreciable enough decline from 50,000 to allow some range recovery, while still providing for fairly substantial annual harvests. I also recommend additional research directed at evaluating body condition, productivity with forage condition and quality to evaluate the current 35,000–40,000 herd stocking objective.

Another important issue is the proliferation of 4-wheelers and snowmachines. The increased use of these vehicles raises questions of animal disturbance. During summer migrations, heavy hunting pressure, especially associated with 4-wheeler use, may be influencing summer habitat use. As hunting effort has increased near the Denali Highway, caribou use of this area has declined. Obviously, observed changes in caribou movements cannot be attributed conclusively to hunting and 4-wheelers because caribou continually change habitat use. Field observations, however, indicate that caribou moving toward the Denali country turned around when faced with heavy 4-wheeler hunting pressure. Also, the recreational use of snowmachines has increased tremendously. This increased use could cause disturbance of wintering caribou that eventually causes them to abandon portions of their winter range. The short-term impact of snowmachine disturbance is increased energy expenditure and reduced time foraging. Effects of vehicles on NCH caribou need to be considered in future land use planning activities by BLM and DNR for federal and state lands used by the herd.

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Table 1 Nelchina caribou fall composition counts and estimated herd size, 1993–1998

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
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
1997/98	26	26	17	66	17	3,553	26,438	31,893	34,894
1998/99	21	38	24	63	13	2,394	29,338	38,552	44,192

[a] Spring census.

Table 2 Nelchina caribou harvest data by permit hunt, 1993–98

Hunt No. /Area	Regulatory year	Permits Issued	Percent did not hunt	Percent Successful Hunters	Percent Unsuccessful hunters	Bulls	(%)	Cows	(%)	Unk.	Total Harvest
TC566[a]	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
	1996/97	9,980	31	27	73	1,722	(100)	0	(0)	6	1,728
	1997/98	10,000	27	31	69	2,078	(100)	2	(0)	17	2,097
RC567[b]	1996/97	36,601	62	32	68	726	(22)	2,519	(78)	10	3,255
	1997/98	25,376	71	30	70	438	(28)	1,151	(72)	12	1,601
RC513[c]	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	1,659	22	20	80	117	(53)	105	(47)	5	227
	1996/97	1,639	29	21	79	167	(61)	108	(39)	2	277
	1997/98	1,618	22	10	90	105	(65)	58	(35)	1	164
RC460[d]	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	(1)	1	247
	1996/97	2,044	12	21	79	347	(97)	11	(3)	3	361
	1997/98	632	14	29	71	150	(98)	3	(2)	2	155
RC512[e]	1993/94	34	44	58	42	11	(100)	--	--	--	11
	1994/95	97	35	38	62	24	(100)	--	--	--	24
	1995/96	No hunt									
	1996/97	No hunt									
	1997/98	No hunt									

Table 2 Continued

Hunt No. /Area	Regulatory year	Permits Issued	Percent did not hunt	Percent Successful Hunters	Percent Unsuccessful hunters	Bulls	(%)	Cows	(%)	Unk.	Total Harvest
DC590[f]	1993/94	40	48	29	71	4	(67)	2	(33)	0	6
	1994/95	60	53	21	79	5	(83)	1	(17)	0	6
	1995/96	100	46	41	59	13	(59)	9	(41)	0	22
	1996/97	100	63	19	81	5	(71)	2	(29)	0	7
	1997/98	100	57	26	74	7	(70)	3	(30)	0	10
Totals for	1993/94	11,379	21	62	38	3,226	(61)	2,015	(39)	29	5,281
all permit	1994/95	10,194	26	48	52	2,731	(77)	822	(23)	20	3,573
hunts	1995/96	14,748	22	43	57	2,986	(61)	1,907	(39)	23	4,916
	1996/97	50,349	52	29	71	2,944	(53)	2,639	(47)	18	5,601
	1997/98	37,730	56	30	70	2,778	(70)	1,217	(30)	32	4,027

[a] Tier II subsistence drawing permit.

[b] Tier I subsistence registration permit.

[c] Subsistence registration for local residents, administered by BLM as federal hunt RC513 in 1990.

[d] A winter registration hunt for residents of Alaska in GMU 12.

[e] Subsistence registration for Unit 12 residents, administered by Fish and Wildlife Service as Federal Hunt RC512.

[f] A drawing sport hunt.

Table 3 Nelchina caribou harvest and accidental death, 1993–98

Regulatory	Reported						Estimated			Accidental	Grand
Year	M	(%)	F	(%)	Unk.	Total	Unreported	Illegal	Total	death	total
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
1996/97	2,944	(53)	2,639	(47)	18	5,601	500	300	800	200	6,601
1997/98	2,778	(70)	1,217	(30)	32	4,027	500	300	800	200	5,027

Table 4 Nelchina caribou Hunt TC566 annual hunter residency and success, 1993–98

	Successful				Unsuccessful				
Regulatory	Local[a]	Nonlocal			Local[a]	Nonlocal			Total
year	resident	resident	Nonresident	Total	resident	resident	Nonresident	Total	hunters
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
1996/97[b]	180	4,803	--	4,983	541	11,085	--	11,626	16,609
1997/98[b]	124	3,574	--	3,698	492	8,072	--	8,564	12,262

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

[b] Tier I and II combined.

Table 5 Nelchina caribou Hunt TC566 annual harvest chronology percent by harvest period, 1993–98

	Harvest Periods														
	Weeks (fall)								Months (winter)						
Regulatory year	1	2	3	4	5	6	7	8	Oct.	Nov.	Dec.	Jan.	Feb	Mar.	*n*
1993/94	6	11	11	7	8	6	7	--	--	-	--	21	7	16	4691
1994/95	4	9	11	9	15	13	14	--	--	--	--	21	1	3	3069
1995/96	6	9	10	7	10	11	10	--	--	5	6	4	5	17	4396
1996/97	6	12	12	9	9	13	16	15	3	2	1	1	1	1	1673
1997/98	4	5	5	8	9	9	12	10	10	24	2	1	0	1	2052

Table 6 Nelchina caribou Hunt TC566 harvest percent by transport method, 1993–98

	Percent of harvest								
Regulatory year	Airplane	Horse	Boat	3- or 4-Wheeler	Snowmachine	ORV	Highway vehicle	Unk.	*n*
1993/94	5	1	6	22	26	8	31	1	4738
1994/95	6	1	8	36	14	11	23	1	3103
1995/96	6	1	10	31	19	8	23	1	4457
1996/97	9	1	13	41	5	11	18	2	1728
1997/98	9	1	10	28	22	9	19	1	2097

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, was resident in Unit 18. This herd was located in the Kilbuck and Kuskokwim mountains southeast of Bethel. Radiotelemetry locations have shown 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. Conservative management techniques were used to protect this small, discrete, resident herd in the Kilbuck Mountains. Since 1994 and through this reporting period, 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 has severely restricted data collection for the KCH and has caused a reevaluation of caribou management strategy objectives 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 in recent years this study 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. The department joined the local residents and user groups to begin the process to develop the Kilbuck Caribou Herd Cooperative Management Plan (KCHCMP). The cooperative management process continues to provide an instrumental forum to discuss management with local residents in Unit 18.

MANAGEMENT DIRECTION

MANAGEMENT OBJECTIVES

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

1. Changing the harvest in response to population size of the KCH as follows:
    - No harvest allowed when the population is <1000 animals.
    - Allow a 5% harvest when the population ranges between 1000–3000 animals.
    - Allow a 7.5% harvest when the population ranges between 3000–5000 animals.
    - Reevaluate the harvest and strategy when the population exceeds 5000 animals.
2. Gathering accurate harvest information for the KCH.
3. Increasing compliance with caribou hunting regulations.

The presence of overwhelming numbers of Mulchatna caribou within the range of the KCH in Unit 18 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, the harvest and management strategies for the KCH are being reconsidered.

METHODS

The cooperative study of the KCH was continued during the reporting period. Department and FWS staff completed multiple radiotracking flights using fixed-wing aircraft to monitor radio collars in both the Kilbuck and Mulchatna herds during 1996–1998. Near the end of this reporting period, we were monitoring 31 radio collars deployed within the "traditional" range of the Kilbuck Herd and 67 radio collars deployed elsewhere on Mulchatna caribou. Caribou locations were mapped using Global Positioning System (GPS) equipment. Detailed methodology for Kilbuck caribou radiotelemetry study is available in Hinkes (1989) and Ernst (1993).

Management planning meetings took place from December 1990 through November 1995 and included users of the caribou resource and management agencies. Contact with the members of this group has been maintained throughout the reporting period. However, since the area biologist died in November 1996, there has been an interruption of regular meetings by the group.

RESULTS AND DISCUSSION

POPULATION STATUS AND TREND

Population Size

Before 1994 the KCH population remained small but was growing and expanding its range when it was overrun by approximately 35,000 Mulchatna caribou in September/October 1994. A second influx of approximately 36,000 Mulchatna caribou occurred during the fall of 1995. In 1996 and 1997 similar influxes and mixing of caribou occurred (Table 1). Data collection on the formerly discrete Kilbuck Herd is now impossible. Therefore, neither census nor composition surveys were conducted.

Prior to the presence of Mulchatna caribou, a minimum population estimate of 4220 caribou in the KCH was derived from an aerial census conducted in late 1991. Since then, we have had low predation rates, mild winters, and mixing with Mulchatna caribou. How these factors influence KCH population growth is difficult to determine. Population size not only depends on reproduction and survival but also on the interpretation of what constitutes a "herd" and the ramifications of mixing with the MCH.

Until 1994 we considered the KCH a distinct resident population in Unit 18. Since then, we have observed mixing of the KCH and the MCH and seasonal emigration of KCH from Unit 18 when the MCH returned to calving grounds in Unit 17. We have also seen continued seasonal immigration and range expansion of Mulchatna caribou into Unit 18. At this time the KCH no longer appears to be a distinct herd in Unit 18. However, there has been continual interest and progress achieving management goals among members of the cooperative management working group. This progress has focused on the KCH and, largely because of this, it is still worth considering the KCH a distinct herd in Unit 18.

Population Composition

Because of the influx of Mulchatna caribou, we did not attempt to obtain population or composition data for the KCH during the reporting period. However, during brown bear survey flights in May 1998, we observed caribou calving in poorly aggregated groups in traditional Kilbuck calving areas.

Distribution and Movements

Cooperative efforts between the department and FWS to document the distribution of the KCH and, more recently, the MCH in Unit 18 continued through the reporting period. During the fall of 1996 and 1997, approximately 25–40,000 caribou from the MCH moved into lower Kuskokwim River drainages, occupying an area extending from the Whitefish Lake area near Aniak as far south as the Goodnews River drainage. They shared ranges with the KCH until late March when they began moving into Units 17A, 17B, and 19B.

Occasionally, caribou are reported west of the Kuskokwim River. These reports are sporadic and no long-term presence of caribou west of the Kuskokwim River has been established.

MORTALITY

Harvest

Season and Bag Limit

Units and Bag Limits	Resident Open Season (Subsistence and General Hunts)	Nonresident Open Season
Regulatory year 1996–1997		
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:		
2 caribou total		
One bull by registration permit OR up to 2 caribou	1 Sep–30 Sep Season between 1 Oct–31 Mar may be opened by emergency order	
NONRESIDENT HUNTERS:		No open season.
Regulatory year 1997–1998		
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:		
Up to 5 caribou	Season to be announced by emergency order	
NONRESIDENT HUNTERS:		No open season.

Board of Game Actions and Emergency Orders. To prevent overharvest of Kilbuck caribou, managers opened the winter caribou season by emergency order only when enough Mulchatna caribou were present in Unit 18 to overwhelm the smaller resident Kilbuck herd. In late September 1996, an emergency order was issued to increase the bag limit to 2 caribou and to extend the season from 1 Oct 1996–31 March 1997 in Unit 18 south of the Yukon River.

For the Spring 1997 meeting, the Board of Game accepted an Agenda Change Request from the Kilbuck Caribou Planning Team and considered a proposal to allow taking up to 5 caribou during a season announced by emergency order in the portion of Unit 18 south of the Yukon River. The board adopted the proposal as regulation and the department issued an emergency order on 22 August 1997 to open the season from 25 August 1997–31 March 1998 with a bag limit of 5 caribou.

Hunter Harvest. During the 1996 state fall hunting season (1 Sep–30 Sep), an undetermined number of registration permits were issued. (The actual number is difficult to reconstruct due to the death of the previous area biologist). After this registration permit hunt, 24 hunters reported harvesting 32 caribou, including 26 bulls and 6 cows.

In 1996–1997, a general hunt from 1 October–31 March was opened for residents by emergency order. After this hunt, 9 unsuccessful hunters reported hunting in Unit 18. Successful hunters reported taking 69 bulls and 17 cows for a total of 86 caribou. Residency of the hunters includes 62 hunters living in Unit 18, 1 successful hunter and 2 unsuccessful hunters residing outside Unit 18, and 1 successful hunter did not report residency.

Total reported harvest for 1996–1997 was 118 caribou. These reports need to be viewed as absolute minimum harvest figures. Anecdotal information from local residents suggests that up to several hundred caribou may have been taken between November 1996 and the end of March 1997, but the harvest was not reported.

In 1997–1998, a general hunt from 25 Aug–31 Mar was opened for residents by emergency order. After this hunt, 68 successful hunters reported taking 98 bulls and 32 cows for a total of 130 caribou in Unit 18. There were 10 unsuccessful hunters reporting at the end of the season. Residency of the hunters includes 67 hunters living in Unit 18 and 9 successful hunters and 2 unsuccessful hunters residing outside Unit 18.

Natural Mortality

Little information is available regarding natural mortality of Kilbuck caribou. 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 an important prey species for these wolf packs. Wolf sightings are becoming more numerous in the Kilbuck Mountains.

Another source of mortality may be predation by brown bears. Brown bears are numerous in the Kilbuck and Andreafsky mountains. However, we do not have any estimate of predation rates on Kilbuck caribou.

HABITAT

Assessment

The lichen ranges in the Kilbuck and southern Kuskokwim Mountains are in excellent condition and could support more caribou. 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 have not been grazed by caribou for the last 100 years, and not by reindeer for the last 60 years. We believe the range in Unit 18 could support many more caribou.

COOPERATIVE MANAGEMENT PLAN

The KCH Cooperative Management Plan was developed and finalized on October 6, 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 Nov 1995 to allow new regulations with different seasons and bag limits while Mulchatna caribou are present in Unit 18. Even though the distinctiveness of the KCH has become uncertain as it mixes with Mulchatna caribou arriving in Unit 18, the Cooperative Planning Group has agreed to remain a forum for discussion of caribou management within the unit.

CONCLUSIONS AND RECOMMENDATIONS

Since 1986 the FWS and the ADF&G have cooperatively studied the KCH. 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 12 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 it was engulfed by very large numbers of Mulchatna caribou beginning in late October 1994. Since the arrival of Mulchatna caribou, it has been impossible to distinguish the KCH from the MCH. Radio collar locations of Kilbuck caribou show that Kilbuck caribou have been mixing with Mulchatna caribou and have regularly left 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 number of caribou in eastern Unit 18, regardless of whether they are of 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, calving ground surveys, and to assist in determining appropriate seasons established by emergency order. Radiocollars 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 further investigation. Additional animals from both herds should be radiocollared to better determine their entire range and movements.

The MCH has continued to grow dramatically 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 has become seasonally indistinguishable from the Mulchatna Herd. This situation will probably continue until the MCH eventually declines and retreats from Unit 18. If and when that happens, it is our hope that a small remnant herd of caribou will remain in the Kilbuck Mountains.

We should attempt to recognize the impact of the growth of the Mulchatna Herd on smaller herds, such as the Kilbuck Herd, especially when setting management objectives and proposing regulations. 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:

- Complete an annual census after the rut between the end of October and early December, depending on snowfall. However, the census may need to be completed in the summer when there is maximum separation of the Mulchatna and Kilbuck herds.
- Complete composition surveys annually during October.
- Complete calving surveys in late May or early June of each year.
- Maintain a minimum of 1 radiocollared animal per 500 animals in the KCH. This may prove impossible if range overlap with the Mulchatna Herd remains extensive.
- Collect better harvest information.

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Table 1 Number of caribou in eastern Unit 18, 1991–1997

Year	Caribou in eastern Unit 18	Comments
1991	4220	KCH still discrete
1994	35,000	First year of mixing of KCH and MCH
1995	36,000	
1996	25,000–40,000	
1997	25,000–40,000	

LOCATION

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

HERDS: Beaver Mountains, Big River–Farewell, Rainy Pass, Sunshine Mountains, and Tonzona (McGrath area herds)

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

Historically, caribou have played an important role in this area. Although documentation is poor, discussions with village elders and reports of early explorers (Hemming 1970) support the idea that caribou sporadically existed in far greater numbers and over a greater range during the 1800s than presently. I suspect the Mulchatna caribou herd once roamed throughout the Kuskokwim Basin, but as numbers dwindled, they retreated to the better range to the south (Whitman 1997). As the Mulchatna Herd continued to increase during the 1990s (the 1996 summer estimate was over 200,000 animals), it increased its winter range northward and began 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 rather than the influence of reindeer genes.

Caribou herds in the Kuskokwim Mountains north of the Kuskokwim River were described 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 Sunshine Mountains. 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) were previously called the Kuskokwim Mountains Herd. Based on Pegau's work, there are only 2 groups of caribou in the Kuskokwim Mountains that warrant herd status: Beaver Mountains and Sunshine Mountains.

Herds presently recognized south of the Kuskokwim River include the Tonzona, Big River–Farewell (previously called Big River), Rainy Pass, and Mulchatna herds. Radiocollaring

confirmed the separate identity of the Tonzona Herd, although there is some interaction between this herd and the Denali Herd (Del Vecchio et al. 1995). 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 during the following year and did not return for at least 2 years. These observations raised as many questions as they answered, and the discreteness and extent of the range of the Big River–Farewell Herd is still poorly understood.

The Rainy Pass area and the drainages at the head of the South Fork Kuskokwim River and surrounding area are inhabited by resident caribou. These caribou constitute 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 expansion into more northerly areas by the Mulchatna caribou herd has increased its availability to village hunters in all Kuskokwim River villages downstream from Nikolai, including hunters from major population centers of McGrath and Aniak. The Big River–Farewell, Tonzona, and Rainy Pass herds have generally been harvested by hunters who fly into the area primarily for sheep, moose, and bison hunting. Harvest from the Beaver Mountains and Sunshine Mountains herds has totaled less than 15 caribou per year since winter seasons were suspended.

MANAGEMENT DIRECTION

MANAGEMENT GOALS/OBJECTIVES

- Ensure that hunting does not cause or continue declines of caribou herds or reduce bull:cow ratios to unacceptably low levels in Units 19 and 21.
    - Periodically estimate herd size, bull:cow ratios, and trend of the herds south of the Kuskokwim River as funds allow.
    - Determine the seasonal ranges and discreteness of the southern Kuskokwim herds, specifically the Big River–Farewell and Rainy Pass herds as soon as funding becomes available.
- Provide for continued consumptive use of caribou.
    - Maintain an open fall hunting season for bulls as long as the bull:cow ratio stays above 25:100 in the Kuskokwim herds.
    - Determine the dynamic consumptive demands for caribou in consultation with the Division of Subsistence.

- Monitor movement of Mulchatna caribou into Units 19 and 21, and open an either-sex season by emergency order during these influxes.

METHODS

We reviewed hunter harvest reports and entered and tabulated harvest data annually. Harvest data were summarized by regulatory year (RY = 1 July–30 June) and do not include Mulchatna Herd animals taken in Unit 19.

Incidental observations of caribou numbers and calving areas were made from small, fixed-wing aircraft.

RESULTS AND DISCUSSION

POPULATION STATUS AND TREND

We did not complete any systematic population surveys during this reporting period. However, Palmer ADF&G and Denali National Park and Preserve staffs completed a count of the Rainy Pass Herd incidental to a sheep survey in Unit 16.

Population Size

The Beaver Mountains Herd has declined since the early 1960s. In 1963 Skoog (1963) estimated 3000 animals. In 1986, Pegau (1986) estimated 1600. In 1992 Whitman (1995) estimated 865 caribou were present, and in 1994 he felt that only 536 remained (Whitman 1997). During early summer 1995, Whitman counted only about 400 animals when the herd was concentrated on its calving area.

The Sunshine Mountains caribou herd has also declined in recent years. Whitman estimated the population was 700 animals in 1994, but in 1995 he estimated only 500 animals. Based on Whitman's observations, the dynamics of this herd seem to mirror those of the Beaver Mountains Herd (and some other small, mountain herds like the Chisana and Mentasta), with predators probably having a major impact on calf survival (Jenkins 1996; Whitman 1997; Mech et al. 1998).

The Rainy Pass Herd probably numbered 2100–2600 caribou. In July 1996, 1093 caribou were counted in Unit 16 incidental to sheep surveys. Whitman (pers commun) suspected that 1000–1500 more caribou of the Rainy Pass Herd were located in Unit 19 and were not counted at that time. Whitman (1997) estimated the Big River–Farewell Herd was 1000–2000 animals.

In 1991, National Park Service staff estimated 1300 caribou in the Tonzona Herd. This estimate was done as a comparison to the nearby Denali Herd that inhabits the national park.

The Mulchatna Herd has grown to over 200,000 animals and has extended its range into the Kuskokwim Drainage. The ranges of the Beaver Mountains, Sunshine Mountains, and Big River–Farewell herds currently overlap with the dynamic winter range of the Mulchatna Herd.

Distribution and Movements

Beaver Mountains. The Beaver Mountains Herd ranges from the Beaver Mountains in the north to as far south as Horn Mountain near Red Devil (Pegau 1986). Calving is in the Beaver Mountains, but postcalving groups are throughout the herd's range. Wintering areas include the north side of the Kuskokwim Mountains from the Iditarod River north to the Dishna River.

Sunshine Mountains. The range of the Sunshine Herd is predominantly in the drainages of the Nixon Fork from Cloudy Mountain to Von Frank Mountain and in the headwaters of the Susulatna River, including fossil mountain and the Cripple Creek Mountains. Calving occurs throughout the range, with wintering areas mostly in the drainages of the Nixon Fork. In midsummer caribou are in the mountains, primarily the Sunshine Mountains.

Tonzona. The Tonzona Herd's range is from the Herron River to the lower Tonzona River near Telida and north to Otter Lake. Summer concentrations are in the foothills of the Alaska Range. Winter range consists of the lower elevation areas from Telida up the Swift River and north to the Otter Lake area (Del Vecchio et al. 1995).

Big River–Farewell. The range of the Big River–Farewell Herd is approximately from the South Fork of the Kuskokwim River southwest to the Swift River. Summering areas are in the foothills on the north side of the Alaska Range. Wintering areas are located in the flats north of the summer range.

Rainy Pass. The Rainy Pass Herd's range is not well known. The herd has been found from the confluence of the Post River south through Rainy Pass to the west side of Cook Inlet. Caribou have been observed throughout the mountains in the summer in both Units 16B and 19C. Wintering areas are largely unknown.

MORTALITY

Harvest

Season and Bag Limit.

Unit/Bag limit	Resident open seasons	Nonresident open seasons
Unit 19A, Lime Village Management Area.		
RESIDENT HUNTERS: 4 caribou.	10 Aug–31 Mar	
4 bulls or 4 cows w/o calves.	1 Apr–9 Aug	
NONRESIDENT HUNTERS: 1 caribou.		10 Aug–31 Mar
Remainder of Unit 19A and all of Unit 19B.		
RESIDENT HUNTERS: 5 caribou, no more than 2 may be bulls.	1 Aug–15 Apr	
NONRESIDENT HUNTERS: 2 caribou.		1 Aug–15 Apr

Unit/Bag limit	Resident open seasons	Nonresident open seasons
Unit 19C		
RESIDENT AND NONRESIDENT HUNTERS: 1 bull.	10 Aug–10 Oct	10 Aug–10 Oct
Unit 19D, drainage of the Nixon Fork.		
RESIDENT AND NONRESIDENT HUNTERS: 1 caribou.	10 Aug–30 Sep	10 Aug–30 Sep
Unit 19D, remainder.		
RESIDENT HUNTERS: 1 caribou.	10 Aug–30 Sep 1 Nov–31 Jan	
or 5 caribou.	Season to be announced.	
NONRESIDENT HUNTERS: 1 caribou.		10 Aug–30 Sep
Unit 21A		
RESIDENT AND NONRESIDENT HUNTERS: 1 caribou.	10 Aug–30 Sep 10 Dec–20 Dec	10 Aug–30 Sep 10 Dec–20 Dec
Unit 21E		
RESIDENT HUNTERS: 1 caribou or 2 additional caribou during winter if season announced.	10 Aug–30 Sep	
NONRESIDENT HUNTERS: 1 caribou.		10 Aug–30 Sep

Board of Game Actions and Emergency Orders. The Board of Game adopted a regulation allowing us to open a season by emergency order in Unit 19D (except the drainages of the Nixon Fork River) if the Mulchatna caribou herd moves north from Unit 17. The bag limit is 5 caribou for resident hunters. This regulation resulted from a March 1997 petition to the board from Peter Tony of Nikolai. The local advisory committee favored this petition and the department supported it. The Mulchatna Herd did not move north into Unit 19D during 1997. They did move north in 1998, and the season was opened by emergency order during 10 November 1998–31 March 1999.

Hunter Harvest. The use of local caribou herds by hunters decreased in Unit 19. During RY 1990–1991 through 1995–1996, the average reported harvest of caribou was 160. During this reporting period, the average reported harvest was 88 caribou (Table 1). I think this decreasing harvest of local caribou herds was directly related to the recent increases in the size of the Mulchatna Herd (Van Daele 1997) and to the change in bag limit from 1 caribou to 1 bull for the Rainy Pass and Big River–Farewell herds (Units 16B and 19C). The greatest harvest decrease over the past 5 years was in the Rainy Pass Herd (Table 2). Harvests from the Tonzona, Beaver

Mountains, and Sunshine Mountains herds have remained relatively stable since RY 1993–1994. Harvests from the Big River–Farewell Herd fluctuated, but the average take from RY 1989–1990 through 1992–1993 was 59 caribou and from RY 1993–1994 through 1997–1998 was 55.

During this reporting period, females composed <1% of the Unit 19 caribou harvest (Table 1).

Hunter Residency and Success. Since fall 1996, migration patterns of the Mulchatna Herd enabled local hunters (Unit 19 residents) to increase their harvest of caribou. The Mulchatna Herd was the only herd readily accessible by boat, and harvest from McGrath area herds by local hunters was low (Table 3). During RY 1989–1990 through 1995–1996, local hunters took <6% of the reported harvest of local caribou herds. During this reporting period, local hunters took <1% of the reported harvest of the local caribou herds. It should be stressed, however, that local users are less inclined to report their hunting activities than are nonlocal and nonresident hunters. During this reporting period, Alaskans who were not local residents harvested about 20%, and nonresidents of the state harvested the remaining 70% of harvested animals. Historically (RY 1989–1990 through 1995–1996) nonlocal Alaskans took 41–53% of the total harvest. Most harvest data came from hunters hunting the Big River–Farewell, Rainy Pass, and Tonzona herds. Primarily guided and nonlocal hunters used these herds.

Hunter success averaged about 55% during this reporting period and historically. Because of disproportionate returns (many unsuccessful hunters do not report), I believe the actual success rates were slightly lower, averaging about 40–50%. This success rate does not include harvest of Mulchatna caribou taken in Unit 19, which if included would increase the success rates to approximately 80%. Fall 1998 checkstation information from the Hoholitna River indicated over 80% success among Mulchatna Herd hunters.

Hunter effort, as measured by the number of days both successful and unsuccessful hunters reported they remained afield, did not change significantly in the past decade. For all Unit 19, 21A, and 21E caribou hunters during this reporting period, the reported length of hunting trips averaged 5.4 days for successful hunters and 7.0 days for unsuccessful hunters. The combined average for the 2 groups was 6.0 days afield.

Harvest Chronology. Most caribou that were not part of the Mulchatna Herd were taken during August and September. During this reporting period, about 35% of the harvest was during August, 64% was in September, and 1% was during October. This harvest chronology did not change significantly in the past 5 regulatory years (Table 4).

Transport Methods. Aircraft were the most common means of hunter transportation to access the small Kuskokwim herds. During this reporting period 82% of caribou hunters used aircraft, 12% of the hunters used 3- or 4-wheelers, 5% used horses, 3% used boats, <1% of caribou hunters used snowmachines, and zero percent of caribou hunters used highway vehicles (Table 5).

Other Mortality

No specific data were collected concerning natural mortality rates or factors during this reporting period. However, I suspect wolf predation is relatively high within most of the McGrath area herds. The low percentage of calves (<1%) and the early calving dates found during survey

flights in the Beaver Mountains indicate the Beaver Mountains Herd is highly productive but suffers from high neonatal mortality. The Sunshine Mountains Herd probably also suffers high predation mortality. Throughout the mid-1990s winters were not as severe as the early 1990s, hopefully reducing the high rates of natural adult and calf mortality witnessed earlier (Whitman 1995).

HABITAT

Biologists have not investigated caribou range conditions in Units 19 and 21 in recent years, but range is probably not limiting. Lichens seem abundant on winter ranges, and these areas supported 4–5 times as many caribou during the 1960s. Body size of adults was also relatively large when radio collars were deployed in the 1980s. Early calving is another indicator that body condition is good.

NONREGULATORY MANAGEMENT PROBLEMS/NEEDS

Our greatest caribou management problem in the Kuskokwim drainage is lack of information. The best example is the Rainy Pass Herd. Comprehensive surveys have never been conducted in the herd's range. We need to document current numbers, composition, and seasonal distribution. Data collection is especially important because hunter use of the Rainy Pass Herd is high. We also need information about the Beaver Mountains and Sunshine Mountains Herds. We think these herds are declining, but definitive data have not been collected about population size, trend, or composition. The only recent information we have about these herds is aerial surveys during the calving period. There has also been little information collected on the Big River–Farewell Herd. Considering the harvest, this herd also should be more closely monitored.

CONCLUSIONS AND RECOMMENDATIONS

We did not make progress achieving current objectives during this reporting period because funding was not available for the management program due to limited funding statewide. These small herds have relatively small harvests, and some of the herds are in logistically difficult locations, making survey work costly. However, coordinating fall surveys with those done in Southwest Alaska could help reduce costs and make surveys on the Kuskokwim herds practical. Additional effort should be focused on basic understanding of the dynamics of Unit 19 and Unit 21 caribou herds. More money and effort should be expended in the area to document herd sizes, composition, and range boundaries.

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Table 1 McGrath[a] area caribou harvest by sex, regulatory years 1989–1990 through 1997–1998

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
1996–1997	94 (100)	0	1	95
1997–1998	79 (99)	1 (1)	1	81

[a] Excludes Mulchatna caribou herd animals taken in Unit 19.

Table 2 McGrath[a] area caribou harvest by herd, regulatory years 1989–1990 through 1997–1998

	Successful Hunters						
Regulatory year	Beaver Mtns	Sunshine Mtns	Farewell/ Big River	Rainy Pass	Tonzona	Unspecified	Total
1989–1990	12	2	49	84	12	9	168
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
1996–1997	5	0	35	42	12	1	95
1997–1998	0	0	44	24	11	2	81

[a] Excludes Mulchatna caribou herd animals taken in Unit 19.

Table 3 McGrath[a] area caribou harvest by location of residence, regulatory years 1989–1990 through 1997–1998

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
1996–1997	3	20	68	91	75
1997–1998	2	16	58	81	72

[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 harvest by month, regulatory years 1989–1990 through 1997–1998

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
1996–1997	0	34	58	0	1	0	0	0	2	95
1997–1998	0	27	52	1	0	0	0	0	1	81

[a] Excludes Mulchatna caribou herd animals taken in Unit 19.

Table 5 McGrath[a] area caribou harvest by transport method, regulatory years 1989–1990 through 1997–1998

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
1996–1997	78	8	0	6	1	2	0	0	96
1997–1998	65	0	0	15	0	1	0	0	81

[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 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 growing Delta Herd eventually swamped the Yanert Herd, and Yanert caribou adopted the movement patterns of the larger herd (Valkenburg et al. 1988).

By the mid-1970s the herd rose from anonymity to a herd of local and scientific importance. Its close proximity to Fairbanks and fairly good access made it popular with Fairbanks 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.

Estimated at 1500–2500 in 1975, the Delta Herd 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 statehood in 1959, 2 wolf control programs have been conducted in the unit. From 1976–1982, state biologists killed wolves from helicopters to increase moose and caribou. From October 1993 to December 1994 state biologists and trappers reduced wolf numbers by trapping to halt the decline of the caribou herd. This ground-based control program was terminated amid considerable controversy. Boertje et al. (1996) summarized the influence of the earlier program 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 remain regional priorities. 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 (Valkenburg 1997).

MANAGEMENT DIRECTION

MANAGEMENT GOALS

Since the mid-1970s, goals for the herd included providing high quality hunts, maximum harvests, and trophy caribou. The recent decline of the herd gave impetus to the current management goals of restoring the herd and resuming 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 6000–8000 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 300–500 caribou.
- Gather information on predator:prey ratios and on the significance of predation and weather as natural mortality factors.
  - Cooperate with Research Study 3.37.

METHODS

We estimated population size using the radio-search 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 28 June 1997 and 29 June 1998 using 5 radiotelemetry-equipped aircraft, including the Beaver.

We conducted composition surveys using 2 R-22 helicopters and Bellanca Scout or Piper Super Cub aircraft. Biologists in the fixed-wing aircraft located the radiocollared caribou. Observers in the R-22s classified caribou that were in groups with radiocollared members and also classified

any 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 search 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 1532 caribou on 3 October 1996 under clear skies and light winds. We classified 1598 on 27 September 1997 again under adequate conditions. Composition data from 1 October 1998 are included in this report for continuity.

We summarized harvest data by regulatory year (RY = 1 July–30 June) and monitored harvest characteristics through permit reports.

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 have varied (Table 1). Survey data indicated the herd increased slightly in 1994 and 1995, but subsequent data indicated a stable or declining trend.

Population Composition

Bull:100 cow ratios have varied considerably since 1990, ranging from 25 to 44. The ratio of large bulls:100 cows improved once the decline ended (Table 1). Most of the short-term variance in bull:cow ratios since 1992 is probably a result of variable behavior and distribution of bulls during counts. Weather can affect herd distribution, 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, the area used for calving extended 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, the area that became the primary calving area by 1993. During the remainder 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.

	Resident season	Nonresident season
Unit 20A: 1 bull by drawing permit only. Up to 100 permits may be issued.	10 Aug–20 Sep	10 Aug–20 Sep

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 RY 1996–1997. As noted previously, harvest was suspended in 1992. The division recommended 75 permits based on improvement in recruitment and large bull:cow ratios. The division issued 75 permits in RY 1996–1997 and RY 1997–1998. The department issued 100 permits in RY 1998–1999 in response to proposals to increase the number of permits. No emergency orders were issued.

Permit Hunts. Both the numbers of hunters and success rates increased in the second year of this hunt. This was probably due to increased awareness of the hunt (Table 2).

Hunter Residency and Success. Local residents of Unit 20 were the most successful caribou hunters (19 during 1996–97 and 32 during 1997–98). Nonlocal residents were next with 3 successful hunters during 1996–97 and 11 during 1997–98. Nonresidents were least successful during both years (Table 2).

Harvest Chronology. During 1996–97 harvest was fairly evenly distributed, with more harvests occurring in September than in August. During 1997–98 most of the harvest occurred during 10 September–20 September (Table 3).

Transport Methods. During 1996–97 successful hunters preferred 3- or 4-wheelers (36) and aircraft (32) to using ORV's (18) and highway vehicles (9) to access the field (Table 4). During 1997–98 most caribou hunters in the subunit used 3- or 4-wheelers (52) and airplanes (14). However, 10 hunters used horses to access the field, which was similar to the number of hunters using ORV's (11) and highway vehicles (11) (Table 4).

Other Mortality

Research staff conducted calf mortality studies, and wolves, grizzly bears, and eagles are primary predators of caribou in the subunit. Details of causes and trends in calf and adult mortality are in research reports and publications (Davis et al. 1991, Boertje et al. 1996, Valkenburg et al. 1996, 1997). Calf and adult survival were poor during the population decline, marking the subunit as part of the intensive management program developed to reduce wolf numbers in order to rebuild the caribou populations. Valkenburg (1997) tested a diversionary feeding program that addressed predation by a wolf pack in the Wells Creek area.

The primary concern is whether the herd will be able to grow or support improved harvests with increasing wolf densities. Wolf numbers are currently high due to the abundant moose population. It is unlikely that the herd will grow substantially at this time and moderate declines are possible.

HABITAT

Assessment and Enhancement

Research and management staff 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 caribou of other Interior herds. Valkenburg (1997) detailed trends in weights of caribou calves.

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 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. Nonetheless, it is unlikely that the herd will grow substantially at this time and moderate declines are possible.

We met the objective to maintain 30 bulls:100 cows and 6 large bulls:100 cows. However, even with favorable weather, meeting management objectives of 6000–8000 and harvest of 300–500 caribou soon is unlikely under current management options. During intensive management planning efforts, we reevaluated population size objectives and concluded that a herd of 5000–6000 caribou is optimal. That planning process is ongoing and objectives do not require modification at this time. However, the objectives currently contain numerous activities that will be deleted during the next reporting period. Only the objectives for population size, harvest, bull:cow ratios, and reducing wolf predation will carry over.

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Table 1 Delta Caribou Herd fall composition counts and estimated population size, 1983–1998

Survey date	Bulls: 100 Cows	Large bulls: 100 Cows	Calves: 100 Cows	Calves %	Cows %	Small bulls %	Medium bulls %	Large bulls %	% Total bulls	Composition sample size	Minimum herd size[a]	% 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
9/27/97	27	9	18	12	69	48	20	32	19	1598	3699	43
10/1/98	44	9	16	10	62	31	49	20	27	1519	3829	40

[a] Numbers of caribou counted during summer survey from the same calendar year.
[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 radio collars.

Table 2 Delta caribou annual hunter residency and success, regulatory years 1996–1997 through 1997–1998

Regulatory year	Successful				Unsuccessful				Total hunters
	Local[a] resident	Nonlocal resident	Nonresident	Total (%)	Local[a] resident	Nonlocal resident	Nonresident	Total (%)	
1996–1997	19	3	0	22 (50)	17	4	1	22 (50)	44
1997–1998	32	11	1	44 (71)	16	2	0	18 (29)	62

[a] Residents of Unit 20.

Table 3 Delta caribou annual harvest chronology by harvest periods, regulatory years 1996–1997 through 1997–1998

Regulatory year	Harvest periods				
	8/10–8/20	8/21–8/31	9/1–9/11	9/10–9/20	*n*
1996–1997	23	23	27	27	22
1997–1998	27	18	14	41	44

Table 4 Delta caribou harvest percent by transport method, regulatory years 1996–1997 through 1997–1998

Regulatory year	Percent harvest by transport method[a]							
	Airplane	Horse	Boat	3- or 4-Wheeler	ORV	Highway vehicle	Unk	*n*
1996–1997	32	0	0	36	18	9	5	22
1997–1998	14	10	0	52	11	11	2	44

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 Yukon, Canada. It has 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 was 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 10,000–20,000 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 due to a combination of high harvests, severe winters, and high numbers of wolves (Davis et al. 1978; Valkenburg and Davis 1989). The population low occurred during 1973–1976 when the herd was 5740–8610 caribou. Due to decreased herd size between 1966 and 1975, the FCH reduced its range size 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.

The FCH began increasing in 1976 in response to favorable weather conditions, reduced harvests, and a natural decline in wolf numbers. In 1990 the herd was estimated at 22,766 caribou (the annual rate of increase during 1976–1990 was 5–10%). During 1990–1995 the herd remained relatively stable with an estimated population between 21,884 and 22,558 caribou.

Within its range, the FCH historically provided much of the food needed by the villages and communities, by Alaskan and Yukon mining camps, and by other early residents. From the late 1800s to World War I, the herd was subject to market hunting in both Alaska and Yukon. 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 Yukon. During the 1970s and 1980s, Fortymile caribou hunting regulations were

designed to benefit the subsistence hunter and to prevent harvest from limiting herd growth. Bag limits, harvest quotas, and season openings tailored to benefit local residents were primarily used to meet these objectives. Hunting seasons were deliberately set to avoid the period when road crossings were likely. Consequently, hunter concentration and harvest distribution shifted from along highways to along trail systems accessed from the Taylor Highway and to areas accessed from small airstrips within the Fortymile and Charley River drainages.

During the 1990s, harvest was further restricted to ensure little impact on herd growth, but harvest regulations became increasingly complex due to dual state and federal management. A spin off from reduced quotas and complex regulations was increased competition between Alaska hunters for the limited quota. In 1994 residents of Tok and members of the Tr'on dek Hwech'in First Nation requested the department, federal agencies, and Yukon Department of Renewable Resources to work with the public to develop a cooperative management plan that benefited herd growth and all users of the herd.

MANAGEMENT DIRECTION

Since the FCH decline in the early 1970s, many residents of Alaska and the Yukon have called for management programs designed to increase herd size. Optimism for herd recovery increased following annual growth of 7–10% during the 1980s. In 1990, representatives of the Yukon Department of Renewable Resources, Canadian Wildlife Service, and ADF&G met in Whitehorse, Yukon to decide management direction for the FCH. All parties were in agreement that the primary goal should be reestablishing the herd in its historic range. This goal was presented to the residents of the upper Tanana/Fortymile Rivers region and was strongly supported. The primary management tools were reduced harvest and, if necessary, predator management.

During development of the Fortymile caribou management program, we failed to foresee the effects of federal subsistence management and special interest politics on our programs. We realized our lack of foresight concerning federal subsistence management when we asked the Federal Subsistence Board (FSB) 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 Alaska National Interest Lands Conservation Act (ANILCA). The federal agencies decided that managing the FCH hunt by a harvest quota without a guaranteed allocation for federally eligible subsistence users violated ANILCA. They felt this ANILCA violation prevented them from following ADF&G's harvest management direction by stopping their hunts before the scheduled closure. Between 1991 and 1995, because of the inability of the agencies to agree on a harvest management direction, the possibility of an overharvest increased and the public contended with more complex regulations.

Another lack of foresight affecting the original plan concerned predator management and public response to it. In 1992 the Alaska Board of Game (BOG) 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 special interest groups to stop us from implementing them. It was obvious to all that were involved in FCH management that a new management direction that included input from the federal agencies and the Alaskan public was necessary.

Many local people were unhappy with FCH 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 (Team) was established. The Team comprised 14 public members representing subsistence users from Alaska and Yukon, sport hunters, Native villages and corporations, and environmental groups and agency representatives from ADF&G, Bureau of Land Management, US Fish and Wildlife Service, National Park Service, and Yukon Department of Renewable Resources. The Team developed a management plan that was endorsed by the BOG, the FSB, and the Yukon Fish and Wildlife Board. The plan included management recommendations for herd population, harvest, and habitat to be used by the BOG and the FSB during their regulatory decision process.

Boertje and Gardner (1998*a*) found consistent evidence that wolf predation was the major factor limiting herd growth. The Team concluded that reducing wolf predation was essential to stimulate and hasten herd growth. The Team recommended a combination of agency conducted nonlethal wolf control and public wolf trapping to reduce wolf numbers and, hopefully, wolf predation.

The following are the current management goals and objectives that were developed by the Team and the Upper Tanana/Fortymile and Eagle advisory committees. The BOG also endorsed them. These goals and objectives will change following completion of the FCH harvest plan in 2001.

Management Goals and Objectives

- Restore 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 5–10% between June 1996 and June 2001.
        - Reduce annual harvest quota to 150 bulls.
        - Reduce calf mortality from wolf predation by reducing wolf numbers by 70–80% on the herd's summer range, excluding Yukon-Charley National Preserve, using a combination of public wolf trapping and nonlethal techniques including wolf fertility control and relocation.
    - Maintain an October bull:cow ratio of at least 35:100.
        - Maintain a bull only harvest at a level that will not cause a reduction in bull numbers.

- Minimize the impact of human activities on caribou habitat.
  - Work with land agencies, landowners, and developers to mitigate developments detrimental to caribou.
  - Maintain a near-natural fire regime.
- Provide for increased caribou hunting, viewing, and other wildlife-related recreation in Alaska and Yukon.

METHODS

Population Census

We censused the FCH between late June and mid July 1988–1998, excluding 1993. We used 3 to 5 spotter planes (Super Cub PA-18 or Bellanca Scout), 1 radiotracking plane (Cessna 206 or Bellanca Scout), 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). All photographs were counted twice, each time by a different person. If counts were within 3% of each other, the 2 counts were averaged; otherwise, photographs were counted a third time. No correction factors were used to account for caribou missed during the search. We derived the population estimate by adding individual caribou counted on photographs to caribou counted from spotter planes.

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

Fall Composition Surveys

Each year we estimated herd sex and age composition between late September and mid October (Table 1). We used a Bellanca Scout to locate most of the herd by radiotracking collared animals. Since 1993 we have used a Robinson-22 helicopter to classify each caribou as a cow, calf, or bull. Bulls were further classified as small, medium, or large based on antler size. We attempted to classify 12–15% of the herd. Since 1996, costs for the composition surveys have been shared between ADF&G, FWS, and BLM.

Spring Composition Surveys

We have not conducted spring composition surveys since 1993 because most of these data are collected during the calf mortality study. 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 for the 1992 survey.

HERD CONDITION

During the report period, we used 3 indices to evaluate herd condition: 1) fall calf weights, 2) percent natality of radiocollared cows, and 3) median calving date. Fall calf weights were obtained during fall capture activities conducted in 1991–1998. We evaluated the other 2 indices by radiolocating at least 50 adult cows (≥3 years old) on a daily basis during calving until 2 days following birth. Median calving date was the day by which 50% of the adult collared cows gave 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 50–70 radiocollared adults. From 1994 to 1998 an additional 50–72 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 radio collars of dead caribou as soon as possible after detection in an attempt to determine cause of death.

HARVEST

Harvest was monitored using registration hunt reports. We analyzed data on harvest success, hunt area, hunter residence and effort, and transportation type. To ensure against an overharvest, successful hunters were required to report their kill within 3 days. During 1996 we used a checkstation to monitor the hunt to further ensure the harvest quota was not exceeded. Harvest data were summarized by regulatory year (RY = 1 July–30 June).

RESULTS AND DISCUSSION

POPULATION STATUS AND TREND

Population Size

The herd grew 4% in 1996, 10% in 1997, and 20% in 1998 due to elevated herd pregnancy rates in 1996 and 1998 and to improved adult and calf survival rates (Boertje and Gardner 1998*b*). As of 26 June, estimated population of the herd was 31,029 caribou (Table 1). Optimal weather conditions and reduced predation, particularly by wolves, contributed to these factors. The wolf population was reduced on the herd's wintering grounds by elevated wolf harvest rates during 1995 and 1996. It was also reduced on the eastern portion of the herd's summer range by public wolf trapping and by ADF&G's wolf relocation program. Favorable winter snow conditions have prevailed since winter 1995–1996, and caribou, in better condition, were more successful evading predation.

Population Composition

During the report period the average fall percent calves in the herd was the highest since the late 1950s. Percent calves in the herd was 18.1% during the herd's growth phase in the 1980s, 16.8% during the stable phase between 1990 and 1995, and 21% between 1996 and 1998 (Table 1). Due to low harvests over the past 18 years, the bull:cow ratio was comparable to lightly harvested

herds and has remained stable. Estimated ratios in late June counts were more variable, probably because June counts are more difficult to do accurately (Table 2). Population modeling predicts the bull:cow ratio will continue to increase if recruitment remains above 30 calves:100 cows, harvest is maintained at the current level of 150 bulls, and the annual survival rate of bulls remains ≥85%.

Distribution and Movements

In 1997 the FCH summered between the upper Salcha River, Mount Harper, and Glacier Mountain. During August and September most of the herd ranged in the Charley River, Copper Creek, upper Salcha and Goodpaster River drainages. The remaining caribou either were in the Birch Creek drainage or in the vicinity of Mount Warbelow and upper Bullion and Hutchinson Creeks. During the rut, most of the herd was in the Mosquito Fork drainage. There were few caribou in the Charley River and North Fork drainages.

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. It was 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 in 1998 was 19 May. The primary calving grounds were between the Three-finger Fork of the Charley River and the upper Salcha River, primarily within the Copper Creek, main Charley, Crescent Creek, Beverly, and Lost Creek drainages. About half of the calves born prior to peak calving were born below treeline due to deep, soft snow conditions. By early June most of the herd moved south onto Mount Harper. In mid June most of the herd was moving to Glacier Mountain following the high ridges between Three-finger Charley and Copper Creek and then along the ridge system separating North Fork drainages from the Seventymile drainages. We conducted the 1998 census on 28 June, and over 97% of the herd (based on radiotelemetry) was between North Peak and Glacier Mountain. The herd ranged primarily between the Goodpaster and Salcha Rivers to upper Birch Creek during August to mid September.

Beginning in mid September 1998, most of the herd traveled southeast and most of the rut occurred in the upper Middle Fork, Goodpaster, and Salcha River drainages. After the rut the herd became very loosely aggregated, and by December it was distributed throughout its summer and winter ranges. Snow depth was below average and did not impede movements or range use.

Annual herd movements were comparable during the report period except that the concentrated calving grounds changed each year. What environmental factors the herd selects for when choosing its primary calving areas are not known, but this year it appeared much of the early calving in the trees was due to an extensive and deep snow pack during mid May. The herd has begun to show greater use of the Birch Creek drainages during late summer and early fall. This distribution pattern increases the herd's vulnerability to hunters along the Steese Highway and its associated trails.

MORTALITY

Harvest

Season and Bag Limit. See Table 3 for specific bag limits and seasons for state and federal hunts.

Board of Game Actions and Emergency Orders. All board actions during 1991–1995 were detailed in Gardner (1993, 1995). In 1996, there were significant policy changes affecting the state and federal hunting seasons and quotas for FCH. During the spring meeting, 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 an overharvest, the board gave ADF&G authority to close the Chicken Trail to caribou hunters using motorized vehicles; limit locales and times registration permits are issued; require a short report period by successful hunters; and enact area, road, and temporary season closures if the herd becomes too vulnerable to harvest.

Since 1996, FCH harvest was allocated between 3 hunts. Registration hunt RC863 was open between 10 August and September in Units 20B and 20D and had an annual harvest quota of 15 bulls. Residents and nonresidents could participate. RC863 was closed by emergency order on 31 August 1996, 5 September 1997, and 27 August 1998. RC865 was open between 10 August and 30 September in Units 20E and 25C and had an annual harvest quota of 85 bulls. Only Alaska residents could participate in this hunt. RC865 was closed by emergency order on 29 September 1996 and 21 August (Unit 25C) and 1 September 1998 (Unit 20E). RC867 had both a federal season (15 November–28 February) and a state season (1 December–28 February) open in both Unit 20E and 25C with a combined quota of at least 50 bulls. RC867's quota included any bulls not harvested during the fall season. Only Alaska residents could participate. RC867 was closed by emergency order on 26 December 1996, 2 January 1998, and 3 December 1998.

In spring 1996 the FSB made the following 2 important decisions in support of the Fortymile Caribou Plan: 1) it adopted the harvest quota of 150 bull caribou for the herd, which meant that both state and federal seasons would close once the quota was reached and 2) it agreed both state and federal hunts would be managed using a joint state/federal registration permit that would be administered by the state. 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 were consistent under state and federal regulations and, compared with past years, they were much easier for hunters to understand (Table 3).

During its spring 1997 meeting, the BOG adopted a regulation allowing ADF&G to conduct nonlethal wolf control between fall 1997 and spring 2001 to benefit the FCH. The program also had to be approved by Governor Tony Knowles following the results of the National Academy of Sciences review of wolf control. Governor Knowles allowed us to proceed in November 1997.

Hunter Harvest. Since RY 1996–1997, the annual Fortymile caribou harvest quota has been 150 bulls. Through the use of registration permits and emergency orders, harvest was limited to 146–154 caribou including illegal kills (Tables 4 and 5). Hunters supported the reduced harvest by voluntarily foregoing hunting Fortymile caribou. During the report period, about 50% fewer hunters participated in the hunt.

Illegal Harvest. Since RY 1992–1993, the number of illegally harvested cow caribou (found or reported) was 3–21 (2–9% of the harvest). 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. More information to help hunters become better at identifying caribou is needed because the bag limit for many caribou hunts around the state is being restricted by sex of the animal or antler conformation. In the ADF&G Tok office, we informed hunters by photographs, pamphlets, and by video as they registered for the hunt. This effort seems effective, based on the Fish and Wildlife Protection officer's observations along the Taylor Highway. I am doubtful that illegal harvest will decline below 3–10% because of the annual influx of hunters with little or no caribou hunting experience and because there are hunters willing to take a chance on questionable animals in order to kill a caribou during a hunt.

Harvest Plan. Following the completion of the Fortymile Caribou Management Plan in 2001, harvest quotas will increase. The current management plan states that harvest will return to at least 2% of herd size at that time. Currently, the Fairbanks, Upper Tanana/Fortymile, Eagle, Delta, and Central advisory committees are drafting a harvest plan to manage Fortymile harvest beginning in 2001. This coalition is currently seeking ideas from Alaska and Yukon publics to include in the plan. Members of the coalition will draft herd population and harvest goals and objectives using input from the Team, the Yukon Fish and Wildlife Management Board; hunting, conservation, and animal welfare groups; and from individuals. The next step will be to develop harvest quotas, season dates, bag limits, harvest allocation, and methods and means, including strategies for managing roadside hunts to meet herd goals. The coalition is also working closely with ADF&G and the federal agencies to ensure the plan is biologically valid and does not violate state or federal mandates. A Yukon harvest plan is also being developed by the Yukon public in close consultation with the Alaska coalition. Herd population goals were agreed to by both planning groups. The Alaska plan will be submitted to the BOG and the FSB in December 1999 for action in spring 2000. The Yukon plan will be submitted to the Yukon Fish and Wildlife Board in 2001.

Hunter Residency and Success. During the report period, 532–880 people annually participated in FCH hunts (Table 6). The number of participants annually in each registration permit hunt were RC863, 64–72 hunters; RC865, 323–589 hunters; and RC867, 114–227. Success rates by hunt ranged from 15–36%, 15–25%, and 18–31% for RC863, RC865, and RC867, respectively. Residency and harvest success information for all hunts combined is included in Table 6.

The intent of the Fortymile Caribou Management Plan was to reduce harvest to the minimum subsistence levels during 1996–2001. Hunts RC865 and RC867 were structured to offer adequate opportunity for those who have the longest history hunting FCH or have the greatest subsistence needs. Before the reduced harvest, 26% of the participants were subsistence hunters who took 21% of the harvest. Since the reduced harvest quota, 39% of the participants were subsistence hunters who took 31% of the harvest. In terms of meeting subsistence needs, the harvest reduction has not been a detriment.

Nonresidents can participate in hunt RC863. The hunt area is remote and is primarily accessed by air. Nonresidents composed 14–28% of the hunters and took 44–74% of the harvest. Air taxi operators flew in all of the nonresidents. Most of the resident hunters accessed the area from the

Steese Highway but were not successful because there are no trails to the areas where the herd ranged.

Harvest Chronology. During the report period, >90% of the FCH was in the upper Salcha and Goodpaster Rivers and Birch Creek drainages during the first 7–10 days of the fall season. About 20% of the herd was accessible to hunters along trails adjacent to the Steese Highway (Unit 25C). As a result, 50–91% of the harvest during the first 2 weeks occurred in that area. In 1998 all but 10 of the 85 bull quota was taken in Unit 25C. It was the intention of the Team that harvest be distributed across the herd's range to meet subsistence needs. If the herd is accessible in one area of its range, the harvest quota will be reached quickly, denying many people the opportunity to hunt. A possible solution to ensure equitable harvest distribution across the herd's range would be to create a third fall registration permit hunt with its own quota that covers Unit 25C. This will be discussed with the BOG in spring 1999.

Since the reduced quota was enacted in RY 1996–1997, harvest primarily has occurred during 3 periods (Table 7). Most harvest occurred during the first week either along the Steese or Taylor Highways when most hunters were in the field. The other 2 periods were during the 1–15 September moose season when hunters were looking for both moose and caribou and 26–30 September when the herd was near the Taylor Highway.

During the winter seasons from RY 1991–1992 to RY 1998–1999, there were caribou available in Units 20E and 25C throughout the season. However, in RY 1998–1999 a greater percentage of the herd was available on opening day; consequently, the winter quota was reached quickly (3 days). Normally temperature, holidays, and available daylight affect harvest timing during the winter season and the season runs 3–4 weeks.

Transport Methods. Transportation types used by successful hunters in each of the 3 registration permit hunts differ. During the report period, successful hunters in RC863 used airplanes 82–88% of the time. This hunt area is remote with no trails and cannot be reached by ground transportation.

During the report period, the 3 most common transportation types used by successful hunters in RC865 were 4-wheelers, airplanes, and highway vehicles. The hunt area is accessible using the Taylor or Steese Highways and is interspersed with trails and suitable landing areas. Herd distribution dictates the most efficient transportation type. In RY 1997–1998 the herd remained in the central portion of its range for most of the season and was accessible only by aircraft, resulting in fewer animals harvested along trails and highways. In RY 1998–1999, much of the herd was close to the Steese Highway and associated trails. Hunters using 4-wheelers and highway vehicles took 79% of the fall harvest. RC867 is a winter hunt and hunters access the herd using snowmachines and highway vehicles along the Taylor and Steese highways. Data for FCH from all 3 hunts reflect these variations (Table 8).

Other Mortality

Boertje and Gardner (1998*a*, 1998*b*) described in detail factors limiting the FCH. In summary, wolf and grizzly bear predation were the most important sources of mortality. Wolves were the most important predator. Wolves killed 2000–3000 calves and 1000–2300 older caribou annually

during 1994–1997. Herd nutritional status was good based on pregnancy rates and calf weights. Antibody screening of blood samples collected since 1980 indicated there were no known infectious diseases affecting population dynamics of the FCH. Winter range is in excellent shape and can support elevated caribou numbers, both in regard to lichen availability on current range and to the availability of vast expanses of winter range formerly used by the herd.

The Fortymile Caribou Management Team used this information to develop management recommendations designed to restore the herd's use of traditional range. The Team recommended nonlethal wolf control methods that were adopted by the BOG. These methods included relocation of all subordinate wolves from the herd's summer range and fertility control of the dominate pairs. All nonlethal control activities are conducted outside Yukon-Charley National Preserve and do not violate NPS policies or mandates.

As of 1 March 1999, 39 subordinate wolves 11 months and older were relocated from the herd's summer range. Through a combination of trapping and relocation, 2 dominant wolves per pack were left in 13 of the planned 15 packs. During the same period, we sterilized 29 dominant wolves. Two of these have died (1 from trapping and 1 killed by other wolves). Of the 5 packs we fertility-controlled before last year's breeding season, no pups were produced, and the fertility-controlled pairs maintained their territory. As a result, wolf numbers were reduced by 84% within the eastern and southern portions of the herd's summer range. Results of the program will be reported in our 2001 Caribou Management Report and in our annual research progress reports.

The impacts of predation, other sources of mortality (drowning, abandonment, disease, etc.), and harvest by humans on the growth of the FCH were also estimated using a population model developed by M McNay (ADF&G). The primary working components of the model are 1) current composition, recruitment, and population data for the FCH; 2) wolf and bear population size estimates; and 3) bear and wolf predation rates on FCH since 1991. The model indicated that wolves and bears combined were removing 21% of the postcalving population while people were removing <2%. The model predicted that the FCH would increase significantly if wolf numbers were reduced by at least 70%. Further reduction of harvest would 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 winters 1991, 1992, 1995, and 1996, 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 (30–60%) (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 and the far eastern portion 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 occurred because many adult cows did not gain sufficient fat to ovulate in 1992. This may have happened because of a 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. Overall, we found consistent data for moderate to high nutritional status in the Fortymile Herd when compared to other Alaska herds (Boertje and Gardner 1998*b*). Also, indices to nutritional status improved when the herd began to increase.

Enhancement

The Alaska Interagency Fire Management Plan, implemented in the early 1980s, should ensure a near-natural fire regime necessary for the long-term management of caribou range in Interior Alaska. In July 1998 we burned 58,000 acres of spruce forest in the eastern portion of the herd's range in Alaska. This area was covered by climax spruce forest. Based on caribou range recovery in adjacent burns, we expect benefits to caribou from this fire within 10–20 years.

One of the goals of the Fortymile Caribou Management Plan is to ensure adequate range for the herd during and after recovery. Team members from both Alaska and Yukon are working with landowners, land managing agencies, and developers to work toward this goal. Current habitat/development issues are mostly related to mining in the herd's calving and postcalving areas. The herd is most sensitive to disturbance during calving and postcalving. The calving period is important because the adult cows are in poor physical condition due to lactation and disturbance will add to their energy demands. This period is critical to the survival and development of calves, and disturbance may increase their vulnerability to predators if they are periodically displaced. Free movements of the large groups that form during the postcalving period are critical. A possible solution to the development issue is to limit (temporarily and spatially) mining activities based on caribou distribution and movements during mid May to the end of June. The Team members' goal is to find a compromise that meets the needs of the herd, landowners, and developers.

CONCLUSIONS AND RECOMMENDATIONS

The FCH increased through the 1980s at an annual rate of 5–10%. Between 1990 and 1995, it was essentially stable. The rate of increase improved between 1996 and 1998 due to optimal environmental conditions and reduced predation. We continued to evaluate harvest by humans, range quality, predation, disease, and weather as possible factors limiting herd growth. We found that predation by wolves primarily on calves was the primary limiting factor. Nonlethal wolf control in combination with public trapping was implemented in November 1997. The goal of reducing wolf numbers is being achieved. As of 1 March 1999, we completed treatment of 13 of the planned 15 packs.

Harvest was not a limiting factor to herd growth even before the harvest quota was reduced to 150 bulls in RY 1996–1997. Since 1973 hunters have harvested <2% of the Fortymile caribou population in all but 3 years. During FY 1996–1997 through 1998–1999, harvest was <1%. Weather and predation, not harvest, caused these minor fluctuations. Hunters contributed to the herd recovery effort by supporting reduced harvest. During the life of the plan, hunters have

verified their support by voluntarily foregoing their opportunity to participate in the hunts. During the past 3 years hunter participation has declined by 50%.

State and federal harvest regulations are now consistent, making them easier to understand and greatly reducing the chance for overharvest.

A coalition of the Upper Tanana/Fortymile, Fairbanks, Delta, Eagle, and Central advisory committees are developing a harvest plan to be presented to the Board of Game and Federal Subsistence Board in the year 2000. The plan will have recommendations on harvest goals and objectives and on quota, seasons, bag limits, allocation, and methods and means.

The Fortymile Caribou Management Plan was fully implemented during this report period. Reduced harvest quota and nonlethal wolf control is ongoing. The Team will meet with principal landowners, land managing agencies, and developers to work toward protecting critical habitat, while meeting the needs of landowners and developers.

We are meeting current management goals and objectives. New goals and objectives will be developed following termination of the Fortymile Caribou Management Plan in 2001.

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Table 1 Fortymile caribou fall composition counts and population size, 1986–1998

Date	Bulls: 100 Cows	Calves: 100 Cows	% Calves	% Cows	% Small bulls	% Medium bulls	% Large bulls	% Bulls	Composition sample size	Estimate of herd size[a]
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	48	30	17	56	37	36	27	27	2530	21,884
10/3/93	46	29	17	57	48	36	17	26	3659	
9/30/94	44	27	16	57	45	33	22	24	2990	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
9/30/97	46	41	22	53	48	28	24	25	6196	25,910
9/29/98	40	38	21	56	49	27	24	23	4322	31,029

[a] Herd estimates were the result of the summer censuses.

Table 2 Fortymile caribou mid to late June composition counts[a], 1985–1998

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 1994–1998

Table 3 Fortymile Caribou seasons and bag limits, regulatory years 1987–1988 through 1997–1998

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 1 bull 8/10–9/30[b] 12/1–2/28[b] 1 bull	–[a]	8/10–9/20 1 bull 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 1 bull 8/10–9/30[b] 12/1–2/28[b] 1 bull		8/10–9/20 1 bull 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[c] 1 bull 8/10–9/30[bd] 12/1–2/28[bd] 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[de] 1 bull 12/1–2/28[de] 1 caribou WEST: 8/10–9/20 1 bull 8/10–9/30[e]	–[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[de] 1 bull 12/1–2/28[de] 1 caribou WEST: 8/10–9/20 1 bull 8/10–9/30[e] 12/1–2/28[e] 1 caribou	EAST: 8/10–9/30[de] 1 bull 12/1–2/28[de] 1 caribou WEST: 8/10–9/20 1 bull 8/10–9/30[e] 12/1–2/28[e] 1 caribou	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[de] 1 bull 12/1–2/28[de] 1 caribou WEST: 8/10–9/20 1 bull 8/10–9/30[e] 12/1–2/28[e] 1 caribou	EAST: 8/10–9/30[de] 1 bull 12/1–2/28[de] 1 caribou WEST: 8/10–9/20 1 bull 8/10–9/30[e] 12/1–2/28[e] 1 caribou	8/10–9/20 1 bull	8/10–9/20 2/15–3/15 1 bull
1993–1994	8/10–9/20[d] 1 bull	No open Season	8/10–9/20 1 bull	No open season	8/10–9/30[de] 1 bull 12/1–2/28[de] 1 bull	8/10–9/30[f] 1 bull 12/1–2/28 1 bull[f]	8/10–9/30[de] 1 bull 12/1–2/28[de] 1 bull	8/10–9/30[f] 1 bull 12/1–2/28[f] 1 bull
1994–1995	8/10–9/20[d]	No open	8/10–9/20[d]	No open	8/10–9/30[de]	8/10–9/30[f]	8/10–9/30[de]	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 12/1–2/28[de] 1 bull	1 bull 12/1–2/28 1 bull[f]	1 bull 12/1–2/28[de] 1 bull	1 bull 12/1–2/28[f] 1 bull
1995–1996	8/10–9/20[d] 1 bull	No open Season	8/10–9/20[d] 1 bull	No open season	8/10–9/30[de] 1 bull 12/1–2/28[de] 1 bull	8/10–9/30[f] 1 bull 11/15–2/28 1 bull[f]	8/10–9/30[de] 1 bull 12/1–2/28[de] 1 bull	8/10–9/30[f] 1 bull 12/1–2/28[f] 1 bull
1996–1997	8/10–9/20[d] 1 bull	No open season	8/10–9/20[d] 1 bull	No open season	8/10–9/30[de] 1 bull 12/1–2/28[de] 1 bull	8/10–9/30[fg] 1 bull 11/15–2/28 1 bull[f]	8/10–9/30[de] 1 bull 12/1–2/28[de] 1 bull	8/10–9/30[fg] 1 bull 12/1–2/28[f] 1 bull
1997–1998	8/10–9/20[d] 1 bull	No open season	8/10–9/20[d] 1 bull	No open season	8/10–9/30[de] 1 bull 12/1–2/28[de] 1 bull	8/10–9/30[fg] 1 bull 11/15–2/28 1 bull[f]	8/10–9/30[de] 1 bull 12/1–2/28[de] 1 bull	8/10–9/30[fg] 1 bull 12/1–2/28[f] 1 bull

[a] No separate season.
[b] Subsistence hunters or residents domiciled in communities or units in rural areas as defined by the Federal Subsistence Board and Alaska Board of Game.
[c] Drawing permit for resident hunters only.
[d] Registration hunt.
[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 Fortymile caribou harvest by type of hunt, regulatory years 1989–1990 through 1998–1999

Hunt number	Regulatory year	Permits Issued	% Did not hunt	% Successful hunters	% Unsuccessful hunters	Harvest			Total reported 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[i]	1025	28	16	84	138	7	0	145	150 bull quota
	1997–1998[j]	1305	31	16	84	143	8		151	150 bull quota
	1998–1999[j]	885	36	29	71	151	3		154	150 bull quota
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	1991–1992	20				4	0	0	4	
Federal hunt	1992–1993	244	18	39	61	59	12	11	82	
	1993–1994	77	58	3	97	1	0	0	1	

Table 4 Continued

Hunt number	Regulatory year	Permits Issued	% Did not hunt	% Successful hunters	% Unsuccessful hunters	Harvest			Total reported harvest[a]	Notes
						Bulls	Cows	Unk		
	1994–1996[g]	<30	100	0	0	0	0	0	0	
	1996–1997[h]	0	0	0	0	0	0	0	0	
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	1025	28	16	84	138	7	0	145	150 bull quota
	1997–1998	1305	31	16	84	143	8		151	150 bull quota
	1998–1999	885	36	29	71	151	3		154	150 bull quota

[a] Total harvest does not include harvest occurring in Canada. Canadian harvest since 1973 has been less than 20 caribou per year. Total does not include extrapolation for nonreporting from general hunts.
[b] Hunt 575 was 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. Approximately 35–40% of successful hunters do not report in general hunts, so totals for these hunts are actually higher.
[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.
[i] Includes RC865 and RC867.
[j] Includes RC863, RC865, and RC867.

Table 5 Fortymile caribou harvest and accidental death, regulatory years 1985–1986 through 1998–1999

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	138	0	0	138	0	7	145	1	146
1997–1998	143	0	0	143	0	8	151	0	151
1998–1999[d]	151	0	0	151	0	3	154	0	154

[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.

Table 6 Fortymile caribou hunter residency and success of hunters reporting residency, regulatory years 1989–1990 through 1998–1999

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	33	96	17	146 (22)	214	301	1	516 (78)	662
1997–1998	53	83	7	143 (16)	250	480	7	737 (84)	880
1998–1999[bc]	52	92	7	154 (29)	109	266	3	378 (71)	532

[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.

[c] Unknown residents included in total.

Table 7 Fortymile caribou fall harvest by time period, regulatory years 1988–1989 through 1998–1999

Regulatory year	Harvest periods								*N*
	8/10–8/16	8/17–8/23	8/24–8/30	8/31–9/6	9/7–9/13	9/14–9/20	9/21–9/27	9/28–9/30	
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
1996–1997[f]	14	10	9	12	13	4	7	7	76
1997–1998[f]	22	3	1	18	12	9	16	6	87
1998–1999	57	20	4	1	0	0	0	0	82

[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.
[f] Data from RC865 only. Harvest quota was 85 bull caribou.

Table 8 Fortymile caribou harvest percent by transport method, regulatory years 1987–1988 through 1998–1999

Regulatory year	Harvest percent by transport method									
	Airplane	Horse	Boat	3- or 4-Wheeler	Snowmachine	ORV	Highway vehicle	Walking	Unk	*n*
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	29	0	4	18	12	5	30	0	1	146
1997–1998	36	1	4	15	22	7	11	0	3	143
1998–1999[e]	16	0	3	56	0	5	14	0	5	93

[a] General hunt numbers only.

[b] Drawing and registration permit hunt results.

[c] Registration permit hunt results only.

[d] Registration permit and general hunt results.

[e] Fall hunt only.

LOCATION

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

HERDS: Galena Mountain, Ray Mountains, Wolf Mountain

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

BACKGROUND

Caribou in Units 21D and 24 are in 3 distinct herds located north of the Yukon River in the Kokrines Hills and Ray Mountains. They are the Galena Mountain, Wolf Mountain, and Ray Mountains Herds, named for a mountain peak or mountains where the herds calve.

Each herd has a distinct calving area. The western group of approximately 250–500 animals typically calves east of Galena Mountain and winters west of the mountain. Galena Mountain is a local name given the 3274 ft unnamed mountain northeast of Galena. 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 600–850 animals. The eastern group calves primarily on the south side of the Ray Mountains and winters on the north side in the Kanuti-Kilolitna drainage. With approximately 1500–1800 animals, this is the largest of the 3 herds.

The Galena and Wolf Mountain herds are difficult to survey or census during fall and winter because they travel in small groups in dense black spruce forest where sightability is poor. The Ray Mountains Herd is also difficult to survey because fog, clouds, and winds often limit survey opportunities in fall.

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 commercial reindeer operation in that area ended around 1935, and there is no evidence of reindeer physical characteristics or reindeer genes in the herds. The mid May calving dates of all 3 herds also indicate the animals are caribou. Local residents were aware of these herds for many years, but the Alaska Department of Fish and Game (ADF&G) did not survey the herds until 1977.

These caribou herds are rarely hunted because they are relatively inaccessible during the hunting season, and few people outside the local area are aware of them. Since the early 1970s, hunting seasons were 10 August–30 September for the Galena and Wolf Mountain Herds, principally 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 was previously under Western Arctic caribou herd (WACH) regulations. The combined average of reported and known unreported harvest from all 3 herds over the last 10 years was less than 10 caribou per year.

MANAGEMENT DIRECTION

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 growth of 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 are on the same wintering grounds.

METHODS

The methods outlined in this report reflect efforts to accomplish the activities and management objectives established in the previous reporting period. Specifically, objectives were to determine population size, calving locations, rutting area, and winter distributions for all herds, and determine major mortality factors of the Ray Mountains Herd.

Caribou from these herds were monitored through cooperative radiotelemetry studies involving ADF&G, Fish and Wildlife Service (FWS), and 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 Mountains 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.

Standard morphometric measurements were taken on all captured caribou, and blood was sampled for antibody testing and mitochondrial DNA (mtDNA) analysis (Wolf Mountain and

Galena Mountain Herds). M Cronin, LGL Research Associates, Anchorage conducted the mtDNA analysis.

For the Ray Mountains 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 1994–1998. Surveys flown during this reporting period (regulatory years [RY] 1996–1997 and 1997–1998; RY = 1 July–30 June) for the Galena and Wolf Mountain Herds were conducted using fixed-wing aircraft that did not allow for sex or age classification. We monitored hunting mortality from caribou harvest reports and interviews with local residents. Harvest data were summarized by regulatory year (RY = 1 July–30 June).

RESULTS AND DISCUSSION

POPULATION STATUS AND TREND

Population Size

The Galena Mountain Herd has never been censused, but the population was probably 300–500 caribou. The highest number of caribou seen was 313 in December 1998 (Table 1). Its population trend was probably stable because of relatively moderate winters and dense habitat. Although radiocollaring caribou was expected to help locate caribou aggregations, use of the collars did not increase the number of caribou found. The use of radio collars did demonstrate that caribou occupy dense black spruce habitat during the rut, where sightability is low. 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 of the Wolf Mountain Herd was conducted in October 1995 (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 was 600–850 caribou, which was higher than previous estimates. That higher estimate of the population reflected improved survey methods rather than population growth. The population was probably stable.

The Ray Mountains Herd was first thoroughly surveyed in fall 1983 and periodically surveyed by BLM for the next 2 years. On 1 November 1983, 400 caribou were counted. In 1987 the population estimate was 500 (Robinson 1988) based on a survey of all known upland ranges, but excluding the Caribou Mountain area. Composition counts during a radiotracking flight in October 1998 indicated a new minimum herd size of 1756 (Table 3). The population probably declines in years of poor recruitment and increases when recruitment is good, but it has increased at a mean rate of about 10% per year since 1983.

Population Composition

Counts of the 3 herds were conducted with fixed-wing or helicopter aircraft, and not all counts yielded composition data (Tables 1–4). Helicopters were used beginning with the 1992 fall surveys and provided the first accurate composition data on these herds. Comparison of composition data to previous years is inconclusive due to limited data, and only caribou in the Ray Mountains were classified during the report period. Ray Mountains caribou had calf:cow

ratios of 13:100 in 1997 and 32:100 in 1998. The combined average ratio for 4 years of previous composition data yields an average of 19 calves:100 cows with a range of 12–31 calves:100 cows.

Calf:cow ratios of the Ray Mountains, Wolf Mountain, and Galena Mountain herds are similar to other Interior herds, with means and ranges of 20:100 (12–32:100), 25:100 (15–36:100), and 21:100 (7–40:100) for the 3 herds, respectively. Calf:cow ratios for the Fortymile Herd between 1985 and 1994 averaged 29:100 with a range of 16–37:100 (Boertje et al. 1995). The Delta caribou herd calf:cow ratio between 1970 and 1993 averaged 29:100 with a range of 2–65:100. The highest values often occurred following predator control programs (Valkenburg 1994).

Distribution and Movements

Galena Mountain Herd. Galena Mountain caribou usually migrate toward alpine areas east of Galena Mountain in April. They are found on the alpine slopes of the southern Kokrines Hills during calving season. Most radiocollared caribou were in alpine areas west of the Melozitna River from June to September in all years. In September, a few bulls have been seen along the Yukon River and also north of Galena. During October, the caribou usually migrate from alpine areas across Galena Mountain toward the Holtnakatna Hills and around Hozatka Lake where they winter. In October 1995 radiocollared caribou from the Galena Mountain Herd were in the Holtnakatna Hills when composition counts were conducted. In 1996 they were scattered from these hills eastward to the Melozitna River where some were mixed with Wolf Mountain caribou (Saperstein 1997).

In late September–early October 1996, 10,000–15,000 caribou from the Western Arctic Herd moved east into Unit 21D. They crossed the Koyukuk River about 50 miles upstream of the mouth of the river. 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. A general migration pattern for the Wolf Mountain Herd was hypothesized based on tracks seen during surveys in the early 1980s. 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. Radiocollared caribou confirmed these patterns but also identified specific sites. In May 1995 the radiocollared caribou were located in the headwaters of Hot Springs Creek. In May 1996 they 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. The herd was on the north side of Wolf Mountain in the west fork of Wolf Creek in October 1995. And in October 1996, the herd was on the lower part of the Melozitna River, approximately 10–35 miles southwest of Wolf Mountain.

Ray Mountains Herd. Prior to October 1994, there were no radiocollared caribou in the Ray Mountains, and 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 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. Near Sithylemenkat Lake small groups of male caribou (10–20) were regularly seen earlier in the year

during March, and during this time 200 caribou were seen in the Kanuti Lake area. We do not know if these caribou were from the Ray Mountains Herd or Western Arctic Herd.

Since radiocollaring began in October 1994, radiolocations during winter were primarily on the northern slopes of the Ray Mountains and during calving season were on the southern slopes of the Ray Mountains in the upper Tozitna River drainages. Summer range is in the alpine areas of the Ray Mountains, frequently in the Spooky Valley area around Mount Henry Eakins and occasionally in the alpine areas south of the upper Tozitna River (Jandt 1998).

Body Weights and Genetics

During October, female calves from the Galena Mountain Herd were among the heaviest in Alaska (Valkenburg et al. 1993). Weights of Wolf Mountain and Ray Mountains calves were also heavy. Analysis of mitochondrial DNA by Cronin et al. (1995) indicated that none of the samples from Galena Mountain Herd, Wolf Mountain Herd, or Ray Mountains Herd caribou contained any unique reindeer genes. Allele frequencies were similar to other Alaskan caribou and were not consistent with any known allele frequencies for reindeer. The Galena Mountain/Wolf Mountain samples also contained a rare allele not previously reported for reindeer or caribou in Alaska. The significance of this rare allele is unknown.

MORTALITY

Harvest

Season and Bag Limit.

Units and Bag Limits	Resident/Subsistence Open Seasons	Nonresident Open Seasons
Unit 20F Tozitna River drainage.		
RESIDENT HUNTERS: 1 caribou; however, only bull caribou may be taken during the 10 Aug–30 Sep season.	10 Aug–30 Sep 1 Dec–10 Dec 1 Mar–15 Mar	
NONRESIDENT HUNTERS: 1 bull.		10 Aug–30 Sep
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 confluence, and the Fish Creek drainage, including Bonanza Creek. One bull.	10 Aug–30 Sep	10 Aug–30 Sep
Unit 25D, that portion 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 Western or Central Arctic caribou herds seasonally occupy areas in Units 24 and 21D north of the Yukon River and west of the trans-Alaska pipeline. Seasons and bag limits in that area reflect harvest recommendations for those herds.

Board of Game Actions and Emergency Orders. In March 1991 the Alaska Board of Game gave us emergency order authority to open a portion of Unit 21D when WACH are present. A bag limit of 2 caribou was established. This action allowed hunters the opportunity to take caribou while protecting the smaller Galena Mountain Herd that may be intermixed with the WACH. This special winter season is not opened unless the Galena Mountain Herd constitutes 10% or less of the total number of caribou north of the Yukon River and east of the Koyukuk River in Unit 21D. It was not opened during this reporting period.

The Board of Game took no actions and no emergency orders were issued during this reporting period.

Hunter Harvest. During the RY 1996–1997 and 1997–1998 hunting seasons, only 1 bull caribou was reported taken. It came from the Galena Mountain Herd (Table 5).

Hunter access to the Ray Mountains Herd during the open season in early March is limited to lengthy snowmachine trips. The Galena Mountain Herd is most accessible for hunting when it crosses the Galena-Huslia winter trail during winter. The season there was closed during winter 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 was able to access a limited part of the Wolf Mountain Herd's range and occasionally took caribou from this herd, and moose hunters on the Melozitna River occasionally took Wolf Mountain caribou. Success of hunters in all 3 herds was limited, and most hunters were not local residents (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 3–5 caribou are taken along the Yukon River in the Rampart-Tanana section (Osborne 1995). These caribou, usually bulls, are occasionally found on remaining snowbeds near the river in August, or wandering to the river during September. In addition, 5–7 caribou are probably taken by hunters using snowmachines from Tanana (Osborne 1995).

Other Mortality

Judging from fall calf percentages (Tables 1–4), natural mortality of caribou calves was high in all 3 herds. Black bears may be the primary calving ground predators on the Wolf and Galena Mountain herds, and they were often seen during calving surveys. Grizzly bears are throughout the calving ranges of all 3 herds. Predation was probably the main limiting factor, but the objective of determining mortality factors in the Ray Mountains Herd was not achieved due to the lag time before collars emitting mortality signals could be retrieved. Total adult mortality has been very low.

CONCLUSIONS AND RECOMMENDATIONS

The mountains between Galena and the upper Hodzana River on the north side of the Yukon River contain 2700–3150 caribou in 3 herds centered around 3 main calving areas. Although open caribou hunting seasons exist, few are taken due to limited access. Predation is probably restricting herd growth; lichen ranges are lush, and the early calving date and large body size and weight of calves and adults for the Ray Mountains Herd indicate good nutrition (Osborne 1995). The large body size and heavy weight of calves and adults in the Galena Mountain Herd also indicate excellent nutrition (Osborne 1995).

Both management goals for the report period were apparently met. Because all 3 herds seem to be stable or increasing, it is implicit that the limited harvest had no negative effect on the population. The second goal was also achieved, at least to the extent there were no population declines that would require more restrictive harvest regulations.

Progress was made toward the objectives of determining calving locations and seasonal distributions for the Galena Mountain and Ray Mountains Herds (Saperstein 1997; Jandt 1998). Seasonal distribution for both of those herds was well-defined in those studies. An understanding of the seasonal distribution for the Wolf Mountain Herd was not improved during this reporting period. Although a specific location of rutting activities was not determined for the Wolf and Ray Mountains herds, late fall radio collar locations for both herds were probably consistent with traditional rutting areas. The objective to determine population size for the Ray Mountains Herd was completed.

It is difficult to demonstrate whether either of the 2 Galena Mountain Herd objectives were achieved. Because censuses of the Galena Mountain Herd were not completed, we cannot determine population status or trend and, therefore, do not have information to support lengthening the hunting season. Based on minimum counts, the population was probably static. With regard to the second objective of the Galena Mountain Herd, because there were no emergency winter seasons during the report period due to the presence of the Western Arctic caribou herd, the potential overharvest of the Galena Mountain Herd was not an issue.

To allow harvest from the WACH in Unit 21D east of the Koyukuk River and to 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 managers distinguish them from the WACH. In addition, radio collars should help managers obtain better population estimates. Other management work on these herds will

remain a low priority because of insignificant harvest and the small number of caribou in the Galena, Wolf Mountain, and Ray Mountains Herds.

Finally, changes in Unit 24 caribou regulations are needed. Seasons for the Ray Mountains Herd in Unit 24 should be modified so they are consistent with the Unit 20F winter season. Also, regulations in the area north of the Kanuti River in Unit 24, excluding the Dalton Highway Corridor, should be consistent with the remainder of the Unit 24 where Western and Central Arctic herds occur seasonally. Regulations south of the Kanuti River and east of the Tanana-Allakaket winter trail, excluding the Dalton Highway Corridor, should be consistent with the regulations in Unit 20F of the Tozitna drainage. The Dalton Highway corridor seasons in Unit 24 should be consistent with Unit 25D west fork Dall River regulations. The area north of the Kanuti River would then be consistent with the rest of Unit 24, where WACH regulations apply. Because of the sustained growth of the Ray Mountains Herd over the last 10 years and the low harvest, we should revert to an either-sex bag limit for the fall hunting season. This would increase opportunity to some degree, especially during the last 10 days of the season when bulls are in the rut.

Because the goals and objectives of the current report period have either been realized or they do not allow for objective evaluation, the goals and objectives for the next report period will be changed to:

MANAGEMENT GOALS

- Ensure harvest does not result in a population decline.
- Provide increased opportunity for people to participate in caribou hunting.

MANAGEMENT OBJECTIVES

- Harvest up to 50 cows and up to 75 bulls from the Ray Mountains Herd.
- Harvest up to 10 cows and up to 25 bulls from the Wolf Mountain Herd.
- Harvest up to 10 cows and up to 25 bulls from the Galena Mountain Herd.

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Table 1 Galena Mountain caribou fall population data, 1991–1998

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	186
10/95	28	19	40	211	59	310
10/96	37	13	19	151	56	232
12/98[a]						313

[a] Fixed-wing survey, no composition classifications.

Table 2 Wolf Mountain caribou population data, 1991–1998

Date	Cows	Calves (%)	Bulls	Total
6/91	117	18 (12)	11	146
6/92				595
1993[a]				
5/94	337	121 (26)	16	474
1/95				194
10/95	192	51 (15)	103	346
10/96	167	37 (14)	62	266
5/97[b]				423
1/98[b]				163

[a] No surveys.
[b] Bureau of Land Management survey; no composition classifications.

Table 3 Ray Mountains caribou population data, 1991–1998

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[c]						140[d]
10/94[c]						652
10/94	37	19	78 (12)	403	148	629
1/95[c]						684
6/95[e]						1731
10/95	34	12	83 (8)	681	230	994
10/96	28	15	145 (10)	971	271	1387
10/97	33	13	100 (9)	757	257	1114
10/98	26	32	357 (20)	1110	289	1756

[a] Includes 50 unclassified adults.
[b] Included 245 unclassified adults.
[c] No composition classifications.
[d] Caribou Mountain portion only.
[e] Photocensus.

Table 4 Galena Mountain caribou summer calving counts, 1991–1994[a]

Date	Cows	Calves (%)	Bulls	Total
6/91	97	11 (8)	27	135
6/92	191	13 (5)	37	241
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

[a] No counts completed during 1995–1998.

Table 5 Ray, Galena, and Wolf Mountain caribou reported harvest, regulatory years 1990–1991 through 1997–1998

Regulatory year	Herd					
	Ray Mountains		Galena Mountain		Wolf Mountain	
	Bulls	Cows	Bulls	Cows	Bulls	Cows
1990–1991	3	0	0	0	1	0
1991–1992	2	0	0	0	1	0
1992–1993	5	0	0	0	2	0
1993–1994	9	0	0	0	0	0
1994–1995	2	0	1	0	2	0
1995–1996	0	0	0	0	0	0
1996–1997	0	0	1	0	0	0
1997–1998	0	0	0	0	0	0

Table 6 Galena Mountain, Wolf Mountain and Ray Mountains caribou hunter residency and success, regulatory years 1990–1991 through 1997–1998

Regulatory year	Successful				Unsuccessful				Total hunters
	Local resident[a]	Nonlocal resident	Nonresident	Total	Local resident[a]	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	5	2	7	1	7	2	10	17
1993–1994	1	6	1	8	0	15	2	17	25
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
1997–1998	0	0	0	0	1	5	2	8	8

[a] Residents of Units 20; 21B, C, and D; and 24.

LOCATION

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

HERD: Western Arctic

GEOGRAPHIC DESCRIPTION: Northwest Alaska

BACKGROUND

The Western Arctic Caribou Herd (WACH) ranges over approximately 140,000 mi^2 (363,000 km^2) of northwestern Alaska (Fig. 1). Summer range encompasses the calving grounds and consists of the northern foothills and mountains of the Brooks Range west of the Trans-Alaska Pipeline. Since the mid 1980s, most of the WACH has wintered in the eastern third of the Seward Peninsula to the Tagagawik drainage and in the Nulato Hills south to the Unalakleet drainage. Additionally, during the late 1990s, a large faction of the WACH wintered in upper Koyukuk River drainages.

In the early 1970s, the WACH population was approximately 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 1990, the WACH grew about 13% annually. Since 1990, the WACH has grown 1–3% annually.

MANAGEMENT DIRECTION

MANAGEMENT GOALS

- To protect and maintain the WACH and components of the natural ecosystem upon which it depends.
- To provide for subsistence and recreational hunting on a sustained yield basis.
- To provide for viewing and scientific study of caribou.
- To perpetuate associated wild carnivore populations.

MANAGEMENT OBJECTIVES

- To maintain a postcalving population of ≥200,000 caribou.
- To minimize conflicts with the reindeer industry.
- To monitor the size and composition of this population.
- To improve public understanding of WACH management, improve harvest reporting, and encourage public involvement in the regulatory process.
- To minimize impacts of industrial development on caribou and their habitat.

- To cooperatively manage this herd by involving the department, federal land managers, private organizations, and interested users.

METHODS

Conventional VHF and satellite radiotelemetry techniques were used to estimate population size, adult mortality, calf production and recruitment, sex and age composition, movement patterns and distribution. Configuration of the conventional collars, relocation techniques, types of data collected, allocation of collars between bulls and cows, and sources of error in telemetry data have been previously described in Dau (1997*a*).

As in the past, we attempted to complete each "collar year" (1 Oct–30 Sep) with ≥100 functional transmitters on living caribou during this reporting period. Even though we have not attempted to radiocollar a uniform cross-section of ages and sexes in the population, the radiocollars on cows probably represent an accurate sample of the female cohorts because collars are deployed annually among all female cohorts >2 years old and cows with and without calves. Only those individuals in very poor physical condition are not collared. Conversely, we do not have an accurate cross-section of bull cohorts because only large adults are selected for collaring, thereby skewing the sample toward older aged animals.

We began the 1996–1997 collar year with 128 potentially active conventional collars on living caribou (116 cows and 12 bulls). Of these, 12 collars on cows were also equipped with a platform terminal transmitter (PTT or satellite collar); however, 1 of the PTTs was no longer transmitting. We began the 1997–1998 collar year with 129 potentially active conventional collars on living caribou (116 cows and 13 bulls). Of these, 12 collars on cows were also equipped with a PTT, but only 7 were functional.

During the reporting period all radio collars, except 2 satellite collars, were deployed during September at Onion Portage on the Kobuk river in Unit 23. The rationale and methods for this technique have been previously described in Dau (1997*a*). The 2 satellite collars, purchased by the North Slope Borough Department of Wildlife Management, were deployed during April 1997 using net gun capture techniques near Anaktuvuk Pass in Unit 26A. As in the past, we did not remove radio collars or recollar WACH caribou during the reporting period.

Thirty-nine radio collars were deployed on 8 bulls and 31 cows at Onion Portage during September 1996; 7 of these collars (1 bull and 6 cows) were equipped with a PTT. In September 1997, 22 caribou (5 bulls and 17 cows) were radiocollared; 2 collars on cows were equipped with a PTT. In September 1998 (after this reporting period), 38 caribou (8 bulls and 30 cows) were radiocollared, and 10 collars on cows were equipped with a PTT.

Varying configurations of satellite collars (PTTs) manufactured by Telonics, Inc (Mesa, AZ) have been used on WACH. The history and objectives of the WACH PTT program, configuration of the satellite collars, PTT duty cycles, and use of data was summarized by Dau (1997*a*). In summary, the PTT configurations have the following characteristics:

> Configuration 1. ST-3/Mod 400. Deployed prior to 19901789g. 1 Watt output. Two canisters: large canister contains PTT beacon; small canister contains VHF beacon. Two-

season duty cycle: 6 hrs on once every 3 days (i.e., 6 hrs on, 66 hrs off) except for 30 days in June when the PTT transmits 6 hrs daily.

Configuration 2. ST-3/Mod 600. Deployed 1990–1997. 1789g. 1 Watt output. Two canisters: large canister contains PTT beacon; small canister contains VHF beacon. Two-season duty cycle : 6 hrs on once every 3 days (i.e., 6 hrs on, 66 hrs off) except for 30 days in June when the PTT transmits 6 hrs daily. Two refurbished ST-3/Mod 600 collars were deployed on adult cows in 1997.

Configuration 3. ST-14/Mod 600. Deployed 1998. 1789g. 1 Watt output. Two canisters: large canister contains PTT beacon; small canister contains VHF beacon. Six new ST-14/model 600 collars were deployed on adult cows. We modified the duty cycles of some units to prolong battery life as follows. We programmed 2 PTTs with the same duty cycle as Configuration 2, we programmed 2 PTTs to transmit 6 hrs once every 6 days and daily between 25 May–25 Jun, we programmed 2 PTTs to transmit 6 hrs once every 3 days during 1 Sep–28 Feb, once every 6 days during 1 Mar–24 May, once daily during 25 May–25–Jun, and once every 6 days during 26 Jun–31 Aug. "Real time" clocks were used in all ST-14 PTTs to ensure accurate changes in seasons, regardless of the activation date of the collar.

Configuration 4. ST-10/Mod 600. Deployed 1998. 1388g. !/4 Watt output. Single canister contains PTT beacon and VHF beacon. This configuration is lighter because: 1) the ST-10 PTT uses 2 C cell batteries (the ST-14 requires 2 D cell batteries); 2) both the PTT beacon and the VHF beacon are enclosed in a single canister (separate canisters are used in earlier configurations); and 3) less collar material is used. In addition to being lighter, the single canister configuration will probably ride better on the caribou's neck than the ST-14/model 600 configuration. A conservative duty cycle that provides 1 location every 6 days (except during 25 May–25 June when the PTT will transmit 6 hrs daily) was used to compensate for the smaller batteries in the ST-10s. During the 6 months these collars have been deployed, the ST-10 PTTs have provided location data comparable to the ST-3 and ST-14 configurations.

The Model 400 VHF transmitter did not provide the range or life span comparable to the Model 600 VHF transmitters used on conventional radio collars. As a result, we often failed to locate caribou with Configuration 1 collars through conventional tracking techniques and rarely retrieved these collars from the field. From 1990 to 1997, we used Configuration 2 collars (PTT paired with a Model 600 VHF transmitter). This configuration worked well for conventional and satellite telemetry applications. However, the ST-3/model 600 satellite collars were heavier than conventional radio collars (1789 g vs. 795 g) and appeared to predispose WACH caribou to mortality (Dau 1997*a*). Therefore, in 1998 we worked with Telonics, Inc to develop a lightweight PTT/VHF transmitter configuration. In 1998 we used 3 lightweight satellite collars (Configuration 4) and deployed them on cow caribou at Onion Portage.

Before 1998 no PTT transmitters contained "real time" clocks; therefore, duty cycles began when the PTTs were activated. Variation in activation date affected the period when daily PTT locations were collected during the calving season.

We used the aerial direct count photo extrapolation technique (Davis et al. 1979) to determine the size of the WACH population. The last census was during July 1996 (Dau 1997*b*). Department policy recommends we census the WACH every 3 years until there is evidence of a rapid population decline warranting more frequent estimates of population size. The next census will be attempted during July 1999.

Population composition for the WACH was determined using calving surveys during June, fall composition counts during October, and spring short-yearling surveys during April–May. Calving surveys were conducted in a C-185 with 2 observers during 1997 and 1998. Survey techniques, criteria to determine maternal status and geographic coverage were the same as previously described (Dau 1997*a*). In 1997, flights were conducted 4–7 June. In 1998 they were flown 12–15 June (1 cow was located on 4 June). In both years, areas outside core calving areas were searched at low intensity for radiocollared cows.

Fall composition surveys were conducted 10–12 October 1997 and 4–9 October 1998 using techniques previously described by Dau (1997*a*). As in previous years, we retrieved moose and caribou radio collars on mortality mode in conjunction with fall composition surveys.

Spring composition (short yearling) surveys were conducted during 21–23 April and 28 May 1997. In 1998 short yearling surveys were conducted during 17 and 23 April and during 4 and 18 May. In both years we used survey techniques previously reported by Dau (1997*a*).

Distribution and movements of the herd were assessed using spring and fall rangewide telemetry surveys completed during 1997 and 1998 in conjunction with other telemetry surveys. Flights were based out of Barrow, Kotzebue, Nome, and Fairbanks using survey techniques previously described by Dau (1997*a*).

Mortality rates for adult WACH caribou were estimated from annual mortality rates of cows with conventional radio collars during the 12-month period 1 Oct–30 Sep ('collar-year'). The 1 October 1996–30 September 1997 mortality estimate corresponds with the 1997 recruitment (i.e., short yearling) estimate. Three "collar years" (1995–1996, 1996–1997, and 1997–1998) span this reporting period.

Only cows with conventional radio collars were used to monitor adult caribou mortality (Dau 1997*a*). Radiocollared cows not located for 2 years were retroactively dropped from the sample of potentially active collars. Therefore, annual mortality estimates were modified for up to 2 years. Estimated mortality rate includes all sources of mortality. Radiocollared bulls were not used to estimate mortality for the herd for reasons reported by Dau (1997*a*).

During rangewide telemetry surveys, 127 of 146 potentially active collars (87%) were located during fall 1996; 107 of 146 potentially active collars (73%) were located during winter/spring 1997; 120 of 153 potentially active collars (78%) were located during fall 1997; 83 of 140 potentially active collars (59%) were located during spring 1998; and 93 of 150 potentially active collars (62%) were located during fall 1998 (after this reporting period).

We monitored harvest of WACH caribou using 2 separate reporting systems: 1) registration permits for local hunters residing within the range of the WACH (west of the Dalton Highway and north of the Yukon River) and 2) statewide harvest tickets for all other nonlocal and

nonresident hunters. Local hunters who register to hunt WACH caribou receive a letter at the end of each regulatory year asking how many caribou they harvested the preceding fall and during winter/spring. There is no limit to the number of registration permits issued each year, and permits are free. Nonlocal and nonresident hunters were required to use the statewide caribou harvest tickets and report their harvest to the department within 15 days of the close of the season; however, no reminder letters were sent to nonlocal hunters who failed to voluntarily report the results of their hunt, and the reporting requirement was not enforced. As with the registration permit system, statewide caribou harvest tickets are free.

In addition to these harvest reporting systems, the department (Subsistence Division) has estimated caribou harvests for selected villages within the range of the WACH using community-based assessment techniques (Georgette 1994). Most of these estimates have provided only "snapshots" of harvests for specific villages. However, community-based techniques have been used in Anaktuvuk Pass and Nuiqsuit to monitor harvests annually for many years. Community-based estimates indicate only about 10% of caribou taken by local residents are reported under the registration permit system (Georgette 1994, Dau and Pederson unpubl. manuscript).

In April 1999 department staff conducted community-based harvest assessments in Buckland, Shungnak, Shaktoolik, Shishmaref, and Elim to initiate a program to monitor temporal trends in caribou harvests for all hunters residing within the range of the WACH. Also, beginning in the 1998–1999 regulatory year, the Information Management section of the Division of Wildlife Conservation reestablished sending 2 reminder letters to hunters who do not voluntarily send in their statewide harvest report. Information Management staff will summarize all statewide caribou harvest data.

During the reporting period we collected blood samples to examine prevalence of 8 selected diseases in the herd. Serum collection methods and serological test criteria were previously described by Dau (1997*a*). In 1996 we collected blood samples from 28 bulls and 48 cows. In 1997 we collected blood samples from 24 bulls and 57 cows; in 1998 (following this reporting period) we sampled 51 bulls and 62 cows.

We collected tissue samples from clinically diseased WACH caribou to determine causative agents in the herd. In September1997, 2 local residents and 1 guide provided tissue samples from 3 clinically diseased WACH caribou. One sample consisted of several pounds of skeletal muscle with copious amounts of pus located between the fascia of muscle groups. The other 2 samples consisted of legs with a swollen carpal or tarsal joint. In October 1998 (following this reporting period), 4 clinically diseased WACH caribou were shot from a helicopter and necropsied during fall composition surveys. A calf that had recently died of natural causes (excluding predation or trauma) was also necropsied. All tissue samples were frozen and sent to Dr. John Blake, a pathologist at the University of Alaska in Fairbanks. Dr. Blake submitted samples of these tissues to the National Veterinary Services Laboratory (Ames, IA) for diagnostic culturing. Necropsies were conducted following Dau (1981).

Metals and radioactive isotopes were examined in tissue samples of caribou collected from various locations in northern and western Alaska. Levels of arsenic (As), cadmium (Cd), copper

(Cu), lead (Pb), zinc (Zn) and iron (Fe) were measured for liver, kidney, muscle, and rumen content samples from the following collections of caribou:

- Anaktuvuk Pass – 10 caribou from the WACH, Central Arctic Herd (CAH), and Teshekpuk Lake Herd (TCH) were shot and necropsied March–April 1994
- Teshekpuk Lake Herd – 9 caribou were shot and necropsied July 1995
- Point Hope – 1 WACH caribou starved winter 1994–1995 and was necropsied March 1995; 4 moribund and emaciated WACH caribou were shot and necropsied March 1995
- Cape Thompson – 65 WACH caribou starved fall and winter 1994–1995 and necropsied June and July 1995
- Barrow – 6 TCH caribou were shot and necropsied March and April 1995
- Red Dog Mine – 15 WACH caribou were shot and necropsied March 1996

Effects of metals on caribou were evaluated through gross and histologic examinations (O'Hara et al., in prep.). Mean gross alpha and beta levels of overall radioactive emission as well as mean levels of strontium-90, cesium-137, and potassium-40 were measured for bone and muscle samples for the same collections of caribou. Samples sizes varied among the different isotopes and were generally smaller than those used to measure metal levels. Gross examinations for radioactive poisoning were conducted during all necropsies. These investigations were lead by the North Slope Borough Department of Wildlife Management with assistance from the Alaska Department of Fish & Game and National Park Service (NPS).

RESULTS AND DISCUSSION

POPULATION STATUS AND TREND

Population Size

The July 1996 photocensus produced a minimum estimate of 463,000 caribou (Table 1, Fig. 2). From 1976 to 1990 the WACH grew at an average annual growth rate of 13%. From 1990–1996, the WACH grew about 2% annually.

Population Composition

Calving. We observed 57 calves:100 radiocollared cows during June 1997 and 53 calves:100 cows in 1998 (Table 2). These ratios are low compared to previous years. Estimates of calf production are probably conservative because we do not record udder status for collared cows (Whitten 1995) and we do not consistently conduct calving surveys just prior to or during peak calving.

There is a strong negative correlation between the calf:collared cow ratio and the proportion of cows with velvet antlers during calving (r = -0.95, n = 11 years). The mean proportion of cows with velvet antlers during years when the calf:cow ratio was >70:100 was 2.8% (SD = 3.3). In contrast, during years when the calf:cow ratio was <70:100, the mean proportion of cows with

velvet antlers was 17.6% (SD = 2.5). Cows with substantial growth of velvet antlers during calving either failed to conceive the previous fall or lost their fetus during early pregnancy. This indicates that low calf ratios are real and not an artifact of sampling error.

Calf production declined from 1987 to 1998 (Fig. 3). The coefficient of determination indicates a gradual linear decline in calf production during this period (R^2 = 0.57, n = 11). However, a scatter plot of this data indicates that a step function decline in calf production may have occurred between 1992 and 1993. The mean calf:cow ratio for 1987–1992 was 78:100 (SD = 4.3). For 1993–1998, this mean was significantly lower (59:100, SD = 4.9, 1-tailed t-test P<0.001, equal variances).

During the 1997 calving surveys, 3 radiocollared cows were found south of the calving grounds, and all were nonmaternal. This was 3% of all collared cows located during the calving surveys and 3% of all potentially active collars on living cows. In 1998, 8 radiocollared cows were located south of the calving grounds, and all were nonmaternal. This was 10% of all collared cows located during the calving surveys and 6% of all potentially active collars on living cows. In both years, all radiocollared bulls located during calving surveys were south of the Brooks Range.

Many WACH cows calved farther north and east during 1997 than in previous years; many were located in and north of the Meade River. One cow was located on the North Slope coastal plain at 70° 6′ N Latitude, 159° 7′ W Longitude.

There has been no correlation between the June calf:adult cow ratio and the fall calf:cow or fall calf:adult caribou ratios (r = 0.18 and 0.02, respectively, n = 6). Likewise, there has been no correlation between the June calf:adult cow ratio and subsequent April/May calf:adult ratio (r = 0.16, n = 11). This indicates calf survival through summer and fall has a larger effect on fall and spring calf ratios than initial calf production (at least when calf production is >50 calves:100 adult cows).

Fall composition. The fall calf:cow ratio was 49:100 in 1996, 43:100 in 1997, and 45:100 in 1998 (after this reporting period). This ratio has ranged from 34–52:100 since 1992 when we initiated fall composition surveys from an R-22 helicopter (Table 3). Part of the variability in fall calf:cow ratios may be attributable to misclassification of small bulls as cows during some years (P Valkenburg, pers commun).

The calf:adult (bulls and cows >12 mos. old) ratio has ranged from 24–33:100 since 1992. This ratio is less vulnerable to misclassification than the calf:cow ratio; however, spatial or temporal segregation of bulls and cows could confound calf:adult estimates because we do not sample the entire WACH. A primary reason for conducting fall composition surveys is that bull/cow segregation is lowest during rut. However, fall WACH composition surveys are often conducted prior to peak rut before maximum mixing occurs because of weather considerations and aircraft availability. Our qualitative observations during fall surveys and reports from local residents indicate that segregation of bulls and cows still occurs during this time, but varies among years in degree as well as spatial and temporal pattern. There is a weak correlation between the October calf:adult ratio and subsequent April/May calf:adult ratio (r = 0.75, P<0.10, n = 4).

The fall bull:cow ratio was 51:100 in 1996, 49:100 in 1997, and 54:100 in 1998 (after this reporting period). Misclassification, segregation between bulls and cows, and sampling variability may account for more variability in this parameter than actual changes in population composition.

During the 1996–1998 fall composition surveys, we retrieved a total of 37 caribou, moose, and muskoxen radio collars (30 conventional and 7 satellite collars). Collar retrieval partially defrays costs associated with fall composition surveys. Additionally, collar retrieval enables us to efficiently utilize conventional transmitter frequencies and is an environmentally responsible approach to telemetry studies.

Spring composition. We observed 26 short yearlings:100 adults in spring 1997 and 21:100 in spring 1998 (Table 4). The short yearling:adult ratio declined from 1980 to 1995 but increased after 1996, possibly as a result of mild winters (Figs. 4 and 5).

As in 1995, the 1997 and 1998 spring migrations were compressed in time and space. In both years most WACH caribou crossed the Kobuk River between Noorvik and Ambler during an 8–10 week period. In early April 1998, the vanguard of the migration (approximately 30,000–40,000 caribou) poured across the Selawik Flats behind a discreet leading edge. Poor weather prevented us from reaching our sampling goal of 10,000 caribou during the spring 1998 recruitment surveys; however, we did sample that portion of the migration that passed through Unit 23 from its vanguard to stragglers. Segregation of short yearlings and adults was striking within large groups during 1998.

Distribution and Movements

Historical summary. Our understanding of the distribution of the WACH has evolved during the last 25–30 years with the application of telemetry techniques in northern Alaska. Caribou have inhabited northwestern Alaska since the Pleistocene period (Guthrie 1968 as reported by Skoog 1968). During the latter half of the 1800s, caribou in northwest Alaska disappeared from the Seward Peninsula and began to decline in coastal portions of Kotzebue Sound. By the 1890s caribou had completely disappeared from Norton and Kotzebue Sounds. The reasons for this decline are unknown but may involve long-term, periodic, natural variations in caribou abundance (Skoog 1968). During this time, caribou remained abundant across the western North Slope (Skoog 1968; Brower, unpubl. ms.).

By the late 1930s caribou in northwest Alaska began to increase and reoccupy Kotzebue Sound. Aggregations estimated >250,000 caribou were observed in the Baird and DeLong Mountains during the mid to late 1940s (Skoog 1968). Although such estimates were little more than qualified guesses, they indicate caribou were abundant within the current range of the WACH during this time.

During the 1950s and 1960s, biologists considered all caribou north of the Brooks Range as a single "Arctic Herd" (Skoog 1968). Two developments in caribou research allowed biologists to refine this. In1968, Skoog identified the single criteria still used today to define caribou herds: repeated use of a discrete calving area. Soon thereafter, funding for caribou research became available as oil development was contemplated on the North Slope and conventional radio telemetry techniques were applied to caribou in northern Alaska. As a result, the "Arctic Herd"

was determined to consist of 4 herds: the Western Arctic, Porcupine Herd, Central Arctic, and Teshekpuk Lake Herds.

During the mid-1970s, most WACH caribou wintered in the Kobuk, Selawik, and Buckland River drainages. However, in some years a substantial portion of the WACH wintered north of the Brooks Range or near Wiseman and Anaktuvuk Pass (J. Davis, J. Hemming and J. Reakhoff, pers commun). As the WACH grew, it extended its winter range during the mid-1980s through mid-1990s south through the Nulato Hills to the Unalakleet River drainage.

Winter range. During the reporting period, WACH caribou extended their winter range onto the Seward Peninsula as far west as the Kougarok Road. Movements of caribou onto the Seward Peninsula were most pronounced during the winters of 1996–1997 and 1997–1998 when 80,000–90,000 caribou were west of the Kiwalik and Koyuk River drainages. Although this was a modest geographic extension of winter range (only 50–60 miles west of areas many WACH caribou had regularly used for the previous 10 years), it had tremendous impact on the Seward Peninsula reindeer industry. Four reindeer herds (Karmun, Deering; Gray, White Mountain; Menadelook, Coffee Dome; and Sagoonick, Shaktoolik) lost ≥50% of their deer to the WACH. Between 1990 and 1995, 3 reindeer herds (Hadley, Buckland; Sheldon, Candle; and Henry, Koyuk) were either essentially or completely lost to the WACH. During the winter of 1996–1997, some TCH caribou wintered on the Seward Peninsula as well.

Movement of WACH caribou onto the Seward Peninsula provided hunters from Nome and surrounding communities their first opportunities to harvest caribou in >100 years, and hunting was intense along the Kougarok Road and near Council. Village hunters and reindeer herders report that an increase number of wolves has been a secondary effect of caribou moving onto the Seward Peninsula.

Approximately 50,000–60,000 WACH caribou wintered between the Alatna Hills, Iniakuk Lake, and North Fork of the Koyukuk River during the winter of 1997–1998. This was the first time a substantial number of WACH caribou wintered in this portion of the Koyukuk River drainage since the early 1970s (J. Reakhoff, pers commun).

During November–December 1997, southernmost WACH caribou were in proximity to northernmost Mulchatna Herd caribou. A caribou reconnaissance flight between Dillingham and Unalakleet revealed caribou were distributed continuously north (presumably WACH caribou) and south (presumably Mulchatna Herd caribou) of the Yukon River delta (L. Van Daele, pers commun). A relatively small portion of the WACH (roughly 10,000–20,000 caribou based on radio collars) has used this area for 1–2 months during several winters since 1990. However, this is the first time Mulchatna Herd caribou have moved this close to the WACH.

Based on data collected from radio collars, approximately 50–75% of the TCH migrated into Unit 23 during mid to late November 1996. These caribou wintered along the Chuckchi Sea coast from Cape Lisburne to Cape Krusenstern, and throughout the southern portion of Unit 23 between the Purcell Mountains and Seward Peninsula Lava Beds. A satellite-collared cow collared north of Anaktuvuk Pass and presumed to belong to the WACH spent the winter of 1996–1997 with many other WACH caribou near the west end of the Seward Peninsula Lava Beds. During fall 1997, this cow migrated north to the Beaufort Sea coast with other collared

TCH caribou. Unfortunately, we were unable to determine whether this cow belonged to the WACH or TCH before the PTT and conventional transmitters expired. Teshekpuk Lake caribou were easily accessible from Point Hope, Kivalina, Noatak, Kotzebue, Selawik, and Buckland during the winter of 1996–1997, and hunting mortality appeared high, especially near Kotzebue.

Calving grounds. The WACH continued to calve in the Utukok Hills as they have since the mid 1970s (J. Coady, pers commun). Since the late 1980s, calving appears to have become dispersed. For example, during June 1997 many WACH cows calved in and north of the Meade River drainage.

Satellite collars. Satellite collars enabled us to effectively search for conventional radiocollared caribou. They also allowed us to notify reindeer herders of potential conflicts with caribou during periods of inclement weather and short day length. Viewed collectively, satellite collars reflected the onset of spring and fall migrations and movements during summer and winter.

Despite never having >9 functional PTTs on living WACH caribou at any time before 1998, satellite collars have illustrated the overall distribution of the WACH within and among years amazingly well. For example, the scatter plot of all WACH PTT locations collected since 1987 closely agrees with our representation of overall range (Fig. 1) determined from thousands of conventional collar locations.

Scatter plots for WACH and TCH satellite collars fit together like pieces of a jigsaw puzzle. This indicates these herds may be more discrete than previously thought. This is not to suggest these herds do not mix. Conventional and satellite collars unequivocally indicate WACH caribou use TCH range during summer and early fall, and the TCH use WACH winter range.

In 1998 we began using ArcView to plot locations of WACH PTTs. Several considerations are relevant to evaluating the distribution and movements of WACH caribou from PTT data. Virtually all radio collars are deployed on WACH caribou at Onion Portage during September. This overrepresents use of this area as a migratory corridor and may overestimate use of winter range in areas south of the Kobuk River because we only sample animals moving into this portion of winter range. Radiocollared caribou are not randomly distributed in the herd until the summer (June/July) following collaring. Differences in frequency of location among seasons (calving vs. winter), years (as the number of PTTs varies) and PTT duty cycles affect scatter plots of WACH distribution as well.

MORTALITY

The adult cow mortality rate during 1997–1998 was possibly the lowest ever recorded (Table 5, Fig. 4). This is probably attributable to the mild winters experienced throughout the range of the WACH during 1996–1997 and 1997–1998.

The unusually high mortality estimate for 1983–1984 (29%) appears erroneous. Although we do not have reason to discount this estimate, it is highly unlikely that almost one third of the WACH actually died during this time, considering the rate of population growth between 1982 and 1986 (Table 1, Fig. 2). Also, there is no anecdotal information or corollary evidence to indicate a mortality event of this magnitude. A more plausible explanation is the sample of collared cows experienced higher mortality than the overall population. More likely, given the low mortality

estimates for 1981–1982 and 1982–1983 and low search effort during early telemetry surveys (S. Machida and D. James, pers commun), mortalities may have accumulated undiscovered to be identified in and ascribed to 1983–1984. There is no way to determine *a posteriori* what caused the high adult mortality estimate for 1983–1984. The questionable accuracy of the 1981–1982 through 1983–1984 mortality estimates allows several approaches to interpreting adult mortality trend:

The most conservative approach is to discount the 1981–1982 through 1983–1984 mortality estimates as erroneous. This approach suggests there has been no temporal trend in mortality during the 1984–1985 through 1997–1998 collar years ($R^2 = 0.003$, $n = 14$).

An alternative approach is to discount only the 1983–1984 mortality estimate as inaccurate. The mortality estimates for 1981–1982 and 1982–1983 (6% each year) seem plausible in relation to estimates for1987–1988 (9%) and 1997–1998 (6%). This approach suggests adult mortality slowly increased from the early 1980s to mid 1990s (Dau 1997*a*).

A third approach is to accept all annual mortality estimates at face value. This approach also suggests adult mortality slowly increased from the early 1980s to mid 1990s and indicates adult mortality rate can be highly variable among years.

Three-year moving averages of annual adult mortality estimates incorporate or minimize some of the uncertainty in determining year of death for collared caribou (Fig. 5). Using all annual estimates of adult mortality (including 1981–1982 through 1983–1984), this approach suggests mortality has oscillated between 10–20% since the early 1980s. A shortcoming of this approach is that it may artificially minimize annual variability in adult mortality. This variability may be as important, or even more important, than mean level of mortality in affecting the population dynamics of the WACH.

Perhaps the best way to evaluate adult mortality is to consider 3-year moving averages and the annual values to understand long-term trends and annual variability, keeping in mind limitations of mortality estimates during the early 1980s.

Estimates of adult cow mortality should be viewed as a conservative index of WACH mortality because they ignore bulls, which tend to have higher mortality rates than cows, and because emaciated, injured, or clinically diseased cows are not collared, even though they are in the population. Although these factors would shift the WACH mortality curve up, they should not affect its temporal trend (Dau 1997*a*).

Adult caribou mortality is most meaningful when considered in relation to recruitment. The significance of Figs. 4 and 5 is that from the early 1980s to mid 1990s recruitment and adult cow mortality converged, regardless of how you interpret mortality trend. This is consistent with photocensus results indicating that growth of the WACH slowed after 1990. During 1997 and 1998, the separation between recruitment and adult cow mortality suggests the WACH growth rate may have again increased.

Harvest

Season and Bag Limit. On state-managed lands the following seasons and bag limits were in effect throughout the reporting period:

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	No closed season	No closed season
Cows	1 July–15 May	1 July–15 May

Federal hunting seasons during this reporting period were identical to state regulations during this reporting period. However, the bag limit was 15 caribou per day for federally qualified subsistence users in Unit 23. The federal bag limit in other units used by the WACH was 5 caribou per day.

Board of Game Actions and Emergency Orders. In response to 80,000–90,000 WACH caribou moving onto the Seward Peninsula during September and October of 1996 and 1997, the following emergency orders were issued:

Emergency Order 05–03–96. This order, issued 30 October 1996, opened caribou hunting in Unit 22D from 31 October 1997 to 30 June 1997. The bag limit was 5 caribou per day. Because no caribou season existed for Unit 22D, this emergency order required Board of Game approval via teleconference before it could be issued. This slowed the process of opening caribou hunting and angered some Nome residents who were eager to take caribou.

Emergency Order 05–01–98. This order, issued 14 January 1998, opened caribou hunting in that portion of Unit 22D including the Kuzitrin drainage east of the Taylor Highway.

In addition to these emergency actions, the Board of Game considered a proposal (Number 15) during the October 1997 meeting to establish a permanent caribou hunting season in Unit 22D with season dates and bag limit comparable to other neighboring units in northwest Alaska. The board rejected this proposal based on testimony from the Reindeer Herders Association that: 1) caribou do not regularly use this area; 2) hunters will mistakenly harvest reindeer when no caribou are in the area; and 3) the department can open caribou hunting by emergency order when they move into this area.

Harvest Assessment. Since hunters cannot determine herd identity for caribou taken in areas occupied by more than 1 herd, it is difficult to correlate harvest estimates with the abundance of

CAH, TCH, and WACH caribou. The timing and degree and duration of mixing among these herds vary annually.

Hunter Residency and Success. During the 1996–1997 regulatory year, 887 local hunters registered to hunt WACH caribou. Of these, 384 (43%) hunters (205 successful and 179 unsuccessful) reported taking 1031 caribou. During the 1997–1998 regulatory year, 587 local hunters registered for this hunt; 272 (46%) hunters (125 successful and 147 unsuccessful) reported taking 639 caribou. The number of local hunters who register to hunt WACH caribou is probably influenced more by the availability of village license vendors than variation in the actual number of hunters. Community-based harvest assessments indicate local hunters currently take approximately 20,000 WACH caribou annually and that $\leq$10% of the actual caribou harvest is reported under the registration permit system (Georgette 1994).

During the 1996–1997 regulatory year, 334 nonlocal hunters (268 successful and 68 unsuccessful) reported taking 472 WACH caribou through the statewide caribou harvest ticket system. In 1997–1998, 300 nonlocal hunters (218 successful and 82 unsuccessful) reported taking 363 WACH caribou. These are minimum estimates of both hunters and harvests because compliance with reporting requirements was voluntary. The actual harvest by nonlocal hunters is thought to be 1000 to 3000 WACH caribou annually.

Harvest levels for communities near the periphery of the WACH range vary substantially among years in relation to caribou movements. Even communities located within high-use seasonal ranges or migration areas experience large seasonal and annual differences in harvests as availability of caribou fluctuates. The uncertainty associated with caribou availability and their frequent periods of superabundance occasionally results in waste of this valuable resource. Hunters sometimes take more caribou during winter than they can dry or freeze during summer, and surplus carcasses are taken to the dump when they thaw in the spring. Also, inexperienced hunters sometimes kill caribou in poor condition and abandon them when they discover they have no fat. The perception that the WACH is currently too large and is destined to crash contributes to waste by both sport and subsistence hunters.

Harvest Chronology. Subsistence harvests of WACH caribou are throughout the year. Regional subsistence hunting patterns have developed over generations in response to seasonal movements of caribou. For example, Point Hope and North Slope villages harvest WACH caribou mainly during summer, while Shaktoolik and Unalakleet hunters take them during winter. In Unit 23, harvests are usually high during fall and spring migrations. Unlike many subsistence activities that are seasonally specific, subsistence hunting of caribou occurs whenever caribou are available.

During fall, subsistence hunters primarily harvest large bulls because they provide the best meat. Once bulls enter rut and become unpalatable, typically around 7–12 October, most subsistence hunters take cows until approximately March or April. During the rest of the year, subsistence hunters take caribou of both sexes based on availability and body condition.

Virtually all harvest by nonlocal hunters is between late August and late October and peaks during September. Nonlocal hunters harvest large bulls almost exclusively, even after the onset of rut.

Transport Methods. Most subsistence hunters harvest WACH caribou using snow machines during October–May and boats or 4-wheelers during the rest of the year. Few local hunters use aircraft to hunt caribou. In contrast, nonlocal hunters depend almost entirely on aircraft to access caribou hunting areas. Once in a hunting area, many sport hunters use boats. Although a few guides have long used 4-wheelers for hunting, this practice has dramatically increased since the mid-1990s. In Unit 23, increasing numbers of village residents are 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 for the WACH (Table 6). Incidence of the respiratory viruses IBR, BVD, and PI3 appears to have remained high since 1992. A large female calf that died of acute natural causes in October 1998 showed hemorrhage on the surface of the lungs typical of pneumonia caused by respiratory viruses (Dieterich 1981); no lungworms were present. In contrast, exposure to *Brucella suis* biotype 4 has remained low since 1992. The high variability in exposure to brucellosis between 1992 and 1998, 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.

Local subsistence hunters continued to report high numbers of "sick" caribou during this reporting period. Most maladies described by hunters appeared to be tapeworm larvae or abscesses. The disparity between local hunters' observations and serology results indicates serologic tests are missing some pathogens in this herd. For example, 8–10 caribou with lesions symptomatic of hoof rot (*Fusobacterium necrophorum*), for which there is no serologic test, were observed during October 1998 composition surveys.

Two of 35 serum samples (6%) randomly selected from the 113 caribou sampled during September 1998 (after this reporting period) had elevated haptoglobin levels; neither were positive for brucellosis (other serologic test results not available). In addition, of the 5 WACH caribou necropsied during October 1998, 2 of 3 caribou with swollen joints had elevated haptoglobin levels; 1 caribou with no obvious swelling but positive for brucellosis had an elevated haptoglobin level; 1 emaciated bull with a swollen tarsal joint but negative for brucellosis did not exhibit an elevated haptoglobin level; and the female calf with no obvious swelling that appeared to have died from an acute lung infection did not have an elevated haptoglobin level. Overall, haptoglobin levels appeared to correctly identify inflammation for 4 of the 5 caribou necropsied.

A 2-step approach to monitor disease in the WACH is worth considering. Haptoglobin levels could reflect overall levels of disease in this herd. Specific serologic tests for caribou with elevated haptoglobins could then identify causes of inflammation.

Metals and radioactive isotopes. Necropsies showed no gross evidence of poisoning by metals or radioactive isotopes. In fact, all caribou collected near the Red Dog Mine were in good condition, and all adult cows were pregnant. Their meat was salvaged and donated to elders in Kotzebue and Barrow. Likewise, no caribou sampled at any location showed elevated levels of radionuclides (O'Hara et al., in prep.).

Results of metals analyses are less clear (O'Hara et al., in prep.). This may be partly because all sample sizes of caribou were small relative to the size of the WACH population. Also, for at least some metals (e.g., Fe), effects of starvation on metal physiology and postmortem changes in metal levels may have affected the results. Although differences in mean levels of individual metals were apparent among geographic locations, these differences were not consistent among tissue types. For example, mean Pb (lead) was highest for the Red Dog Mine sample of kidney tissue but lowest for muscle tissue. Maximum mean metal levels for WACH caribou were below levels considered toxic for domestic livestock. There was no evidence that metal toxicity or deficiency contributed to the death of caribou sampled near Cape Thompson, that either has affected the general health of the WACH, or that either poses a threat to people who consume caribou.

HABITAT

Assessment

The department did not monitor range condition for the WACH during the reporting period. In 1997, BLM continued to evaluate WACH winter range in the Nulato Hills and McCarthy's Marsh (Seward Peninsula Fish River Flats; R. Meyers, pers commun). No habitat assessments were conducted during 1998.

NONREGULATORY MANAGEMENT PROBLEMS/NEEDS

WACH Co-management

During the previous reporting period, the department began to investigate co-managing the WACH with subsistence hunters and other stakeholders. Co-management is a resource stewardship process emphasizing shared decision-making through communication across cultural boundaries. Successful caribou co-management examples include the Porcupine and Beverly/Qamanirjuag Caribou Management Boards in Canada and the Qavilnguut (Kilbuck) Caribou Herd Cooperative Management Plan in Alaska.

For department biologists, co-management offers the advantage of greater participation in day-to-day WACH management by Alaska Native subsistence hunters, more effective integration of western and indigenous knowledge about caribou, and greater coordination in administering a caribou herd across many jurisdictions and cultural boundaries. Many Alaska Native organizations see co-management as an opportunity to assume a more meaningful role in protecting their subsistence-based cultures and in managing the caribou resource.

During this reporting period a WACH Co-management Working Group was organized, consisting of most resource agency and stakeholder representatives concerned with the WACH. During 1997 and 1998 the Working Group evaluated a draft co-management plan prepared by Maniilaq Association in the Kotzebue area. In February 1999, the working group decided to table the Maniilaq co-management plan. However, using a consensus process, the Working Group developed a statement of purpose, goals, and objectives that were developed from discussions of the Maniilaq proposal. The Working Group also decided to continue meeting on a permanent basis and will begin reviewing the 1984 WACH Strategic Management Plan (ADF&G unpubl. ms). The Working Group is still informally organized and is operating on the assumption that to

"do nothing would be the worst mistake of all." Rules of membership and service need to be developed.

The department has been the resource agency leading the effort to explore co-management as an option for the WACH. The effort appears to be progressing. Success in co-managing the WACH is probably contingent upon the department's desire to continue sharing its management authority to the maximum extent legally possible. But the critical evaluation of this effort will be in the minds of the people who depend on the WACH, especially Alaska Native subsistence hunters in northwest Alaska. If co-management appears to them as a more valid and meaningful way of managing the caribou resource, the effort will have been successful.

School programs

As in the past, department staff made presentations on WACH caribou in schools throughout the range of this herd. The department's "Project Wild" coordinator made presentations to teachers in Deering during 1997 and Kotzebue during 1998 (after this reporting period). Ambler high school students participated in the Onion Portage (Kobuk River) collaring project during September 1996 and 1997. In 1998 (after this reporting period), Division of Wildlife Conservation public communication staff filmed high school students from Ambler and Kotzebue participating in the Onion Portage collaring project.

Conflicts between the WACH and reindeer industry

Since approximately 1990, 7 of 14 reindeer herds have lost ≥50% of their animals to the WACH. Although many thousands of caribou moved onto the eastern Seward Peninsula during October 1998 (after this reporting period), conflicts with reindeer were decreased because most caribou continued moving south and east into the Nulato Hills by late November.

User-group issues

Conflicts between nonlocal hunters, commercial operators, and local hunters intensified in portions of WACH range during this reporting period. Residents of Anaktuvuk Pass felt that big game guide camps north of the village were diverting caribou during fall migrations. Also, during September 1998 (after this reporting period), 5 residents of Shungnak robbed 3 parties of nonlocal hunters at gunpoint within Gates of the Arctic National Preserve. Alcohol was involved, but this situation shows the dissatisfaction and conflict between local and nonlocal hunters.

Special funding ($30,000) was provided to Kotzebue Division of Wildlife Conservation staff to address user conflicts during the fiscal period July 1998–June 1999. This complex issue involves all hunters, not just caribou hunters, and is affected by 1) the heavy reliance on aircraft by nonlocal hunters and commercial operators in contrast to local hunters' use of boats and snow machines; 2) deteriorating hunting conditions (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. The limiting factor driving this conflict in northwest Alaska is not inadequate numbers of wildlife, certainly not with regard to WACH caribou. Rather, the limiting factor in these conflicts is inadequate space to accommodate all users.

CONCLUSIONS AND RECOMMENDATIONS

Census results indicate the WACH grew rapidly from approximately 1975 through 1990. Since 1990, this herd has grown slowly. The reduction in population growth rate appears to be attributable to declining recruitment rather than increasing adult mortality. Temporal trends in recruitment and adult mortality appear consistent with census results. Calf production also continued to decline during this reporting period. Predation and hunting do not currently appear to be limiting the size of the WACH.

Body condition of WACH caribou has shown no clear temporal trend. In 1993 and 1995 when fall caribou body condition was poor, the "bottleneck" appeared to occur during summer. The reasons for this are unknown but may be related to the amount of time that 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, reports from local hunters and opportunistic observations by department staff indicate the prevalence of sick or heavily parasitized caribou has increased since 1990. We should consider a 2-step approach to evaluate disease: 1) initially measure haptoglobin levels in all serum samples to monitor overall levels of disease and 2) follow with specific serologic tests to identify causative agents for individuals with elevated haptoglobin levels.

Losses of reindeer to the WACH continued during the reporting period. 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, and budgets. The department should continue to increase the number of PTTs in the WACH to minimize conflicts between caribou and the reindeer industry and improve our understanding of caribou distribution and movements.

Conflicts between local subsistence hunters, nonlocal sport hunters, and commercial operators have intensified in portions of WACH range since 1992. The limiting factor driving these conflicts is inadequate space to accommodate all users.

The department should continue to evaluate co-management of the WACH.

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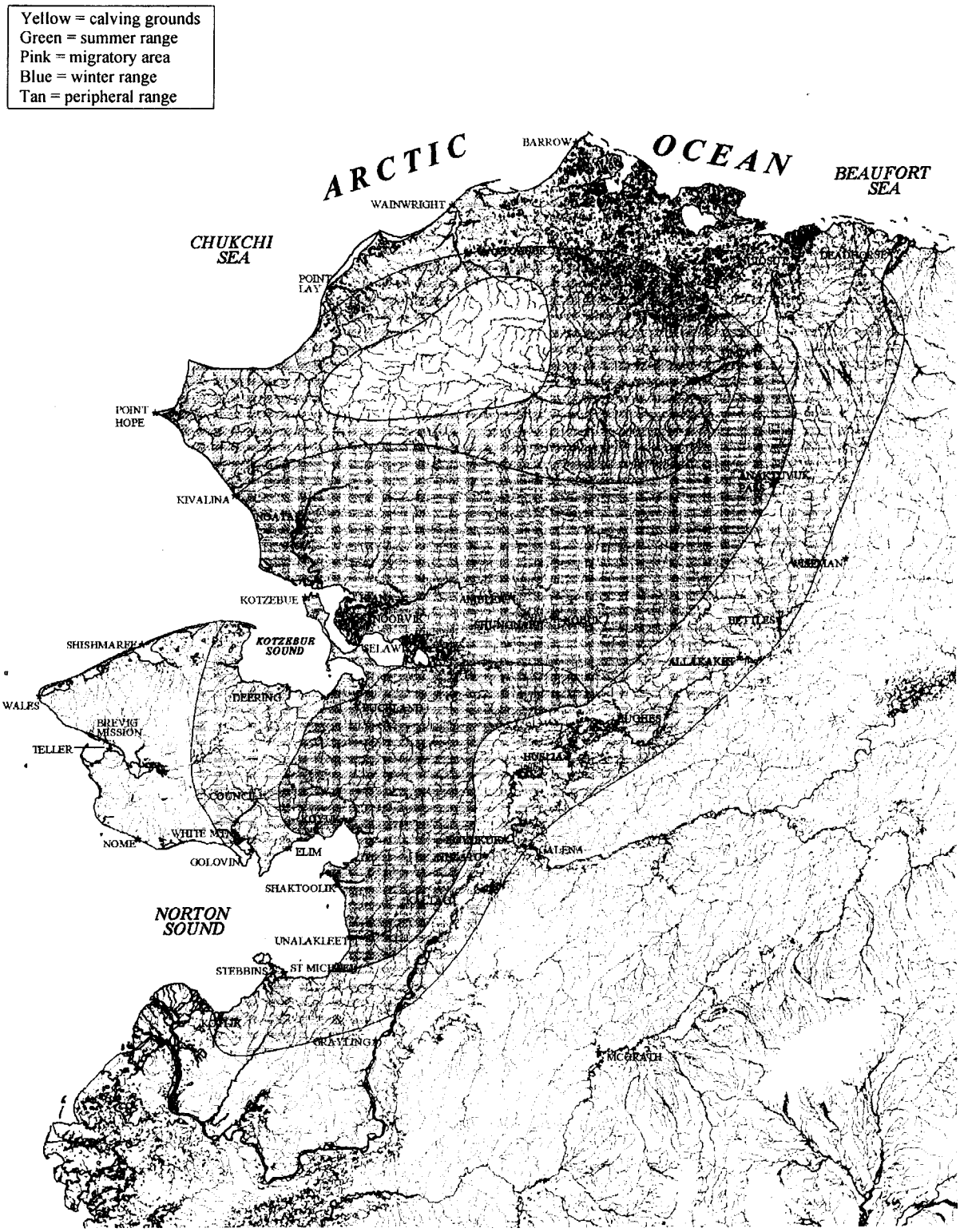

Figure 1 Seasonal ranges of the Western Arctic Caribou Herd

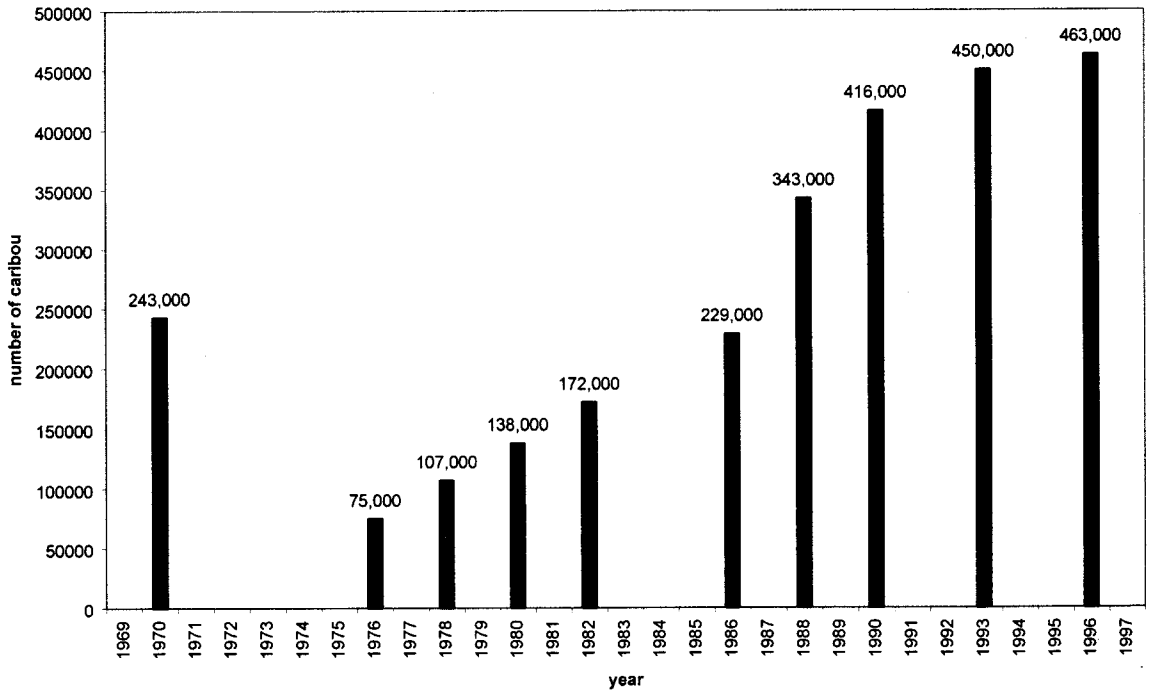

Figure 2 Photocensus population estimates of the Western Arctic Caribou Herd, 1970-1996

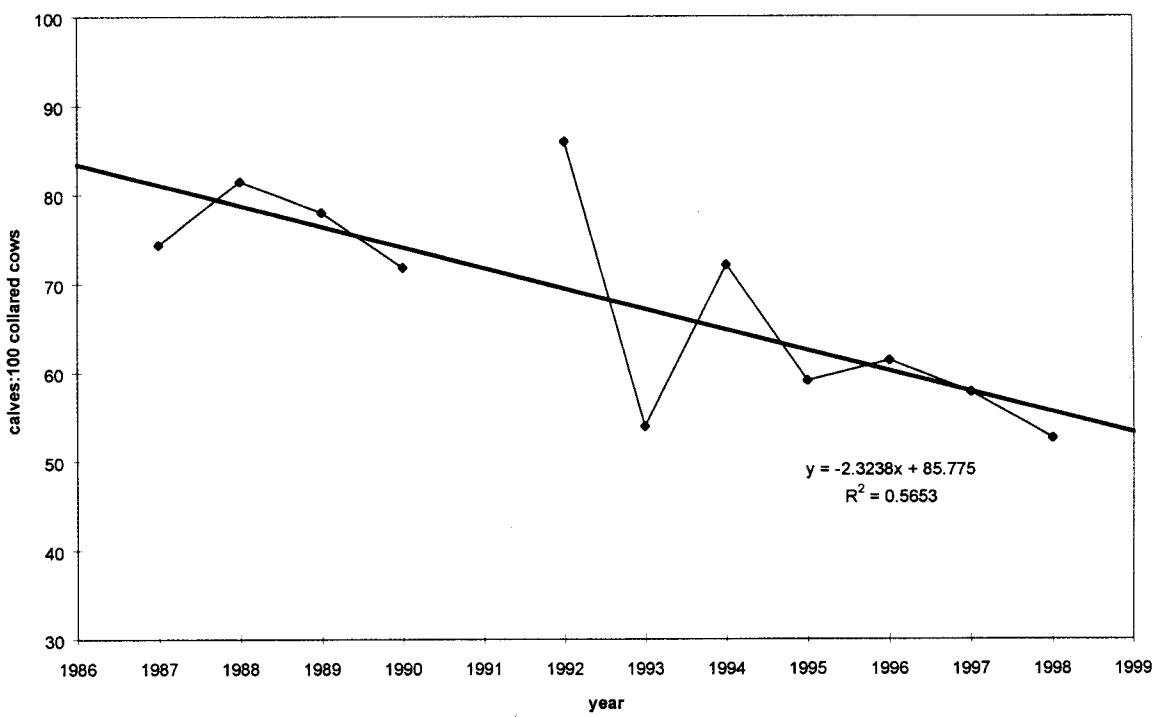

Figure 3 Results of calving surveys for the Western Arctic Caribou Herd, 1987-1998

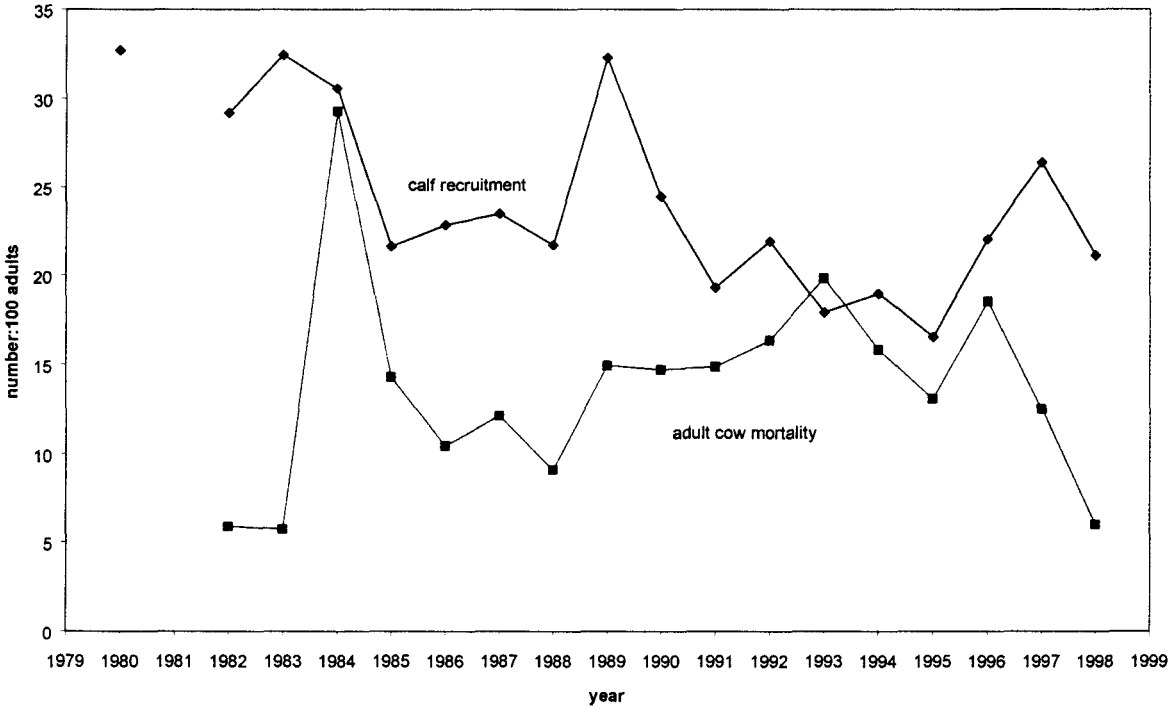

Figure 4 Annual estimates of Western Arctic Herd adult cow mortality and calf recruitment, 1980-1998

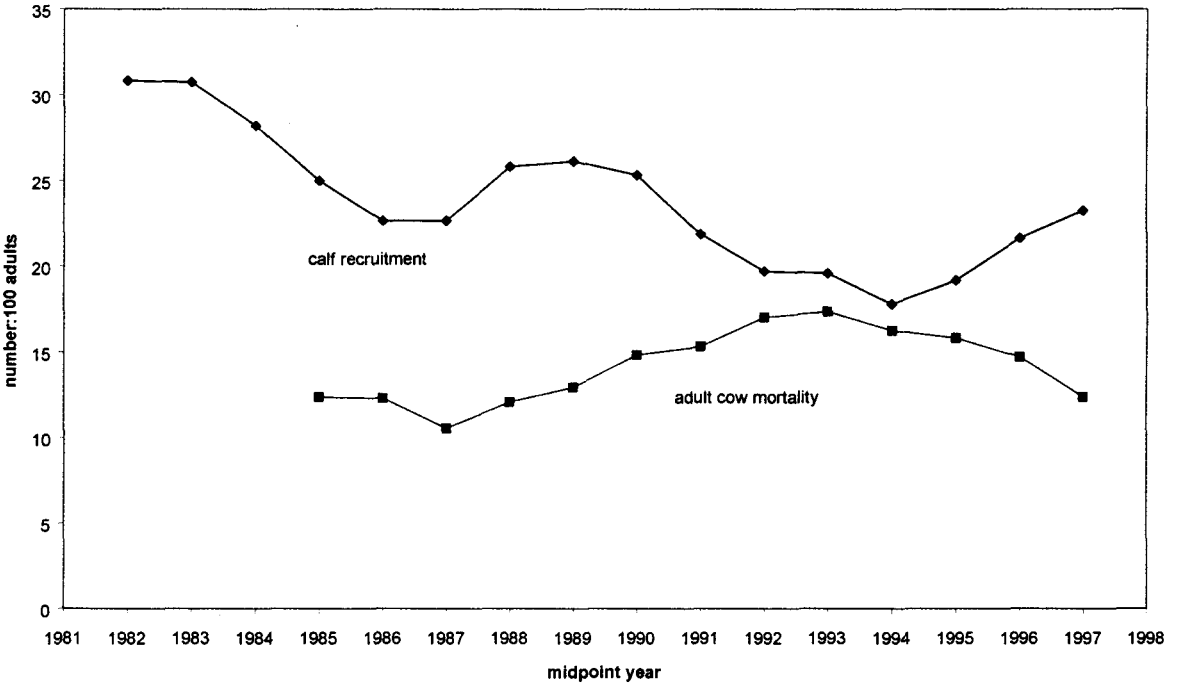

Figure 5 Three-year moving averages of Western Arctic Caribou Herd adult cow mortality and calf recruitment (excludes 1981-1982 through1983-1984 mortality esitmates)

Table 1 Photocensus population estimates of the Western Arctic Caribou Herd, 1970–1996

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		
1994		1	454,000
1995		1	459,000
1996	463,000		

[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, 1987–1998

Year	June dates	With Calf	No Calf 1 hard antler	No Calf soft antler	No Calf no antler	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	1	21	79	57	22	72
1995	9–13, 19–20	47	2	13	21	83	49	34	59
1996	5–6, 13–14	38	16	13	21	88	54	34	61
1997	4–7	39	13	17	22	91	52	39	57
1998	12–15	37	5	17	21	80	42	38	53

Table 3 Fall population composition of the Western Arctic Caribou Herd, 1961–1998

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
1997	2588	5229	2255	10072	43	29	49
1998	2298	4231	1909	8438	45	29	54

Table 4 Short yearling[a] survey results of the Western Arctic Caribou Herd, 1980–1998

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							31[b]
1982	3988	1164	5152			29	31
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	22
1997	9298	2438	11736	40	56	26	23
1998	7409	1585	8994	34	46	21	

[a] Short yearlings are 10–11-month-old caribou.
[b] Calculates average using values from 1980 and 1982.

Table 5 Annual mortality and binomial confidence intervals for Western Arctic Caribou Herd cows collared with conventional radiocollars, 1981–1982 through 1997–1998 "collar years" (1 Oct–30 Sep)

				Binomial Confidence Level		
Collar year[a]	Sample size[b]	No. died	Mortality rate[c] (%)	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	108	20	19	14–24	13–26	12–27
1996–1997	104	13	13	8–18	8–19	7–20
1997–1998	102	6	6	3–10	3–11	2–12

[a] "Collar year" defined as 1 October–30 September

[b] Sample size = total number of potentially active 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, 1962–1998

	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	20	(71)	38	(71)	30	(66)	7	(71)	0	(71)			1	(70)	3	(76)
1997	1	(75)	32	(75)	40	(73)	1	(75)	0	(71)			0	(75)	0	(76)
1998															7	(113)

[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 in Canada. Most of the herd's 130,000-mi^2 range is remote, roadless wilderness. Most calving by the PCH occurs 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 in 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. A representative of ADF&G sits on the board, along with representatives of the governments of the United States, Canada, Yukon and Northwest Territories, and communities and Native organizations from Alaska and Canada. Board recommendations, biological studies, and Congressional actions regarding the opening of ANWR to petroleum development 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. The herd continued to decline to an estimated 129,000 animals in 1998.

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 PCH caribou. However, 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).

Management Goals

The following goals, proposed by the International Porcupine Caribou Board (International Porcupine Caribou Board 1998: Appendix 1), were used to guide management activities during recent years.

- Conserve the PCH and its habitat through international cooperation and coordination so that the risk of irreversible damage or long-term adverse effects as a result of the use of caribou or their habitat is minimized.
- 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.

Management Objectives

To accomplish goals, the following management objectives were established:

- Maintain a minimum population of 135,000 caribou.
- Monitor the harvest through field observations, hunter reports, and contact with residents.
- Conduct censuses and sex and age composition counts.

METHODS

Personnel from ADF&G, ANWR, and Yukon Renewable Resources Department (YRRD) cooperatively estimated population size with an aerial photocensus conducted on 30 June and 1 July 1998 using counting methods described in previous reports (Whitten 1993*a*). Movements, productivity, mortality, and seasonal distribution of the herd were also periodically monitored (Fancy and Whitten 1991, Whitten 1993*b*, 1995*a*). Calf production and survival of radiocollared cows were monitored during June (Whitten et al. 1992). In addition, personnel from YRRD conducted composition counts on the PCH winter range during March of each year.

Harvest tickets submitted by nonlocal hunters (Alaskans residing outside Units 25, 26B, and 26C) provided most data on harvest in Alaska. ADF&G Division of Subsistence staff gathered additional data on harvest by local hunters through field interviews. Canadian harvest and composition data were obtained from the Yukon Department of Renewable Resources. Harvest data were summarized by regulatory year (RY = 1 July–30 June).

RESULTS AND DISCUSSION

POPULATION STATUS AND TREND

Population Size

Personnel from the ADF&G, US Fish and Wildlife Service (FWS), and YRRD counted 127,944 caribou on aerial photographs taken in June and July 1998. An additional 412 caribou were seen in small groups, but were not photographed. The total count was 128,356. Because some small groups of caribou may have been missed, we estimated that herd size was about 129,000 (Table 1). During the last survey in July 1994, we estimated the herd at 152,000 caribou. The highest population ever recorded was 178,000 during 1989. These results indicate the herd has declined by approximately 4% per year since 1994. It is possible that, as in previous surveys, the 1998 census slightly underestimated the population. However, it is unlikely that census errors account for the decline that has occurred since 1994.

Population Composition

We have not estimated composition of postcalving groups since 1992, and the last fall composition count was done in 1980 (Table 2). The bull:cow ratio is unknown but probably is between 35 and 60:100 because of relatively good recruitment and low harvest. Surveys of radiocollared cows during late June found 57 calves:100 cows during 1997 and 68 calves:100 cows during 1998 (Table 3). Winter surveys by the YRRD found 46 and 38 calves:100 cows during March 1997 and 1998, respectively (Table 3; D Cooley, pers commun). Composition surveys from different months are not directly comparable. The June surveys included only mature, radiocollared cows and were not representative of the entire herd. Although the March surveys were not limited to radiocollared caribou, only a small proportion of the herd was classified.

Calf:cow ratios probably were influenced by demographic effects of poor calf recruitment during 1991–1993. Adverse weather during these years reduced parturition rates and increased calf mortality. Ratios initially increased during 1994–1996 because fewer nonbreeding cows, aged 1–3 years, were present in the population. Beginning in 1997, ratios declined because the larger cohorts born during 1994–1996 increased the proportion of adults, although most did not initially produce calves. Calf:cow ratios should increase to levels seen before 1991 as these cohorts enter the breeding population.

Reproduction and Calf Survival

Calving surveys during June 1998 indicated that 83% of adult cows produced calves (Table 3). This was slightly above the mean annual parturition rate of 81% observed since data collection began in 1982. Of 48 parturient cows, 39 (81%) had calves surviving until 5 June. No calves were known to have died between 5 June and 30 June, although only 15 calves were observed because the caribou formed large aggregations earlier than usual. During 1997 we estimated a 73% parturition rate and 87% calf survival during June.

Distribution and Movements

Garner and Reynolds (1986), Whitten (1987, 1993*b*, 1995*b*), Whitten and Regelin (1988), Fancy et al. (1989) Golden (1989, 1990) and Whitten and Fancy (1991) summarized information on movements and distribution of the PCH.

An aerial survey during March 1998 indicated that much of the PCH was located in the northern Richardson Mountains. Due to relatively light snow cover, caribou began their spring migration to the coastal plain earlier than in years with more snow, and most reached the Arctic National Wildlife Refuge by 1 June. During both 1997 and 1998, most calving occurred on the arctic coastal plain, including parts of northwestern Yukon and northeastern Alaska. During these years, the proportions of calves born within the nonwilderness portion of the coastal plain of the Arctic National Wildlife Refuge were 34% and 85%, respectively. Snowmelt and new plant growth occurred earlier than in previous years, continuing a trend seen in 1995 and 1996. Caribou left the coastal plain and moved into the Brooks Range foothills of Alaska and Canada during late June and early July. Most of the PCH was in Canada by mid August, and few returned to Alaska during fall. This was consistent with a long-term decline in the number of PCH caribou wintering in Alaska. Consequently, fall subsistence harvests in Alaska were probably low. In the Yukon, caribou were accessible from the Dempster Highway during much of both winters, and harvests were relatively high.

MORTALITY

Harvest

Season and Bag Limit. The state of Alaska hunting season for all hunters during this reporting 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 of Game took no regulatory action regarding the PCH during this reporting period. However, the board considered a proposal to open the season later.

Hunter Harvest. Total harvest for the PCH was approximately 2437 and 1671 during RY 1996–1997 and 1997–1998, respectively (Table 4). This represents 1–2% of the estimated population (Table 1).

Harvests by local and nonlocal residents in Alaska were reported differently. Nonlocal hunters used statewide caribou harvest ticket report cards. Standardized reporting of harvest by hunters living north of the Yukon River was not required after 1989, and prior to 1989 most local residents did not report even though it was required. Therefore, local harvest was estimated.

Harvest by nonlocal hunters was a minor part of the overall PCH harvest and showed no definite trend over the past 5 years. Nonlocal hunters primarily harvested bulls. Most nonlocal hunters were Alaska residents.

In Alaska, local harvest reflected the relative availability of caribou. 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. Harvest in Canada was relatively high because caribou often move through the Old Crow area several times each year. They also spend time in the Richardson Mountains or along the Dempster Highway, which are accessible to residents of Aklavik, Fort McPherson, and several road-connected communities.

Hunter Success. Nonlocal hunter effort and success varied among game management units depending on herd distribution (Table 5). Word travels quickly when PCH caribou are scarce in Alaska, and few hunters travel to the PCH range. Because of their wide-ranging movements and the difficulty and expense of traveling to the area, the PCH has never been subject to a substantial harvest by nonlocal hunters.

Local hunter success during this report period was probably low. Caribou left the Kaktovik area in both 1997 and 1998 before sea ice receded, and local residents were unable to travel to traditional hunting areas by boat. Caribou were available near Arctic Village for only a few weeks in late summer each year, and some other Gwichin villages took small numbers of caribou along the Porcupine River near the Alaska–Yukon border in fall. Most caribou remained in Canada through the winter.

Harvest Chronology. Nearly all nonlocal harvest of the PCH in Alaska occurs during August and early September, when most hunters prefer to be afield. During this reporting period, caribou were available during winter in sparsely populated eastern Unit 25A, but nonlocal hunters made little or no use of them. Local harvest chronology depends on availability of caribou near villages, and harvest occurs whenever caribou are present. However, caribou may be present but inaccessible at Kaktovik during June because traveling conditions are poor.

Transport Methods. Traditionally, nonlocal hunters fly into the PCH range, and a few travel by boat up the Porcupine River. Local residents use boats or ATVs in summer and snowmachines in winter.

HABITAT

Assessment

Carrying capacity of the PCH range is not known. Population density reached approximately 1.0 caribou/mi^2 (0.4/km^2) during the late 1980s. Results of studies on the calving ground indicate calving caribou select areas with rapid plant growth, rather than specific sites or habitats (Fancy and Whitten 1991). Rapid plant growth occurs in different areas annually, but those areas tend to occur most frequently in the region designated by previous researchers as the primary calving area of the PCH. The implication of this 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 a national park. Most of the area is classified as "limited" for fire suppression, and a natural fire cycle generally prevails.

CONCLUSIONS AND RECOMMENDATIONS

Although the 1998 population estimate of 129,000 caribou was below ADF&G's objective of a minimum of 135,000, the actual population was probably higher than estimated and close to the management objective. There were no indications of excessive mortality rates or low productivity, and the herd was well above levels of the 1970s, when it numbered 102,000–110,000. Thus, we should reevaluate the population objective for caribou in the Porcupine herd.

The most likely explanation for the decline in numbers since the 1989 census is reduced calf production or survival during 1991–1993 due to adverse weather. Reduced production or survival was indicated by low March calf:cow ratios (Table 3). Calves born during those years would now be reproductively mature. Relatively low recruitment has resulted in a lower number of reproductively active adults in the herd. Calving surveys indicated that calf production (measured as a proportion of adult cows) since 1993 has been good, and weather conditions have moderated. Thus, the decline should end as calves from these larger cohorts become adults. Although no immediate change in management strategy is needed, the population should be monitored closely during the next 2–3 years. A continuing decline could eventually lead to proposals to reduce harvest of females.

The PCH was lightly hunted, and harvest had little effect on recent population changes. Current productivity and survival and the generally good physiological condition of animals in the herd probably reflect mild climate conditions. If mild weather continues, the herd will probably increase again.

Management objectives for the PCH will be reviewed during the next reporting period. Nonquantitative objectives will be deleted or incorporated into goals approved by the International Porcupine Caribou Board (International Porcupine Caribou Board 1998: Appendix 1). New objectives will be formulated that are consistent with those goals.

ADF&G is cooperating with US Geological Survey-Biological Resources Division, FWS, 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 especially important to calving and postcalving caribou and recommended this area for special consideration in any plans to develop ANWR. However, studies that are more recent indicate all of the ANWR coastal plain and adjacent areas in Canada may be important to the herd over the long term (Fancy and Whitten 1991). ADF&G 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 Porcupine Caribou Herd population estimates, 1961–1998

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
1998	129,000	Radiocensus

[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.

Table 2 Porcupine caribou herd historical postcalving composition counts, 1971–1992[a]

Approximate survey date	Bulls:100 Cows[b]	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[c]	95	43	15	36	15		46	34	19,718
7/83	9	73	38	52	5	61	39	5	2,583
7/86[c]	57	52	22	42	12			24	19,499
7/87[c]	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[d]									
7/91	36	46	28	46	10			17	16,060
7/92	27	55	27	49	10	62	38	13	18,217

[a] Beginning in 1993 composition data were obtained from observations of radiocollared cows (see Table 3).
[b] These figures do not represent overall herd composition of bulls. Accurate bull:cow ratios are usually obtainable only during or prior to the rut in October.
[c] Only these surveys sampled all portions of the herd, including bull groups.
[d] No counts completed.

Table 3 Porcupine caribou herd demographic data, 1987–1998

Birth year	June calving surveys: Cows observed[a]	June calving surveys: Parturition rate	July Calves:100 Cows[b]	March Calves:100 Cows[c]	Population estimate
1987	51	0.78	55		165,000
1988	91	0.84	62		
1989	74	0.78	58	43	178,000
1990	74	0.82	74		
1991	74	0.74	61	22	
1992	78	0.86	49	33	160,000
1993	78	0.68	45	32	
1994	99	0.90	70	40	152,000
1995	95	0.69	59	41	
1996	74	0.89		46	
1997	48	0.73	57	38	
1998	58	0.83	68		129,000

[a] Number of radiocollared cows observed during May and June.

[b] Includes only radiocollared adult cows >3 years old.

[c] As of March of the year following birth of each cohort. Includes all cows >1 year old.

Table 4 Porcupine caribou herd harvest, regulatory years 1984–1985 through 1997–1998

Regulatory year	Reported				Estimated unreported			Total
	M	F	Unk	Total	Alaska	Canada	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	2315
1995–1996	61	7	0	68	200	2069	2269	2337
1996–1997	76	2	0	78	200	2159	2359	2437
1997–1998	58	4	1	63	300	1308	1608	1671

Table 5 Porcupine caribou herd nonlocal[a] hunter success, regulatory years 1991–1992 through 1997–1998

Regulatory year/ Hunters	Unit					Total Units 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
1996–1997						
Total hunters	47	20	0	67	9	76
Successful	29	16	0	45	2	47
% Successful	62	80	0	67	22	62
1997–1998						
Total hunters	56	10	3	69	17	86
Successful	34	5	0	39	6	45
% Successful	61	50	0	57	35	52

[a] Nonlocal includes Alaskans residing outside Units 25, 26B, and 26C.

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

As recently as 1960, 30,000 Fortymile caribou crossed the Steese Highway to calve and 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.

When this caribou herd was first discovered in the late 1970s, it numbered 100–200 caribou (Valkenburg, pers commun). By the time of the first ADF&G annual management report (Valkenburg 1988), BLM estimated its size at around 1000. However, the basis for this estimate is unknown. In a photocensus on 6 July 1992, J Herriges (BLM) counted 832 caribou but extrapolated the estimate to 1200, based on missing radios and a rough estimate of herd composition. In retrospect, it seems most likely the herd grew from about 150 in 1978 to around 900 in 1992 (λ = 1.14). The herd has not been censused since 1992, and recruitment was relatively low, indicating stability from 1992 to 1994. Since then, the herd has probably been growing again.

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.

Public use of the White Mountains is increasing, especially during late winter. BLM continues to improve access and increase recreational opportunities through development. Despite this increased access, annual reported harvests have been low (<27). In 1990, 2 drawing permit hunts (DC877 and DC878) were established to give people opportunity to hunt caribou during winter in the White Mountains. DC877 allowed motorized access hunting, while DC878 was nonmotorized access only. Although 100 permits were issued for the first 3 seasons (50 per hunt), success was low (6 caribou). From regulatory years (RY = 1 July–30 June) 1993–1994 through 1997–1998, the number of permits available was increased to 250 (125 per hunt). However, the increase in permit availability did not produce an increase in harvest, and participation dropped until there were more permits available than applicants. Due to low

harvests and lack of interest, plans were formulated to change the drawing permit hunts to registration permit hunts.

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.

Related Management Activities

- 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

We flew fall sex and age composition surveys on 2 October each year from 1996 to 1998 using a fixed-wing aircraft to locate radiocollared caribou. Once collared animals were located, a Robinson R-22 helicopter was flown to that location and an observer classified individuals by sex and age. The R-22 crew also classified groups of caribou that were observed without the assistance of the fixed-wing aircraft. Caribou were classified into 6 categories: cow, male calf, female calf, small bull, medium bull, and large bull.

We estimated harvest using data from returns of harvest and drawing permit report cards and preliminary results of returns from registration permit reports for RY 1998–1999. Caribou harvested north of the Steese Highway were considered WMH caribou; caribou harvested south of the Steese Highway were considered Fortymile caribou. To separate the WMH from the Ray

Mountains Herd harvest in Unit 20F, animals killed south of the Yukon River were considered WMH caribou. Harvest data were summarized by regulatory year.

RESULTS AND DISCUSSION

POPULATION STATUS AND TREND

Population Size

The WMH was probably growing until 1998, based on recruitment (i.e., fall calf:cow) during the last 3 years (Table 1).

Population Composition

Fall calf:cow and bull:cow ratios in the WMH have been variable (Table 1). However, calf:cow ratios were high enough to allow the herd to grow in most years except for 1998 and 1991–1994. Variation in bull:cow ratios probably reflected unrepresentative sampling because bulls were segregated after the rut (i.e., in 1991 and 1995). Early surveys (i.e., 29 September–6 October) yielded higher bull:cow ratios than later surveys. Differences in composition between years may also be attributed to the behavior of these caribou, because they are usually in small scattered groups and are often in timbered areas. It is easy to miss groups that could affect the overall composition estimates.

Distribution and Movements

The WMH caribou calve primarily in the higher elevation 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 are from mid June to late July as far east as Mount 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. Radiocollared caribou are seldom tracked during the fall or winter.

MORTALITY

Harvest

Season and Bag Limit. The general 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 RY 1996–1997 and RY 1997–1998 seasons, hunt DC877 was open 1–28 February and hunt DC878 was open 1–31 March. For RY 1996–1997, 75 permits were available for each hunt (150 total), while 125 permits were available for each hunt (250 total) during RY 1997–1998. Use of motorized vehicles for hunting was prohibited for DC878. The bag limit for both winter hunts was 1 caribou.

Board of Game Actions and Emergency Orders. The Board of Game at their March 1998 meeting supported a department proposal to change the winter seasons to registration permit hunts, with the existing season restrictions and bag limits. The change was implemented in RY 1998–1999.

Hunter Harvest. Fall harvest was relatively low. The reported fall harvest of WMH caribou was 10–25 over the last 5 years (Table 2).

The total reported harvest for DC877 and DC 878 (RYs 1995–1997) was 1 bull (Table 2). Bad weather, poor traveling conditions, and caribou distribution significantly influenced winter hunt participation. Other factors that affected winter participation were the ineligibility of hunters who have already harvested a caribou in an earlier season and the low success rate for those that did hunt. The change to the registration hunt did not result in a significant increase in caribou harvest.

To estimate a harvest quota for the winter hunt, we used a computer population model designed by P Valkenburg and D Reed (ADF&G). The model indicated the WMH could easily sustain a winter harvest of 25 cows, while still sustaining a fall and winter harvest of 40 bulls.

Permit Hunts. Participation was poor and harvests were low for hunts DC877 and DC878. From RY 1990–1991 through 1997–1998, the total reported harvest was 10 caribou (Table 3). The low harvest occurred despite the availability of 1150 permits. The overall success rate from RY 1990–1991 through 1997–1998 was 5% (10 of 185) for those who reported hunting. During RY 1997–1998, 82 hunters obtained registration permits for the winter hunt and 1 was successful.

Hunter Residency and Success. During RY 1996–1997, 76% (13 of 17) of successful hunters during the general season were Alaskan residents. Of those, 85% (11 of 13) were residents of Unit 20. During the RY 1997–1998 general season, 68% (17 of 25) of successful hunters were Alaskan residents. Of those, 76% (13 of 17) were residents of Unit 20. The overall success rates during the general seasons for RY 1996–1997 and 1997–1998 were 17% (17 of 101) and 16% (25 of 155), respectively (Table 4).

Harvest Chronology. Since RY 1990–1991 (when the winter seasons were opened) 83–100% of the harvest has occurred during the general season (10 August–20 September).

Transport Methods. The most common method of transportation used by successful hunters during general seasons in this reporting period were 3-or 4-wheelers, which accounted for 71% (12 of 17) and 56% (14 of 25) of the respective transportation use (Table 5). Due to the limited participation and low harvests, transportation methods for hunts DC877 and DC878 have little meaning.

Winter travel in the White Mountains can be difficult for hunters, but extension 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.

CONCLUSIONS AND RECOMMENDATIONS

The White Mountains Herd was stable or increasing. Harvests were below the sustainable yield because of remoteness and inaccessibility. Increased hunter effort and harvest during fall may occur because other Interior caribou hunting opportunities have declined and a road to Beaver Creek from the Steese Highway was completed.

The herd could support a higher harvest, and hopefully the switch to the registration system will increase participation and harvest because hunters are no longer required to go through the application and fee process. However, we may need to maintain a longer season to promote additional harvest.

The protection of key seasonal ranges from mining and recreational development should be considered during any land-use planning. Key ranges include known and historic calving areas, summer ranges, wintering areas, and movement corridors.

We met our objective to maintain a fall bull:cow ratio of 30 bulls:100 cows. During this reporting period, fall ratios were 44, 34, and 50 bulls:100 cows. We also met our objective to maintain a minimum of 20 active radio collars in the population.

However, we did not complete activities relating to monitoring herd distribution and estimating population size. During the reporting period, we did not monitor herd distribution; we radiotracked the herd only during the fall composition survey. We need to emphasize and collect more information on distribution and allocate more funds for collecting data on herd distribution in the future. We also did not estimate population size at least every 3 years; WMH postcalving caribou distribution and location (scattered and often in timbered regions), low hunter participation and success, and fiscal considerations have made this activity a low priority.

By working closely with BLM, we monitored increases in recreational uses and development. We should continue attending meetings on development of BLM lands. Such continued interagency cooperation will help effect better management strategies for managing the White Mountains Herd.

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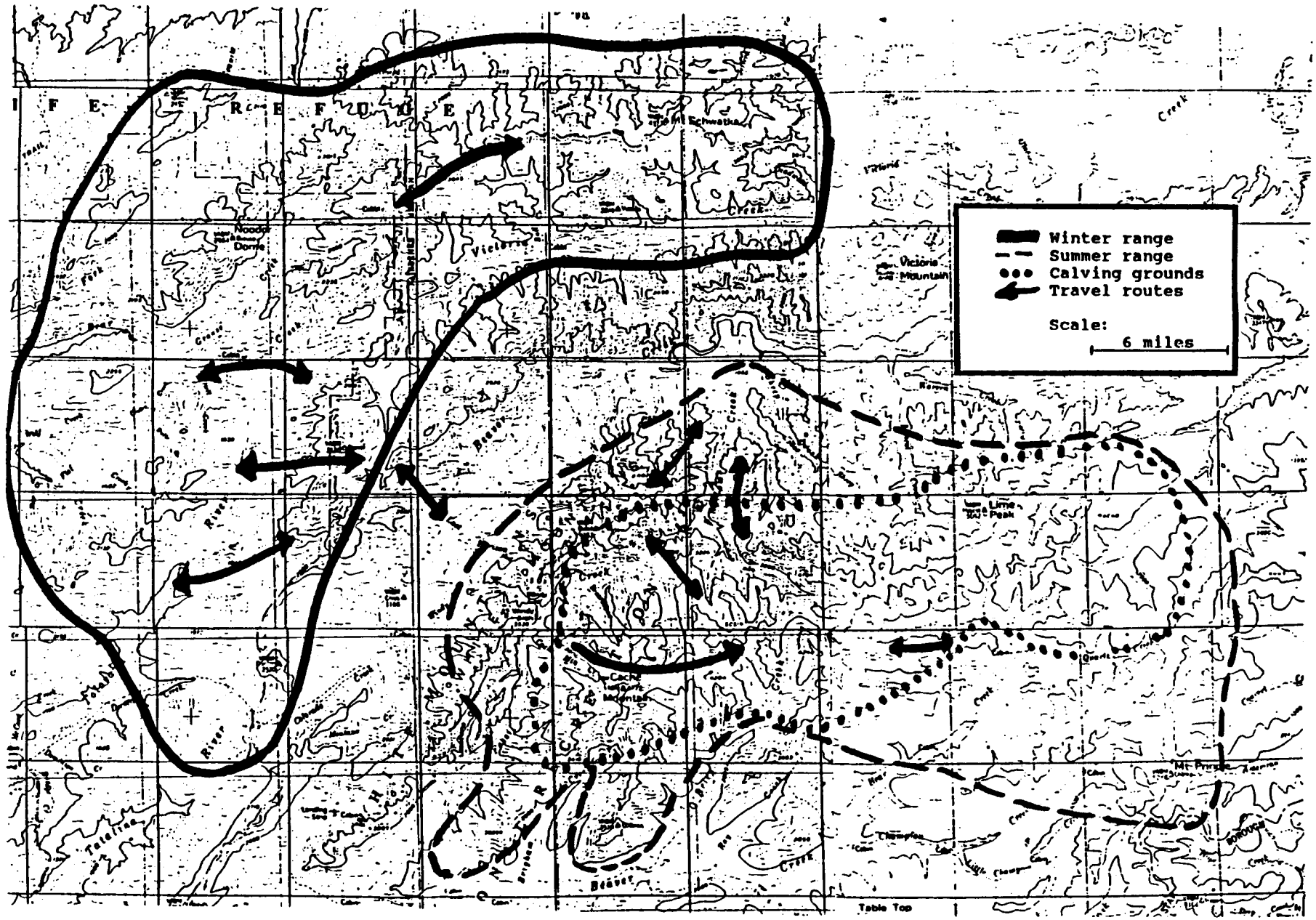

Figure 1 Approximate range of the White Mountains Caribou Herd (based on Durtsche and Hobgood 1990; Hobgood, pers commun).

Table 1 White Mountains caribou herd fall composition counts and estimated population size , 1983–1998

Date	Bulls:100 Cows	Calves:100 Cows	% Calves	% Cows	% Small bulls	% Medium bulls	% Large 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
9/27/93	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	
10/2/97	34	38	22	58	50	19	31	20	341	
10/2/98	50	18	11	60	42	37	21	30	759	

[a] Fixed-wing aircraft.
[b] Actual count of herd size.

Table 2 White Mountains caribou harvest, regulatory years 1987–1988 through 1997–1998

Regulatory year	General season				Permit hunts DC877 and DC878				Total
	M	F	Unk	Total	M	F	Unk	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
1996–1997	17	0	0	17	0	0	0	0	17
1997–1998	25	0	0	25	1	0	0	1	26

Table 3 White Mountains caribou herd harvest data for drawing permit hunts DC877 and DC878, regulatory years 1990–1991 through 1997–1998

Regulatory year	Permits available	Applicants	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
1996–1997	150	135	106	0	0	0	17	86	3
1997–1998	250	90	67	0	1	1	20	46	0

[a] Includes those that did not report.

Table 4 White Mountains caribou herd hunter residency and success during fall seasons, regulatory years 1985–1986 through 1997–1998

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
1996–1997	13	4	17	17	84	83	101
1997–1998	17	8	25	16	130	84	155

Table 5 White Mountains caribou herd general season harvest percent by transport method, regulatory years 1988–1989 through 1997–1998[a]

Regulatory year	Percent by transport method								
	Airplane	Horse	Boat	3- or 4-Wheeler	Snowmachine	ORV	Highway vehicle	Other/Unk	*n*
1988–1989	33	0	0	33	0	17	17	0	12
1989–1990	0	0	0	29	0	29	29	14	14
1990–1991	6	0	6	56	0	6	22	6	18
1991–1992	16	5	0	42	0	21	16	0	19
1992–1993	14	0	0	29	0	14	36	7	14
1993–1994	19	0	0	52	0	0	24	5	21
1994–1995	0		6	72	0	6	17	0	18
1995–1996	40	0	0	40	0	0	20	0	10
1996–1997	6	0	0	71	0	6	18	0	17
1997–1998	20	0	4	56	0	8	4	8	25

[a] Excludes winter permit hunts DC877 and DC878.

LOCATION

GAME MANAGEMENT UNIT: 26A (56,000 mi^2)

HERD: Teshekpuk

GEOGRAPHIC DESCRIPTION: Western North Slope

BACKGROUND

The presence of old drive sites near Teshekpuk Lake indicates that caribou have been hunted in the area since at least late prehistoric times (Silva 1985). The area was used extensively for reindeer herding in the 1930s and 1940s, and local residents report observing caribou in the area throughout the years since the 1930s. The Teshekpuk Caribou Herd (TCH) was documented in the mid-1970s as a separate herd from the Central Arctic (CAH) and the Western Arctic (WACH) herds by Davis and Valkenburg (1978).

The Alaska Department of Fish and Game (ADF&G) 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 assess the size and distribution of the TCH, 12 cows and 8 bulls were instrumented with radio collars in 1980 and monitored jointly by the department and BLM. During July 1984, the first photocensus of the herd was completed using a modified aerial photo-direct count extrapolation (APDCE) technique; department and BLM staff counted 11,822 animals from photographs. Trent and Toovak made a visual count in 1985 and counted 13,406 caribou (department files). As part of a joint telemetry study beginning in 1986, ADF&G, North Slope Borough Department of Wildlife Management (NSB), and BLM collared 17 cow caribou with VHF collars. We completed photocensuses and counted 16,649 caribou in 1989 (Carroll 1992), 27,686 in 1993 (Carroll 1995), and 25,076 caribou in 1995 (Carroll, 1997).

The TCH is an important subsistence resource to hunters from several North Slope villages. Collection of TCH harvest data has traditionally been incorporated into the WACH harvest reporting system because of range overlap between the two herds.

MANAGEMENT DIRECTION

MANAGEMENT GOALS

- Maintain stable or increasing numbers of caribou in the TCH
- Provide continued hunting opportunity on a sustained yield basis

MANAGEMENT OBJECTIVES

The operational management objectives defined in a draft cooperative management agreement between ADF&G, NSB, and BLM are listed:

- Determine the population size of the herd every 2 to 3 years;
- Determine the percentage of calves surviving their first winter;
- Delineate calving area, annually;
- Identify and map the movements and distribution of the herd throughout the year using aerial survey, radiotelemetry, and satellite telemetry data;
- Develop a system to capture caribou for radiocollaring without the use of drugs;
- Encourage local participation in research and management decisions;
- Determine the level of harvest using methods that are acceptable to hunters and the participating agencies;
- Determine significant sources of nonhunter mortality.

METHODS

We flew fall composition surveys in a PA-18 on October 21 1996 and October 15 1997 by locating radiocollared cows and counting adults and calves in the area surrounding the collared animal. Using telemetry equipment to locate radiocollared animals allowed us to distribute our sampling effort throughout the range of the TCH. We did not fly any spring short yearling surveys because the TCH was very dispersed and mixed with Western Arctic Herd caribou.

A Piper PA-18 aircraft was used to fly calving surveys on 6 and 26 of June 1997 and 11 to 15 June 1998. We used telemetry equipment to locate as many collared cows as possible and observed them at close range to determine the success, timing, and general location of calving. We used a Global Positioning System (GPS) receiver to record the latitude and longitude of the calving locations. We worked with the North Slope Borough Geographic Information System to plot and display the calving locations observed since 1990. Postcalving composition surveys were flown on July 5, 1997. We used a Hughes 500 helicopter to fly transects north of Teshekpuk Lake and categorized caribou as cows, calves, or bulls.

Through a cooperative project with the NSB and BLM, we captured 14 caribou using a Hughes 500 helicopter equipped with a skid-mounted net gun on 3 and 4 July 1997. We attached 2 Platform Transmitter Terminal collars (satellite radio collar transmitters or "PTT's") and 12 standard VHF collars to aid in population, productivity, and movement studies. We collected blood samples and measured, weighed, and assessed the body condition of all captured caribou. For the last 8 years, students from several schools have been tracking the movements of the satellite-collared caribou.

The PTT's 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) in Landover,

Maryland using 2 methods. We retrieved current location information from ARGOS, using a computer and modem as needed. Otherwise, we used monthly summaries of all locations distributed on microcomputer distributed by ARGOS. 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

We were unable to estimate the size of the herd during the reporting period. During a photocensus completed on 12 July 1995, Department and NSB staff counted 25,076 caribou. This is a decrease of 4.8% per year since the 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

During 1997 very few cows calved in the traditional calving areas located east, northeast, and north of Teshekpuk Lake and calving success was low. Most of the TCH moved much further south than normal during the winter of 1996–1997. At the time of our calving survey, they were still traveling north and were located south of their traditional calving grounds. In 1997 we flew our first calving survey on 6 June and found only 8 radiocollared cows within 50 miles of Teshekpuk Lake. Six of these cows had calves. Satellite collar and radiotracking information indicated that the remainder of the collared cows were mostly well to the south of the lake. We were unable to survey the southern area because of bad weather and do not know the calving success of these animals in early June. We flew a survey on 26 June and located 21 cows with radiocollars near Teshekpuk Lake. Seven of 21 cows (33%) had calves at their side. Of the 13 cows that had not been found in the traditional calving area on 6 June, only 1 had a surviving calf on 26 June. Calving success was good (75%) for the cows located in the traditional calving area, but either calving success or neonate survival was poor (8%) for the caribou that were still migrating north during the calving period.

Between June 11 and 15, 1998, we located 30 collared cows and 16 of these had calves at heel, for 53% calving success. Four of the collared cows that did not have calves were yearlings in 1997 and wouldn't be expected to have calves. Among mature cows, the calving rate was 62%. During the calving period in 1998, collared cow caribou were scattered from near Barrow and Atqasuk to Kogru Inlet. However, 11 of 16 cows with calves were within the traditional calving area east, northeast, and southeast of the lake.

During postcalving composition surveys in July 1997, we classified 3771 caribou as 2121 cows, 683 bulls, and 967 calves. We calculated the proportions to be 56% cows, 26% calves, 46 calves: 100 cows, 18% bulls, and 32 bulls: 100 cows. The number of calves per 100 cows was lower than in most years, coinciding with the poor calf survival we observed in collared cows during June of 1997. The percentage of bulls was also lower, but this may be explained by the fact that many bulls had not moved north of the lake at that time of our survey. On June 30, 1998, we

classified 3302 caribou as 1364 cows, 1023 bulls, and 915 calves. We calculated the proportions to be 41% cows, 28% calves, 67 calves: 100 cows, 31% bulls, and 75 bulls:100 cows (Table 3).

Unlike previous report periods, we will report fall calf survival rather than spring calf survival results because the TCH caribou were very scattered and mixed with WACH animals during spring. Fall calf survival was fairly high in 1996, but was very low in 1997. In October 1996 we counted 26 calves:100 adults (n = 924), and in October 1997 we counted 16 calves:100 adults (n = 1040) (Table 2). The low percentage of calves in the fall counts in 1997 coincided with the poor calving success in June 1997.

Distribution and Movements

Most TCH caribou move toward 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.

Satellite collar information indicates that TCH caribou winter in varied locations from near Teshekpuk Lake to the Chukchi coast to south of the Brooks Mountain Range (Philo et al. 1993). In 1990–1991 about half of the herd wintered south of the Brooks Range and half were 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. During 1993–1994 icing on the coastal plain caused most of the TCH to move into the area between Umiat and Anaktuvuk Pass with a portion of the herd moving to the south side of the Brooks Range. During 1994–1995, most of the herd was along the Chukchi Sea coast from Wainwright to Cape Lisburne. In 1995–1996 the TLH wintered on the coastal plain, mostly between Dease Inlet and Wainwright.

We monitored 7 satellite collared caribou during 1996–1997 and 6 traveled south of the Brooks Range and were distributed between Cape Lisburne and the Seward Peninsula in the wintering range of the Western Arctic Caribou Herd. One animal wintered between Atqasuk and Wainwright. One caribou calved in the TCH calving grounds, 1 calved southwest of the lake, and 1 arrived in the Teshekpuk Lake area by late June but did not have a surviving calf. Four of 7 caribou that traveled south of the Brooks Mountain Range died.

During 1997–1998 we monitored the movements of 5 satellite-collared TCH caribou. Three of the satellite collars deployed in 1995 failed because the batteries expired; however, we were able to locate them occasionally using their VHF transmitters. Three satellite-collared caribou wintered in the Atqasuk and Wainwright area, 1 traveled to the Lisburne Peninsula and died, and 1 died near Judy Creek in the Teshekpuk Lake area. One caribou that had been collared north of Anaktuvuk Pass in 1996 was considered a WACH caribou. However, it spent the summer along the Colville River, traveled north in September and October to Dease Inlet and was near Teshekpuk Lake in December when its PTT failed. Two of 5 TCH caribou died during the year and 2 produced calves that survived.

MORTALITY

Harvest

Season and Bag Limit. The hunting seasons and bag limits were 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:		
5 caribou per day; cow caribou may not be taken 16 May–30 June	1 July–30 June	
Nonresident Hunters:		
5 caribou total; cow caribou may not be taken 16 May–30 June.		1 July–30 June

Hunter Harvest. We cannot accurately determine the total TCH harvest because it is difficult to determine what herd a harvested caribou comes from and because only a small proportion of North Slope hunters actually report their harvest. The North Slope Borough has implemented a harvest documentation program in several villages using local village residents as harvest monitors. This method of harvest assessment has helped provide information on the number of caribou harvested in North Slope villages (Brower et al 1997, Hepa et al 1997).

Most of the TCH harvest is from local subsistence hunters because the area is remote and largely inaccessible to nonlocal hunters. Hunting pressure comes primarily from the North Slope villages of Atqasuk, Wainwright, Nuiqsut, and Barrow. According to harvest documentation studies, these villages harvest about 3200 caribou per year (Braund et al 1991, Brower et al. 1997, and Hepa et al. 1997). Radiotelemetry surveys indicate that most, but not all, of the caribou present in the hunting areas near these villages are from the TCH. Harvest levels of TCH caribou are strongly influenced by the distribution of animals during the fall and winter, especially their proximity to village hunting areas. During some years there is substantial harvest from residents of Anaktuvuk Pass, Point Lay, and Point Hope when TCH caribou travel into their hunting areas. During the winter of 1996–1997 much of the herd traveled south of the Brooks Range, and there was a substantial hunter harvest by residents of Unit 23.

Hunter Residency and Success. Most hunters were local residents of Unit 26A. Nonlocal resident and nonresident hunters took a small proportion of TCH caribou, primarily from the Colville River drainage. No quantitative data are available on hunter success, but we believe success rates were high.

Harvest Chronology. Caribou are harvested throughout the year, but most harvest is during July through October (Table 4 and Table 5).

Transport Methods. Caribou hunters in Unit 26A used a wide variety of transport methods. Most residents of the unit used boats and ATV's during July, August, and September; they used snowmobiles during the remainder of the year. Some use of aircraft occurs throughout the year, primarily by nonlocal residents and nonresidents. Hunters occasionally used highway vehicles when caribou moved near the limited road systems, particularly the gas well road near Barrow.

Other Mortality

We have recorded sizable caribou die-offs in past years within the range of the TCH. 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 TCH since caribou from the WACH or the CAH were also 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. Radiocollars indicated that most of these animals were from the TCH. During that winter 36% of the collared TCH caribou died (Carroll 1995).

During 1996–1997, when much of the herd migrated south of the Brooks Range, the mortality rate was higher than normal. Reasons for increased mortality may include higher stress from the long migration, increased hunter harvest, and the increased risk of predation and other factors associated with unfamiliar territory. During 1996–1997 the mortality rate for caribou instrumented with VHF collars was 24%. During 1997–1998 the mortality rate was 14%. Mortality rates for caribou instrumented with VHF collars for other years have ranged from 4% to 36%, but are usually between 11% and 16%.

HABITAT

Assessment

Results of satellite telemetry studies (Philo et al. 1993), VHF radiotracking flights, and composition surveys have indicated that the areas to the southeast, east, and north of Teshekpuk Lake are critical for calving, grazing, migration, and insect relief.

In 1997 BLM began the process of opening the National Petroleum Reserve-Alaska (NPRA), which encompasses much of the TCH range, to oil exploration and development. The first area to be considered was a 4.6 million-acre planning area in the northeast corner of NPRA. This area includes important TCH calving, insect relief, grazing, and migration habitats located near Teshekpuk Lake. After a compilation and review of the available data and many public meetings, it was decided that 87% of the planning area would be available for oil and gas leasing. However, most of the TCH critical habitat areas north and east of the lake would not be available for leasing at this time. It was also decided that there would be no surface exploration or development activity allowed in a strip of land to the west and south of the Teshekpuk Lake and around the Kogru River.

CONCLUSIONS AND RECOMMENDATIONS

The most recent population estimate for the TCH is 25,076 caribou, which resulted from a photocensus completed in 1995. This represents a decline of 4.8% per year since the 1993 photocensus of 27,686 animals. Before 1993 the population increased at a rate of 13.5% per year since 1989, when 16,649 animals were counted. Weather conditions prevented a successful photocensus during the reporting period, and it is a priority to census the herd as soon as possible.

Considering the difficulty to accurately assess harvest for the TCH, the NSB Department of Wildlife Management has implemented a harvest documentation program, using local village residents hired as harvest monitors. This program is now a valuable source of information for harvest of caribou on the North Slope.

We have used a helicopter and net gun to capture caribou since 1990 because local people requested that we do not drug caribou and because federal laws prohibit the use of capture drugs in areas where the hunting season is open. After netting, we used hobbles and masks to control the caribou. We were able to measure, weigh, and collect blood from the animals without the use of sedatives. We had 1 mortality in 1997 when a caribou fell and broke its neck 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 TCH movements. It has shown that TCH 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 there is great variability in winter movements. VHF collars have also been very useful, primarily in conducting censuses, composition surveys, and productivity studies. We need to continue telemetry studies to monitor herd status.

We have provided educational opportunities for North Slope students by allowing them to assist in caribou capture operations, collect samples from captured caribou, and help with necropsy work. In addition, we have been working with several school classes, teaching them to plot caribou locations so they can track the movements of satellite-collared caribou. We plan to continue to work with students whenever possible.

Using satellite and VHF collars, we have learned that the area to the east, northeast, and southeast of Teshekpuk Lake are important to Teshekpuk caribou for calving in the spring, and the area north of the lake is important for insect relief and grazing each summer. As discussed in this report's Habitat Assessment section, BLM began the process of opening a planning area in the northeast corner of NPRA, which includes these critical habitat areas, to petroleum leasing and development. After a public review process, it was decided that 87% of the planning area would be open for leasing but that the most critical habitat areas for the TCH would not be available for leasing or surface development activity at this time. However, the critical TCH habitat area also has the highest prospects for petroleum reserves, so the issue will probably be revisited. It is important to continue surveys in this area so resource managers make informed decisions regarding the habitat of the Teshekpuk Caribou 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 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 and fall composition data for the Teshekpuk caribou herd, 1990–1997

Year	Adults	Short Yearlings	Total	Short Yearlings:100 Adults
1990(spring)	278	74	352	27
1991(spring)	532	168	700	24
1992(spring)	635	223	858	26
1993(spring)	1197	265	1462	22
1994(spring)	1281	205	1486	16
1995(spring)	1382	255	1637	18
1996 (spring)	1787	575	2362	32
1996 (fall)*	733	191	924	26
1997 (fall)*	895	145	1040	16

*Surveys flown in fall instead of spring.

Table 3 Teshekpuk caribou herd postcalving composition counts, June–July, 1991–1998

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
1997	32	18	46	26	56	3771
1998	75	31	67	28	41	3302

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.

Table 5 Percent and chronology of annual caribou harvest among Nuiqsut and Atqasuk residents 1994–1995[b]

Village	Jul–Aug	Sep–Oct	Nov–Dec	Jan–Feb	Mar–Apr	May–Jun	Annual Harvest
Atqasuk	40%	37%	14%	5%	1%	2%	187
Nuiqsut	38%	35%	7%	6%	8%	7%	249

[b]Data from Brower et al. 1997 and Hepa et al. 1997.

LOCATION

GAME MANAGEMENT UNIT: 26B and 26C (25,787 mi^2)

HERD: Central Arctic

GEOGRAPHIC DESCRIPTION: Central Arctic Slope and Brooks Range

BACKGROUND

The Central Arctic caribou herd (CAH) was first recognized by biologists as a discrete herd in the mid-1970s (Cameron and Whitten 1979). The herd's summer range extends from the Colville River to the Canning River along the coast. Much of the summer range lies within, or adjacent to, the industrial area near Prudhoe Bay. The CAH winters to the south and southeast of the oilfield, from the northern foothills to the southern slopes of the Brooks Range. Variable mixing 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 frequently occurs. However, there is no documentation of permanent exchange of caribou among these herds.

The CAH 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). Herd size was estimated at 19,700 in summer 1997. 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 of the range.

Oil exploration and development on the North Slope began in the late 1960s and 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 CAH. 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 CAH caribou through the Prudhoe Bay oilfield (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).

MANAGEMENT DIRECTION

Based on the hypothesis that displacement, if of sufficient magnitude, would be harmful to the CAH (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. The current management objectives reflect these concerns.

MANAGEMENT GOALS AND OBJECTIVES

- Minimize the adverse effects of development on caribou.
  - Work with industry to ensure free passage of caribou.
  - Work with industry and other agencies to minimize disturbance to caribou in proximity to 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 CAH, especially in areas away from developments.
  - Determine the influence of current harvest levels on the CAH.
  - Minimize harvest of cows from the CAH.
  - 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 in proximity to developments, except where caribou constitute a hazard.
  - Regulate hunting along the Dalton Highway so conflicts between hunters and nonconsumptive users are minimized and caribou are not displaced from the vicinity of the road by hunting.

METHODS

POPULATION STATUS

Population size was estimated in July 1997 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 aircraft. Caribou were counted directly from the photographs.

Initial productivity was determined by estimating parturition rates (calves:100 females) of radiocollared females ≥3 years old in early June 1997, 1998, and 1999. We determined parturition status by calf presence or inferred status from timing of antler shedding and/or udder distension (Whitten 1991; Whitten et al. 1992). Observations were made from fixed-wing aircraft. Data were stratified as Unit 26B west of the Sagavanirktok River (oil exploration and development) and Unit 26B east of the Sagavanirktok River (undeveloped area).

Early recruitment was estimated after most calving should have occurred by determining calf:cow ratios (calves:100 females) from radiocollared females ≥3 years old in late June 1997, 1998, and 1999. Animals were located by the same method described previously. If an udder was detected and a calf not seen during this flight, we assumed the cow had recently lost her calf and she was recorded as "without calf." Data were stratified as Unit 26B west of the Sagavanirktok River (oil exploration and development) and Unit 26B east of the Sagavanirktok River (undeveloped area).

Population Composition

Beginning in 1994, calving composition surveys were conducted every 3 years. Before 1994 they were conducted every year in conjunction with ongoing research.

We conducted calving composition surveys during 10–14 June 1997. A pilot and observer in an R-22 helicopter searched for caribou along 16 3.2-km wide north-south strip transects, spaced at 10-km intervals from the Colville River to the Canning River. On the west side of Prudhoe Bay, transects extended from the coast to 69°50'N and from 150°29'W to 148°57'W. Additional transects were added to the zone within the Milne Point road system to provide more information in the developed area. This zone was apportioned into 1 km distance (width) strata with transects extending from the coast to 70°15'N and 149°53'W to 150°02.5'W. On the east side of Prudhoe Bay, transects extended from the coast to 69°45'N and from 148°27'W to 146°25'W. For each group of caribou located, we recorded total number, sex and age composition, and distance from the coast. (In the future, we will record latitude and longitude.) In previous years, a Bell 206B or Hughes 500D helicopter with 3 observers was used and map location or latitude/longitude was recorded. In addition, past transects on the west side of Prudhoe Bay only extended to 70°N. Because of observations of caribou calving further south on the west side during the past few years, we extended the transects further south in 1997. Fall composition was estimated from a helicopter in mid October. Observed caribou were classified as cows; calves; and small, medium, or large bulls. No fall composition surveys were conducted during regulatory years 1996–1997 through 1998–1999 (RY = 1 July–30 June).

Harvest

Harvest and hunting pressure for residents of Alaska living south of the Yukon River and for nonresidents of Alaska were monitored using harvest reports submitted by hunters. Total harvest, residency and success, chronology, and transportation were summarized by regulatory year.

Alaska residents living north of the Yukon River were not required to obtain the standard caribou harvest tickets/report cards. However, they were required to register with ADF&G or an authorized vendor. The Division of Subsistence estimated caribou harvest at Kaktovik and Nuiqsut.

A checkstation was operated during August and September near the Yukon Bridge in 1991, 1992, 1993, 1996, 1997, and 1998. Results are not presented in this report but are available from ADF&G in Fairbanks.

MOVEMENTS AND DISTRIBUTION

Movements of the CAH were determined from relocations of radiocollared females during June and July, early October, and late April.

RESULTS AND DISCUSSION

POPULATION STATUS AND TREND

Population Size

We estimated 19,700 caribou in July 1997 based on the photocensus conducted during the postcalving aggregation. This number was up slightly compared with the July 1995 estimate of 18,100, although both estimates were lower than the 1992 estimate of 23,444 (Table 1). Cameron et al. 1992 suggested that the CAH likely had reached carrying capacity by 1992. The 1995 and 1997 estimates indicated that the population has probably stabilized.

Parturition rates for all of Unit 26B increased during June 1998 and 1999 (89% and 91%, respectively) compared with those in the previous 4 years (Table 2). Parturition rates were slightly higher in Unit 26B (West) compared with those in Unit 26B (East) during 1997–1999 (78–94% and 50–87%, respectively). Early recruitment for all of Unit 26B increased steadily since June 1994 and was 72–78% during 1997–1999 (Table 2), indicating a stable early calf recruitment for the past 3 years. Early recruitment was higher in Unit 26B (West) than in Unit 26B (East) during 1997–1999 (79–93% and 64–88%, respectively).

Population Composition

Calves:100 cows estimated in calving composition surveys during 1994 and 1997 were 65:100 and 72:100, respectively, and have probably been stable since 1992 (73:100; Table 1). Calves:100 cows estimated in Unit 26B (West) during 1994 and 1997 were 64:100 and 69:100, respectively, and in Unit 26B (East) were 65:100 and 81:100, respectively.

A fall composition survey conducted in October 1996 indicated a bull:cow ratio of 61:100 and calf:cow ratio of 67:100 (Table 3). It is possible that some bulls from the Western Arctic Herd may have been mixed in with the CAH. The bull:cow ratio has been high (>50:100) since 1976. No surveys were conducted in fall 1997 and 1998.

Distribution and Movements

Distribution was unchanged from previous reporting periods. CAH caribou were on the coastal plain between the Colville and Canning Rivers during calving and during summer. Some animals were as far east as the Tamayariak River during late June. In early fall, the herd gradually moved toward the northern foothills of the Brooks Range with some animals migrating to the south side of the Brooks Range in winter. In addition, some of the Western Arctic Herd mixed in with the CAH during both fall and winter. Occasional mixing also may occur with the Teshekpuk Herd during winter and with the Porcupine Herd (PCH) in spring (Apr) and summer (Jul). However, during this reporting period, no mixing with the Porcupine Herd likely occurred because the PCH remained east of the Canning River. In addition, no radiocollared caribou have calved in one herd and subsequently moved to and calved in an adjacent herd since 1975.

MORTALITY

Harvest

Most harvest of the CAH was in Unit 26B, but some harvest occurred in Units 24 and 25A. Occasionally portions of the Western Arctic Herd mixed with the CAH in fall and winter, and these animals were reported as harvest from the CAH.

Season and Bag Limit (RY 1996–1997 through 1998–1999).

Unit/Location	Resident Open Season/Bag Limit	Nonresident Open Season/Bag Limit
Unit 24, except for the Kanuti drainage upstream from and including Kanuti Chalatna Creek, and the Fish Creek and Bonanza Creek drainages of South Fork Koyukuk River.	1 Jul–30 Jun; 5 caribou per day; however, cow caribou may not be taken 16 May–30 Jun.	1 Jul–30 Jun; 5 caribou total; however, cow caribou may not be taken 16 May–30 Jun.
Unit 25A.	1 Jul–30 Apr; 10 caribou.	1 Jul–30 Apr; 5 caribou.
Unit 26B within the Dalton Highway Corridor Management Area.	1 Jul–30 Apr; 2 caribou; however, only 1 caribou may be taken from 1 Jul–30 Sep and cow caribou may be taken only from 1 Oct–30 Apr.	1 Jul–30 Apr; 2 bulls; however, only 1 bull may be taken 1 Jul–30 Sep.
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 latitude 149°04′W longitude, then west approximately 22 miles to 70°10′ latitude 149°56′W longitude, then following the east bank of the Kalubik River to the Arctic Ocean.	1 Jul–30 Apr; 10 caribou	1 Jul–30 Apr; 5 caribou
Remainder of Unit 26B.	1 Jul–30 Apr; 2 caribou; however, only bulls may be taken from 1 Jul–30 Sep and cow caribou may be taken only from 1 Oct–30 Apr.	1 Jul–30 Apr; 2 bulls
Unit 26C.	1 Jul–30 Apr; 10 caribou; however; only bull caribou may be taken 23–30 Jun.	1 Jul–30 Apr; 5 caribou

State regulations that affected caribou hunting along the Dalton Highway were in effect during RY 1996–1997 through 1998–1999. The Dalton Highway Corridor Management Area (DHCMA) extends 5 miles from each side of the Dalton Highway from the Yukon River to the Prudhoe Bay Closed Area. The area was closed to hunting with firearms. However, big game, small game, and fur animals could be taken by bow and arrow only, but hunters had to possess a valid International Bowhunter Education card. In addition, no motorized vehicles (except aircraft),

boats, and licensed highway vehicles may be used to transport game or hunters within the DHCMA.

Federal subsistence hunting regulations also applied on federal lands within the DHCMA during RY 1996–1997 through 1998–1999. Federal regulations allowed the use of firearms for hunting on federal land within the DHCMA by qualified rural subsistence hunters beginning in RY 1992–1993. During the first year of the regulation, qualified hunters included any rural resident. Since then, qualified hunters have included residents of the corridor and the nearby villages of Anaktuvuk Pass, Wiseman, Nuiqsut, and Kaktovik.

Board of Game Actions and Emergency Orders. Beginning in RY 1996–1997, the bag limit for caribou in Unit 26B outside the DHCMA (not including that area southwest of the Kalubik and Kuparuk Rivers) was changed from 1 to 2 caribou. No changes were made during the March 1998 board meeting, and no emergency orders were issued during RY 1996–1997 through 1998–1999.

Hunter Harvest. Reported harvest during RY 1996–1997 (221) was low compared with reported harvest of the previous 3 years ($\bar{x}$ = 349; Table 4). This probably was due to poor weather in September 1996. Reported harvest in RY 1997–1998 was 309. Except for RY 1996–1997, harvest has remained stable for the past 5 years (RYs 1993–1994 through 1997–1998), ranging from 309–372.

Hunter Success. During RY 1996–1997, 384 hunters reported hunting caribou within the range of the CAH (Table 4). Of these, 188 hunters reported harvesting 221 caribou (49% success rate). In RY 1997–1998, 500 hunters reported hunting caribou within the range of the CAH, and 269 hunters reported harvesting 309 caribou (54% success rate). The number of animals reported harvested, number of hunters, and percent success rate during RY 1996–1997 were low compared to those in previous years. This was probably due to poor weather (e.g., rain, fog) on the North Slope during September. Except for RY 1996–1997, hunter success rates have not fluctuated much and have been 49–58% since RY 1990–1991. Reminder letters have not been sent out to hunters for the past 10 years; thus, it is likely that actual success rate is lower than reported.

Harvest Chronology. During RY 1996–1997 through 1997–1998, the greatest proportion of the harvest occurred during August (49% and 61%, respectively). Most of the remaining harvest was in September and October (Table 5). This was similar to harvest chronology in previous years.

Transport Methods. Because of restrictions on the use of off-road vehicles within the DHCMA and the remoteness of Unit 26B, hunters mostly used highway vehicles and aircraft for access. During RY 1996–1997 and 1997–1998, 57% and 70%, respectively, of successful hunters used highway vehicles and 28% and 19%, respectively, used airplanes (Table 6). The use of boats, horses, and dogs were each <10%. Transport methods used were similar to methods in previous years. However, use of boats (including airboats) on the Ivishak and Sagavanirktok Rivers has increased somewhat over the past 5 years.

Natural Mortality

Natural mortality of CAH caribou during calving and postcalving is assumed low because calving was in areas near the coast having few wolves and bears. Radiocollared caribou were tracked infrequently during fall and winter, making it difficult to estimate adult mortality or determine causes of adult mortality. Winter mortality was probably higher during the 1990s compared to winter mortality in previous years because many CAH caribou wintered on the south side of the Brooks Range where the wolf population is higher than on the north side of the range. However, we do not have data on predation rates on the CAH. Known mortalities from radiocollared caribou during RY 1997–1998 and 1998–1999 were 3 and 0, respectively.

CONCLUSIONS AND RECOMMENDATIONS

Parturition rates and early recruitment were high during 1998 and 1999. After completion of the 1997 photocensus, we estimated a population of 19,730 caribou; slightly higher than the 1995 estimate of 18,100 caribou. Harvest was stable the past 5 years. These factors combined indicated that the population was probably stable.

The presence of Western Arctic Herd caribou and other caribou in Unit 26B in some years in fall and winter may relieve harvest pressure on the CAH. 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, 1978–1998

Survey date	Yearling: 100 Cows	Bulls:100 Cows	Calves:100 Cows	Percent calves	Percent yearling	Percent cows	Percent bulls	Composition sample size	Population size
Jun 1978		19	68	36		53	10	950	5000
Jun 1979	24	6	80	38	12	47	3	1865	
Jun 1980	48	4	69	31	22	45	2	787	
Jun 1981	22	9	87	40	10	46	4	3337	8537
Jun 1982		20	62	34		55	11	1101	
Jun 1983		16	86	42		50	8	1879	12,905
12 Jun 1984	25	9	89	40	11	45	4	2692	
13–14 Jun 1985	35	16	88	37	14	42	7	2357	
12–13 Jun 1986	33	7	56	29	16	51	4	891	
13 Jun 1987	19	4	74	37	10	51	2	4839	
10–15 Jun 1988	32	7	66	32	16	49	3	4892	
11–15 Jun 1989	16	6	48	28	9	59	4	2520	
11–15 Jun 1990	11	31	75	35	5	46	14	6543	
17–20 Jun 1991[a]	29	73	45	18	12	40	30	2500	19,046[b]
11–14 Jun 1992 1993[d]	12	6	73	38	6	53	3	5556	23,444[c]
12–14 Jun 1994	8	17	65	29	4	53	9	3638	
29 Jun 1995[e] 1996[d]		113	50	19		38	43	454	18,100[f]
11–12 Jun 1997 1998[d]	37	9	72	33	17	46	4	1995	19,730[g]

[a] Estimated from random stratified quadrat survey of entire caribou distribution. Results not directly comparable with other years.

[b] Ninety-percent confidence interval was 14,677–23,414.

[c] 9 July 1992 photocensus.

[d] No survey.

[e] Only caribou east of Sagavanirktok River sampled in composition count and different method used.

[f] 13 July 1995 photocensus.

[g] 19–20 July 1997 photocensus.

Table 2 Central Arctic Herd caribou parturition rates and early recruitment (calves:100 cows) of radiocollared females ≥3 years old, 1994–1999

	Parturition rates				Early recruitment			
Year	Date	26B (West) (*n*)	26B (East) (*n*)	Total (*n*)	Date	26B (West) (*n*)	26B (East) (*n*)	Total (*n*)
1994	10–14 Jun	50 (6)	91 (11)	76 (17)	27–29 Jun	50 (6)	67 (9)	60 (15)
1995	7–8 Jun	50 (6)	29 (7)	38 (13)	27 and 30 Jun	75 (4)	43 (7)	64 (11)
1996	15–16 Jun	61 (13)	80 (10)	69 (23)	–[a]			
1997	6–7 Jun	78 (14)	50 (12)	65 (26)	29–30 Jun	79 (14)	64 (11)	72 (25)
1998	3–4 Jun	93 (15)	85 (13)	89 (28)	29–30 Jun	80 (15)	76 (17)	78 (32)
1999	5 and 9 Jun	94 (17)	87 (16)	91 (33)	22–24 Jun	93 (14)	60 (15)	76 (29)

[a] No survey completed.

Table 3 Central Arctic Herd caribou fall composition counts, 1976–1998

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
Oct 1976	122	44	17	38				46	1223
Oct 1977	118	55	20	37				43	628
Oct 1978	96	58	23	39				38	816
Oct 1980	132	49	18	35				47	1722
Oct 1981	81	64	26	41	22	41	36	33	1712
16-18 Oct 1992	96	47	19	41	37	27	40	40	2469
1993[a]									
1994[a]									
1995[a]									
22 Oct 1996[b]	61	67	29	44	15	43	43	27	3062
1997[a]									
1998[a]									

[a] No survey.

[b] Approximately 50% of the radiocollared animals were located.

Table 4 Central Arctic Herd caribou harvest and hunter success, regulatory years 1984–1985 through 1997–1998

Regulatory year	Reported harvest				Total hunters	Percent successful hunters[a]	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
1996-1997	200	18	3	221	384	49		
1997–1998	289	18	2	309	500	54		

[a] Percent successful hunters calculated by dividing total reported harvest by number of successful hunters

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

Table 5 Central Arctic Herd caribou harvest chronology, regulatory years 1992–1993 through 1997–1998[a]

	Month													
Regulatory 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
1996–1997	2	0	2	5	0	0	13	108	49	35	1	0	3	218
1997–1998														

[a] Includes only harvest from harvest reporting cards.

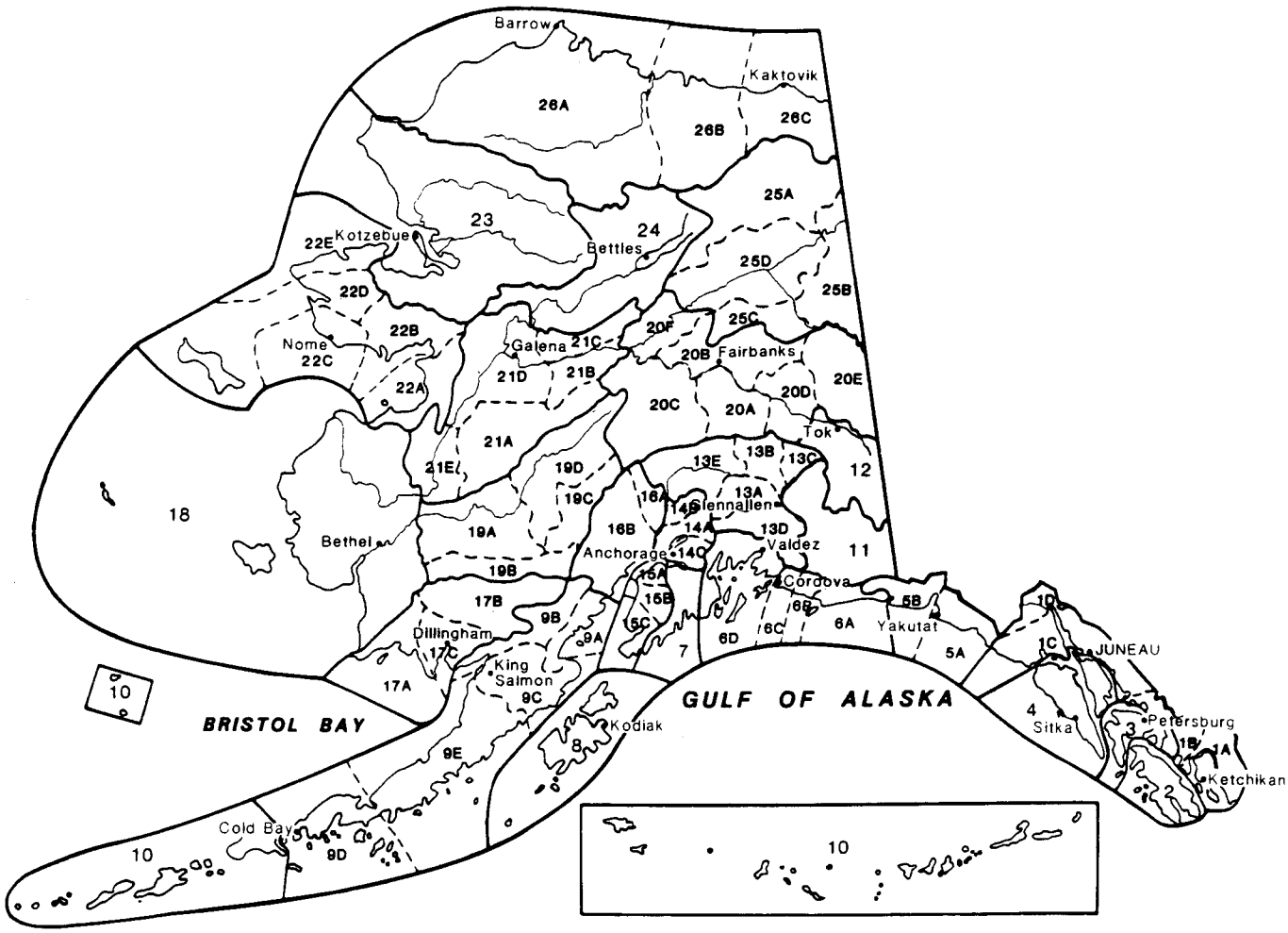
Table 6 Central Arctic Herd caribou successful hunter transport methods, regulatory years 1984–1985 through 1997–1998

Regulatory year	Transport methods								
	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
1991–1992[b]	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
1996–1997	63	8	19	0	0	0	126	5	221
1997–1998	58	7	14	0	0	1	216	10	306

[a] Total hunters reporting.

[b] Checkstation data during Aug and Sep.

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.

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