Alaska Department of Fish and Game
Division of Wildlife Conservation

Federal Aid in Wildlife Restoration
Management Report of
Survery-Inventory Activities
1 July 1992- 30 June 1994

CARIBOU

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Study 3.0
Grants W-24-2 & W-24-3
December 1995

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, and Fox River
Geographical Description: Kenai Peninsula

BACKGROUND

There are 5 small caribou herds on the Kenai Peninsula following reintroductions in 1965-66 and 1985-86 (Spraker 1993). The Kenai Mountains Caribou Herd (KMH) occupies the area drained by Chickaloon River, Big Indian Creek, and Resurrection Creek in Unit 7; Kenai Lowland Caribou Herd (KLH) summers in the area north of Kenai Airport to Swanson River and winters on Moose River Flats and near the outlet of Skilak lake; Killey River Caribou Herd (KRH) is found in the upper drainages of Funny and Killey Rivers in Subunit 15B; Fox River Herd (FRCH) occupies the area between upper Fox River and Truuli Glacier in Subunit 15C; and Twin Lakes Caribou Herd (TLH) occupies the area around Twin lakes and Benjamin creek drainages in Subunit 15B.

Historically, caribou (*Rangifer tarandus*) were found on the Kenai Peninsula (Porter 1893; Seton-Karr 1887; and Schiefner 1874 cited in Lutz 1960; Palmer 1938). Although reports indicate their distribution was widespread, estimates of population size were not given. Because suitable caribou habitat is limited on the Peninsula, caribou were probably never numerous. Caribou antlers originating from the early 1900s have been found in only two areas on the Kenai Peninsula during the past two decades: 1) Caribou Hills and 2) Skilak-Tustumena Benchlands, according to Alaska Department of Fish and Game (ADF&G) and U.S. Fish and Wildlife Service (USF&WS) records.

Caribou were extirpated from the Kenai by 1912 (Palmer 1938). Davis and Franzmann (1979) suggested that caribou began disappearing in the late 1800s due to changes in habitat following extensive wildfires. Market hunters during the early 1900s hunted caribou for mining camps and may have killed most of the remaining original population. Animals not killed by humans probably died through natural attrition and predation.

The USF&WS first considered reintroducing caribou in 1951. However, a reintroduction was not attempted until the mid 1960s when a decision was made by ADF&G to reintroduce caribou to the Peninsula with the objective of establishing viable herds for the purpose of hunting. Despite the success of these reintroductions, the two principal historic ranges, the Caribou Hills and Skilak-Tustumena Benchlands, remained unoccupied.

The Nelchina herd, in Game Management Unit 13 near Glennallen, was selected as the donor herd for the reintroduction. Fifteen caribou (3 males and 12 females) were released at an airstrip on the gas pipeline near the Chickaloon River (N 60°42.0', W 150°11.0') in 1965. This release site was selected as a result of studies conducted in the early 1950s which suggested

the northern portion of the Kenai Mountains could support caribou. A second release of 29 caribou (3 males and 26 females) was conducted at Watson Lake near Sterling, in 1966. The second release was scheduled for Caribou Hills; however, a mechanical failure of the transport vehicle and deteriorating condition of the animals made farther travel impossible. These two reintroductions resulted in the establishment of two caribou herds, Kenai Mountains Herd (KMH) and Kenai Lowlands Herd (KLH) which in 1993 numbered approximately 400 and 86 animals, respectively.

The KMH has been hunted annually since 1972. The number of permits issued and animals harvested sharply increased as hunters became aware of the KMH. In 1974, a harvest quota of 50 caribou was recommended to stabilize the herd at approximately 250 animals. The carrying of their range was unknown. From 1972 to 1976, the department issued an unlimited number of registration permits and the season was closed by emergency order when necessary. In 1977 a limited permit system began that still remains in use. During the past five years the mean annual success rate was 25 percent. Following the 1985 peak in population size, the KMH began to decline from unknown reasons. The department reduced the harvest from 1987 to 1990. The most recent complete survey was conducted in fall of 1992 when 390 caribou were found. Although, results of this survey suggest an increase in numbers, calf recruitment was low. Population trends correlated with harvest data over the past 29 years suggested the carrying capacity for this herd's range was 300 to 350 caribou.

The Kenai Lowlands caribou herd has grown slowly when compared to the other Peninsula herds. Growth has been limited by low recruitment rather than by available habitat. Free-ranging domestic dogs and coyotes probably killed calves in the summer and wolves preyed on all age classes during winter. The KLH was hunted in 1981, and 1989 to 1992. The department issued five permits the first year and three each year after that. Biologists felt harvest were not a significant mortality factor.

Despite these successful reintroductions in 1965/66, historical caribou range in central and southern portions of the Peninsula remained unoccupied. In 1985 and 1986, ADF&G and USF&WS initiated a cooperative program to reintroduce caribou on the Kenai National Wildlife Refuge (KNWR) within this unoccupied range. Eighty animals from the Nelchina Herd were released at four sites. Caribou from the Nelchina Herd were selected as the donor population for two reasons: 1) caribou previously reestablished on the Kenai Peninsula originated form this herd; and 2) a segment of the herd wintered near Glenn Highway along Lake Louise road, thus reducing capture and transportation costs. These reintroductions resulted in establishment of three new herds on the Kenai Peninsula designated as Twin Lakes Herd (TLH), Killey River Herd (KRH) and Fox River Herd (FRH). These herds totaled 36, 281, and 58 caribou, respectively, in November 1993.

MANAGEMENT DIRECTION

The guiding principles of this management plan are to protect the habitats on which caribou herds depend; to maintain viable, healthy herds and to provide consumptive and non-

consumptive opportunities. In order to meet these criteria the following objectives were established for management of caribou herds on the Kenai Peninsula.

Management Objectives:

1. **Establish and maintain caribou populations at optimum levels commensurate with long-term habitat protection.**
   "Optimum" is defined by the following measurable parameters:
   1. A maximum density ranging between 0.8 and 1.0 caribou/km^2
   2. A minimum fall recruitment of 20-25 calves:100cows
   3. A minimum post-hunting season bull:cow ratio of 30-40:100
2. **Provide the opportunity for herds to expand into suitable but unoccupied range.**
3. **Provide for consumptive and non-consumptive recreational use of caribou herds.**
4. **Provide for scientific research on introduced caribou herds.**

METHODS

To achieve the first objective, population size estimates will be obtained and compared with current range use. Fall population size estimates for all herds have been determined and will be continued in the future. Telemetry will be used to locate groups of animals for censusing and determining distribution to calculate densities. Herd sex and age composition data will be collected during fall to obtain calf recruitment, and calf and bull to cow ratios. Composition surveys will be conducted by experienced observers, using a helicopter.

The effect of predators on growth and range expansion of Kenai Peninsula's caribou herds is unknown. Predation may not be a significant limiting factor on the recently introduced herds as witnessed by their seeming normal rates of growth. As moose numbers decline due to forest maturation, caribou will become an increasingly important prey species for predators. Predator control will be reevaluated as deemed necessary.

Monitoring to assure habitat protection will require the following steps:
1. Identify key habitat condition indicators.
2. Identify the costs involved, including personnel, transportation, and equipment needs.
3. Plan a strategy for analysis and repeatability of monitoring habitat changes.

Since caribou herds on the Kenai Peninsula occupy relatively small home ranges, all potential caribou range will be evaluated. Additionally, a program of intensive habitat evaluation should be developed to determine actual carrying capacity for each herd.

Radiotelemetry may provide a process to document natural movement into new areas. Presently Caribou Hills and the alpine area south of Fox River appear to be suitable areas for caribou to inhabit. Another option may be future reintroductions to unoccupied areas.

Caribou from the KLH are presently available for roadside viewing along the Kenai bridge access road as well as neighborhoods between Kenai and Soldotna. The other herds are not found in such developed areas and viewing requires back country travel. Hunting is currently

allowed only on KMH; however, hunts have been approved for KRH and are planned for FRH and TLH.

Specific graduate or Wildlife Cooperative Unit studies relating to caribou and/or their habitats may be developed and initiated. Current ADF&G budgets are committed to surveys and monitoring radiocollared caribou to meet the first management objective.

RESULTS AND DISCUSSION

Population Status and Trend

Population Size:

Kenai Mountains Caribou Herd. The KMH has had three documented population peaks in its 29 year history. The original introduction of 15 animals in 1965 grew to a minimum pre-hunting season population of 339 animals by 1975. The population declined sharply to 193 by 1977, primarily due to overharvest. It increased to another prehunting season peak of 434 in 1985, through more conservative hunting regulations. Herd size has fluctuated downward until it stabilized around 300 animals from 1988 to 1990. Results from the fall 1992 survey indicated the herd increased to approximately 406 caribou before the season (Table 1). The estimated population size shown in Table 1 was determined by adding the reported harvest to the postseason fall survey count.

Kenai Lowlands Caribou Herd. The KLH has been surveyed only during spring due to the heavily timbered area utilized during their fall breeding aggregation. The KLH reached its largest size in spring of 1989, when 117 caribou were observed. The population remained stable in 1990, then declined to 98 animals in 1991. The decline continued, with a count of 74 in 1992 and 66 in 1993, increasing to 86 in the spring of 1994 (Table 2).

Killey River Caribou Herd. By summer of 1987, the KRH contained at least 70 animals. Assuming most emigration had occurred by this time, the herd increased through recruitment at an average annual rate of 26 percent, reaching a minimum population size of 281 by fall 1993 (Table 3).

Fox River Caribou Herd. By 1987, the FRH numbered at least 22 caribou. The herd increased at a rate of 19 percent annually from 1987-1993, excluding one year of zero growth. Fall 1993 survey results indicate that this herd numbers at least 58 caribou (Table 4). Current density is 0.7 caribou/km^2. Assuming annual recruitment will continue at the current mean rate, FRH density will be 1.0 caribou/km^2 (82 animals) by fall 1995.

Twin Lakes Caribou Herd. The TLH is believed to have originated from animals emigrating from KRH shortly after the 1986 release. In 1990, 18 caribou (14 adults and 4 calves) were located in the west fork of Benjamin Creek. By November 1993, this herd's size increased to 36 caribou (Table 5).

Population Composition:

Kenai Mountains Caribou Herd. The 1992 herd composition was 24 calves and 43 bulls:100 cows; calves accounted for 14 percent of the total (390) observed (Table 1). Herd composition has been determined in only two of the past five years, 1990 and 1992. The mean percentage of calves in the herd for these two years was 17 percent. The mean ratio of bulls to cows for the same years was 41 per 100. A survey was not completed in 1993 to determine the herd's status.

Kenai Lowlands Caribou Herd. Data collected from 1989 to 1993 indicate mean June calf survival to be 21 percent of the herd, with a range of 12 to 28 percent (Table 2). Peak calving occurs during the third week of May. Low recruitment has plagued the KLH, probably due to predation by free-ranging dogs, coyotes and wolves. In addition to low recruitment, there is a second reason for concern this herd may not grow in size. The KLH slowly increased in numbers throughout the 1980s, but annual recruitment was not high enough to offset natural attrition due to the aging trend in the population. In 1991 and 1992, for example, 13 randomly captured adult cow caribou comprised six (46%) 10+, five (39%) 6 to 9 and two (15%) 3 to 5 year old animals. If the assumptions are correct that this herd comprises mostly aged adults and that recruitment will remain low due to predation and/or other undetermined environmental factors, then the probability of recovering without assistance is low.

Killey River Caribou Herd. November calf percentages from 1990 to 1993 ranged from 20 to 23 percent, with a mean of 22 percent. Fall calves and bulls per 100 cows were; 43 and 67 in 1992, 44 and 56 in 1993 (Table 3).

Fox River Caribou Herd. Productivity and calf survival in the FRH appears moderately high, ranging from 28 percent in 1989 to 44 percent in 1990, the only years that spring surveys were completed. Fall surveys in 1990, 1992, and 1993 revealed the herd comprised 27, 20, and 12 percent calves, respectively.

Twin Lakes Caribou Herd. Composition for this herd has only been determined in two of the past five years, 1990 and 1993 (Table 5). Calves composed 22 and 17 percent of the total observed in 1990 (18) and 1993 (36), respectively.

Mortality

Harvest:

Season and Bag Limits.

Kenai Mountain Caribou. The open season for resident and nonresident hunters in Unit 7 north of the Sterling Highway and west of the Seward Highway was 10 August to 30 September; the bag limit was 1 caribou by drawing permit only. We could issue 250 permits.

Kenai Lowlands Caribou Herd. The open season for resident and nonresident hunters in that portion of Subunit 15A within the Kenai National Wildlife Refuge was 1 to 20 September in 1992. The 1993 season was closed due to decline in population size. The bag limit in 1992 was 1 bull by drawing permit only; three permits were issued.

Killey River Caribou Herd. A hunting season was not authorized during the reporting period.

Fox River Caribou Herd. A hunting season was not authorized during the reporting period.

Twin Lakes Caribou Herd. A hunting season was not authorized during the reporting period.

Permit Hunts:

Kenai Mountain Caribou Herd. Hunters reported killing 15 and 29 caribou during the 1992 and 1993 drawing-permit hunt, respectively. The harvest comprised 11 (73%) males and 4 (27%) females in 1992. The 1993 harvest comprised 19 (66%) males and 10 (34%) females (Table 6). The 1992 harvest compared closely with the mean 1989 to 1991 harvest of 13 caribou; however, the number of permits issued varied from 50 to 150 (Table 7). In 1993 the number of permits was increased, resulting in an increased harvest of 29 animals. Since permits numbers were limited beginning in 1977, harvests have ranged from 7 to 52 caribou. The largest harvest occurred in 1975, when 87 hunters each reported killing 1 caribou.

Kenai Lowlands Caribou Herd. Hunting was authorized during four of the past five years, 1989 to 1992 (Table 8). Three permits, allowing for harvest of bulls only, were issued in each of these years, resulting in the harvest of two bulls annually from 1989-1991 and one bull in 1992 (Table 9). There was no open season during 1993 due to a declining trend in the population. All permits holders indicated they hunted.

Killey River Caribou Herd. There has been no hunting of the KRH since reintroduction in 1985-86. ADF&G has a hunt approved by the Board of Game scheduled for the fall of 1994. When hunting is initiated, the number of drawing permits will be allocated based on maintaining an annual harvest rate not exceeding 10 percent of the estimated population. With an average annual recruitment of 26 percent, a harvest of up to 10 percent would allow for continued herd growth.

Fox River Caribou Herd. No hunting has been allowed on the FRH. A limited harvest may be necessary by fall 1995 to avoid exceeding a population density of 1.0 caribou/km^2. Harvest and hunting effort data will provide information pertaining to hunters' ability to access the area and harvest animals. Since access into areas occupied by the FRH is difficult, several years of assessing hunter effort and success may be necessary to determine the number of permits required to properly manage annual harvest.

Twin Lakes Caribou Herd. There is currently no hunting of this herd due to its small size.

Hunter Residency and Success:

Kenai Mountains Caribou Herd. Primarily Alaska residents hunted the Kenai Mountains herd. For the combined harvest of 44 caribou for 1992 and 1993, only one hunter (2%) was a non-resident (Table 10). Nonresidents made up 3 percent (4) of the unsuccessful hunters for these years. Hunter success rate for the two year period averaged 27 percent.

Kenai Lowlands Caribou Herd. Table 11 shows that of the seven successful hunters from 1989 to 1992, all were Alaska residents and six were Unit residents. The one successful hunter in 1992 was a Unit resident. All permit holders' hunting achieved a success rate of 33 percent for 1992. Success rate for all hunters for the past five years was 58 percent.

Harvest Chronology:

Kenai Mountains Caribou Herd. Harvest chronology was dissimilar in 1992 and 1993; hunters harvested 20 percent of the harvest in the first 22 days in 1992, compared to 69 percent during the same period in 1993 (Table 12). In fact, 1992 was the only year in the past five that hunters did not harvest most of the animals during this early period.

Kenai Lowlands Caribou Herd. The successful hunter in 1992 harvested a caribou in the first 10 days of the season (Table 13).

Transport Methods:

Kenai Mountains Caribou Herd. In 1992 and 1993, most of the successful hunters used highway vehicles for access, then hiked into the area they hunted (Table 14). In 1992, 7 percent of the successful hunters used aircraft, compared to 27 percent using horses. In 1993, 10 percent used aircraft, compared to 21 percent using horses.

Kenai Lowlands Caribou Herd. The successful hunter in 1992 used a highway vehicle for access, then hiked into the hunt area.

Game Board Actions and Emergency Orders. In spring of 1994, a Department and U. S. Fish and Wildlife Service proposal was adopted by the Board of Game to establish a permit hunt for the Killey River herd for fall 1994. No further Board action was taken during the 1992-93 reporting period.

Habitat

Assessment:

Kenai Mountains Caribou Herds. The KMH occupies that portion of Game Management Unit (GMU) 7 north of the Sterling Highway and west of the Seward Highway. Land ownership is primarily USFS and USF&WS. The herd ranges between elevations of approximately 2,000 to 4,500 feet. Critical winter range includes the windblown ridges of that portion of the Kenai Mountains bordered by American Pass on the south, Little Indian Creek on the north, Big Indian Creek on the west and Resurrection Creek on the east. Caribou extend their range in summer to areas east and south of Resurrection Creek to the Seward and Sterling highways. Calving ground for the KMH extends from American Pass to the headwaters of Big Indian Creek, including the headwaters of American, Hungry and Moose Creeks. There is no known postcalving aggregation area.

There are approximately 1,407 km^2 (563 mi^2) within the known range of the KMH. Winter range is approximately 532 km^2 of the total identified range. Caribou researchers have suggested caribou densities in Alaska should not exceed 1 caribou/km^2 to maintain range quality. The nonmigratory nature of the KMH may cause it to vary significantly downward from this figure. Although habitat components of this herd have not been thoroughly investigated, concerns for habitat limitations have been discussed since the mid-1980s when the herd's performance started to decline. During the period 1980-83, when the herd increased from 248 to 305 animals, the calf to cow ratio remained steady at 43:100; however, it dropped to 25:100 when the herd peaked at 434 in 1985. As far back as 1985, human-caused mortality probably became additive, accelerating the decline. The point at which calf to cow ratios declined appeared to be after the herd exceeded its carrying capacity.

Kenai Lowlands Caribou Herd. The KLH summers in GMU 15A and 15B north of the Kenai airport and south and east of Kalifornsky Beach Road, in an area comprising state, City of Kenai, borough and private lands. It migrates east to winter on the Kenai NWR along Moose River to the outlet of Skilak Lake, occupying approximately 1,179 km^2 (472 mi^2). Unlike ranges for other herds on the Peninsula, summer and winter range are separate for the KLH. The summer range is 254 km^2 (101 mi^2) compared to 925 km^2 (370 mi^2) for the winter range. Calving occurs in the wetlands north of the Kenai airport, along the Kenai River Flats, and the wetlands south and east of Kalifornsky Beach Road. Calving areas are bisected by highways and include high densities of human and industrial activity.

The area occupied by the KLH during winter is primarily spruce forest and open muskeg along the Moose River drainage. Bog-muskeg and open wetlands near the mouth of the Kenai River are used during summer. Total summer and winter range is approximately 1179 km^2 (472 mi^2), and the herd is extending its range. Questions have arisen concerning a declining herd extending its range with the implication that poor quality habitat is the reason for the herd's decline and range expansion. Although range evaluations have not been conducted, the range occupied by this herd is not considered atypical habitat for caribou. Harassment by dogs and human disturbances may be pushing these animals into new areas at the same time their numbers are declining from low recruitment and natural attrition. A thorough evaluation of habitat types and vegetation utilized by the KLH is needed, as well as monitor potential effects caused by continued human development within its summer range.

Killey River Caribou Herd. The KRH comprises the largest group of caribou resulting from the 1985-86 reintroductions. It occupies approximately 371 km^2 (148 mi^2) of Kenai NWR land in GMU 15B, utilizing alpine and subalpine habitat at elevations between 2,000 and 4,500 feet on the benchlands between Skilak Lake and Tustumena Glacier. The benchlands are primarily vegetated with alpine shrub-lichen which is very sensitive to physical disturbance. Willow (*Salix* sp.) covers lower and wetter sites, while dwarf birch (*Betula nana*) occurs on upland and drier sites. Tussocks covered with willow and cranberry (*Vaccinium vitis-idea*) are common over most of the area. There are numerous areas of bare rock and subalpine shrub habitat.

Presently animals of the KRH have restricted their use to above tree line habitat. They winter on windblown ridges of the Kenai Mountains at elevations from 2,500 to 4,500 feet between the Harding Icefield and Skilak-Tustumena Benchlands. Summer range includes the above tree line elevations from 2,000 to 4,500 feet as well as all areas used during the winter.

Density of animals in the KRH is approximately 0.8 caribou/km^2. If the mean rate of increase (26%) remains relatively constant, and assuming no emigration, the KRH could approach a density of 1.0 caribou/km^2 (354 animals) by fall of 1994.

Fox River Caribou Herd. The FRH occupies alpine and subalpine habitats from Tustumena Glacier south to Fox River. This area lies within GMU 15C on KNWR lands. The area contains approximately 85 km^2 (34 mi^2) of potential caribou habitat. Winter range is limited to approximately 56 km^2 of the total range. The FRH originated from a release of 16 caribou near Caribou Lake, located south of Caribou Hills, in April 1986. The animals abandoned the release area by October 1986 and moved into the Kenai Mountains to the northeast. The FRH currently utilizes windblown slopes of the Kenai Mountains during winter, while summer range includes the lower elevations of Truuli Creek drainage at elevations from 2,000 to 4,000 feet. A calving area is unknown.

Truuli Creek Plateau is primarily alpine shrub-lichen tundra. Areas between 1,000 and 2,000 feet contain lowland subalpine shrub habitat, and elevations below 1,000 feet contain mature spruce forest. Vegetation is sparse above 4,000 feet and the east end of the plateau extends to the Harding Icefield. Common plants on the plateau include crowberry (*Empetrum nigrum*), dwarf birch, willow, and dryas (*Dryas octopetala*). Lichen component is chiefly *Stereocaulon* spp., *Cladonia* spp., and *Cetraria* spp.

There is approximately 50 km^2 of additional suitable habitat on benchlands south of Fox River, as well as 70 km^2 in Caribou Hills to the west of Truuli Creek Plateau. Both areas are currently unoccupied by caribou but represent possible summer range expansion.

Twin Lakes Caribou Herd. The TLH occupies the area drained by upper Benjamin Creek and surrounding mountains between Skilak Lake and upper Killey River, an area of approximately 216 km^2 (86 mi^2) The area is characterized by subalpine and alpine plant communities and ranges in elevation from 2,000 to 4,700 feet. Distribution of this herd is not well known as

only a few sightings of caribou are recorded for this area. The extent of movement between the KRH and TLH is another unknown factor in the dynamics of these herds.

Habitat evaluation has not been completed on range used by the TLH. Density is currently estimated at 0.2 caribou/km^2, indicating this herd has the greatest potential for population growth when compared to other Peninsula herds. Assuming the habitat can support a density of 1.0 caribou/km^2, the TLH could increase to approximately 200 animals. If the TLH grows at the same annual recruitment as the KRH, the population should reach 1 caribou/km^2 by spring 2001.

CONCLUSION AND RECOMMENDATIONS

The primary mandate of this planning effort is to establish criteria to maintain viable and healthy herds of caribou on the Kenai Peninsula. Four management objectives are presented to meet that purpose. Caribou herds will be managed based on the following criteria: a maximum density of 0.8-1.0 caribou/km^2, a minimum fall recruitment of 20-25 calves:100 cows, and a minimum postseason bull:cow ratio of 30-40:100.

Caribou range expansion into suitable but unoccupied habitats in Caribou Hills and alpine tundra south of Fox River is desirable. Due to the expense of introducing animals, natural expansion of existing herds into new areas to achieve this objective is favored.

Protection of habitat is a primary responsibility for land managers - USF&WS and USFS. Monitoring of habitat and changes to all five caribou ranges is needed. Some work has been done (Paez 1991) but repeatability of past monitoring needs to be standardized since funding may be difficult. Dave Swanson of the Soil Conservation Service has expressed interest in developing a habitat monitoring program for each caribou herd.

Radiotelemetry will be used to locate animals to document seasonal distribution, estimate population size, delineate calving grounds, productivity and survival rates. Tracking radiocollared caribou should be conducted frequently during calving to assess calf survival and at least monthly during the rest of the year to monitor the herd's activities. Documenting peak calving period and recruitment may provide insight into overall health of the herds. It will be critical to maintain a sufficient number of radio collars in each herd to achieve this objective.

Population Monitoring

Kenai Mountains Caribou herd. Radiotelemetry and summer/fall aerial surveys will continue to be used to assess population trends, composition, winter productivity, mortality, and habitat use patterns for the KMH. A minimum of 10 radiocollared adult female caribou should be maintained each year to facilitate location of the herd (currently there are 4 active collars). The steepness of the terrain where this herd lives makes them extremely difficult to locate on a dependable basis. Traditionally, the KMH has been located by snow-tracking in late October.

The use of radiotelemetry should reduce monitoring flight times and increase the number of caribou found per flight. Fall surveys conducted in late October will provide herd composition and size. Spring surveys will provide data pertaining to selected calving areas and time of calving. Results of a survey in spring 1988 indicate calving occurs after the first of June; however, since time of calving is believed to be correlated to habitat quality, a more accurate assessment is needed.

Kenai Lowlands Caribou Herd. The KLH has been monitored using spring aerial surveys and location of radiocollared adult females. In April 1991 four adult females were collared to facilitate herd location during snow-free periods. Three of these females were killed by wolves during the winter of 1991/92. The remaining female is still alive and her collar is functional. In April 1992 nine additional adult females were captured and radiocollared. Two of these females died, one was killed by a highway vehicle in May 1992, and another was killed in September 1993 by unknown causes. In November 93, we had eight females instrumented with functional collars.

Monitoring of these collared females confirmed eight of 10 produced calves in 1992, and one calf survived until fall. In 1993, five collared females were observed with a calf at heel, and three of the remaining four had distended udders, indicating eight calves were born. Fall 1993 counts indicated only two of those calves survived the summer. Mean summer survival rate for calves born to collared females (n=16) during these two years was 19 percent. Survival rate of adult collared females (n=13) from April 1991 to November 1993 was 62 percent, reflecting a mean annual loss of collared females of 19 percent.

Monitoring of collared females and a calf survival study was initiated in spring of 1994. Ten neonate calves were captured and radiocollared to monitor their survival during summer. Calf collars are designed to break away after 10 months, allowing their reuse in spring of 1995. The objective of this study is to determine the cause(s) of calf mortality during early summer.

Killey River Caribou Herd. A capture operation in April 1994 resulted in deployment of seven additional radio collars. There are currently nine active transmitters. A minimum of 10 animals in the KRH should be instrumented with radio transmitters to determine herd distribution and facilitate monitoring during snow-free periods. Selection of adult females for collaring should provide additional data on calving areas, calf production and survival. Monitoring should be weekly from May 10 to July 15. This herd should be monitored closely due to its documented growth rate and potential to exceed its range capacity.

Fox River Caribou Herd. Radiotelemetry will continue to be used for monitoring the FRH population. Currently there are four active collars in this herd. Collared animals will be used to locate groups for collecting information on population trends, composition, productivity and seasonal distribution as well as identification of specific calving areas and time of calving.

Twin Lakes Caribou Herd. A capture operation in April 1994 successfully radiocollared four adult cows. The objective of this collaring effort will be to document calving areas, calf production and survival, herd size and distribution. USF&WS documented a radiocollared

KRH cow and calf using both sides of the Killey River between June and July 1993. Monitoring radiocollared cows will help in identifying how often animals interchange between ranges. Monitoring should be weekly from May 10 to July 15 to document calving areas and productivity.

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Table 1. Kenai Mountains caribou fall composition counts and estimated popualtion size, 1989-1993.

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
1989/90	--	--	--	--	--	--	--	--	--	--
1990/91	39	34	20	59	--	--	--	21	303	310
1991/92[b]	--	--	--	--	--	--	--	--	--	--
1992/93[c]	43	24	14	60	--	--	--	26	390	406
1993/94[b]	--	--	--	--	--	--	--	--	--	--

[a]Estimated herd size equals postseason count plus harvest.
[b]Surveys were incomplete.
[c]Survey was conducted on 11 November 1992.

Table 2. Kenai Lowlands caribou spring composition counts and estimated popualtion size, 1989-1993.

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
1989/90[b]	--	--	17	--	--	--	--	117	117-130
1990/91[c]	--	--	12	--	--	--	--	98	98-110
1991/92[d]	--	--	24	--	--	--	--	74	74-80
1992/93[e]	--	--	24	--	--	--	--	66	66-75
1993/94[f]	--	--	28	--	--	--	--	86	86-90

[a]Estimated herd size in early June.
[b]Survey date 13 June 90.
[c]Survey date 25 June 91.
[d]Survey date 6 June 92.
[e]Survey date 8 June 93.
[f]Survey date 20 June 94.

Table 3. Killey River caribou fall composition counts and estimated popualtion size, 1989-1993.

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
1989/90[b,e]	--	--	25	--	--	--	--	--	--	132
1990/91[c]	82	55	23	42	--	--	--	35	154	154
1991/92[d,e]	--	--	--	--	--	--	--	--	--	197
1992/93[f]	67	43	20	48	--	--	--	32	222	222
1993/94[g]	56	44	22	50	--	--	--	28	281	290

[a]Estimated herd size in fall
[b]Survey date 18 June 1990.
[c]Survey date 2 November 1990.
[d]Survey date 11 November 1991.
[e]Aerial survey using fixed-wing aircraft - total count only.
[f]Survey date 11 November 1992.
[g]Survey date 15 November 1993.

Table 4. Fox River caribou fall composition counts and estimated popualtion size, 1989-1993.

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
1989/90[b,e]	--	--	44	--	--	--	--	--	23	37
1990/91[c,e]	--	--	27	--	--	--	--	--	--	37
1991/92[d,e]	--	--	44	--	--	--	--	--	23	40
1992/93[f]	74	44	20	46	--	--	--	34	50	50
1993/94[g]	--	--	--	--	--	--	--	--	58	58

[a]Estimated herd size in fall. Not hunted.
[b]Survey date 18 June 1990.
[c]Survey date 2 November 1990.
[d]Survey date 11 November 1991.
[e]Aerial survey using fixed-wing aircraft - total count only.
[f]Survey date 11 November 1992.
[g]Survey date 15 November 1993.

Table 5. Twin Lakes caribou fall composition counts and estimated popualtion size, 1989-1993.

Regulatory year	Total bulls: 100 cows	Calves: 100 cows	Calves (%)	Cows (%)	Small bulls (% bulls)	Medium bulls (% bulls)	Large bulls (% bulls)	Composition Total bulls (%)	Composition sample size	Estimate[a] of herd size
1989/90[c,e]	--	--	--	--	--	--	--	--	--	--
1990/91[d,e]	--	--	22	--	--	--	--	--	18	18
1991/92[f]	--	--	--	--	--	--	--	--	--	14
1992/93[g]	--	--	--	--	--	--	--	--	--	29
1993/94	30	26	17	64	--	--	--	19	36	36

[a]Estimated herd size in fall.

[b]Survey date 18 June 1990.

[c]Survey date 2 November 1990.

[d]Survey date 11 November 1991.

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

[f]Survey date 11 November 1992.

[g]Survey date 15 November 1993.

Table 6. Kenai Mountains caribou harvest and accidental death, 1989-93.

Regulatory year	Hunter Harvest: Reported M	(%)	F	(%)	Unk.	Total	Hunter Harvest: Estimated Unreported	Illegal	Total	Accidental death	Grand total
1989/90	12	(86)	2	(14)	0	14	--	--	--	--	14
1990/91[a]	7	(100)	0	(0)	0	7	--	--	--	--	7
1991/92	9	(56)	7	(44)	0	16	--	--	--	--	16
1992/93	11	(73)	4	(27)	0	15	--	--	--	--	15
1993/94	19	(66)	10	(34)	0	29	--	--	--	--	29

[a]Bull only season in 1990.

Table 7. Kenai Mountains caribou harvest data by permit hunt, 1989-93.

Hunt No. /Area	Regulatory year	Permits issued	Percent did not hunt	Percent successful hunters	Percent unsucessful hunters	Bulls (%)	Cows (%)	Unk.	Total harvest
501/	1989/90	150	49	18	77	86	14	--	14
Unit 7	1990/91	50	40	23	77	100[a]	0	--	7
	1991/92	100	45	29	71	56	44	--	16
	1992/93	100	47	28	72	73	27	--	15
	1993/94	200	47	27	73	66	34	--	29

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

Table 8. Kenai Lowlands caribou harvest and accidental death, 1989-93.

Regulatory year	Hunter Harvest							Accidental death	Grand total
	Reported				Estimated				
	M (%)	F (%)	Unk.	Total	Unreported	Illegal	Total		
1989/90	2	0	0	2	--	--	0	1[a]	3
1990/91	2	0	0	2	--	--	0	1[b]	3
1991/92	2	0	0	2	--	--	0	2[c]	4
1992/93	1	0	0	1	--	--	0	1[e]	2
1993/94	0	0	0	0[d]	--	--	0	7[f]	7

[a] Road killed adult male.
[b] Road killed adult female.
[c] Road killed adult female and calf.
d No hunting season in 1993/94.
e Road killed adult.
f Road killed: 3 adults and 4 calves.

Table 9. Kenai Lowlands caribou harvest data by permit hunt, 1989-93.

Hunt No. /Area	Regulatory year	Permits issued	Percent did not hunt	Percent successful hunters	Percent unsucessful hunters	Bulls (%)	Cows (%)	Unk.	Total harvest
506/15A	1989/90	3	0	67	33	2 (100)	--	--	2
	1990/91	3	0	67	33	2 (100)	--	--	2
	1991/92	3	0	67	33	2 (100)	--	--	2
	1992/93	3	0	33	67	1 (100)	--	--	1
	1993/94[a]	--	--	--	--	--	--	--	--

[a] Season not authorized in 1993/94.

Table 10. Kenai Mountains caribou annual hunter residency and success, 1989-93.

Regulatory year	Successful					Unsuccessful					Total hunters
	Local[a] resident	Nonlocal resident	Nonresident	Total	(%)	Local[a] resident	Nonlocal resident	Nonresident	Total	(%)	
1989/90	1	13	0	14	(18)	9	50	2	62[b]	(82)	76
1990/91	2	5	0	7	(23)	3	20	0	23	(77)	30
1991/92	2	13	1	16	(29)	2	35	0	37	(67)	55[b]
1992/93	1	13	1	15	(28)	4	30	2	38[b]	(72)	53
1993/94	4	25	0	29	(26)	5	78	2	85	(74)	111

[a]Local resident resides in Unit 7 or 15.
[b]Total includes unsuccessful hunters of unknown residence.

Table 11. Kenai Lowlands caribou annual hunter residency and success, 1989-93.

Regulatory year	Successful					Unsuccessful					Total hunters
	Local[a] resident	Nonlocal resident	Nonresident	Total	(%)	Local[a] resident	Nonlocal resident	Nonresident	Total	(%)	
1989/90	2	0	0	2	(67)	1	0	0	1	(33)	3
1990/91	2	0	0	2	(67)	1	0	0	1	(33)	3
1991/92	1	1	0	2	(67)	0	1	0	1	(33)	3
1992/93	1	0	0	1	(33)	0	2	0	2	(67)	3
1993/94	NO SEASON										

[a]Local resident resides in Unit 7 or 15.

Table 12. Kenai Mountains caribou annual harvest chronology percent by time period, 1989-93.

Regulatory year	Harvest periods				*n*
	8/10-8/15	8/16-8/31	9/1-9/15	9/16-9/30	
1989/90	29	36	29	7	14
1990/91	57	14	29	--	7
1991/92	13	40	20	27	15[a]
1992/93	7	13	53	27	15
1993/94	38	31	17	14	29

[a]One hunter failed to report harvest chronology.

Table 13. Kenai Lowlands caribou annual harvest chronology percent by time period, 1989-93.

Regulatory year	Harvest periods 9/1-9/10	9/11-9/20	n
1989/90[a]	50	50	2
1990/91[a]	100	0	2
1991/92[a]	0	100	2
1992/93[a]	100	0	1
1993/94[a]	--	--	0

[a]Season dates September 1-20, 1989-93.

Table 14. Kenai Mountains caribou harvest percent by transport method, 1989-93.

Regulatory year	Percent of harvest Airplane	Horse	Boat	3 or 4-Wheeler	Snowmachine	ORV	Highway vehicle	Unknown	*n*
1989/90	--	14	--	--	--	--	86	0	14
1990/91	--	29	--	--	--	--	71	0	7
1991/92	--	19	--	--	--	6[a]	75	0	16
1992/93	7	27	--	7	--	--	60	0	15
1993/94	10	21	--	--	--	--	59	10	29

[a]ORV includes mountain bike.

Table 15. Kenai Lowlands caribou harvest percent by transport method, 1987-91.

Regulatory year	Percent of harvest								*n*
	Airplane	Horse	Boat	3 or 4-Wheeler	Snowmachine	ORV	Highway vehicle	Unknown	
1989/90							100		2
1990/91	--	--	--	--	--	--	100	--	2
1991/92	--	--	--	100	--	--	--	--	2
1992/93	--	--	--	--	--	--	100	--	1
1993/94				NO SEASON					

LOCATION

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

Herd: Mulchatna

Geographical Description: Drainages into northern Bristol Bay and the middle Kuskokwim River

BACKGROUND

Little information is available on the Mulchatna Caribou Herd (MCH) before 1973. The first historical accounts of caribou in the area are in the journals of agents of the Russian-American Fur Company (Van Stone 1988). During his travels in 1818, through areas now included in Game Management Subunits 17A and 17C, Petr Korsakovskiy noted 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 began increasing again in the Mulchatna River area in the early 1930s (AK. Game Comm. Reps. 1925-39), remaining relatively stable throughout that decade. There were indications the herd began declining in the late 1930s (Skoog 1968); however, substantive information was not 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 availability. Documentation on the numbers and fate of these animals is 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. Reasons for the demise of the reindeer herds include wolf predation and the expansion of the commercial fishing industry. Local residents 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 1,000 caribou (ADF&G files 1974). The population increased to approximately 5,000 by 1965 (Skoog 1968). In 1966 and 1972 relatively small migrations across the Kvichak River were recorded; however, major movements of this herd were not observed until recently. An estimated 6,030 caribou were observed on a survey in June 1973, but it was not until June 1974 that a major effort was made to accurately census this herd. A total of 13,079 caribou was counted at that time, providing a basis for an October estimate of 14,231 caribou.

Photocensusing was used to monitor the herd as it declined in size through the 1970s. Seasons and bag limits were reduced continuously during that decade. Locating caribou during surveys was a problem, and biologists often underestimated the herd size. Twenty radio transmitters were placed on caribou in the MCH in 1981, providing assistance in finding postcalving aggregations. During a photocensus on 30 June 1981, 18,599 caribou were counted. Photocensus estimates of the MCH since then have documented a steady increase.

MANAGEMENT DIRECTION

Management Objectives:

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

Additional objectives include:

1 manage the MCH for maximum opportunity to hunt caribou, and
2 manage the MCH in a manner that encourages range expansion west and north of the Nushagak River.

METHODS

Biologists conducted photocensuses of the MCH during the postcalving aggregation period in late-June or early-July in most years from 1980 to 1994. In recent years, censuses have been scheduled on an alternate year basis, occurring in even years.

Department personnel from the Dillingham office coordinate the censuses; personnel from Lake Clark National Park, Togiak National Wildlife Refuge, and Yukon Delta National Wildlife Refuge assist with surveys. Surveyors, using Super Cub (PA-18) and Cessna 185 aircraft, estimate the number of caribou each observes and they photograph discrete groups with hand-held 35-mm cameras.

Beginning in 1994, large aggregations were photographed with an aerial mapping camera mounted in a DeHavilland Beaver (DH-2) aircraft. We estimated herd size by adding 3 components of the survey: 1) the number of caribou counted in photographs; 2) the estimated number of caribou observed but not photographed; and, 3) the estimated number of animals 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. These surveys had not been conducted since 1987, but they were scheduled on an alternating year basis, occurring in odd years.

We have captured and radiocollared MCH caribou in most years since 1980. Between 15-18 April 1994, we radiocollared 20 female caribou in the vicinity of Sparrevohn Air Force Station

using a Hughes 500-D helicopter with a skid-mounted net gun. This effort was a cooperative effort among the department, the Bureau of Land Management, and the U.S. Air Force. Beginning in 1992, we scheduled collaring programs on alternate years, to occur in even years.

We conducted radio-tracking flights throughout this reporting period to continue the demographics study that began in 1981. Supplemental funding from Cominco Exploration-Alaska and the Bureau of Land Management allowed us to schedule monthly flights during 1994. We analyzed radiotelemetry data under a contract with Cominco from 1992-94 (Van Daele and Boudreau 1992, Van Daele 1994).

We conducted harvest monitoring and enforcement activities along the Mulchatna and Nushagak Rivers during the first half of September when hunting pressure was most intense. Harvest data were collected from statewide harvest reports. Hunter "overlay" information was not keypunched, and reminder letters were not sent to hunters who failed to report.

RESULTS AND DISCUSSION

Population Status and Trend: Between 1981 and 1992 the MCH increased at an annual rate of 17% (Figure 1). From 1992-94, the annual rate of increase was 28%. The dramatic growth of the herd was attributed to a succession of mild winters, movements onto new range, low predation rates, and an estimated annual harvest rate of less than 5% of the population since the late 1970s.

Population Size: We conducted photocensuses of the MCH on 28-29 June 1994. Based on results of that survey, the minimum population estimate for the MCH was 168,351 caribou (Table 1). These data indicated the herd continued to increase in size during this reporting period.

Population Composition: We conducted a sex and age composition survey on a large aggregation of caribou (ca. 50,000) about 25 miles long and 5 miles wide in the Mosquito River and Keefer Creek drainages on 18-19 October 1993. The group consisted of all sex and age classes, but many of the large bulls were lagging behind the rest of the group. Bull:cow and calf:cow ratios were relatively high within this sample (Table 2).

We conducted radiotelemetry flights to delineate calving areas on 23, 24 and 27 May 1994. The peak of calving was during the census period. About 50,000 adult caribou were in the Tikchik River basin, and a survey of several bands of caribou yielded a ratio of 70 calves:100 cows. A few cows were observed nursing 2 calves at the same time, which was evidence of twinning.

Distribution and Movements: The MCH continued to increase its range as it increased in number. To follow the movements of the herd, we had 57 caribou with radio collars in the MCH in July 1994. These included 12 deployed in 1986-88 and 9 deployed in 1990.

Wintering Areas - The most significant wintering area for the MCH was along the west side of Iliamna Lake. There was continued intermingling of the MCH and the Northern Alaska Peninsula Caribou Herd (NAP) on winter ranges. Analysis of radiotelemetry data indicated the MCH has been moving its winter range to the south and west during most of the last decade (Van Daele and Boudreau 1992). Many caribou from the MCH spent the winter south of the Kvichak River as far as the Alagnak River.

Some caribou occupied other wintering areas in large numbers during this reporting period. Up to 10,000 animals wintered in the Aniak River drainage, according to local residents. A large group of up to 20,000 caribou spent the winter in the basin between Lime Village and Sparrevohn. Another group of about 10,000 MCH caribou were in the vicinity of Egigik during the winter of 1993-94. Since 1986, an increasing number of caribou have wintered between the Nushagak and Wood rivers, south of Kemuk Mountain. There were contining reports of a few caribou crossing the Wood River into an area between Dillingham and Aleknagik.

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 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 1,000 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 in the vicinity of Harris Creek, northeast of the village of Koliganek. Large male aggregations (>10,000) were along Vukpalik Creek in the Nushagak drainage and Hook Creek in the Hoholitna drainage (Van Daele 1993).

During our survey in May 1994, caribou were not in the historic calving areas along the upper Mulchatna River and the Bonanza Hills. Many small groups of females were scattered along the northern tributaries to the Mulchatna, primarily in the Mosquito and Old Man River drainages. Several thousand females, in small groups, were within about 25 miles of the Big Bend of the Nushagak. There were about 50 calves:100 cows in these groups, and many were still pregnant.

The main calving group was in the Tikchik Basin, east of Upnuk and Nishlik Lakes, an area typically used during postcalving aggregations. Large groups were found throughout the basin, with trails coming from the north, east and west. We estimated that 50,000 adult females were in the area, with a calf:cow ratio of 70:100. Ten of the 18 radiocollared Kilbuck caribou were in the basin; about 20,000 males were resting along the south and west slopes of Taylor Mountain, approximately 60 miles to the northeast. The basin was snow-free, but there was not much forage available.

Summer Range - During the summer and fall, the MCH moved throughout their range from the Kvichak River in the southeast to Holy Cross on the Yukon River in the northwest. Primary use areas were between the Mulchatna and Kuskokwim Rivers. During a radio-

tracking flight on 27 June 1994, we found a herd of caribou 18 miles long by 1 mile wide near the headwaters of the Nushagak River. We estimated this group contained 150,000 caribou.

Several peripheral groups were independent from the MCH. A group of 1,300 caribou was between Portage Creek and Etolin Point. Caribou in the Kilbuck Mountains and in Rainy Pass appeared to be distinct from the MCH, but there was overlap during the year. Radiotelemetry data confirmed another group resided in the upper Stuyahok and Koktuli River drainages (Van Daele and Boudreau 1992, Van Daele 1994). During the winter these caribou intermingled with the main herd, but they did not migrate with the herd in the spring.

Mortality

Harvest:

Season and Bag Limit. Hunting was prohibited in Subunit 17A and that portion of Subunit 17C west of the Nushagak River. The caribou season for Alaska resident, subsistence, and nonresident hunters in Subunits 9B, 17B, 17C (remainder), 19A (south of the Kuskokwim), and 19B was 1 August to 15 April. The bag limit for resident hunters was 5 caribou, including no more than 2 bulls. The bag limit for nonresidents was 2 caribou.

Game Board Actions and Emergency Orders. During their 1993 spring meeting, the Board of Game recognized the increase in the size of the MCH and liberalized the season and bag limit. A proposal to allow same-day-airborne hunting of caribou within the MCH range was brought to the Board in 1994. They agreed with the concept of the proposal but opted to defer action on it until they heard more widespread public testimony.

Hunter Harvest. The harvest from the MCH was 2,804 caribou during the 1993-94 hunting season (Table 3). This was the highest harvest ever recorded for the MCH. As in previous years, the majority of the harvest was males (80%).

Data from harvest reports must be viewed with caution because overlays are not keypunched, and there was not a way to objectively analyze the rate of return. The estimated unreported harvest during this period was 2,000, yielding an estimated total harvest of over 4,800 caribou.

Most of the unreported harvest was attributed to local and other Alaska residents. Subsistence Division household surveys conducted in local villages from 1983 to 1989 indicated an estimated annual harvest of 1,318 caribou (P. Coiley, ADFG-Subsistence pers. commun.). The number of caribou harvested by local residents has probably increased since the Subsistence surveys. Unreported harvest by other Alaska residents was more difficult to quantify.

Field observations indicated the density of hunters in the range of the MCH during the fall season has increased steadily since the early 1980s. Harvests, however, have remained less than 5% of the population, and harvests have not seemed to limit herd growth or range

expansion. The prohibition of hunting in the portion of Subunit 17C west of the Nushagak River probably contributed to the increased caribou use of this area.

Hunter Residency and Success. Nonresidents made up 47% of the hunters (n = 802) during the 1993-94 season. Nonlocal Alaska residents accounted for 53%, and local residents 3% of the total hunters who returned harvest reports. Eighty-six percent of the hunters who reported successfully harvested at least 1 caribou (Table 4).

Harvest Chronology. Most (86%) of the reported harvest in 1993-94 occurred during August and September. March was also an important month for harvesting caribou, accounting for 5% of the reported harvest and a large portion of the local unreported harvest. This harvest chronology was comparable to previous years (Table 5).

Transport Methods. Aircraft were the most common (86%) means of hunter transport during the 1993-94 hunting season (Table 6). Boats (10%) and snowmachines (2%) were important means of transportation. Boats and snowmachines were the main transportation methods for local hunters and were probably underreported in our harvest data.

Other Mortality: There were several observations and reports of wolf and brown bear predation on caribou during this reporting period, but predation rates appeared to be low. An increased number of hunters along the Mulchatna River reported encounters with brown bears, including bears on fresh kills, bears on hunter-killed carcasses, and bears raiding hunting camps. Individual bears were learning to exploit an abundant autumn food source.

Caribou collared in 1992 had a higher than expected mortality rate. Eight of 20 (40%) caribou collared near the proposed Cominco mine site had died or slipped their collars by the end of 1993. This was substantially higher than the mortality rate of caribou collared in 1990 (18%) and 1991 (22%) by the end of 1993 (Van Daele 1994). By the end of 1994, only 7 of the 1992 collars were on live caribou; this was a mortality rate of 65% in less than 3 years. Reasons for this were unclear.

Habitat

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

Portions of the range were showing heavy use. Extensive trailing was evident along migration routes. Some of the summer/fall range near the Tikchik Lakes was trammeled and heavily grazed, and winter range on the west side of Iliamna Lake was heavily used. Many of the areas the MCH was expanding into have not been used by caribou for over 100 years, or by reindeer for over 50 years. These areas have vast quantities of ungrazed lichen communities.

CONCLUSIONS AND RECOMMENDATIONS

The MCH continued to experience exceptionally rapid growth in population and extended their range during this reporting period. The minimum postcalving population estimates have increased from 18,599 in 1981 to 168,351 in 1994. In 1994 the herd surpassed the Porcupine caribou herd in size, making it the second largest caribou herd in the state.

Although annual harvests remained at less than 5% of the population, the total harvest and the number of hunters afield have steadily increased. The MCH was 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, have made this herd increasingly popular with nonresident hunters. However, the mobility of the herd and the inaccessibility of much of its range to hunters made hunting logistics challenging.

During the past decade, 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. The herd's range encompasses over 40,000 mi^2, and large portions of the herd were pioneering new winter, calving and summer ranges in good to excellent caribou habitat. There was evidence of localized overutilization in portions of the range, but most of the areas used by the MCH were in good condition.

We do not know how long the tremendous growth rate of this herd can continue. There were few, if any, signs of stress in the herd. Most of the adult females captured in the spring were pregnant and in good physical condition, calf production and survival were high, and there was not any evidence of disease. Predation rates were low and the herd continued to move into good habitat.

In spite of these indicators, such rapid population growth cannot continue indefinitely. We should continue to monitor the herd closely 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.

Increased harvest pressure on the MCH affected other big game populations in the area. Illegal moose harvests decreased as local hunters increased their use of caribou meat. The increased number of caribou has attracted more nonlocal hunters interested in "combination hunts." The Board of Game addressed this issue in 1993 by imposing stricter bag limits on moose hunters in Unit 17.

The MCH presents new management challenges as it enlarges its size and range. Because 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. It also overlaps with the southern fringes of the Western Arctic caribou herd's range. We must determine how (or if) we can manage each herd separately when setting management objectives and proposing regulatory formulas.

Harvest data for the MCH are of limited value because there is not an objective method to determine the rate of return of harvest tickets. Overlay data have not been keypunched and reminder letters have not been sent to nonrespondents since 1986. Important management decisions have been based on assumptions rather than objective data. The department should strive to improve the quality of the harvest data to better manage the MCH as well as the smaller herds on the same range. Improved harvest data will also be vital if it becomes necessary to limit harvest pressure.

Recommended management actions include:

1 Conduct an annual photocensus of the MCH during postcalving aggregations in 1996 and 1998;

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 caribou from the main winter range of the MCH each April to investigate body condition;

4 Conduct calving surveys in May of each year;

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

6 Maintain at least 1 active radio collar per 2000 caribou in the MCH by scheduling capture operations in April 1996 and 1998;

7 Develop an improved method of collecting harvest data and implement the method before the 1995-96 hunting season;

8 Continue to work with other land and resource management agencies and land owners on MCH management; and,

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

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Figure 1. Minimum estimated population size of Mulchatna caribou herd, southwest Alaska, 1980 - 1994.

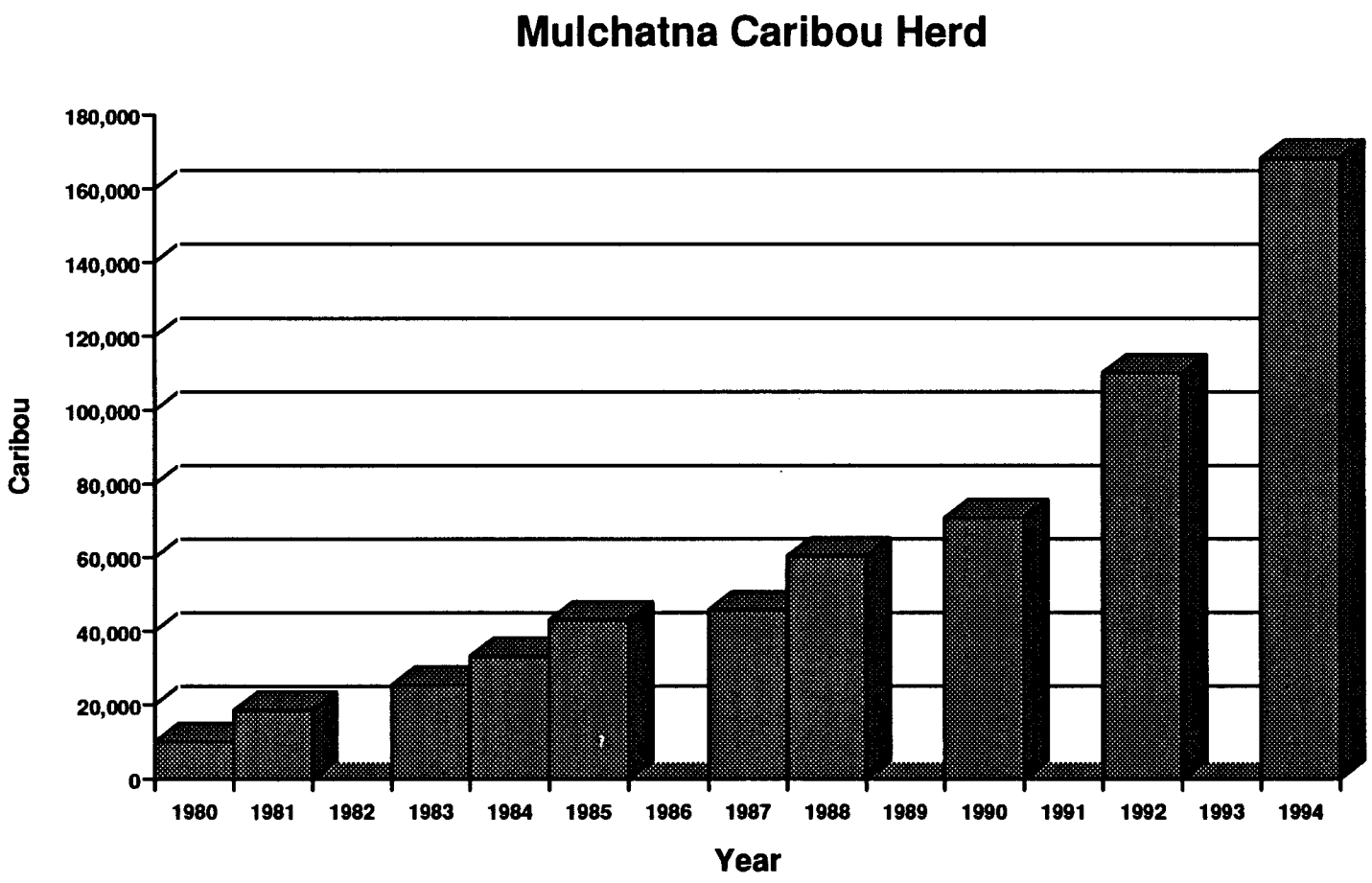

Table 1. Mulchatna caribou herd estimated population size, 1989/90-1994/95.

Regulatory year	Date	Preliminary estimate[a]	Minimum estimate[b]	Extrapolated estimate[c]
1989/90	28 Jun 89	51,868	--	70,000
1990/91	01 Jul 90	61,851	70,652	82,000
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

[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 during the census.
[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, 1989-1993.

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]
1989/90	---	---	---	---	---	---	---	---	---	70,000
1990/91	---	---	---	---	---	---	---	---	---	82,000
1991/92	---	---	---	---	---	---	---	---	---	90,000
1992/93	---	---	---	---	---	---	---	---	---	115,000
1993/94	42	44	24	54	---	---	---	23	5,907	150,000

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

Table 3. Mulchatna caribou harvest and accidental death, 1989-93.

Regulatory year	Hunter Harvest: Reported M (%)	Reported F(%)	Reported Unk.	Reported Total	Estimated Unreported	Estimated Illegal	Estimated Total	Accidental death	Grand total
1989/90	88	11	<1	1,201	1,500	--	1,500	--	2,701
1990/91	84	16	<1	1,151	1,500	--	1,500	--	2,651
1991/92	86	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	<1	2,804	2,000	--	2,000	--	4,804

Table 4. Mulchatna caribou annual hunter residency and success, 1989-93.

	Successful				Unsuccessful				
Regulatory year	Local resident	Nonlocal resident	Nonresident	Total (%)	Local resident	Nonlocal resident	Nonresident	Total (%)	Total hunters[a]
1989/90	46[b]	424	621	85	1	117	70	15	1,279
1990/91	87[b]	366	532	87	12	70	68	13	1,135
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

[a] Includes hunters of unknown residency.

[b] Includes residents of Game Management Unit 17

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

Table 5. Mulchatna caribou annual harvest chronology percent by time period, 1989-93.

Regulatory year	Harvest Periods August	September	October	November	December	January	February	March	April	*n*
1989/90	23	59	4	1	1	1	1	11	0	1,201
1990/91	21	51	6	1	2	1	4	14	0	1,138
1991/92	29	43	6	<1	2	1	4	12	0	1,573
1992/93	30	54	5	1	<1	<1	1	8	0	1,305
1993/94	36	50	5	<1	1	1	1	5	2	2,779

Table 6. Mulchatna caribou harvest percent by transport method, 1989-93.

Regulatory year	Percent of harvest								
	Airplane	Horse	Boat	3 or 4-Wheeler	Snowmachine	ORV	Highway vehicle	Unknown	*n*
1989/90	85	<1	9	1	3	0	0	2	1,398
1990/91	84	1	7	1	7	<1	<1	2	1,277
1991/92	81	<1	9	1	9	<1	<1	2	1,750
1992/93	88	<1	8	3	3	<1	<1	0	1,353
1993/94	86	1	10	1	2	<1	1	0	2,356

LOCATION

Game Management Unit: 9C and 9E (19,560 mi^2)
Herd: Northern Alaska Peninsula
Geographical Description: Alaska Peninsula

BACKGROUND

The Northern Alaska Peninsula Caribou Herd (NAPCH) ranges throughout Subunits 9C and 9E. Historically, the size of this population 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 occurred during the late 1940s (i.e., 2,000 caribou) and by 1963 the herd had increased to over 10,000 animals. The first radiotelemetry-aided census in 1981 estimated 16,000 caribou and by 1984 the herd had increased to 20,000. Between 1963 and 1994 the herd remained remarkably stable between 10,000 and 20,000.

MANAGEMENT DIRECTION

Management Objectives

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

METHODS

A radiotelemetry-aided aerial photocensus was conducted each year in late June on postcalving concentrations. Using a helicopter-mounted net gun, in April 1992 biologists captured 16 adult females to assess body size and condition; 15 were radiocollared. In April 1994 we captured 16 caribou to measure and radiocollar. Biologists conducted fall sex and age composition surveys with a helicopter in October of each year. We flew reconnaissance flights (using radiotelemetry) to periodically monitor herd movement. We monitored the harvest by harvest ticket reports.

RESULTS AND DISCUSSION

Population Status and Trend

Minimum counts from photocensuses during 1981-1993 ranged between 15,000 and 19,000. Annual variations in counts were caused by changes in herd size and/or sampling error (restricted coverage due to poor weather, errors in visual estimates, etc.). Despite these fluctuations in numbers, the NAPCH has been relatively stable within the desired population

limits for the past 13 years. Because of concerns about winter range quality, we decided in the late 1980s to try 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 expanded coverage of fringe areas, tallied 12,000 caribou. Thus, it appeared the herd began a decline in 1992. The first year's decline was not viewed with alarm because the herd was at the desired level. In addition, we anticipated harvest pressure would decline due to liberalized regulations for the growing Mulchatna herd and closure of the King Salmon Air Force Base.

Population Size: Over the past 14 years the size of the NAPCH has been reported in 2 ways - the actual number of caribou counted during the postcalving photocensus, rounded to the nearest 100 and an estimated total herd size which included 1,000 to 1,500 "uncounted" caribou believed to be in fringe areas. Actual counts from the 1993 and 1994 photocensuses were 15,000 and 12,000. Coverage of the summer range in 1993 was comparable to previous years, and we estimated the total herd contained 16,000 animals. In 1994, the Alaska Peninsula/Becharof Refuge staff covered portions of the Aleutian Mountains and Pacific drainages where they counted 1,457 caribou. This area had not been counted since the early 1980s, so the 1994 photocensus count of 12,000 caribou represents a more complete "minimum count" than from photocensuses in recent years. The 1994 estimate of total herd size was 12,500.

Population Composition: A sample of 2,766 caribou was classified in October 1992 and had 40 bulls and 44 calves:100 cows (Table 1). A sample of 2,436 caribou classified from the June 1993 photocensus showed 30% calves in the herd. A sample of 3,021 caribou classified in October 1993 had 44 bulls and 40 calves:100 cows. Calves made up 22% of the sample (Table 1). In June 1994, there was 25% (n = 5,514) calves in postcalving aggregations.

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 began earlier, and for the past 5 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. Starting in 1986 many caribou wintered between the Naknek River and the Alagnak River, and even as far north as Big Mountain on Lake Iliamna, where they have intermingled with a portion of the Mulchatna herd. During the 1993-94 winter, an estimated 3,000-4,000 NAPCH animals migrated north of the Naknek River, where they mixed with an estimated 15,000-20,000 Mulchatna caribou. A telemetry flight on 26 January, 1994 documented, for the first time, movement of some Mulchatna caribou south of the Naknek River where they competed for forage on the traditional NAPCH winter range. Subsequent monitoring of both herds failed to document permanent egress by either herd. During 1994 postcalving surveys, only 1 NAPCH animal was unaccounted for, and its radio had been transmitting for over 5 years, well past the expected battery life.

Mortality

Harvest:

Season and Bag Limit. In 1992-93, the open season for all hunters in Subunits 9C and 9E was 10 August to 31 March. The bag limit for resident hunters was 4 caribou; however, not more than 2 could be taken from 10-31 August; the September-November bag limit was 1. The bag limit for nonresident hunters was 1 caribou.

In 1993-94 the resident season within the Pacific drainages of 9E, southwest of Seal Cape, opened on 1 July, with a bag limit 2 bulls until 10 August when either sex could be taken. Additionally, the resident season in all of 9E was extended to 30 April, with a bag limit of 2 caribou.

Game Board Actions and Emergency Orders. Responding to a request from the villages of Pilot Point and Port Heiden, the Board of Game passed an emergency regulation in early April, 1992 to authorize a 4-day season for that portion of 9E south of and including the Ugashik drainage with a bag limit of 1 antlerless caribou. The harvest "quota" was 75 caribou. This opening was held 18-21 April under an emergency order, and 94 caribou were taken (Fall 1992). Because of more frequent delays in the southern migration of the NAPCH, the Board in 1993 extended the season through April in 9E. To provide additional subsistence opportunities for the villages on the Pacific side of 9E, the Board also opened the area south of Seal Cape from 1 July-9 August, with a 2 bull limit.

Hunter Harvest. The 1992-93 harvest from the NAPCH was 921 caribou (Table 2); this included 816 males (89%) and 98 females (11%). Most local and some nonlocal hunters did not report killing caribou. The nonsubsistence reporting rate was estimated at 60% (Sellers 1989) and unreported subsistence harvest has been estimated at 900-1,000 (Morris 1985, Morris 1987). Consequently, the total human harvest was estimated at 2,300. In 1993-94, the reported harvest jumped to 1,345 and was the highest ever recorded. However, 57% of the total harvest came after December within the Naknek drainage when a large number (15,000-20,000) of Mulchatna caribou were mixed with NAPCH animals. Consequently a substantial portion of the winter harvest was of Mulchatna caribou. The reported harvest from 9E was only 395, compared to an average of 460 during the late 1980s. We did not receive any reports of caribou harvested during the new, 1 July-9 August season in the southeastern portion of 9E. While the reported harvest in 9E has declined slightly since 1987, the harvest in 9C, especially during the winter, has increased dramatically.

Hunter Residency and Success. Success rates for all hunters averaged 84% for 1992-93 and 93-94 (Table 3), but the reporting rate for unsuccessful hunters was substantially lower than for successful hunters. In 1992-93 the percentages for successful hunters were 14%, 44% and 43% for locals, other Alaskans, and nonresidents, respectively. In 1993-94 successful hunters comprised 10% local, 55% other Alaskans, and 34% nonresidents. The larger bag limit for residents and the abundance of caribou along the King Salmon-Naknek road system attracted

a large number of nonlocal Alaskans during the 1993-94 winter. Alaskans accounted for 90% of the 1993-94 NAPCH harvest.

Harvest Chronology. As caribou have become more available along the King Salmon-Naknek road system in the winter, the chronology of the harvest shifted dramatically toward the late season (Table 4). September was the most important month, especially for nonresidents, because of the combination of good weather conditions and easy access by boat and aircraft. The subsistence harvest was opportunistic and chronology of harvests varies among villages, depending upon caribou availability.

Transport Methods. The percentage of successful hunters using aircraft declined and use of 3 or 4-wheelers increased (Table 5) as more of the harvest occurred during winter in the Naknek drainage.

Other Mortality: Radio collars were used on the NAPCH to facilitate annual postcalving photocensuses. Mortality censors were not used in most transmitters and telemetry flights were sporadic. These 2 factors precluded dating of natural mortalities. Nevertheless, the rate of natural mortality increased in recent years. From October 1980 through March 1984, the average annual mortality rate was 7%. During the next 4 years, the annual mortality rate averaged 18%, and since 1988 has averaged 25%. Of 15 cows radiocollared in April 1992, 4 died within the first year (annual mortality rate of 27%) and 5 died during 1993-94 (annual mortality rate of 46%). Of 16 caribou radiocollared in April 1994, 4 were dead by late June 1994. The 4 deaths were not related to being captured because all survived at least 1 week and moved considerable distances (9, 30, 45, and 90 miles) from the capture site. Unfortunately, the cause of death was determined only in a few cases because we could not inspect the kill sites promptly.

During the 1993-94 winter, at least 2 groups, about 30 animals, were swept under the ice and drowned in the Naknek River.

Habitat

Assessment: We were unable to assess range conditions because quantitative data were not available. Analysis of data (i.e., weights and body size) from the caribou relocated in 1988 and from animals captured in April 1990, 1992 and 1994 showed NAPCH adult females were intermediate in body size and condition between the Southern Alaska Peninsula herd (SAPCH) and Mulchatna herd animals (Pitcher et al. 1990). Progeny of the relocated caribou on the Nushagak Peninsula were larger than animals from the parent NAPCH (ADF&G unpublished data and Hinks and VanDeale 1994). Adult cow body size, condition, and herd productivity were better than those documented for the SAPCH during its decline. However, the drop in productivity noted in 1994, the increased morality rate, and expansion of winter range north of the Naknek River indicated the NAPCH winter range was deteriorating.

Nonregulatory Management Problems/Needs

This herd was nominated by a panel of caribou biologists for experimental management because the NAPCH has been stable for the past 30 years at a 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 body condition. It will be necessary to maintain 20-25 functional radios on females to accomplish this objective.

Recent advances in monitoring the condition of caribou herds (P. Valkenburg, memo dated 4 January 1995) include collecting or radiocollaring female calves in April. The rationale for handling female calves is they better reflect range quality and weather stress because their body condition is more sensitive and 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. We will implement these procedures for the NAPCH in 1995.

CONCLUSIONS AND RECOMMENDATIONS

We have achieved management objectives for the NAPCH for the past 13 years. Population objectives do not need to be adjusted at this time, and we will attempt to maintain the herd at 15,000 animals. To accomplish this, harvests, particularly of cows, must be reduced. During the 1994-95 regulatory year, department staff made a concerted effort to direct hunters to the Mulchatna herd. This was effective until the Mulchatna herd moved into a very remote area during September. In November 1994, the Board of Game adopted an emergency regulation, suggested by the Naknek-Kvichak Fish and Game Advisory Committee, to reduce the winter bag limit within the Naknek drainage to 1 caribou per calendar month, with not more than 1 cow per regulatory year. Based on preliminary results, this new restriction was successful in reducing 1994-95 harvest.

I recommend continuing efforts to redirect hunting pressure toward the Mulchatna herd and maintaining the restrictive winter bag limit for the Naknek Drainage. If the herd continues to decline in 1995, more drastic reductions in harvest should be imposed promptly. More intensive monitoring of population parameters will be needed to evaluate whether the current population objective is appropriate given range conditions and competition from the Mulchatna herd for winter forage.

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Table 1. Northern Alaska Peninsula caribou fall aerial (helicopter) composition counts and estimated population size, 1987-94.

Regulatory year	Bulls: 100 cows	Calves: 100 cows	Small bulls (% of bulls)	Medium bulls (% of bulls)	Large bulls (% of bulls)	Total bulls (%)	Calves (%)	Total caribou observed	Estimated population size
1987/88	54	51	51	32	17	26	25	1,536	17,000
1988/89	49	48	46	34	20	25	26	1,156	20,000
1989/90	37	33	62	19	9	22	19	312	20,000
1990/91	41	29	NA	NA	NA	24	17	1,484	17,000
1991/92	42	47	54	34	12	22	25	1,639	17,000
1992/93	40	44	44	38	19	22	24	2,766	17,500
1993/94	44	40	52	29	19	24	22	3,021	16,000
1994/95	34	34	58	28	14	20	20	1,857	12,500

Table 2. Northern Alaska Peninsula caribou harvest, 1989-93.

	Reported						Estimated	Grand
Year	Males	(%)	Females	(%)	Unknown	Total	unreported	total
1989/90	766	85	137	15	0	903	1,400	2,300
1990/91	679	86	110	14	2	791	1,200	2,000
1991/92	688	86	115	14	3	806	1,200	2,000
1992/93	816	89	98	11	7	921	1,400	2,300
1993/94	1,165	87	175	13	5	1,345	1,500	2,800

Grand total is rounded off.

Table 3. Northern Alaska Peninsula caribou annual hunter residency and success , 1989-93.

Regulatory year	Successful				Unsuccessful				Total hunters
	Local resident	Nonlocal resident	Non-resident	Total (%)	Local resident	Nonlocal resident	Non-resident	Total (%)	
1989/90	49	345	358	752 (98%)	4	6	5	15 (2%)	767
1990/91	51	270	321	640 (84%)	8	76	39	123 (16%)	763
1991/92	56	283	282	621 (79%)	15	120	27	162 (21%)	783
1992/93	91	291	268	662 (82%)	18	110	21	150 (18%)	812
1993/94	86	465	288	839 (85%)	10	98	32	142 (15%)	985

Table 4. Northern Alaska Peninsula caribou annual harvest chronology percent by time period, 1984-93.

Regulatory year	August	September	October	November	December-March	*n*
1984/85	23	40	15	14	9	742
1985/86	12	38	22	13	15	751
1986/87	26	36	13	10	14	720
1987/88	13	31	23	19	11	999
1988/89	11	37	19	7	27	981
1989/90	10	37	21	5	28	899
1990/91	12	36	12	4	36	884
1991/92	14	35	20	2	29	789
1992/93	9	34	12	2	43	971
1993/94	9	22	11	1	57	1,345

Table 5. Northern Alaska Peninsula caribou harvest percent by transport method, 1989-93.

Regulatory year	Percent of harvest							
	Airplane	Horse	Boat	3 or 4-wheeler	Snowmachine	ORV	Highway vehicle	*n*
1989/90	68	0	13	7	4	1	8	758
1990/91	64	0	12	11	1	3	9	632
1991/92	60	0	14	14	4	1	7	616
1992/93	52	0	16	18	3	2	7	643
1993/94	44	0	13	29	6	1	7	821

LOCATION

Game Management Unit: 9D and 10 (6,435 mi^2)
Herd: Southern Alaska Peninsula
Geographical Description: Alaska Peninsula and Unimak Island

BACKGROUND

The range of the Southern Alaska Peninsula caribou herd (SAPCH) includes the Alaska Peninsula southwest of Port Moller. There have been numerous reports of caribou moving between Unimak Island and the mainland, including what may have been a substantial emigration in 1976. Historically, the size of the SAPCH has varied, ranging from 500 to over 10,000. Skoog (1968) speculated the Alaska Peninsula was marginal habitat for sustaining large caribou populations because of periodically severe icing conditions and ash from frequent volcanic activity affecting food supply and availability. The herd grew in numbers from 1975 to 1983 and declined from 1983 to the present. Numbers of caribou on Unimak Island have also varied substantially, ranging from 5,000 in 1975 (Irvine 1976) to 300 since 1983.

Harvest of the SAPCH was high from 1980-1985, probably exceeding 1,000 in several years. Starting in 1986, restrictive regulations reduced harvests as the herd continued to decline. By 1993 the herd was below 2,500 and hunting was closed. Poor nutrition played a role in the decline of the SAPCH. Predation by wolves and brown bears, as well as human harvest, may have contributed to the decline (Pitcher et al. 990).

MANAGEMENT DIRECTION

Management Objectives

To maintain a population of 4,000 to 5,000 caribou in midsummer with an October sex ratio of 20-40 bulls:100 cows.

METHODS

Since 1984 biologists have conducted a postcalving, aerial radiotelemetry survey in late June or early July in most years. Periodically, in October we flew sex and age composition surveys with a helicopter and used occasional radiotracking flights to monitor herd distribution. The staff of the Izembek National Wildlife Refuge (INWR) conducted a late fall/winter aerial census along systematic transects. We monitored hunter harvests by harvest tickets and supplemented by field checks by INWR staff around Cold Bay. Studies were begun on causes of low calf recruitment in the SAPCH (Pitcher et al. 1990) during 1989-1990, and a student (Eric Post) from UAF began a study of range conditions in 1991.

RESULTS AND DISCUSSION

Population Status and Trend

Population Size: We counted postcalving aggregations on 22-23 June, 1993 and 27-28 June, 1994 with total counts of 1,495 and 2,137, respectively. We estimated herd size at <2,500. Similar surveys in 1991 and 1992 tallied 2,287 and 2,380 caribou, respectively.

Population Composition: During 1993 and 1994 postcalving surveys, 16% and 21% of the caribou observed were calves. The June 1994 postcalving surveys showed higher calf production on the Caribou River Flats (28%, n = 588) than in the Black Hills (18%, n = 1,401), as documented previously (Pitcher et. al 1990, Sellers 1994). Fall helicopter surveys in 1993 and 1994 showed 16% (n = 745) and 18% (n = 531), respectively (Table 1). Ratios were 30 and 29 bulls and 24 and 28 calves per 100 cows, respectively. Recent composition surveys indicated improvements in recruitment and more bulls (probably as a result of the hunting closure) (Table 1).

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

Mortality

Harvest:

Season and Bag Limits. The 1992-93 hunting season in Subunit 9D and Unimak Island (Unit 10) for resident hunters was 10 August to 30 September and 1 December to 31 March. The bag limit was 1 bull. For nonresident hunters the season was 1-30 September and the bag limit was 1 bull. In 1992-93, only local residents could hunt on federal lands. The 1993-94 hunting season was closed by emergency order.

Game Board Actions and Emergency Orders. In October 1990, the U.S. Fish and Wildlife Service (USFWS) exercised its regulatory authority under ANILCA and announced an emergency closure of nonsubsistence hunting on federal lands. USFWS made this closure to insure a priority for local residents in anticipation of an influx of nonrural hunters if the caribou became available along the Cold Bay road system. ADF&G submitted a proposal for the spring 1991 Board of Game meeting to eliminate nonresident hunting. This proposal also split the resident season by closing it from 1 October to 30 November when caribou typically are near the Cold Bay road system. INWR staff and the department made this proposal to

avoid a Tier II hunt by proposing a state season that would not be attractive to nonlocal hunters. To reduce confusion, the INWR staff recommended to the Federal Subsistence Board that nonlocal residents be allowed to hunt on federal lands. It was acknowledged that nonlocal Alaskans would not be interested in hunting federal lands if the season was closed during October and November. The Federal Subsistence Board did not rescind the subsistence-only season for federal lands and the Board of Game closed the 1991-92 resident season during October and November and shorted the nonresident season to 1-30 September. This season remained in effect for the 1992-93 regulatory year.

The 1993-94 state seasons and federal subsistence season were closed by emergency order when the herd fell below 2,500 animals. Because the Board did not consider proposals regarding caribou at the spring 1994 meeting, the 1994-95 season had to be closed by emergency order.

Hunter Harvest. The 1992-93 reported harvest of the SAPCH was 25 bulls (Table 2). Local residents, other Alaskans, and nonresidents accounted for 32%, 16% and 52% of successful hunters, respectively, (Table 3). The season closed before caribou became available along the Cold Bay road system, and few residents found it feasible to travel to Cold Bay for 1 caribou. Virtually all nonsubsistence hunters used aircraft for access, while most subsistence harvest occurred near Cold Bay with the use of highway vehicles or 3- or 4-wheelers (Table 5).

Other Mortality: Annual survivorship of radiocollared adult females from the SAPCH was estimated at 0.61 from 1987-90. This was extremely low compared to other Alaska caribou herds (Pitcher et al. 1990). We were unable to determine causes of death, although we suspect predation by wolves and bears. These predators were abundant on the SAPCH range. Preliminary analysis of data collected since 1990 showed the average annual survival rate of radiocollared caribou has increased to approximately 0.86. This reduction in mortality reflected a younger average age of the collared caribou and reduced abundance of wolves after the 1990 rabies outbreak.

Calf survival in the SAPCH has been low throughout the 1980s; however, during 1992-94 the percentage of calves in the herd was 16% and 21% in late June. Fall calf:cow ratios in 1993 and 1994 were the highest observed since the 1970s. Pitcher et al. (1990) believed poor nutrition and predation were factors in the low survival of calves, but the reduced caribou density and low number of wolves improved survival.

Habitat

Assessment: Habitat on the Caribou River flat is substantially different than that in the Black Hill-Trader Mountain area; i.e., the Caribou River flat is a wet, lowland area with abundant sedge meadows interspersed with willow shrublands. The Black Hill-Trader Mountain and Cold Bay areas are generally mid elevation ericaceous shrub/tundra. Plant phenology is earlier on the Caribou River flat.

An analysis of fecal pellets showed very high use of mosses (Pitcher et al. 1990), an indication of poor range condition. Pitcher et al. (1990) reported adult female caribou from the SAPCH were smaller and weighed less than cows from the Northern Alaska Peninsula or Mulchatna herds. Although SAPCH cows were smaller than NAPCH cows, there was a slight increase in body weight (Table 6).

A graduate student, Eric Post, from the University of Alaska, Fairbanks, studied caribou range from 1991-93. Dr. D. Cline was his advisor, and the Department and the USFWS were cooperators.

CONCLUSIONS AND RECOMMENDATIONS

The herd is well below the previous population objective of 5,000 to 6,000 caribou. However, if density-dependent food limitation is the cause of the decline and is operative at the current population size, then this objective is inappropriate. Unless we obtain information supporting a different approach, every effort should be made to prevent the herd from further decline (i.e., a density of about 0.4 caribou/km^2). Predators might prevent a small, low-density herd from recovering for an extended period, particularly where caribou are the only large mammalian prey. It may be difficult to manage this herd at a level between nutritional and predator limitation.

Close cooperation between the department and the INWR staff is essential for effective management and research. A cooperative, interagency management plan was adopted in April 1994. This plan sets the following population and management objectives:

1 Sustain a total population of 4,000-5,000 animals
2 Maintain a fall bull:cow ratio of 20-40:100
3 There will not be a harvest when the herd is below 2,500 animals
4 A limited harvest of bulls will be allowed when the herd exceeds 2,500 animals as long as there are at least 20 bulls:100 cows
5 Cow harvests will be phased in when the population reaches 3,500. If the population reaches 4,000, harvests will be increased to prevent growth.

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Table 1. Southern Alaska Peninsula caribou fall composition counts and estimated population size, 1990-93.

Regulatory year	Bulls: 100 cows	Calves: 100 cows	Bulls (%)	Calves (%)	Total Caribou observed	Estimated population size
1990/91	19	12	15	9	1051	3,300
1991/92	28	19	29	13	883	2,800
1992/93	22	22	15	15	746	2,800
1993/94	30	24	20	16	745	2,000

Table 2. Southern Alaska Peninsula caribou harvest, 1989-93.

	Reported							
Year	Males	(%)	Females	(%)	Unk.	Total	Estimated unreported	Grand total
1989/90	50	(85%)	9	(15%)	0	59	150	200
1990/91	43	(98%)	1	(2%)	1	45	50	100
1991/92	35	(100%)	0	(0%)	0	35	40	75
1992/93	25	(100%)	0	(0%)	0	25	40	65
1993/94	No hunting season							

Grand total is rounded off.

Table 3. Southern Alaska Peninsula caribou annual hunter residency and success, 1989-93.

Regulatory year	Successful				Unsuccessful				Total hunters
	Local resident	Nonresident resident	Non-resident	Total (%)	Local resident	Nonlocal resident	Non-resident	Total (%)	
1989/90	21	3	24	48 (92%)	1	2	1	4 (8%)	52
1990/91	14	8	23	45 (79%)	4	8	0	12 (21%)	57
1991/92	16	6	13	35 (87%)	3	2	0	5 (13%)	40
1992/93	8	4	13	25 (69%)	6	2	3	11 (31%)	36
1993/94	No hunting season								

Table 4. Southern Alaska Peninsula caribou annual harvest chronology percent by time period, 1989-93.

Regulatory year	August	September	October	November	December-March	*n*
1989/90	0	26	28	20	28	48
1990/91	0	25	41	10	24	51
1991/92	3	54	3	0	40	35
1992/93	0	60	4	0	39	25
199394	No hunting season					

Table 5. Southern Alaska Peninsula caribou harvest percent by transport method, 1989-93.

Regulatory year	Percent of harvest							
	Airplane	Horse	Boat	3 or 4-wheeler	Snowmachine	ORV	Highway Vehicle	*n*
1989/90	41	0	10	10	0	0	27	59
1990/91	56	0	7	9	0	2	26	43
1991/92	34	0	20	20	3	6	17	35
1992/93	50	0	13	8	0	0	29	25
1993/94	No hunting season							

Table 6. Average body measurements (SD) of caribou from 2 Alaska Peninsula herds, 1980-94.

Herd/Year	Weight (lbs)	Mandible	Total length	Girth	Hind Foot	Tarsus	Sample size
NAPCH							
1980					56.4 (1.2)		9
1988		26.6 (1.0)		123 (2.9)	54.5 (1.4)	39.4 (1.6)	10
1990	220 (22)	27.0 (0.8)	194 (7.3)	113 (29.4)	54.4 (1.4)		16
1992	236 (19)	27.4 (1.1)	197 (6.6)	120 (2.9)	53.9 (2.2)	39.9 (1.1)	16
1994	240 (20)	27.4 (1.1)	190 (6.1)	115 (3.7)	53.5 (1.3)	40.0 (1.4)	16
Mean	232 (22)	27.1 (1.1)	194 (7.3)	117 (17.2)	54.4 (1.8)	39.8 (1.3)	
SAPCH							
1988	198 (10)	25.8 (0.8)			52.5 (1.2)	38.8 (0.8)	10
1990	189 (15)	26.0 (0.7)	191 (6.3)	119 (4.1)	53.1 (1.3)	38.4 (0.7)	12
1992	200 (17)	26.1 (0.7)	190 (8.5)	117 (4.4)	52.3 (0.8)	38.9 (0.8)	11
1994	214 (15)	26.2 (0.7)	186 (5.5)	113 (2.9)	52.5 (1.2)	39.2 (0.8)	16
Mean	198 (17)	26.1 (0.7)	189 (7.0)	116 (4.6)	52.7 (1.1)	38.9 (0.8)	

LOCATION

Game Management Unit:	12 (3300 mi^2) and adjacent Yukon Territory (500-1000 mi^2)
Herd:	Chisana
Geographical Description:	Upper Chisana and White River drainages in the Wrangell-St. Elias National Park and Preserve in southeastern Unit 12 and adjacent Yukon Territory, Canada

BACKGROUND

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

During the early 1900s the CCH was an important food source for residents of the Athapascan villages at Cross Creek and, later, Cooper Creek; the CCH was also the food source 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 again after the Cooper Creek village burned down in the mid 1950s (Record 1983).

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

Before the mid-1980s, the CCH was not a high management priority because of its small size, the area's remoteness, and the light and selective (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 census and composition surveys. Subsequently, 14 calves and 2 adults were collared in early October 1990, and another 10 adult females were collared in late September 1991. The NPS provided most of the funding for radiocollaring and monitoring the herd.

MANAGEMENT DIRECTION

Due to the different mandates and philosophies of the ADF&G and the NPS, a cooperative Chisana Caribou Management Plan will be developed during 1995. The plan will recommend management direction for future population and harvest management.

The following are interim Chisana caribou management goals and objectives:

Management Goals

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

Management Objective

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

METHODS

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

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

We captured and radiocollared Chisana caribou during 1987, 1990, 1991, 1993, and 1994 to meet the following objectives: 1) to improve the efficiency of the census and composition surveys; 2) to monitor seasonal distribution and movement patterns; 3) to evaluate calving behavior, 4) to evaluate herd condition; 5) to estimate annual mortality rates; and 6) in 1994, to obtain blood samples to determine pregnancy rates, herd genetics, and incidence of disease. The number of active collars operating during the report period ranged from 11 to 28.

During 1993 and 1994 we used 3 indices to evaluate herd condition: 1) percent pregnancy of radiocollared cows, 2) median calving date, and 3) percentage of calves of radiocollared cows dying during the first 48 hours of birth. We determined pregnancy by monitoring the radiocollared cows on a daily basis during late May by determining the presence of hard antlers, distended udders, or the presence of a calf. In 1994 we captured 30 adult cows and collected blood to determine pregnancy, using a serum progesterone assay testing technique.

We monitored the CCH harvest using information from returned harvest ticket reports and, in 1993, from a registration permit. Under the harvest ticket report system, harvest is normally underestimated and a correction factor is needed. Most caribou in the Chisana caribou hunt are taken by guided clients, and their reports were completed and turned in by their guides. Thus, the harvest report return rate in this area is high, and harvest ticket returns were not corrected for nonreporting by successful hunters. Registration permits were used in 1993 to ensure the harvest quota was not exceeded.

RESULTS AND DISCUSSION

Population Status and Trend

Population Size: The CCH increased through the 1980s and reached its peak in 1988 at around 1900 caribou. Since 1988 the herd declined by an average of 9.5% annually and by fall 1994 was estimated at 803 caribou.

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

Natality: Estimated natality rates were low in 1993 and 1994, and during 1993 only 50% of the cows were pregnant in March. On 31 May 1993 the calf:cow ratio was 38:100 but declined to 19:100 by 13 June 1993. In 1994 the pregnancy rate increased to about 86% and on 30 May the estimated calf:cow ratio was 73:100. However, on 17 June 1994 the calf:cow ratio had declined to about 11:100. Fall composition data demonstrated that natality rate had a minor influence on fall calf:cow ratios.

Distribution and Movements: The CCH's range is relatively small (3500 mi^2), encompassing the Nutzotin and northern Wrangell Mountains between the Nabesna and Generc rivers. Seasonal movements are normally short (< 50 mi). During years of relatively deep snowfall, the herd moves to the eastern end of its range in Canada and winters within the spruce forests along the Beaver Creek drainages. In 1992 snowfall was very early (9 Sep) and deep. The herd moved further north and wintered in the forested habitats in the vicinity of Wellesley Lake. In years of average snow, most of the herd remains on sedge-grass range primarily in Alaska. 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 appear to have a core calving area but instead spreads out across most its range. Calving was limited to higher elevations (4800 and 6600 ft) in 1993 but occurred in spruce to alpine habitats (3400-6600 ft) in 1994. In 1993 and 1994 we monitored calving behavior and found that parturient Chisana cows sequester themselves and select high elevation habitats that offer escape from predators even though food is scarce there. 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.

Mortality

Harvest:

Season and Bag Limit.

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

Board of Game Actions and Emergency Orders. During spring 1993 the Board of Game created a registration permit hunt for Chisana caribou. To ensure against 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, ADF&G decided on a harvest quota of zero and issued no permits for Chisana caribou in 1994.

Human-induced Mortality. Between 1991 and 1993 the average Chisana caribou reported harvest (18.7) declined, compared with the previous 4 years (54.7; Table 3). Guides and air taxi operators voluntarily reduced their harvest in response to the herd's decline.

About 1.5%-3.6% of the CCH has been harvested annually since 1991. All reported harvest has been bulls. The reported harvest from Alaska and the Yukon has had little effect on herd growth. Little is known about the extent and composition of the unreported subsistence harvest in the Yukon. If the subsistence harvest is as high as expected, herd trend may have been affected. Because the herd is inaccessible most of the year, little or no illegal harvest occurs in either Alaska or the Yukon.

Hunter Residency and Success. Nonresidents have been responsible for 58% of the Chisana caribou harvest since 1990 (Table 4). All of the nonresidents were guided and their success rate averaged 81%. Local residents have taken only 9% of the total Chisana caribou harvest since 1990.

Hunter Effort. The number of days spent afield in 1993 by successful hunters (4.0) equaled the previous 6-year mean (4.0). In 1993 the number of days spent hunting by unsuccessful hunters (8.0) exceeded the 6-year average of 6.8 days (Table 5).

Harvest Chronology. In 1993 harvest chronology was similar to past years (Table 6). Normally, most of the harvest occurs during the first 2 weeks of the season with slightly more taken during the first week (57%). During 1993, 53% of the harvest was taken during the first week. Harvest timing depends on caribou distribution and on hunter effort. In September, the first week's higher harvest occurs because at this time most nonresident hunters are on multiple species hunts.

Transport Method. During the past 5 years transportation use by successful hunters has remained about the same (Table 7). All hunters of the CCH must initially use aircraft to reach the Chisana area. Most Alaskan residents hunt on foot from remote float or wheel plane access points. The remainder of the Alaskan residents fly into an established airstrip and then use either 3- or 4-wheelers or horses to hunt. In comparison, nonresidents hunt almost exclusively with horses after flying into one of the established guide camps.

Natural Mortality: During 1990 and 1991 the annual mortality rate for collared adult females was 9.1%. We estimated overwinter mortality of calves at 64% between October 1990 and June 1991, based on the fate of 11 radiocollared female calves. 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. Three of the deaths, 1 adult cow and 2 calves, can be attributed to wolves based on the timing of death (midwinter). Between 1992 and 1994 the annual mortality rate increased to 15%-30%. During 1994 the cause of death for 3 of the 4 radiocollared cow caribou was predation. Apparently, the other caribou died in an avalanche.

Insignificant calf recruitment occurred during 1990 through 1994 (0-11 calves:100 cows). High summer calf mortality is the primary cause of the low calf numbers in fall. Pregnancy rates were low in 1993, and possibly during 1991 and 1992, but even when they were high calves did not survive. Calf mortality during the first 48 hours appeared to be high in 1993. Adverse climatic conditions were probably the cause of the reduced pregnancy rates and the high early mortality (< 48 hrs). Winters 1991 and 1992 were relatively severe in terms of snow depth and late spring snows, while summers 1990, 1991, and 1994 were much hotter and drier than normal.

Grizzly bears and wolves have been found to be the primary causes of calf mortality in the Denali and Mentasta herds which are showing the same population and calf recruitment trend as the CCH. Reports from the public and incidental sightings by ADF&G staff indicate that predators, primarily wolves and grizzly bears, may move to calving areas. Between 1990 and

1992 coyotes were abundant within the Chisana range and could have been an important predator on calves. During those years coyotes were observed killing calves.

The CCH range presently supports at least 40-50 wolves in 6 packs within the herd's range in Alaska. The grizzly bear population is lightly harvested throughout the range and is probably near the natural density for an Interior population of about 16 bears/1000 km^2. The coyote population declined in 1993, and coyotes are no longer plentiful.

Habitat

Assessment: Prior to the 1990s the most frequently used range of the CCH for both winter and summer was predominantly grass-sedge habitat with few lichens. During the early 1990s the herd has been wintering in the timbered habitats along the Chisana River and Beaver Creek drainages in the eastern portion of the herd's range. This area supports a good standing crop of lichens. The CCH selected that area to winter in 1991, 1993, and 1994. The herd wintered further north in 1992 in the Wellesley Lake area in the Yukon. Fecal samples collected that winter indicated lower than expected use of lichens and higher use of ledum and moss (Yukon Department of Renewable Resources, unpubl. data). Boertje (1981) found that fecal samples containing high proportions of mosses and evergreen shrubs indicate caribou are using overgrazed or suboptimal range. Fecal samples will be collected during winter 1994 to further assess the winter range along Beaver Creek and White River in the Yukon.

A graduate program designed to assess the effects of summer climatic conditions on productivity and nutrition of Chisana caribou was initiated in summer 1994. Results of this study should be available in 1996.

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

CONCLUSIONS AND RECOMMENDATIONS

The CCH has declined by 57% since 1988 due primarily to poor calf recruitment and, since 1992, to high adult mortality. Since 1991 recruitment has averaged less than 3.5 calves:100 cows. Primary factors contributing to low calf numbers are low natality rates and high early calf mortality (< 48 hrs old) caused by adverse weather conditions and predation. Predation has been the cause of 92% of the mortality for radiocollared animals > 4 months old. Since 1990 hunting has removed 2.2% or less of the population annually and has not limited the herd's ability to grow. Overall winter range quality is not known but that portion near Wellesley Lake is suboptimal. For the herd to stabilize, calf recruitment rate must increase about 20 calves:100 cows, and cow and bull mortality rates must decline to 0.10 and 0.15, respectively.

The extremely low recruitment rates experienced by the CCH over the past 4 years have never been documented in any other wild caribou herd. Sufficient funding should be appropriated for at least the next 2 years to determine pregnancy, natality and perinatal mortality rates, and to evaluate the primary limiting factors.

Since 1991 harvest was reduced through a voluntary agreement with the principal hunters and guides and during 1993 by a harvest quota regulated by a registration permit system. Harvest has taken < 2.2% of the population since 1991. Because of low calf recruitment for the past 6 years, even this low harvest had an effect on the bull:cow ratio. In 1993 the bull:cow ratio declined below the management objective of 30:100. In 1994 the Chisana caribou hunting season was not opened and until calf recruitment improves and bull numbers increase, the season will remain closed.

Since 1990, 43% of hunters participating in the Chisana caribou hunt were nonresidents and were responsible for 58% of the harvest. Local subsistence users harvested only 8 (9% of the harvest) caribou during this period.

A Chisana caribou planning process was initiated in 1994. The completed plan will recommend management and harvest strategies for the Chisana Herd that will meet the mandates of ADF&G and NPS. Annual harvest rate and allocation will be the primary focus of the plan, which should be completed spring 1996.

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Table 1. Chisana caribou fall composition counts and estimated population size, 1987-1994.

Date	Bulls: 100 cows	Calves: 100 cows	Percent calves	Percent cows	Percent small bulls (% of bulls)	Percent medium bulls (% of bulls)	Percent large bulls (% of bulls)	Percent bulls	Composition sample size	Total count of herd size[a]
10/9/87	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			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[b]	76	34	43	23	24	1142	1270
10/5/93	24	2	2	79	30	45	24	19	732	869
9/29/94	27	11	8	72	20	44	35	20	543	803

[a] Based on population modeling.

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

Table 2. Chisana caribou postcalving composition counts, 1989-1994.

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

Table 3. Chisana caribou harvest and accidental death, 1989-1994.

Regulatory year	Alaska harvest							Yukon harvest		
	Reported				Estimated					
	M	F	Unk	Total	Unreported	Illegal	Total	Reported[a]	Unreported	Total
1989-1990	34	0	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

[a] An additional 5-20 caribou are taken by Native residents of the Yukon in the vicinity of the Alaska Highway near Beaver Creek when caribou winter there. Many Chisana caribou wintered there in 1991-1992 and 1992-1993.

Table 4. Chisana caribou hunter residency and success of hunters in Alaska, 1990-1994.

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

[a] Before 1990-1991 harvest data had not been computerized.
[b] Not all hunters reported their residency so totals are lower than total in Table 3.
[c] No open season.

Table 5. Mean days hunted for successful and unsuccessful hunters of Chisana caribou in Unit 12, 1984-1994.

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

[a] Data not available.
[b] No open season.

Table 6. Chisana caribou harvest by time period, 1987-1994.

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

[a] Data not available.
[b] No open season.

Table 7. Chisana caribou harvest by transport method, 1987-1994.

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

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

LOCATION

Game Management Unit:	Portion of Unit 12 and 20D (1900 mi^2)
Herd:	Macomb
Geographical Description:	Eastern Alaska Range between Delta River and Yerrick Creek south of the Alaska Highway

BACKGROUND

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

With increased use of 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). Larson (1976) reported that the MCH consisted of a nucleus of about 250 caribou that remained on the Macomb Plateau year-round and a group of approximately 250 caribou that moved to the plateau in October and November to rut.

By 1975 the MCH was reported to number 700-800 caribou. This apparent increase in herd size from 1972 to 1975 was probably 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. In 1978 the bag limit for Macomb caribou 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 that 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 Macomb caribou. With wolf control, fall calf survival increased from 13 calves:100 cows in 1980 to 33 calves:100 cows in 1981.

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

Previous management objectives for the MCH 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, a population estimate for the MCH resulted in an estimate of 800 caribou. Information gathered from local residents suggested that historically more caribou were between the Robertson and Delta rivers than there were in 1988. Therefore, a population size objective was established to increase MCH size to 1000 caribou by 1993. However, between 1988 and 1992 the herd declined to 550. Other Alaska Range herds also declined during the period.

MANAGEMENT DIRECTION

New management goals and objectives were developed for the MCH during this reporting period and are listed below.

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

2. Provide an opportunity to hunt caribou in an area free of motorized vehicles.
   Maintain the Macomb Plateau Controlled Use Area.

3. Determine calf survival and factors affecting calf survival.
   a. Maintain 20 active radiocollars on caribou.
   b. Conduct fall composition counts annually.

4. Determine age at first reproduction in females as an indicator of food availability and body condition.
   When collars are deployed, they will be placed on female calves.

METHODS

Radiocollared caribou were located from fixed-wing aircraft and a Robinson R-22 helicopter to conduct population estimates. Groups of caribou were counted visually. We used the R-22 to classify caribou according to sex and age during population estimates. Caribou classified for sex and age composition data were classified as calves, bulls, or cows. Bulls were further classified as either small, medium or large, based on antler size.

Radiocollars were placed on 11 female and 1 male caribou during April 1994. All caribou were approximately 11 months of age at the time of capture. Caribou were immobilized using carfentanil citrate (Wildnil®, Wildlife Pharmaceuticals, Fort Collins, Colo.) and xylazine hydrochloride (AnaSed®, Lloyd Laboratories, Shenandoah, Ia. 51601). Caribou were weighed and several body measurements were taken.

RESULTS AND DISCUSSION

Population Status and Trend

Population Size: The MCH continued to decrease slowly between 1992 and 1994 (Table 1). The MCH did not meet the herd size management objective of increasing to 1000 caribou by 1993.

Population Composition: Survival of calves to fall continued to be poor with only 13 and 10 calves:100 cows in 1993 and 1994 respectively (Table 1). The MCH bull:cow ratio remained low in 1993 and 1994 (Table 1). If recruitment remains low, the decline in the bull:cow ratio may continue despite the cessation of hunting.

Distribution and Movements: During the MCH census on 2 October 1993, caribou were located on the Macomb Plateau between the Johnson River and Bear Creek. During the MCH census on 28 September 1994, most caribou were located on the Macomb Plateau between the Johnson River and Bear Creek. However, 1 group of about 37 caribou was located in Sheep Creek near the Gerstle River, and another group of 68 was located in McCumber Creek. In November 1994 a small group of Delta Herd caribou, including 1 with a radiocollar, crossed the Delta River and wintered near Jarvis Creek, an area used in summer by some Macomb caribou.

Mortality

Harvest:

Season and Bag Limit. The 1993-1994 and 1994-1995 hunting seasons were canceled due to the low number of bulls (Tables 2-6).

Board of Game Actions and Emergency Orders. The Delta Fish and Game Advisory Committee submitted a regulation proposal to the Alaska Board of Game for consideration at the March 1995 meeting for intensive management of predators and prey in Unit 20D, including the MCH, in accordance with Senate Bill 77.

Natural Mortality: No natural mortality rates were calculated during this reporting period, but because the population appears to be stable and recruitment is low, adult natural mortality must also be low.

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

CONCLUSIONS AND RECOMMENDATIONS

The MCH failed to meet its 1993 herd size objective of 1000 caribou and currently numbers about 500 caribou. The most likely reasons the MCH failed to reach its herd size objective is poor calf survival and my inability to implement programs to improve calf survival. The department should continue to work with the Delta Fish and Game Advisory Committee as options for implementing plans to increase the size of the MCH are developed for the October 1995 Board of Game meeting. Hunting should resume if the herd has at least 400 caribou with a bull:cow ratio of at least 30 bulls:100 cows.

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Table 1: Macomb caribou fall composition counts and estimated population size, regulatory years 1982 to 1994.

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

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

Table 2. Macomb caribou harvest[a] and accidental death, 1985-1994.

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]									
1993-1994[b]									
1994-1995[b]									

[a] Includes permit hunt harvest.
[b] Hunt canceled.

Table 3. Macomb caribou hunter residency and success of permit hunters, 1986-1994.

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]									

[a] Resident of Unit 20D.
[b] Hunt by drawing permit.
[c] Hunt by registration permit.
[d] Hunt canceled.

Table 4. Macomb caribou harvest data by permit hunt, 1985-1994.

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

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

Table 5. Macomb caribou harvest by time period, 1987-1994.

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]										

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

Table 6. Macomb caribou harvest percent by transport method, 1986-1994.

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

[a] Includes permit hunt harvest.
[b] Walking was not listed as a transportation type from 1986-1987 to 1989-1990.
[c] Hunt canceled.

LOCATION

Game Management Units: 13 and 14B (25,000 mi^2)
Herd: Nelchina Caribou Herd
Geographical Description: Nelchina Basin

BACKGROUND

The Nelchina Caribou Herd (NCH) contained 5,000-15,000 caribou in the late 1940s. The herd increased during the early 1950s, aided by intensive predator control. It continued to expand and peaked at about 70,000 caribou by the mid-1960s. A dramatic decline began in the late 1960s and the herd numbered between 7,000 and 10,000 caribou in 1972. In 1973-74 the NCH began to increase and continued to grow through the late 1980s.

The NCH has been important to hunters because of its accessibility and proximity to Anchorage and Fairbanks. Hunters killed 131,000 Nelchina caribou between 1954 and 1993. 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 to a 7-month season from August to March. Annual harvests from 1955 through 1971 ranged from 2,500 to more than 10,000 caribou. The department recognized a decline in 1972, and 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 restrictions, the reported harvests ranged from 560 to as high as 1,200 caribou and exceeded the desired harvest level. In 1976 the season was closed by emergency order after hunters killed 800 caribou in 5 days. It became apparent a short season was not controlling the harvest. Since 1977 Nelchina caribou have been hunted by permit only.

MANAGEMENT DIRECTION

Management Objectives

The management objectives are to maintain the herd at approximately 40,000 caribou by manipulating human harvests, with a minimum of 40 bulls:100 cows and 40 calves:100 cows. The department recommends the annual harvest based upon population estimates, overwinter adult survival, and calf recruitment.

METHODS

Biologists conducted an annual census and sex and age composition counts during the past 6 years and biennially prior to 1988. The censuses involved aerial counts of caribou observed in postcalving aggregations, and counts were followed immediately by sex and age composition

surveys. Surveyors estimated the cow base and the proportion of calves and bulls in the postcalving aggregations. Biologists carried on aerial sex and age composition counts annually during the fall, estimating herd composition and evaluating calf recruitment. We extrapolated fall population estimates from the counts and composition data.

Surveyors located radiocollared caribou seasonally to determine herd distribution, sex and age composition, and seasonal range use. We attempted to maintain between 30 and 40 radiocollared caribou in the herd each year.

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

RESULTS AND DISCUSSION

Population Status and Trend

Population Size: The NCH population estimate decreased slightly from 45,484 caribou in 1992 to 44,093 in 1994 (Table 1). The 1994 estimate was 9% higher than the 1993 estimate of 40,361 caribou but below the most recent herd population peak of 45,484 obtained in 1992, indicating a cessation of growth in this herd. The estimated density was 1.0 caribou/km^2 in 1994, based on an approximate range of 44,200 km^2 (Lieb et al. 1988). A count was conducted on a subherd of the NCH located in the upper Susitna River area along the Alaska Range in Subunit 13E. A total of 2,014 caribou were observed during the 30 June count. Previous estimates for this area ranged between 1,600 and 2,400 caribou.

Population Composition: We observed 37 calves:100 cows during the 1993 postcalving survey. This was the lowest calf:cow ratio obtained in almost 20 years. From 1983 through 1992 postcalving calf:cow ratios were much higher, ranging from 51 to 63 calves:100 cows. The calf production and/or survival increased in 1994 with 46 calves:100 cows observed. Postcalving calf:cow ratios over the past 2 years indicated a decline in productivity. Typically, calf:cow ratios decline between summer and fall; there was a 3% decline 1994. The 1994 fall ratio of 40 calves:100 cows was similar to the 5-year average (1988-92) of 41 calves:100 cows and well above the 1993 figure of 24.

We observed 46 bulls:100 cows during the fall 1994 survey. Fall bull ratios have been lower the last few years, especially when compared to figures of 50-60 bulls:100 cows observed during the 1980s. This reduction was the result of a harvest regime in which approximately 85% of the caribou killed during hunting seasons were bulls. During the last 2 fall composition surveys, bulls have been classified as either small, medium or large. Classification is based on antler and body size. In both years 45% of the bulls were classified as small, 35% medium and 20% large. This size distribution was expected from a heavily exploited bull population where yearly bull recruitment was high but few bulls survive heavy hunting pressure long enough to mature.

Distribution and Movements: Caribou distribution and movement during the reporting period were similar to prior years. Calving took place in the eastern Talkeetna Mountains from Fog Lakes southeast to the Little Nelchina River. The core calving area centered around the Oshetna River and Kosina Creek. This was the area used during the postcalving and early summer period. Caribou were spread widely over lower elevation hills in the eastern Talkeetna Mountains, the Watana Mountains, and the Susitna River east to the Alphabet Hills by the end of August. The NCH usually began to migrate east during late September or early October. During this reporting period 50-70% of the NCH moved into Unit 12 and even into the Yukon during winter. The NCH animals mixed with Mentasta herd animals during this time. Areas within Unit 13 utilized as wintering grounds included the upper Susitna and Nenana river drainages as far west as Cantwell in 13E and the Tangle Lakes region in Subunit 13B. During recent years more caribou have migrated east out of Unit 13 every year.

Spring migrations start by mid-March when caribou gradually move northwest toward Unit 13. By late April or early May caribou cross Unit 13 along a band extending west from Slana to Sourdough, then across the Lake Louise Flats to the Talkeetna Mountains.

Mortality

Harvests:

Season and Bag Limit. The 1992 and 1993 seasons for subsistence hunters (566T) in Unit 13 was from 10 August to 20 September and 5 January to 31 March. The bag limit was 1 caribou in the fall or 1 antlered caribou in the winter. There was a state registration subsistence hunt (RC460) for Nelchina caribou in Unit 12 during winter; it was opened and closed by emergency order. The Unit 13 federal subsistence seasons in 1992 and 1993 were 10 August to 20 September and 5 January to 31 March and the bag limit was 2 caribou. The Unit 13 federal subsistence hunt was a registration hunt administered by the Bureau of Land Management and only residents of Units 11, 12 or 13 along the Nabesna Road were eligible.

Board of Game Actions and Emergency Orders. In 1989 the Alaska Supreme Court determined local residency as a criterion for determining subsistence eligibility was unconstitutional. Consequently, the BOG determined all Alaskans were subsistence users. The sport harvest of Nelchina caribou was eliminated and only Tier II subsistence hunting has been allowed since 1990.

The Federal Government assumed control of wildlife management on federal lands following the McDowell decision. A federal board was created to establish subsistence seasons and bag limits on federal lands beginning with the 1990 season. The major difference between the federal and state caribou hunts was that only a very small portion of Subunit 13B is federal land. This restricted the opportunity to take caribou under a federal permit.

Hunter Harvest. The harvest in 1992-93 for the combined state and federal hunts was 3,927 caribou; the harvest was 5,270 caribou in 1993-94 (Table 2). The 1993-94 harvest was a 34% increase over the 1992-93 harvest, and double the take of the previous 3-year (1989-91)

mean annual harvest of 2,642 caribou. Cow harvests doubled over the past 2 years. The winter bag limit was 1 antlered caribou to encourage the harvest of cows and immature bulls. Most of the larger breeding bulls had shed their antlers before the winter season.

Illegal and unreported harvests of Nelchina caribou were a significant source of mortality as was wounding loss (Table 3). The most common type of illegal harvest occurred when a permittee failed to validate the permit after taking a caribou. Once a permittee transports a caribou from the field without punching the permit tag, there was minimal chance of citing them for taking additional caribou on the same permit. Enforcement was increased and permittees failing to validate permits before transporting their caribou were cited.

Yukon residents harvested an additional 15 animals from the NCH during the winter of 1993-94 when the animals moved into Canada. This harvest could increase if the NCH continues migrating into the Yukon in substantial numbers and locals become aware of the opportunity to take caribou.

Road kills occur during winter and are correlated with snow depth. Roads bisect much of the winter range and caribou seek the salt spread on the plowed highway. The number of caribou killed in vehicle collisions is unknown because reporting is incomplete. A minimum of 50 caribou were killed by the Alaska Railroad in Subunit 13E near Cantwell. In some years many caribou winter near Cantwell and are subjected to railroad mortality.

Permit Hunts. Nelchina caribou were harvested exclusively by permit hunts. From 1989 to 1993 the number of Nelchina permits issued increased from 3,674 to 11,379 (Table 2). There are 2 types of permits issued for the Nelchina caribou hunts. A Tier II subsistence permit accounted for most of the permits. Applicants were scored on subsistence critera and the highest scores qualify for a Tier II permit. As the NCH has grown, the allowable harvest has increased each year; accordingly, the BOG has increased the number of Tier II permits issued. The registration permit was used in less popular hunts such as the Federal Subsistence Hunt in Unit 13 and the Unit 12 winter hunt.

Harvest data are presented in Table 2 for the permit hunts. The State Tier II subsistence hunt is the largest and accounts for 90% of the caribou harvest. All Alaska residents may apply for this hunt and permits are issued in the order in which an applicant scores. This is a very popular hunt in the State with nearly 16,000 applicants for the 9,000 permits issued.

The Unit 13 federal hunt, Hunt 513, was a registration hunt for residents of Units 11, 12 and 13 along the Nabesna Road. The number of participants and harvest has declined somewhat in the last 2 years. The cause of the decline was that the State selected most of the federal lands previously open to caribou hunting, reducing the size of the hunt area and greatly restricting hunting opportunity. The potential for a high harvest exists, however, because the major caribou migration corridor near Sourdough was federal land, open to hunting. Caribou utilize the Sourdough to Paxson area during the rut and winter migration. Ideal access along the Richardson provides hunters an easy opportunity to kill caribou when animals utilize this area during the season. In 1992 caribou crossed this area on 19 and 20 September, the last 2 days

of the season. A firing line was created and numerous caribou were taken in a very short period. Such situations, while providing an easy way to kill caribou, create unacceptable hunt conditions; 1 hunter was wounded.

The state RC460 registration hunt in Unit 12 was smaller because fewer caribou were available. A small federal registration hunt occurred on the Tetlin Wildlife refuge for local rural residents. Harvest data were not available for this hunt.

Hunter Residency and Success. Only Alaska residents were allowed to hunt Nelchina caribou. In 1991 local hunters took 898 animals (31%) and nonlocals took 1,946 caribou (69%) (Table 4). In 1993 local residents killed 593 caribou (11%) and nonlocals 4,475 animals (89%). Nonlocals harvested more caribou in 1993 than 1991 because the federal registration hunt harvest has declined due to state selection of federal land. Also, as more Tier II permits were issued, a higher percentage went to nonlocals.

Hunter effort varied somewhat among years, depending on caribou distribution and migration patterns in relation to the road system and hunter access points. Successful permittees spent an average of 4 days hunting compared to 7 days in the field for unsuccessful hunters.

Hunter success in 1993 was 62%, a decline from the 1989 rate of 70%. The decline in hunter success was attributed to the increase in permits issued. As more permits were issued, hunter effort decreased. Under a Tier II permit system, the same individuals and families get permits every year. Because up to 3 members of a household could receive a permit, the number of permits may exceed the need for caribou.

Harvest Chronology. Fall was the most important time to take caribou (Table 5) and 53% of the harvest occurred in the autumn. Hunting occurred throughout the fall and was not concentrated early or during moose season. The winter hunts were important and very popular when caribou were available. Weather and caribou location dictated when hunters were afield in January, February or March. Heavy hunting pressure occurred at the start of the winter season when caribou numbers were limited, especially around Cantwell and the Western Denali Highway. In some years, a high proportion of the Nelchina herd migrated out of the hunt area into Unit 12 and Subunit 20E. Winter distribution of the caribou remaining in Unit 13 further affected success rates. Caribou must be near a highway during the winter for a high harvest.

Transport Methods. Highway vehicles were the predominant form of transportation (31%) in 1993-94, followed by snowmachines and 4-wheelers (Table 6). During the past few years, the use of 4-wheelers has increased, while aircraft use has declined. The use of snowmachines fluctuated widely and was dependent on the availability of caribou during the winter hunt.

Other Mortality: Wolf predation was a potentially significant mortality factor for the NCH. The number of wolves harvested by hunters and trappers was relatively high on the core Nelchina caribou range during the mid-1980s. The low wolf population was probably a factor in the high calf survival during that period, thus aiding the growth of the NCH. Since 1988,

wolves have increased over much of the Nelchina caribou range. Field observations of wolf-killed caribou indicated wolf predation on caribou increased as the wolf population increased. Ballard et al. (1987) reported Unit 13 wolves preyed primarily on moose and did not follow migrating caribou out of the pack territory. Wolf packs may not migrate out of Unit 13 with the caribou, but recent field observations indicated wolves heavily utilize caribou when the herd moves through a pack's territory. The most important factor limiting predation on caribou by wolves in Unit 13 was the winter migratory pattern of the NCH. A very large percentage of caribou in the NCH leave Unit 13 from October until April and winter in Units 12 and 20.

Winter snow accumulations have been above average in Unit 13 during recent years with the last 6 winters classified as severe. A severe winter has average snow depths exceeding 28 inches over much of the winter. The fact that much of the NCH winters in Unit 12 where snow depths were much lower has reduced the impact of deep snow on caribou numbers. The strongest influence of deep snow during these years was in the increased energy costs to pregnant cows migrating to calving grounds. However, we have not documented an increase in caribou mortality attributable to severe winter conditions. Mortality of radiocollared cows increased but was attributed to wolf predation given the time of the death or the location.

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. Lieb (1994) described the Nelchina caribou range, range station locations, and results of long-term monitoring. In this study, Lieb concluded lichen use was high during the 1960s when caribou were abundant and resulted in a decline in lichens on the Nelchina range. Following a decline in caribou numbers, lichen increased over the range from the early 1970s to 1983. However, as the herd doubled in size over the decade between 1974-1983, the trend of increasing lichen biomass ceased in areas of substantial caribou use. Between 1983 and 1989, increased 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. This compared to 33% of the range in each category in 1983.

In the important calving and summer range in the Eastern Talkeetna Mountains, Lieb (1994) reported the lowest lichen biomass ever recorded with the preferred lichen species virtually eliminated. Caribou in this area shifted from a diet of lichen to vascular plants. Lichen standing crops were expected to continue decreasing if herd size remained constant.

In 1990 the department initiated studies of body condition of Nelchina caribou to evaluate the carrying capacity of the Nelchina caribou range. Researchers evaluated body condition of adult cows captured in late April or early May. Initial analysis indicated Nelchina animals were in poorer body condition than animals from the Alaska Peninsula or the Mulchatna Caribou Herds (Pitcher 1991). The problem with this comparison was the NCH was an interior herd and the others used in the comparison were more coastal with a milder climate. Also, NCH

animals were not in poor condition overall. Caribou examined had just completed a migration from wintering areas which undoubtedly resulted in use of fat reserves.

Body condition of NCH was monitored by sampling spring weights of female calves. Results in 1992 indicated cow calves wintering in Unit 12 were in better condition because they had greater body weight (Valkenburg 1993) than those wintering in Unit 13. This was attributed to deeper snow conditions on winter habitat in Unit 13. The body weights for female calves collected during April 1993 were the lowest over a 3-year period. Biologists did not observe a trend in weight decline, however, as weights in 1992 were the highest obtained. Studies need to continue to determine how these data should be interpreted to monitor herd health.

Enhancement: Caribou habitat enhancement is not planned in the near future. Enhancement depends on the occurrence of wildfire. 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. In spite of the plan, fires have not been allowed to burn, regardless of the suppression category of the land. In fact, Unit 13 has not had a large fire since 1950.

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

Nonregulatory Management Problems/Needs

The concerns and problems associated with monitoring the size and condition of the Nelchina herd include: (1) accurately estimating population size and trend; (2) monitoring animal condition; (3) translating range and animal condition information into a reasonable estimate of the optimum caribou population; (4) managing predator populations; and (5) minimizing land use activities that adversely affect the Nelchina range.

I recommend an annual census and composition count. Without an annual census and composition count, population status and trend are more difficult to determine and changes may go unrecognized for several years. I also recommend conducting surveys of peripheral calving and postcalving sites throughout the Nelchina range to estimate numbers of caribou in subherds. These areas should probably be surveyed every fourth year. Concerns of overharvesting subherds, such as the upper Denali located near Cantwell, during winter seasons have been expressed. The recent survey of the upper Denali subherd indicated harvest rates have not exceeded sustainable levels.

We should maintain and monitor the Nelchina range stations and establish additional stations in important habitats such as the Eastern Talkeenta Mountains and wintering grounds in Units 13, 11 and 12. Research is needed on the calving grounds to determine effects of eliminating lichens and the availability of alternative forage.

The department should continue to monitor the body condition of Nelchina caribou. We should examine growth and size measurements, along with other condition factors such as fat indices, parasite load, and blood parameters. The suspended research project designed to investigate ways to utilize individual animal's health as an indicator of population status should be reinstituted.

I also recommend developing a program to monitor the wolf population on the Nelchina range and predation on caribou. Wolf predation rates on Nelchina caribou are unknown. Because the number of wolves has increased in Unit 13 and caribou harvests are high, it is important to have good information on wolf numbers and predation levels, especially on calving grounds.

CONCLUSIONS AND RECOMMENDATIONS

A decline in calf production indicated a reduction in the productivity of the NCH. The very low calf production in 1993 may have been due to stress, diminished body condition resulting from an especially cold year with deep, lingering snows during the spring of 1992, and early snow/record cold that fall. Cameron and Ver Hoef (1994) found when body condition declined, cow caribou skipped a calving interval until body condition improved. Unusually harsh summer conditions in 1992 may have prevented caribou from attaining the nutritional level needed to conceive and carry a fetus. However, comparing composition data from the early to mid 1980s with that over the past few years indicated a trend of lower calf production and not a 1-year decline due to severe weather.

The decline in calf production may reflect impoverished range conditions. Range survey data support this conclusion. Lowering the nutritional intake of cows due to increased density on the calving ground could result in decreased calf production. Messier et al. (1988) hypothesized that increased density on the George River Caribou Herd resulted in lowering the nutritional level of individual animals and productivity of the herd declined. If the NCH is at or has exceeded the optimum herd size that allows maximum productivity, herd growth should be prevented. Consideration should be given to changing the management objective from *stabilizing* the herd at 40,000 to *reducing* the herd.

I recommend increasing monitoring activities to determine if reducing herd size would increase productivity. Research into the importance of heavily utilized calving and summer ground is warranted because range utilization in the eastern Talkeetna Mountains is the heaviest in the unit.

Cow harvests need to be increased if the herd is to be maintained at the present size or reduced. To maintain the herd at its current level, cows must account for at least 40% of the annual harvest. A harvest comprised of 50% cows would result in a gradual herd reduction, while taking 60% cows would rapidly reduce the herd. Fall harvests have been comprised of 80% or more bulls. Cow harvests increase during winter hunts because bulls are often not available, and the regulation requiring harvesting antlered caribou during the winter hunt increases cow harvests because most large bulls shed antlers after the rut.

I recommend increasing cow harvests and changing hunt conditions to ensure an adequate cow harvest every year. Relying on the winter hunt to provide an adequate cow harvest is a management practice that needs to be changed. The only year that cow harvests have approached desired harvest rates was in 1993. In many years caribou are not available due to the winter migration or distribution being limited to remote areas. An example is caribou concentrating in Cantwell, leading to unsafe hunting conditions. In order to shift pressure on cows to the fall season, I recommend issuing cow only permits valid for the fall season only. The number of permits issued would be determined yearly based on herd size and management objectives for the desired yearly kill. These would be Tier II permits issued to individuals with qualifying scores lower than those issued any caribou permits. They would be in addition to any sex permits currently issued. No changes are recommended in the current permit other than to try and reduce the percentage of bulls in the harvest. For a harvest of 5,000 caribou (3,000 bulls, 2,000 cows), I propose issuing 7,500 regular permits and 2,000 cow only permits. To increase the harvest, only cow permits should be issued as the bull harvest should be kept at 3,000. To harvest 6,000 caribou, 3,700 cow permits would be issued and for a 7,000 caribou harvest, 5,600 cow permits issued.

One problem that may arise from issuing a large number of fall permits is crowding of hunters. This could be alleviated by limiting the hunt period for the cow permits. For example, for the 6-week fall season, permits could be issued for 3 two-week hunt periods.

Another regulatory management problem that needs to be addressed is the heavy influx of hunters into small communities when caribou are located there. Problems arise because of trespass over private property, shooting near dwellings and people, and disposal of trash and even more important, gut piles. This has been a problem at Cantwell because caribou have been wintering in town. The problem has occurred to a lesser extent in the past in other areas such as Lake Louise. In order to address the current problem, I recommend closing the immediate community of Cantwell to hunting during the winter season. The hunt condition recommendation is to prohibit hunting within 1/2 mile of the road from Milepost 207 to 213 of the Parks Hwy. and from Mile 130 to Cantwell on the Denali Hwy. This recommendation addresses a public relations and safety problem, not a biological one.

An alternative to issuing cow permits for the fall hunt would be to eliminate the state registration hunt in GMU 12 and allowing Tier II hunters to hunt in GMU 12 and 20E during the winter when the NCH migrates east. This could create a management problem by increasing the possibility of harvesting some Mentasta caribou that may mix in with the NCH. However, by monitoring the location of Mentasta caribou, incidental Mentasta caribou harvests could be minimized with emergency closures of portions of GMU 12 utilized by Mentasta animals. This proposal would also allow residents of GMU 12 to hunt Nelchina caribou in the fall.

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Table 1. Nelchina caribou fall composition counts and estimated population size, 1989-1994.

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
1989/90	49	39	21	53	26	2,817	31,851	40,317	39,754
1990/91	42	33	19	57	24	3,671	29,909	36,860	42,127
1991/92	51	45	23	50	26	2,187	34,594	44,903	46,634
1992/93	48	40	21	53	25	4,135	35,807	45,484	46,948
1993/94	41	24	14	61	25	4,220	34,491	40,361	46,226
1994/95	46	40	22	54	25	3,564	34,611	44,093	43,536

[a]Spring census.

Table 2., Nelchina caribou harvest data by permit hunt, 1989-94.

Hunt No. /Area	Regulatory year	Permits isssued	Percent did not hunt	Percent successful hunters	Percent unsuccessful hunters	Bulls (%)	Cows (%)	Unk.	Total harvest
565[a]	1990/91	6,825	30	54	46	1,825 (74)	639 (26)	26	2,490
566T[b]	1990/91	877	29	45	65	167 (62)	104 (38)	3	274
	1991/92	2,802	11	80	20	1,476 (75)	488 (25)	9	1,973
	1992/93	6,503	19	66	34	2,187 (64)	1,232 (36)	20	3,439
	1993/94	9,003	20	67	33	2,828 (60)	1,486 (40)	24	4,738
513[c]	1990/91	792	36	45	55	167 (86)	28 (14)	2	197
	1991/92	2,201	22	46	54	482 (76)	151 (24)	14	647
	1992/93	2,013	19	46	54	291 (66)	151 (34)	12	454
	1993/94	1,690	35	35	65	202 (62)	124 (38)	5	331
RC460[d]	1989/90	152	24	73	27	61 (79)	16 (21)	5	82
	1991/92	822	19	42	58	257 (94)	3 (1)	13	273
	1992/93	No hunt							
	1993/94	686	18	38	62	196 (98)	5 (2)	--	201
Totals for all permit hunts	1989/90	3,674	23	70	30	1,659 (84)	313 (16)	14	1,986
	1990/91	8,665	30	52	48	2,207 (73)	780 (27)	33	3,020
	1991/92	5,943	16	64	36	2,237 (78)	645 (22)	38	2,920
	1992/93	8,517	20	61	39	2,505 (64)	1,386 (36)	36	3,927
	1993/94	11,379	21	62	38	3,226 (61)	2,015 (39)	29	5,270

[a]Registration permit subsistence hunt for all Alaskans.
[b]Tier II subsistence drawing permit. A winter hunt only in 1990-91.
[c]Subsistence registration for Unit 13 residents, administered by BLM as federal hunt 513 in 1990.
[d]A winter registration hunt for residents of Alaska in GMU 12.

Table 3. Nelchina caribou harvest and accidental death, 1989-93.

Regulatory year	Hunter harvest								Grand total
	Reported				Estimated				
	M (%)	F (%)	Unk.	Total	Unreported	Illegal	Total	Accidental death	
1989/90	1,659 (84)	313 (16)	14	1,986	100	50	150	200	2,336
1990/91	2,207 (73)	780 (27)	33	3,020	200	100	300	200	3,520
1991/92	2,237 (78)	645 (22)	38	2,920	200	100	300	200	3,420
1992/93	2,505 (64)	1,386 (36)	36	3,927	200	100	300	200	4,427
1993/94	3,226 (61)	2,015 (39)	29	5,270	200	100	300	200	6,070

Table 4. Nelchina caribou annual hunter residency and success, 1989-93.

Regulatory year	Successful				Unsuccessful				Total[b] hunters
	Local[a] resident	Nonlocal resident	Nonresident	Total[b]	Local[a] resident	Nonlocal resident	Nonresident	Total[b]	
1989/90	544	1,442	--	1,986	328	533	--	861	2,847
1990/91	355	2,665	--	3,020	690	2,166	--	2,863	5,883
1991/92	898	1,946	--	2,857	843	483	--	1,348	4,205
1992/93	700	3,224	--	3,927	934	1,532	--	2,466	6,393
1993/94	593	4,475	--	5,269	852	2,089	--	3,192	8,461

[a]Local resident means a resident of Units 13, 11 or 12 along the Nabesna Road.
[b]Total includes unknown residency.

Table 5. Nelchina caribou annual harvest chronology percent by time period, 1989-93.

Regulatory year	Harvest periods: Weeks (fall) 1	2	3	4	5	6	7	8	Months (winter) Nov.	Dec.	Jan.	Feb.	Mar.	*n*
1989/90	9	13	13	16	16	12	11	--	--	--	4	1	1	1,986
1990/91	1	1	83	1	1	1	1	1	--	--	4	2	3	3,020
1991/92	9	9	8	9	8	11	7	--	8	1	10	5	15	2,857
1992/93	6	12	10	7	9	9	7	--	--	--	9	7	22	3,927
1993/94	6	10	10	7	8	6	6	--	4	--	21	6	16	4,891

Table 6. Nelchina caribou harvest percent by transport method, 1987-93.

Regulatory year	Percent of harvest: Airplane	Horse	Boat	3- or 4-Wheeler	Snowmachine	ORV	Highway vehicle	Unk.	*n*
1987/88	10	1	10	22	7	16	33	1	1,747
1988/89	10	1	10	18	6	15	38	2	1,656
1989/90	10	1	9	21	4	15	35	5	1,986
1990/91	10	2	7	33	3	10	30	5	3,020
1991/92	5	1	6	16	16	7	43	6	2,857
1992/93	5	2	6	19	22	8	36	2	3,927
1993/94	5	1	6	22	26	8	31	1	4,738

LOCATION

Game Management Unit: 18 (41,159 mi^2)
Herd: Kilbuck Mountain
Geographical 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 found in the lowlands of the Delta. Only one small herd, the Kilbuck Mountain (KCH) or Qavilnguut herd, is resident in Unit 18. Radiotelemetry data indicate that Kilbuck caribou calve on high ridges in the western portion of the Kuskokwim Mountains, summer in alpine meadows, and winter in valleys, wind-blown slopes further west and south. Their range includes the eastern portion of Unit 18, encompassing the edge of the lowlands of the Delta and the montane western border of Subunits 19B and 17B (Figure 1).

The caribou season in the Kilbuck mountains was closed during June of 1985. Since the closure of the season, the department and the U.S. Fish and Wildlife Service (FWS) have conducted a cooperative study of the KCH. Numerous aerial survey flights and radiotelemetry were completed and have been discussed in previous annual progress reports.

MANAGEMENT DIRECTION

Management Objectives

General management objectives for Unit 18 are to increase caribou numbers and to better ascertain the status and size of the KCH. Specific management objectives are to reduce harvest when the population is low. No harvest would be allowed when the herd is smaller than 1,000 animals. Harvest will be restricted to 5% when the herd numbers 1,000-3,000 animals and 7.5% when the herd numbers 3,000-5,000 animals; the harvest strategy will be re-evaluated when the herd reaches 5,000. Additional management objectives include gathering accurate harvest information and increasing compliance with caribou hunting regulations.

METHODS

A cooperative study of the KCH begun during 1986 was continued during the reporting period. Department and FWS staff completed 32 monthly radiotracking flights to monitor 24 active radio collars during the reporting period using fixed-wing aircraft. The location of caribou were mapped using LORAN C and GPS equipment. Of the 32 flights, we completed 4 during late November and early December for an aerial census of the KCH. We selected the census area size based upon known radiocollared caribou locations, and 25 polygons were

delineated within the census area (Figure 2). This census area was extended from the one completed in 1991, which had only 19 polygons. The reason for this expansion was that the Kilbuck herd had extended the size of its winter range. Detailed methodology for Kilbuck caribou radiotelemetry study is available in Hinkes (1989) and Ernst (1993).

We used a helicopter to complete fall composition counts of the Kilbuck caribou population north and east of Eek Lake, including the Kisaralik and Kwethluk drainages.

FWS conducted 4 flights during May, using one fixed-wing aircraft (PA-18), to survey the calving grounds, locating all radiocollared females and evaluating composition of a sample of animals near the instrumented caribou. An additional 9 caribou (1 adult female and 8 female short-yearlings) were affixed with radio collars in November 1992 soon after completion of our annual composition flight.

RESULTS AND DISCUSSION

Population Status and Trend

Population Size: The KCH, located in the Kilbuck and Kuskokwim mountains southeast of Bethel, remained low in density but continued to grow in size and extend their range. The current minimum population estimate for the KCH is 4,220 caribou. This estimate is based on an aerial census completed during November and December 1991, a second census completed during November and December 1993, and a 15% projected recruitment rate from 1993 to 1994.

The KCH is increasing in size based upon fall censuses completed during 1989, 1991, and 1993. Census data indicate the minimum annual rate of increase was approximately 23% between 1989 and 1991, and 15% between 1991 and 1993. Increased caribou sightings between 1986 and early 1994 are also indicative of increasing population size. This increase can be attributed to a succession of mild winters from 1989 through 1993, low predation rates, a limited annual harvest rate of less than 5% since 1991, influx of animals from the nearby Mulchatna Herd, and virgin range not grazed by substantial numbers of caribou or reindeer for at least 50 years.

Results of the cooperative study indicate that the KCH behaves as a distinct, resident population. Evidence supporting this conclusion included the presence of discrete calving areas and the fidelity of radiocollared animals to the study area. This evidence also indicates that some overlap of Mulchatna and Kilbuck caribou range occurred during certain times of the year.

Population Composition: We completed composition surveys of the KCH during 1992 and 1993. Composition counts were visually done out of a helicopter during low-level flight. During October 1992, a sample of 1,007 caribou were located in 43 groups (480 males, 416 females, and 111 calves). During November 1993, we classified 1733 caribou (861 males, 675

females, and 197 calves). Some larger groups were difficult to classify because caribou had already begun to segregate into bull and cow/calf herds. Previous years' surveys and this year's survey yielded high bull:cow ratios, indicative of very little hunting pressure on males or an influx of males from a nearby herd. The bull:cow ratio ranged between 115-120 bulls per 100 cows during the past 2 years.

During the 1993 calving ground survey, a count of 440 females resulted in a calf:cow ratio of 50:100. During the 1994 calving ground survey, many radiocollared females were found near a large calving aggregation of Mulchatna caribou. In fact, 10 of the 18 active female collared animals were present far east of their normal distribution. The cow:calf ratio for 1994 was 66 calves:100 cows.

Distribution and Movements: The cooperative effort between the department and the FWS to document distribution of the KCH continued this reporting period. As of November 1992, 20 KCH caribou (1 male and 19 females), representing approximately 0.5% of the herd, were instrumented with radio collars. These collars were deployed during 1987, 1988, 1989, and 1992. During October 1994, an additional 28 collars were deployed on short-yearling females during an influx of over 30,000 Mulchatna animals. We do not know what percentage of the collared animals were Mulchatna animals, but it is possible all 28 collars were deployed on Mulchatna animals.

All radiocollared caribou remained in the western and central Kuskokwim and southern Kilbuck mountains. The herd has extended its winter range south and west near Three Step Mountain, the Eek River, the Great Ridge, and the flats between Akiak and Bethel. A single radiocollared male moved north and east of Aniak Lake in July 1990, 1 female moved near Nishlik Lake during July of 1991, and 10 females were in the northern Tikchik basin, calving with approximately 50,000 Mulchatna herd animals. All of these animals eventually returned to traditional KCH winter range.

Our observations indicate range overlap between Mulchatna and Kilbuck caribou occasionally occurred near the southern Kuskokwim and Kilbuck mountains, the Tuluksak River, Marvel Creek, and the Heart Lake area. Much of this overlap occurs in the mountain passes between Units 19B, 17B, and 18.

Mortality

Harvest:

Season and Bag Limit:

Unit 18, south of the Kuskokwim River	Sep. 1 - Sep. 30	1 bull caribou by State registration permit
Unit 18, south of	No open season	

the Yukon River

Remainder of Unit 18	All hunters: Feb. 1 - 31 Mar.	1 caribou
Yukon Delta National Wildlife Refuge and Togiak National Wildlife Refuge	Dec. 15 - Jan. 9 Feb. 23 - Mar. 15	1 bull by Federal Registration Permit

Human-Induced Mortality: Harvest of Kilbuck caribou by registration permits for the 1992-1993 season was 24 bulls during the September state hunt and 63 bulls during the federal winter hunt. The 1993-94 season yielded a harvest of 21 bull caribou during the state's September hunt, and 53 bulls during the federal hunt. During the winter of 1993-1994 winter, approximately 14,000 Western Arctic Herd caribou migrated into the northwestern unit 18 near Kotlik, Emmonak, and the Andreafsky Mountains. Hunters from the communities of Marshall, Pilot Station, Mountain Village, St. Marys, Kotlik, and Emmonak probably harvested several hundred caribou from this herd. This harvest estimate was based upon interviews with hunters and Federal Refuge personnel.

Board of Game Actions and Emergency Orders. The Alaska Board of Game closed the caribou hunting season in Unit 18 south of the Yukon River in June 1985 because we believed harvest was exceeding sustained yield limits. The rapid growth and recovery of the Kilbuck herd since that time confirms our belief that human harvest was a major factor limiting herd growth.

The village of Kwethluk petitioned the Alaska Board of Game on April 3, 1990 to reopen the Kilbuck caribou herd to hunting. The Board denied their request. On April 4, 1990 the village of Kwethluk took their petition to Federal District Court, and the Court ordered the department to allow residents of Kwethluk harvest 50 antlerless male caribou.

The Alaska Board of Game tried to reestablish a caribou season south of the Kuskokwim River by use of Tier II Subsistence permits during a season of February 23 through March 15, 1992. However, local subsistence hunters preferred the federal season which coincided with the state season because it allowed only rural residents of Unit 18 to participate in the hunt. The State season was closed by emergency order, and only a federal season occurred during February 23 through March 15, 1992.

During the spring Board of Game meeting in 1992, a Sept. 1 - Sept. 15 season and a 1 bull bag limit by registration permit was enacted. During the 1993 spring Board of Game meeting, a proposal drafted jointly by the department and the Kilbuck (Qavilnguut) Caribou Herd management planning committee was presented to extend the fall season from September 1 - September 15 to September 1 - September 30 for 1 bull caribou by registration permit. This change in regulation was adopted and the new season began during September 1993.

Natural Mortality: Little information is available regarding natural mortality. A female caribou was documented as killed by a pack of 7 wolves in the southern Kilbuck Mountains during February 1988 and another one was killed during November 1988. We believe that a pack of 7 wolves and another pack of 5 animals ranged over the study area during the last 4 years, and caribou are probably an important prey species. We observed 4 kill sites during the November 1991 census, 2 of which had wolves bedded down nearby. A pack of 7 wolves was seen chasing caribou between the Fog River and the Kisaralik River during this survey. Wolves and wolverines are becoming more numerous in the Kilbuck Mountains in response to increasing populations of large ungulates.

Both the Kilbuck and Andreafsky mountains support substantial numbers of brown bears. Two grizzly bears were observed on the calving grounds in the Kilbuck Mountains during calving surveys in May 1988, and 9 were observed in 1989 (Hinkes 1989). We did not observe any bears during the 1990 calving ground survey because excessive wind and turbulence made visibility more difficult. Although we did not observe bears during the 1991 or 1992 calving ground surveys, bear tracks and other sign nearby indicated their presence. During the 1993 brown bear capture operation in the southern Kilbuck Mountains, approximately 70 different bears were observed within or near the core range of the KCH.

Habitat

Assessment: The lichen range in the Kilbuck and southern Kuskokwim mountains is in excellent condition and could support more caribou. Only 0.4 caribou/km^2 occupy the current range of the KCH. Neither the Andreafsky nor the Kilbuck mountains have been substantially grazed by caribou or reindeer for over 50 years (Calista Professional Services and Orutsararmuit Native Council, 1984). The tundra areas between the Yukon and Kuskokwim Rivers also have not been grazed upon for the last 100 years. We believe all areas could support much higher densities of caribou.

CONCLUSIONS AND RECOMMENDATIONS

The KCH has been studied on a cooperative basis by the FWS and the Department since 1986. Estimated at 4,400 animals, the KCH is a distinct herd resident in the Kilbuck and southern Kuskokwim Mountains. We have observed these caribou calving for 8 consecutive years on high ridges near Kisaralik Lake, east and north of Greenstone Ridge, ridge tops on the southern edge of the Kilbuck Mountains, and the southwest edge of the Kuskokwim Mountains. The herd has continued to grow and extend its range. For the first time, 10 out of 18 female caribou with radio collars moved far east of their normal calving area during 1991, and calved with the Mulchatna Herd.

The season for Kilbuck caribou had remained closed since June of 1985 because previous annual harvests probably had exceeded recruitment. During the fall of 1989, knowledge of increasing caribou numbers sparked interest among local politicians and leaders, the media, subsistence hunters, and various agencies regarding the possibility of future hunting of the

KCH. Unfortunately, no formalized management goals were in place. During this time, the Association of Village Council Presidents (AVCP) and the FWS continued to support the season closure until population levels increased. Continued research on this particular herd is necessary to determine if hunting could be allowed in the future.

Local hunters were frustrated that the season remained closed and opportunities for alternative hunting were lacking. On April 2, 1990, the village of Kwethluk petitioned the Alaska Board of Game to open the caribou season in the Kilbuck Mountains. On April 3 the Board denied the Kwethluk petition. On April 4 the village of Kwethluk took the issue to federal court, and on April 5, 1990 the court ordered the department to allow residents of Kwethluk to harvest 50 antlerless male caribou. The hunt was monitored by the Department and the Kwethluk I.R.A. Council. Thirty-nine animals were harvested during a 10-day season (April 5 to April 15).

The department realized early on a management problem existed with respect to Kilbuck caribou harvests, which probably exceeded recruitment before 1985. More restrictive management measures were put in place to help the herd recover. The department also realized these measures could never succeed without support from the users of these caribou. During the spring of 1990, the department made a commitment to the Alaska Board of Game and the user groups that they would take the lead role in future management planning.

Management planning meetings took place between December 1990 and April 1994 among users of the caribou resource and the management agencies. Eighteen villages from the Yukon-Kuskokwim region, AVCP, FWS, and the department have met 8 times to discuss working cooperatively on Kilbuck caribou herd management and to draft a Kilbuck caribou herd management plan. The Plan is made up of goals and objectives to conserve this caribou herd and its habitat. The cooperative management planning process is a joint effort between users and the agencies to allow a limited subsistence harvest of the herd, while allowing the herd to grow.

The Kilbuck Cooperative Management Plan was developed and finalized on October 6, 1994, after extensive agency and public input over a 4-year period, and provides guidelines for management of the KCH.

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 herd size. We should also complete composition counts during the spring or fall to determine the sex and age structure of the herd and to insure that sex ratios and recruitment remain adequate. We should continue radiotracking flights to locate groups for census, composition counts, and calving ground surveys. Radio collars should be retrieved periodically and replaced with refurbished collars when collars are dropped, lost to mortality, or battery life is exhausted. The data gathered from the aerial surveys could be incorporated into a basic simulation model designed to predict population changes.

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 establish the overall range and movements of the two herds. If the 28 collars deployed in October 1994 were put on Mulchatna animals, an additional number of collars will have to be placed on Kilbuck caribou when the two herds are separate.

We should continue to support cooperative management planning process involving local hunters, AVCP, the FWS and other interested groups.

Recommended management actions for the next several years include:

1 Complete an annual census after the rut between the end of October and early December, depending on snowfall. This census timing may have to be changed to the summer when the two herds (Mulchatna and Kilbuck) are most likely to be separated.
2 Complete composition surveys annually during October.
3 Complete calving surveys in late May or early June of each year.
4 Maintain a minimum of 1 radiocollared animal per 500 animals in the KCH.
5 Develop an improved method of collecting harvest information.

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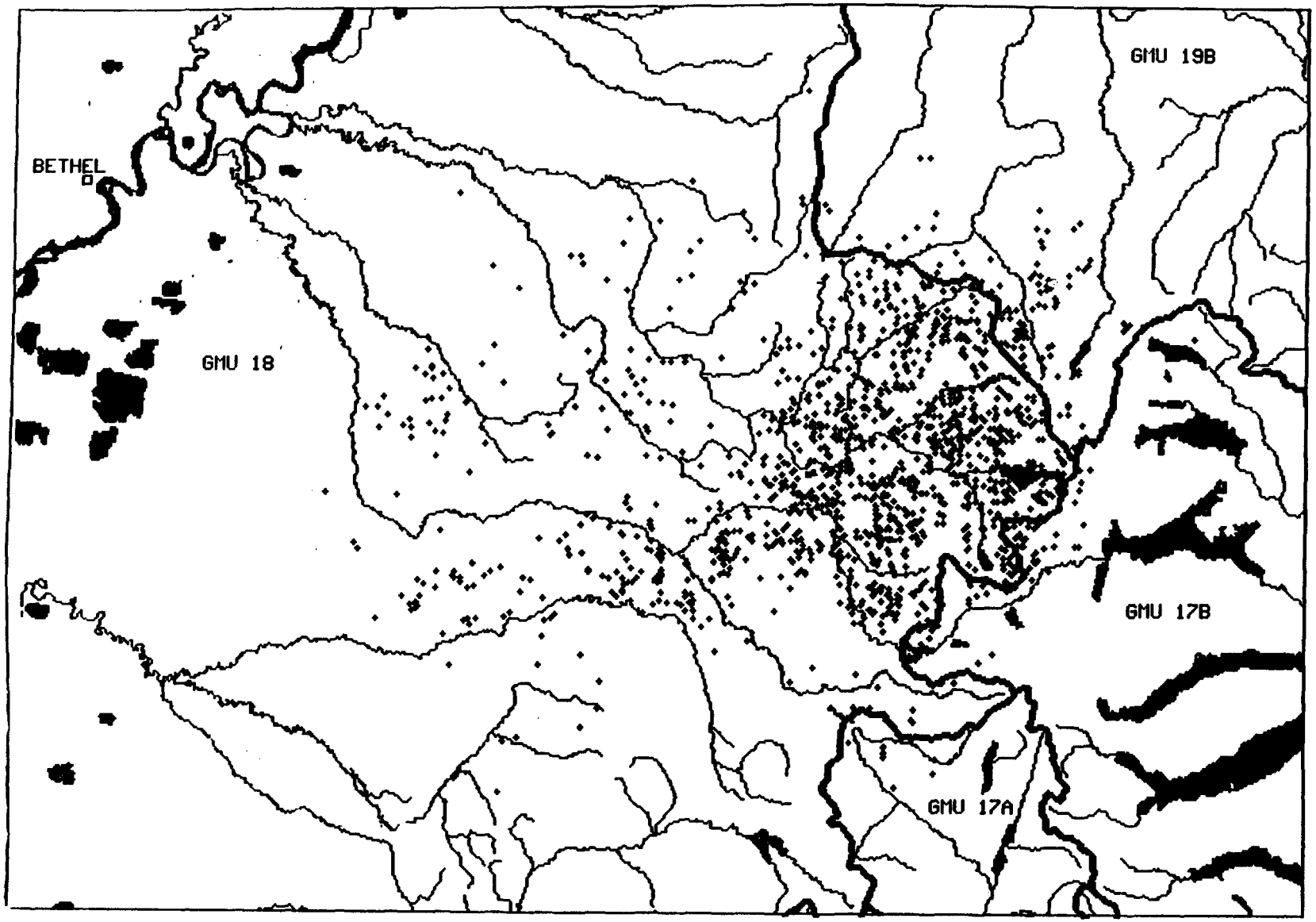

Figure 1. Range of the Kilbuck Caribou Herd based on radiotelemetry from 1987 through 1993.

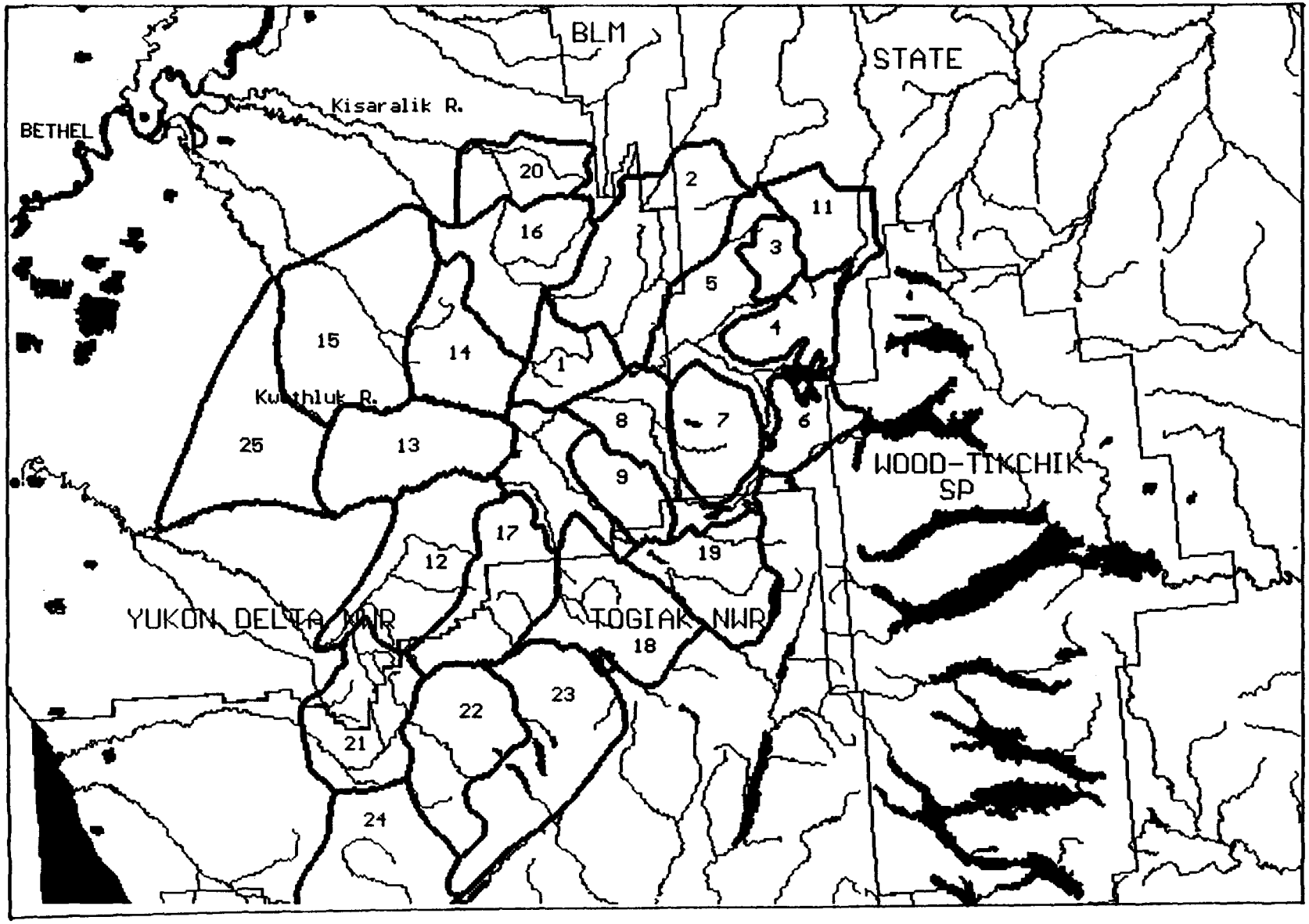

Figure 2. Extended census area including 25 polygons, Kilbuck Caribou Herd, 1986-1994.

Table 1. Estimated Size of Kilbuck Caribou Herd, 1980-1993.

Regulatory year	Estimates derived from ADFG reports	Aerial Survey counts
1980-81	50 minimum	17 caribou
1981-82	50 minimum	32 caribou
1982-83	less than 200	[a]
1983-84	less than 300	66 caribou
1984-85	75 minimum	[a]
1985-86	less than 200	83 caribou
1986-87	less than 300	188 caribou
1987-88	less than 900	685 caribou
1988-89	less than 1000	1,587 caribou[b]
1989-90	1,384 minimum	1,384 caribou[c]
1990-91	1,220 minimum	1,220 caribou[d]
1991-92	2,584 minimum	2,584 caribou *
1992-93	3,000 +	Incomplete
1993-94	3,682 minimum	3,682 caribou*

[a] Aerial surveys not done
[b] Evidence of one radio-collared Mulchatna herd animal (a female) during this November 1988 count and a possible influx of other Mulchatna animals
[c] Aerial survey completed November 1, 1989
[d] Aerial survey only partially completed on November 14, 1990. Number is a partial count.
* Censuses were completed during the years 1991 and 1993.

LOCATION

Game Management Unit: 19 (A, B, C, and D) and 21 (A and E) (60,523 mi^2)

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

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

BACKGROUND

Caribou have undoubtedly played an important historic 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 they presently do. As testament to their previous occurrence, a large mountain in the western Kuskokwim Mountains is called Horn Mountain, a reference to the fact that caribou horns were traditionally gathered here for use as implements and tools by the surrounding Native communities. Caribou no longer exist in that area. I suspect that the Mulchatna Caribou Herd once roamed throughout the Kuskokwim Basin, but as numbers dwindled, they retreated to the better range to the south. As the Mulchatna Herd increases (the 1994 summer estimate was 180,000 animals), it is expanding its range northward and using portions of Unit 19.

In the Kuskokwim Mountains, which divide Unit 19 from Unit 21, small caribou bands have apparently existed since 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 reasonably common for herders to lose them. Some people believe that the *Rangifer* herds present in the Kuskokwim Mountains today are descendants of feral reindeer or reindeer/caribou hybrids. The only possible supporting evidence for this theory is the fact that the Beaver Mountains Caribou Herd calves much earlier than many caribou herds (early to mid May), but this may be 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 have variously been referred to in previous reports as the Kuskokwim Mountains Herd/Herds or the Beaver Mountains Herd and Sunshine (Sunshine-Nixon) Mountains Herd (Shepherd 1981, Pegau 1986). In the early 1980s, Pegau (1986) collared caribou in the Beaver Mountains and in the

Sunshine Mountain. During the course of his 4-year study, no range overlap was documented. Radiocollared caribou from the Beaver Mountains ranged south almost to Horn Mountain. Caribou in that portion of the Kuskokwim Mountains (near Horn Mountain) had been referred to as the Kuskokwim Mountains Herd.

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

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

The Rainy Pass area and the drainages at the head of the South Fork of the Kuskokwim and surrounding area are inhabited by resident caribou. These caribou are called the Rainy Pass Herd; this herd is perhaps the least studied and least understood in the state. Major questions remain about herd size, discreteness, and interactions/relationship to Mulchatna Herd caribou. South of the Kuskokwim River there has been little use of caribou by Native hunters in recent times, except that residents of Nikolai occasionally have opportunities to hunt Tonzona caribou. Mulchatna caribou have increasingly been hunted along the Hoholitna River. The Big River-Farewell herds are taken primarily by hunters who fly into the area for moose and bison hunting and the Rainy Pass Herd is taken by hunters who fly into the area for sheep and moose hunting. Harvest from the Kuskokwim Mountains (north of the Kuskokwim River) has totaled less than 15 caribou per year since the winter hunting season ended.

MANAGEMENT DIRECTION

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

South of the Kuskokwim River in the Alaska Range, hunting pressure has been increasing and the management goals have been to determine the size, identity, and ability of those herds to withstand harvest.

The present goals and objectives were proposed in 1990 at the Division of Wildlife Conservation's caribou workshop.

MANAGEMENT DIRECTION

Management Goals and Objectives:

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

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

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

2. Provide for continued consumptive use of caribou.

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

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

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

METHODS

Hunter harvest reports were reviewed and tabulated annually and incidental observations of caribou numbers and calving areas were made. A photocensus of the Mulchatna Caribou Herd was completed by personnel from Dillingham, Bethel, McGrath, and Fairbanks. Additionally, surveys of the Beaver Mountains and Sunshine Mountain were completed during May and June 1994. I surveyed all alpine areas on the north side of the Kuskokwim River from Flat to Von Frank Mountain in a Piper Supercub. Caribou were concentrated near snow beds and all caribou were counted and classified as adults or calves.

RESULTS AND DISCUSSION

Population Size, Status, and Trend

Twelve groups or single animals totalling 429 caribou were surveyed in the Beaver Mountains vicinity in mid May. Calves composed 20% of the herd. By the second week in June, an aerial survey of the same locations showed only 1 remaining calf in 330 caribou (< 1% calf survival). Only alpine caribou range was surveyed, but I think about 75% of the caribou were counted during the mid May surveys. Consequently, I estimate the population to number 536 animals. This is lower than my 1992 estimate of 865 caribou, considerably lower than Pegau's (1986)

estimate of 1600 animals, and far below Skoog's (1963) estimate of 3000. The population of the Beaver Mountains Caribou Herd appears to have declined considerably since the 1960s and 1970s.

During the same survey in mid May, 553 caribou were counted in what has been considered the range of the Sunshine Mountain Herd (Cloudy Mountains, 202; Cripple Creek Mountains, 50; Page Mountain, 26; Sunshine Mountain, 275). I again assumed that approximately 75% of the herd was accounted for, bringing the total for the northern Kuskokwim Mountains to 691. This is close to the previous estimate of 500-600 (Pegau 1986). The total estimated population north of the Kuskokwim River is now almost 1600, which is still 500 less than Pegau estimated in 1986.

Distribution and Movements: No additional data have been collected since June 1985 (Pegau 1986). However, harvest analyses and incidental observations have provided some insights into caribou movements.

A summer census of the Mulchatna Caribou Herd (see Unit 17 Management Report) was conducted during 1994. This herd typically resides in Unit 17, but recent herd growth to an estimated 180,000 caribou in 1994 included a northward range expansion into Unit 19, as well as eastward into Unit 18. Mulchatna caribou are now regularly hunted along the Hoholitna, Holitna, and Stony rivers in Unit 19. As this herd continues to expand, I suspect that additional expansion of range will occur.

Mortality

Season and Bag Limit.

Units and Bag Limits	Subsistence/ Resident Open Seasons	Nonresident Open Seasons
Unit 19A that portion within the Lime Village Management Area. Resident Hunters: 4 caribou; however, cows with calves may not be taken from 1 April-9 August. Nonresident Hunters: 1 caribou.	1 Jul-30 Jun	10 Aug-31 Mar
Unit 19A north of the Kuskokwim River: 1 caribou.	10 Aug-30 Sep 1 Nov-28 Feb	10 Aug-30 Sep
Unit 19A south of the		

Kuskokwim River, (except the Lime Village Management Area)and Unit 19B. Resident Hunters: 5 caribou; however, no more than 2 may be bulls. Nonresident Hunters: 2 caribou.	1 Aug-15 Apr	1 Aug-15 Apr
Unit 19C: 1 caribou.	10 Aug-10 Oct	10 Aug-10 Oct
Unit 19D south and east of the Kuskokwim River and North Fork of the Kuskokwim River: 1 caribou.	10 Aug-30 Sep 1 Nov-31 Jan	10 Aug-30 Sep
Remainder of Unit 19D: 1 caribou.	10 Aug-30 Sep	10 Aug-30 Sep
Unit 21A: 1 caribou.	10 Aug-30 Sep 10 Dec-20 Dec	10 Aug-30 Sep 10 Dec-20 Dec
Unit 21E: 1 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

Harvest:

Human-induced Mortality. Following increases in hunting activity from the period 1986-1987 through 1991-1992, harvests have declined in Unit 19 and 21A during each of the past 2 years (Table 1). Including Mulchatna Caribou Herd harvests in Unit 19, however, the trend in numbers of hunters and total unitwide harvests are increasing. The greatest declines in harvest during the past 2 years have come from the Rainy Pass Caribou Herd, following the regulation change allowing only harvest of bulls (Table 2). I suspect that unreported take is high throughout the area, with the documented take probably only 50%-75% of the actual harvest.

Hunter Success and Residency. Reported hunter success has averaged about 80% during the past 5 years. Because of disproportionate returns, I believe the actual success rates are probably much lower, averaging about 50%. Reported success rate on all Unit 19, 21A, and 21E herds during the 1993-1994 season was 81%.

About half the hunters reporting from Units 19, 21A, and 21E are nonresidents (Table 3). I assume that resident hunters are probably underrepresented by the harvest ticket returns, and

that the harvest by residents is substantially higher than that represented by harvest ticket analyses. Hunters (both successful and unsuccessful) reported hunting an average of 6.2 days, with hunts lasting from 1 to 21 days.

Harvest Chronology. Fifty-five percent of the reported 1993-1994 caribou harvest occurred in September, about 40% during August, and the remainder in November, December, and January (Table 1). I do not think harvest chronology has changed significantly over the past 5 years.

Transport Methods. During the past 5 years, 1037 of 1271 (82%) caribou hunters who reported transportation method on their harvest report cards used airplanes (Table 4). The remaining transport methods were distributed among horse, boat, snowmachine, and off-road vehicles (including 3- and 4-wheelers).

Sex of Harvest - During the period 1989-1990 through 1992-1993, about 12% of the Unit 19 caribou harvest was composed of females. The change in regulations in Unit 19C making the legal harvest bulls only has resulted in only about 2% cows being harvested during the 1993-1994 season (Table 5).

Natural Mortality: Although no specific data have been collected concerning natural mortality rates or factors during this reporting period, I suspect that wolf predation is relatively high within most of the Unit 19 and 21 caribou herds. The low proportion of Beaver Mountains Herd calves (<1%) and the early calving dates suggest that the Beaver Mountains Herd is highly productive but has high calf mortality. The Sunshine Mountain Herd may also suffer high mortality. Winter severity was been relatively high during the past 2 years and is thought to have contributed substantially to natural adult and calf mortality.

CONCLUSIONS AND RECOMMENDATIONS

To meet the objectives stated previously in this report, additional effort must be focused on basic understanding of the Big River-Farewell and Rainy Pass herds.

The Unit 19C regulatory change allowing harvest of bulls only has apparently decreased the harvest pressure on cows from the Rainy Pass (as well as other Unit 19C) caribou herds. Some caribou in the Rainy Pass Herd should be radiocollared, and an estimate of herd size and recruitment (fall composition count) completed.

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Table 1. McGrath[a] area caribou annual reported harvest by month, 1989-1993.

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

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

Table 2. McGrath[a] area caribou annual reported harvest by herd, 1989-1993.

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

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

Table 3. McGrath[a] area caribou annual reported harvest by location of residence, 1989-1993.

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

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

Table 4. McGrath[a] area caribou annual reported harvest by transport method, 1989-1993.

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

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

Table 5. McGrath[a] area caribou annual reported harvest by sex, 1989-1993.

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

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

LOCATION

Game Management Unit: 20A (6796 mi^2)
Herd: Delta (including former Yanert Herd)
Geographical Description: Central Alaska Range and Tanana Flats

BACKGROUND

During the past 25 years, the Delta Caribou Herd fluctuated in size from 5000 in 1969 to about 1500-2000 in 1975, then up to nearly 11,000 in 1989, and down to about 3700 caribou in 1993 (Davis et al. 1991; ADF&G, unpubl. data). The herd has been ideal for long-term research because of its proximity to Fairbanks, the considerable background information available on the herd, options for intensive management, and high public interest in the herd. In addition, the adjacent Denali Caribou Herd provides valuable comparative information as an unhunted herd in a similar area. Long-term study of the population dynamics of the herd began in 1979, and 2 major reports (Davis and Valkenburg 1985, Davis et al. 1991) and numerous scientific papers have been completed. Since 1991, 3 research progress reports have been written.

Regulations pertaining to hunters pursuing Delta caribou have been relatively complex and have changed frequently. Before 1974 there were liberal either-sex general hunting seasons within the range of the Delta and Yanert herds. From 1974 through 1979 hunting seasons were closed because recruitment was very low from 1972 to 1974 (2-10 calves:100 cows), and the population was low. Hunting resumed in 1980 when 200 drawing permits were issued for bulls only. For 2 more years hunting was by drawing permit only. In 1983 a long, general open season resulted in a harvest of over 1100 caribou which stabilized the herd and seemed excessive. Registration permits were tried in 1984, but due to caribou distribution over 400 caribou were taken in the first 3 days of the season, and an emergency closure was implemented. From 1985 to 1991 a 2-3 week general open season in the less accessible portions of the unit (Wood River and Yanert controlled use areas and Little Delta and Delta Creek drainages), and permit drawing hunts in the Ferry Trail and Healy-Lignite Management Areas, provided a relatively predictable harvest of 300-500 caribou annually. Hunting was prohibited in Unit 20A after 11 September 1991 due to the dramatic population decline. Davis et al. (1991) thoroughly reviewed the regulations from 1968 to 1990.

Before 1987 the Delta and Yanert herds were considered distinct herds based on their segregation during calving. However, by 1987, the growing Delta Herd overlapped with the Yanert Herd on all seasonal ranges. Since 1988 there has been no biological basis for herd distinction, and the herds have been managed as a single herd. In this report the Delta and Yanert herds are collectively referred to as the Delta Herd.

In recent years the Delta Herd has been the focus of statewide and national attention. To reverse the decline of the Delta Herd and to more quickly return to a sustainable harvest of 300-500 caribou, the Board of Game approved a 3-year wolf predation control program in a

portion of Unit 20A. The control program, which began in October 1993, was controversial and was suspended after the 1994 gubernatorial election. Objectives 1 and 3 below are part of the wolf predation control implementation plan that has been in regulation since 1993 (5 AAC 92.125).

Management Objectives

1 Reverse the decline of the herd and increase the midsummer population to 6000-8000 caribou by 1998.

2 Maintain at least 30 bulls:100 cows and at least 6 large-bulls:100 cows in the herd.

3 Sustain an annual harvest of 300-500 caribou by 1998.

4 Gather information on predator:prey ratios and on the significance of predation, weather, and density as mortality factors that potentially limit the Delta Herd.

METHODS

Population Size: We estimated population size by censusing the herd using the modified aerial photo-direct count-extrapolation (Davis et al. 1979) and/or radio-search technique (Valkenburg et al. 1985). Caribou were photographed with a Fairchild T-11 9x9-inch belly-mounted aerial camera in a Dehavilland Beaver and with 35-mm cameras (Kodak Ektar ASA 100) from other fixed-wing aircraft. Small groups were counted but not photographed.

On 15 June 1993 we censused the herd with 4 pilot/observer teams during 12.8 hours of searching approximately 1000 mi^2. Teams completed visual searches, using radiocollared caribou to locate the maximum number of aggregations. Teams also conducted visual searches in assigned count areas after radiocollared caribou had been located. Only cows were radiocollared. Weather and survey conditions were very good throughout most of the census. Four biologists/technicians counted caribou on the photographs using a 10X magnifier. If counts varied between observers, an average of the counts was used in most cases.

Cool, wet weather in mid June delayed the 1994 Delta photocensus until 30 June. Four pilot/observer teams used radiotelemetry to locate collared caribou and search for caribou in the remaining area. We completed the census after 25 hours of searching approximately 1000 mi^2. Weather was cool (40°-45°F) and we found many small groups of caribou. Unlike in 1993, it was not hot enough for caribou to be seeking insect relief on remnant snow beds until late morning. Three biologists counted caribou on the photographs with a 10X magnifier. If counts varied between counters, we used the mean. All photos were counted by at least 2 of the counters. In the 1994 census, in addition to having radiocollars on cows of all ages, 10 yearling bulls were also collared.

Population Composition: We conducted fall composition counts in 1992, 1993, and 1994, and parturition surveys in 1993 and 1994.

Fall- We weighted results based on the distribution of radiocollared caribou. We based our classification during the fall survey on the following criteria:

Cow	Vulva visible as dark vertical line; body size larger than calf.
Calf	Small body size; short face; antlers small, often only a spike or with 1 brow tine, antlers black and velvet covered. Behavioral cues often helped confirm classification as a calf.
Small Bull	"Cow-sized" animal or somewhat larger with antlers nearly indistinguishable from an adult cow; uniformly whiter rump below anus; tail often has a "cottontail appearance"; penis sheath occasionally visible from the side. This category includes all yearlings and many 2-year-olds.
Medium Bull	Antlers clearly larger than cows or small bulls; uniformly white rump below anus; as in small bulls, tail may appear fuller than in cows. This category includes bulls of several cohorts, includes some 2-year olds, all 3-year-olds, and some 4-year-olds.
Large Bull	Large-bodied, white-maned bulls; fully mature antlers that probably would not undergo significantly greater development in antler spread, beam length, or weight in subsequent years. This category includes some 4-year-olds and most older bulls.

On 25 September 1993 we classified 1526 caribou, or approximately 40%-50% of the Delta Herd, from an R-22 helicopter. We located radiocollared caribou from a fixed-wing to assist us in locating as many animals as possible. Survey conditions were good, with snow less than 3 inches deep and mottled (25%-50% snow cover) at Iowa Ridge, and 4-10 inches deep and not mottled (75%-100% cover) in the Yanert.

On 3 and 4 October 1994 we used an R-22 helicopter with 1 observer tallying composition with a 5-place counter, and simultaneously recording it with a tape recorder. During the survey we located 52 of 55 (90%) of the radiocollared caribou; 26 were east of the Wood River, 18 were in the foothills west of the Wood River, and 8 were in the Yanert. We reclassified caribou east of the Wood River on 6 October because we had initially only classified caribou around the radiocollared caribou. In retrospect, because of the unusual distribution of caribou, we missed many bulls and some cow-calf pairs that were not with rutting groups. During the recount, we classified all caribou seen. Our final composition sample included 2131 caribou, or approximately 49% of the herd. Snow cover was patchy on 3 October but the ground was relatively bare on 6 October and caribou were more visible.

Parturition Surveys: On 25 May 1993, we classified caribou encountered on the calving grounds in Wells Creek and the Upper Nenana River from a Bell-206 helicopter. We classified each caribou as a parturient cow, nonparturient cow, calf, or bull. Parturient cows included caribou that had a distended udder, 1 or 2 hard antlers, or a calf-at-heel. On 2 June 1994 we classified caribou on the calving grounds in Wells Creek and Dick Creek from an R-22 helicopter with the same criteria.

RESULTS AND DISCUSSION

Population Status and Trend

Population Size: Between 1979 and 1989, the Delta Herd population size grew nearly continuously (Fig. 1). The number of caribou counted during the censuses then declined (46%) from the peak of 10,690 in 1989 to 3661 in 1991. In 1994 the Delta Herd increased due to the relative strength of the 1994 calf cohort.

Census results provide us with a minimum herd size because each year a relatively small but unknown number of caribou are not counted during the census. The size of this missing segment varies from year to year. Confidence in our census results is highest when the census includes all radiocollared caribou. We think both counts completed during this reporting period were good. In 1993 most caribou were aggregated on snow beds for insect relief and we located 44 of 45 radiocollared caribou. In 1994, we located 60 of 62 radiocollared caribou (remaining 2 suspected to have nonfunctional collars) and, although not aggregated on snow beds, 73% of the caribou counted were in groups of at least 100 caribou.

Population Composition:

Recruitment. During 4 of the last 5 years, recruitment to the Delta Herd has been low, as evidenced by fall calf:cow ratios of 6-17:100 (Table 1). These low calf:cow ratios contrast to much higher ratios (29-46:100) during the early- to late-1980s. The 1993 ratio of 6:100 was the lowest recorded since 1974. The 1994 ratio increased to 23 calves:100 cows, which suggested that the population decline had stopped but was not going to increase as rapidly as we had hoped following wolf reduction.

Poor recruitment was not unique to the Delta Herd during 1990-1994. Fall calf:cow ratios in the adjacent Denali have been nearly identical to the Delta Herd since at least 1990 (Table 2). The Macomb Herd has only had 9-17 calves:100 cows since 1990 but did not show an increase in 1994 like the Delta and Denali herds. The White Mountains and Fortymile herds had consistently higher ratios (13-25:100 and 16-33:100, respectively) than the Alaska Range herds.

Data from the adjacent Denali Herd (Adams et al., in press) indicate that the primary reason for low recruitment in that herd, and probably in the DCH as well was heavy predation by wolves and grizzly bears (*Ursus arctos*). Poorer nutrition due to unfavorable weather from

1989 to 1993 probably made caribou calves more vulnerable to predation. However, wolf numbers were also much higher during the early 1990s than previously.

Bull:Cow Ratios. Estimates of bull:cow ratios are influenced by recruitment, hunting, segregation of bulls away from cows, timing of composition counts, and observer classification bias. Fall bull:cow ratios in the Delta Herd have varied widely during the last 10 years (Table 1). Ratios increased from 1983 (35:100) to 1985 (49:100), then generally decreased during the next 5 years due to selective hunting. Since 1989 estimated bull:cow ratios have remained below our objective of 30:100 (except in 1993) due to poor recruitment.

Since 1985 the number of large bulls in the population has been relatively low (< 10 large-bulls:100 cows during fall). After observing only 2 large-bulls:100 cows in 1989, we established an objective to maintain at least 6 large-bulls:100 cows. The shortened 1990 hunting season probably protected some large bulls but the large-bull:cow ratio has remained low, with only 3-6:100 from 1990-1992. Due to the increasing age of bulls and the closure of hunting, we met our objective during this reporting period, with 7:100 in 1993 and 10:100 in 1994.

Distribution and Movements: Prior to the 1950s through the mid-1980s, the Delta Herd showed strong fidelity to calving areas between the Delta River and the Little Delta River in southeastern Unit 20A (Davis et al. 1991). However, as the Delta Herd increased, it expanded the area it used for calving. Between 1980 and 1987, the Delta Herd calved in 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. Since 1988 the calving areas used by the Delta and Yanert herds have overlapped considerably and the herds have collectively been referred to as the Delta Herd.

Fall and Winter 1992: See Eagan 1993.

Calving and Postcalving 1993: The core calving area in 1993 was in the upper Wells Creek and Nenana River drainages in Unit 13, even though most of the radiocollared cows had been in the traditional calving area near Delta Creek shortly before. They traveled to the calving area via Dick and Louis creeks in the Yanert drainage. By mid June the largest group of caribou (1663) was in upper Kansas Creek. Moderately large groups were also in Louis Creek in the Yanert (528) and in the upper Gold King and Bonnifield Creek drainages (505), with smaller groups between.

Fall and Winter 1993-1994: By late September most of the herd was in the Iowa Creek and Dinosaur Ridge area, Buzzard Creek (Totatlanika River), or in Moose or Revine creeks. Only the caribou in Buzzard Creek were in what we used to consider the traditional rutting grounds. The distribution of caribou may have still been shifting; at least 1 radiocollared caribou had moved from the Healy/Moody Creek area to Mystic Creek during the 2 days prior to our composition survey. Distribution may have been influenced by warm temperatures and lack of snowfall in September, or by range conditions.

All radiocollared Delta caribou remained within Unit 20A during the winter, primarily in 2 areas; the lower Yanert River drainage and the northern foothills of the Alaska Range between Walter Dome and the Delta River, especially in the Little Delta River drainages. Although 4000-5000 Nelchina caribou wintered in the Cantwell area and some moved into the lower Yanert in early March, the 1 radiocollared Nelchina caribou in the group subsequently returned to the Nelchina calving area by late May.

Calving and Postcalving 1994: In spring 1994 radiocollared Delta caribou were in Units 20A and 13. In late April caribou that wintered in the northern foothills of the Alaska Range moved east to the traditional calving area near Delta Creek. About 10 May the herd began to move through the Alaska Range to upper Wells Creek via the Wood River, Dick Creek, and Louis Creek. Most calving occurred in upper Wells Creek. By late June, most of the herd had moved back north into Unit 20A, with 43% of the herd in Mystic Creek and the Gold King benches, and 26% in Buchanan Creek.

Mortality

Harvest:

Season and Bag Limit. There was no open hunting season for the Delta Herd during this reporting period. Historical caribou hunting regulations for Unit 20A were summarized in Davis et al. (1991) (1968-1990) and Eagan (1993) (1990-1992).

Board of Game Actions and Emergency Orders.

Regulatory year 1992-1993 - In March 1992 the board closed all caribou hunting in Unit 20A because of the continuing decline in the herd. In fall 1992, the Joint Boards of Fisheries and Game established the Fairbanks Nonsubsistence Area, which included most of the traditional range of the Delta Herd. The Joint Boards concluded (Finding 92-24-JB) that dependence upon subsistence is not a principal characteristic of the economy, culture, and way of life in this area or community. No subsistence hunting or fishing regulations were permitted within a nonsubsistence area.

Following the Joint Board meeting, the Board of Game adopted the department's draft Area Specific Wolf Management Plan for Southcentral/Interior Alaska, which was drafted after extensive public review. The plan outlined population and harvest objectives for big game species and zoned the entire area into 1 of 7 management zones, based on the intensity of human use and management. Most of the Delta Herd's range was zoned as a 6 or 7 (high human use and moderate/intensive management). The board also passed an Implementation Plan for reducing the number of wolves in a portion of Unit 20A by 70%-80% using aerial control. This wolf control program was intended to prevent a further decline in the Delta Herd by reducing predation. However substantial public controversy surrounded this program, and the Board of Game rescinded their November actions during a January 1993 meeting. The board discussed alternative wolf management strategies at a special meeting in June 1993 and authorized a ground-based control program for Unit 20A.

The board also modified the Strategic Plan by removing the zoning concept and specified conditions under which the board would consider wolf control. This revised document is called the "Wolf Conservation and Management Policy for Alaska". The board then approved 1 wolf predation control implementation plan, which was a 3-year ground-based program in a portion of Unit 20A starting in October 1993. The program objectives are:

1. Reverse the decline of the Delta Caribou Herd and increase the midsummer caribou population to 6000-8000 with a sustainable annual harvest of 300-500 caribou by the year 1998.

2. Determine whether ground-based control methods can effectively reduce wolf numbers temporarily to reverse declines in prey populations.

Regulatory year 1993-1994 - In October 1993 a superior court judge declared the nonsubsistence area portion of the 1992 subsistence law invalid.

Mortality: Between 1 October 1993 and 30 September 1994, there was a marked decline in the mortality of radiocollared adult female (> 16 month) Delta caribou. Only 11% (4/35) of the collared females died, compared with 20% (6/30) during the previous year. Mortality of yearling females also probably declined; none of 12 collared yearlings died. However, mortality of male and female calves born in 1993 continued to be high; 30% (7/23) of the collared calves died.

According to Davis et al. (1991), caribou:predator ratios changed from about 1 wolf:101 caribou and 1 grizzly bear:31 caribou in 1979 to about 1 wolf:50 caribou and 1 grizzly bear:61 caribou in 1989. They stated that throughout the history of the Delta Herd, wolf abundance has correlated negatively with the caribou recruitment rate and positively with the natural mortality rate. Further, that determining if this relationship is one of cause and effect is confounded because of unknown density-dependent relationships within the caribou population. A separate research project is currently investigating factors regulating and limiting the Delta Herd.

Wolf predation on caribou likely declined during this reporting period. In 1993-1994, 60% of the estimated population of 270 wolves were killed by trappers, hunters, or department personnel in 1993-1994. The magnitude of relief to the Delta Herd may not be as high as we had hoped, however, because only 2 or 3 entire packs were removed, and 60% of the 98 wolves killed during the control program were pups. An additional 36 wolves were killed during the control program in 1994-1995 prior to the suspension of the program in December 1994, with few additional wolves taken by hunters and trappers thus far.

Habitat

Because of the concern that the decline in the Delta Herd may be influenced by density dependent factors related to habitat and/or weather we are: 1) studying the influence of

weather on the nutritional quality of plants, 2) collecting fecal samples on the winter range to determine if the abundance of lichens in the caribou diet has declined, and 3) weighing female caribou calves to determine body condition and relating body condition to natality rates. Analysis of fecal samples collected in late winter 1989 and 1993 indicated much of the foothill lichen range in Unit 20A is depleted. Proportion of lichens in the diet was relatively low, and the proportion of mosses high compared with other Interior herds. In fall 1994 body weights of 5-month-old caribou calves increased for the first time since 1990.

CONCLUSIONS AND RECOMMENDATIONS

The decline in the Delta Herd population has reversed. We counted 4341 caribou during our midsummer 1994 photocensus, which represents a 19% increase from the 3661 caribou counted in 1993. Fall calf:cow ratios (23:100) were the highest counted during the last 5 years. This ratio was lower than we expected considering the high initial productivity and may indicate that summer calf mortality is still high, despite the wolf control program. To meet our objective for 6000-8000 caribou by 1998, the herd will need to increase 10%-15% per year until 1998.

We met our objective for at least 30 bulls:100 cows in 1993 (35:100) but not in 1994 (25:100). We met our objective for at least 6 large bulls:100 cows during both years (7:100 and 10:100, respectively). Because of the low recruitment during 4 of the last 5 years, there are relatively few young bulls in the population.

We have not yet met our objective to sustain an annual harvest of 300-500 caribou by 1998. The Board of Game will be considering a proposal in March 1995 to implement a limited drawing permit hunt on the Delta Herd.

Research projects to investigate the influence of predators, weather, and other factors on the Delta Herd are continuing. In addition, we continue to support efforts by the National Biological Service to collect comparative information from the adjacent Denali Herd.

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Table 1. Delta caribou herd fall composition counts and estimated population size, 1983-1994.

Survey date	Bulls: 100 C	Large bulls: 100 C	Calves 100 C	Calves %	Cows %	Small bulls % of bulls	Medium bulls % of bulls	Large bulls % of 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

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

Table 2. Comparison of fall composition of the Delta (Unit 20A) and Denali (Unit 20C) caribou herds, 1984 through 1994.

Year	Bulls:100 cows		Calves:100 cows	
	Delta	Denali	Delta	Denali
1984	42	47	36	36
1985	49	56	36	28
1986	41	56	29	38
1987	32	56	31	37
1988	33	67	35	33
1989	27	--	36	--
1990	38	50	17	17
1991	29	38	8	7
1992	25	44	11	16
1993	35	40	6	6
1994	25	39	23	20

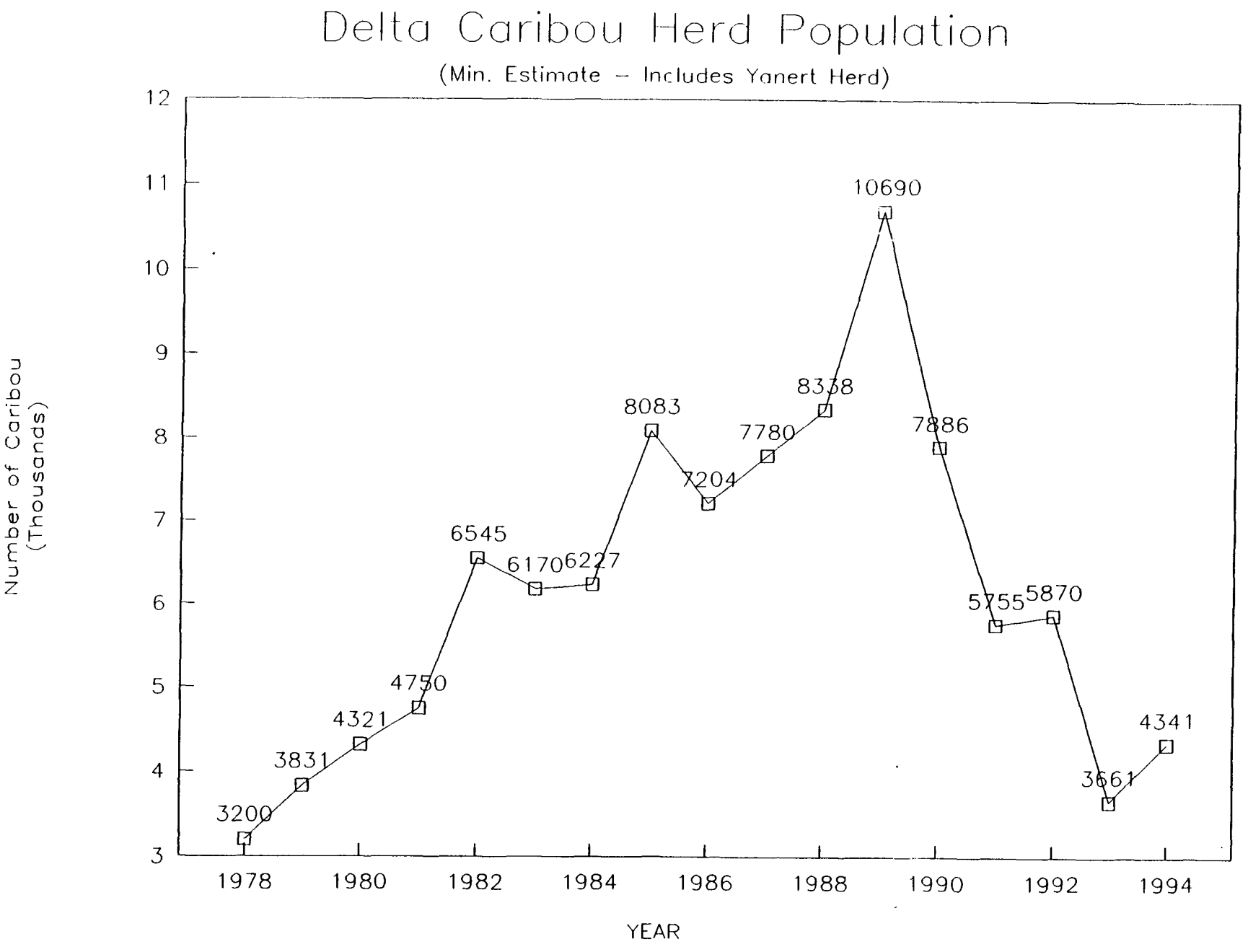

Figure 1. Population estimates from midsummer photocensuses of the Delta Caribou Herd, Unit 20A, 1978-1994.

LOCATION

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

Herd: Fortymile

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

BACKGROUND

The Fortymile Caribou Herd (FCH) is 1 of 5 international herds shared between Alaska and the Yukon Territory. Like other caribou herds in Alaska, the FCH has displayed major changes in abundance and distribution. During the 1920s it was the largest herd in Alaska and one of the largest in the world, estimated at 568,000 caribou (Murie 1935). For unknown reasons, the FCH declined to only 10,000-20,000 by the late 1930s (Skoog 1956). Subsequently, the FCH began increasing possibly as the result of a federal predator control program that began in 1947. By 1953 the herd had increased to over 50,000 (Skoog 1956). Until 1963 the herd fluctuated slightly, but most population estimates were about 50,000 animals (Valkenburg et al. 1994).

Between the mid-1960s and 1975 the herd again declined, probably because of a combination of high harvests, a period of severe winters, and a high wolf population (Davis et al. 1978; Valkenburg and Davis 1989). The population low probably occurred in early 1976 when the herd was estimated at 5740-8610 caribou. The FCH began increasing again in 1976 in response to favorable weather conditions, reduced harvests, and a natural decline in wolf numbers. By 1990, the FCH had increased to about 20,000 (the annual rate of increase ranged from 5% to 10%).

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

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

hunter concentration and harvest distribution has shifted and primarily occurs along the Taylor Highway and from small airstrips within the Fortymile River drainage. As herd distribution and movement patterns changed, hunting seasons were deliberately set to avoid the period when road crossings were likely. Some road-crossing hunts have been deliberately provided since 1990 to accommodate the subsistence hunting priority.

MANAGEMENT DIRECTION

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

During development of the Fortymile caribou management and harvest goals and objectives, we failed to foresee the effects of federal subsistence management and also, the political clout public interest groups would have on our programs. Our oversight was realized 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 developed allocation for federal subsistence users. Because we had a great deal of support within the herd's range for our management programs we were surprised by the amount of interest and effort exerted by outside public interest groups to stop us from implementing them.

The conflict between ADF&G and federal agencies involved harvest management and differing interpretations of ANILCA. The federal agencies decided that managing the Fortymile caribou hunt by a harvest quota without a guaranteed allocation for federal eligible subsistence users violated ANILCA and prohibited the federal agencies from following ADF&G's harvest management direction. Because a cooperatively developed harvest quota and allocation was not in place, ADF&G and the federal agencies disagreed on whether the 1991 and 1992 federal seasons should have been closed. Due to the inability of the agencies to agree on a harvest management direction the public had to contend with more complex regulations and the possibility of an overharvest increased.

Most of the local public was unhappy with Fortymile caribou management direction following the 1992 events and in response, the Upper Tanana/Fortymile Advisory Committee and other public groups requested ADF&G and the federal agencies to work with the public in developing a Fortymile Caribou management plan. In July 1994 a Fortymile Caribou Management Team was established. Members of the team represented the agencies of ADF&G, Bureau of Land Management, US Fish and Wildlife Service, National Park Service, Yukon Department of Renewable Resources, and 19 public representatives. The team's goals are to develop management recommendations for herd population, harvest, and ecosystem management to be used by the Alaska Board of Game (BOG) and the FSB during their regulatory decision process.

The following are the current management goals and objectives. These may be changed by the Fortymile Caribou Management Team during 1995.

Management Goals and Objectives

1. Rebuild the FCH in all of its historic range in Alaska and the Yukon.

    a. When weather-related nutrition is favorable, manage harvest and, secondarily, predation to increase the herd to 50,000 adults or 60,000 caribou by the year 2000.

    b. If the mean annual growth rate is greater than 10%, allow a maximum harvest of 3% of the herd and 1.5% of the females until herd size reaches 50,000 adults or 60,000 caribou. If the mean annual growth rate is 0% to 10%, allow a maximum harvest of 2% of the herd and 0.5% of the females. During years when the herd is declining, hunting may be further restricted and steps to reduce predation will be recommended, assuming poor nutritional status of caribou is not a major factor.

    c. Maintain an October bull:cow ratio of at least 35:100.

2. Minimize the impact of human activities on caribou habitat.

    a. Discourage or modify developments incompatible with caribou.

    b. Maintain a near-natural fire regime.

3. Provide for increased caribou hunting and other wildlife-related recreation in Alaska and the Yukon.

    a. When weather-related nutrition is favorable, manage harvest and, secondarily, predation to increase the herd to 50,000 adults or 60,000 caribou by the year 2000.

    b. Maintain a limited open hunting season when caribou are available to resident hunters in Alaska.

    c. Determine the demand for Fortymile caribou by hunters in Alaska and the Yukon.

METHODS

Population Census

We censused the FCH between late June and mid July in 1988, 1990, 1992, and 1994 using 3 spotter planes (Supercub PA-18 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). The total population estimate was derived by counting the individual caribou on the photographs and adding those caribou in small groups that we counted visually from the spotter planes. All photographs were counted twice, each time by a different person. No correction factors were used to account for caribou missed during the search.

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

Fall Composition Surveys: Between 1989 and 1994 we estimated herd sex and age composition annually between late September and mid October using either a Hughes 500D, Robinson-22 or a Bell Jet Ranger helicopter. Most caribou surveyed were initially found by radiotracking. A pilot/observer team classified each caribou as either a cow, calf, or bull. Bulls were further classified as either small, medium, or large based on antler size. The Yukon government contributed staff and finances to the 1992 and 1993 surveys.

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

Herd Condition: During the report period, we used 4 indices to evaluate herd condition: 1) fall calf weights, 2) percentage of calves of radiocollared cows dying during the first 48 hours of life, 3) percent natality of radiocollared cows, and 4) median calving date. Fall calf weights were obtained during fall capture activities conducted in 1991 through 1994. We evaluated the other 3 indices by radiolocating at least 30 adult cows (3 years and older) 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 had given birth.

Radiotelemetry Data: We obtained herd distribution, movements, and estimates of annual mortality by radiotracking 30-81 radiocollared adults, and during 1994, 50 calves. Calves were located daily during May and June, and at least once every month thereafter. Adults were located approximately once every month throughout the year. We retrieved collars of dead caribou as soon as possible after detection in an attempt to determine cause of death.

Harvest:

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

RESULTS AND DISCUSSION

Population Status and Trend

Population Size: The FCH increased at about 5%-10% annually through the 1980s, reaching its estimated peak of 22,766 caribou in 1990. Between 1990 and 1992 the herd declined by about 4% and in June 1992 numbered 21,884 (Table 1). Since 1992 the herd has remained stable.

Population Composition: Estimated fall bull:cow and calf:cow ratios have remained relatively fairly stable in the FCH since at least 1986, except that calf numbers were low in 1991. Estimated ratios in late June counts have been more variable, probably because June counts are more difficult to do accurately (Table 2). Population modeling predicts the bull:cow ratio will slowly increase if recruitment and harvest remain at 1994 levels.

Distribution and Movements: In 1993 the FCH summered between the upper Salcha River, Mount Harper, and Glacier Mountain. During mid August about 4000 animals moved east to the vicinity of Taylor Mountain and Mount Warbelow. These caribou were available to hunters between 10 August and 16 August. By the end of August, the herd moved west and stayed in the Charley and Salcha rivers and Crescent and Copper creek drainages. During late September the herd became widely distributed and ranged between Mosquito Mountain and American Summit, with the largest concentrations occurring on Chicken Ridge and American Summit.

Similar to 1992, the herd wintered west of the Dennison Fork of the Fortymile River. Throughout the winter the herd remained widely scattered primarily in small groups in the West, Mosquito, Middle, and North Forks of the Fortymile River and in the Upper Eisenmenger, Goodpaster, and Salcha rivers.

Calving began in mid May 1994 (peak was 20 May) in the upper Middle Fork of the Fortymile River, in the South and Eisenmenger Forks of the Goodpaster River, and in Boulder Creek. By early June most of the herd had moved north into the Charley River drainage. During the July 1994 census over 95% of the herd (based on radiotelemetry) were in upper Crescent Creek, upper Charley River, Lost Creek, Gulch Creek, or Williams Creek. The herd remained west of Glacier Mountain throughout July and mid August. As in 1993, a few caribou moved

east during early August and remained in the Bullion and Hutchinson Creek areas but most of the herd remained farther west between Independence Creek and the upper Salcha River. During mid September the herd moved east to the Taylor Highway at American Summit. The herd did not cross the Taylor Highway but instead moved southeast and by 1 October was distributed between Walcutt Mountain and the upper Mosquito and Middle Forks of the Fortymile River.

The herd spent November and December spread across most of its range east of the Taylor Highway but the largest concentration was in the upper West Fork of the Fortymile River.

The major difference in seasonal distribution and movement patterns between 1993-1994 and 1991-1992 is that the herd did not move in mass to Taylor Mountain and Mount Warbelow in August. As a result, the herd was not easily accessible to hunters the past 2 years.

Mortality

Harvest:

Season and Bag Limit. See Table 3.

Board of Game Actions and Emergency Orders. All Board of Game (BOG) actions in 1987 through 1993 were described in detail in Kelleyhouse (1992) and Gardner (1993). In 1993 there were significant changes made in the state and federal hunting regulations for Fortymile caribou. During spring 1993 the BOG decided against a Tier II hunt for Fortymile caribou. Instead, the BOG created 2 registration permit hunts which covered all of the Fortymile caribou range. Each hunt had a separate quota and strict reporting requirements to ensure the quota was not exceeded. The board also changed the bag limit to 1 bull for both hunts. As a precaution against an overharvest, the BOG gave ADF&G authority to enact area, road, and temporary season closures if the herd became too vulnerable to harvest. In 1994 a court decision concerning nonsubsistence areas caused the boundaries of the 2 registration permit hunts to change slightly but the quota, season dates, and bag limits remained the same as 1993.

In 1993 the FSB developed a federal Fortymile caribou registration permit to regulate hunting on federal lands by federally eligible subsistence users. Season dates were the same as the state but the bag limit differed during the fall season in Yukon-Charley National Preserve and during the winter season on all federal land in Units 20E and 25C.

In 1994 the FSB changed the bag limit for both the fall and winter hunts to match the state Fortymile caribou regulations. The FSB also agreed to a federal quota. Specifically, if federal subsistence users had harvested a minimum of 150 Fortymile caribou and the annual herd quota was met, then the FSB would close the federal seasons.

The BOG and the FSB decisions during 1993 and 1994 greatly simplified Fortymile caribou regulations. However, both boards realize there are more management issues that still need to

be decided before the FCH is adequately protected from an overharvest, the mandates of the agencies are met, and most hunters are satisfied with management direction.

Hunter Harvest. During 1993 the total reported harvest was 326 caribou (Table 4). The estimated illegal cow harvest of 20 resulted in an estimated total harvest of 346 caribou (Table 5). The harvest was 1.6% of the estimated population and was below the harvest quota of 440.

The preliminary reported harvest for the 1994 season was 235 caribou. The total 1994 harvest is expected to be between 275 and 300 caribou. The season harvest quota was 442 bulls.

Illegal Harvest. The number of illegally harvested caribou declined in 1991 and 1992 and then stabilized. The annual estimate ranges between 20 and 30 cows. I believe the reason the illegal kill has not continued to decline is due to the annual influx of hunters with no caribou hunting experience. Determining the sex of caribou can be difficult, especially if the hunter does not know all of the distinguishing characteristics.

Hunter Residency and Success. Beginning in 1993 only Alaskan residents were eligible to hunt Fortymile caribou in Unit 20D, outside of the nonsubsistence area, Unit 20E, and Unit 25C (permit hunt RC865). Hunt RC865 was divided into a fall and winter season. In 1993, 428 (22.5%) of the hunt participants were local residents and 1472 (77.5%) were nonlocals (Table 6). The success rate during the fall was 13.2% (for local residents 7.1%) and during the winter the success rate was 25.5% (18.8% for local residents) (Table 4).

During 1993 successful hunters hunted an average 4.2 days compared with 2.2 days in 1992. The difference between the 2 years was due to the herd being accessible throughout the 1992 hunting season.

Under permit hunt RC863, nonresidents can participate. In 1993, 1 (0.4%) of the hunt participants was a local resident, 208 (88.9%) were nonlocals, and 24 were nonresidents. Nonresidents accounted for 34.6% of the harvest under permit RC863 but were responsible for only 2.8% of the total Fortymile caribou annual harvest.

During 1994 we determined the primary occupation of 1351 of the 1908 RC865 permittees. Based on this survey, 25% of the hunters who participated in the state subsistence hunt were military. Many local rural hunters are dissatisfied with the high level of participation by military hunters in the Fortymile hunt. They feel the herd is important for subsistence and do not feel military personnel need the meat to the extent they or other Alaskans do. The local protection officer issues more citations to military hunters and feels as a group they are more willing to break the law. Because of the military influence in the Fortymile hunt, they have been invited to participate in the Fortymile Caribou Management Team's discussion on harvest management. Some changes are necessary to reduce the number of infractions by military personnel and to change their image as subsistence hunters.

Harvest Chronology. In 1993 about 4000 Fortymile caribou were near Mount Warbelow and Taylor Mountain at the onset of the hunting season and remained in that area until 16 August. During the first week of the season, 167 caribou were harvested, accounting for 74% of the total fall harvest (Table 7). The herd remained inaccessible to most hunters for the remainder of the fall season. During the winter season the herd remained distributed throughout its range and, consequently, harvest was fairly evenly distributed over the season. The greatest hunter effort and harvest occurred during the first week.

In 1994 harvest chronology differed substantially from the past 4 years because few (about 1500) Fortymile caribou were in the vicinity of Mount Warbelow at the start of the fall season. The herd remained inaccessible to most hunters until the last 4 days of the season. Few hunters were in the field during late September and little harvest occurred.

Transport Methods. During the 1993 fall RC865 permit hunt, most successful hunters reported using either 3- or 4-wheelers (61.8%) or airplanes (16.6%; Table 8). The use of airplanes by successful hunters increased this year because of boundary changes for the permit area. The area now includes Molly Creek, Slate Creek, and the upper Charley River, the more popular fly in areas in Unit 20E. Hunters using highway vehicles were less successful in 1993, because the herd did not move into the vicinity of either the Taylor or the Steese highways until after the season.

Most successful hunters reported using snowmachines (52.5%) or highway vehicles (41.4%) during the winter hunt in Units 20E and 25C. The Taylor Highway is not maintained during the winter and is difficult to access without a snowmachine or 4-wheel drive truck.

In the RC863 permit area most successful hunters used airplanes (56.3%). Access into this area is difficult due to the lack of trails and suitable river systems.

Other Mortality: We have determined the cause of mortality of 27 collared caribou > 4 months old since October 1991. Wolves killed 22 (81.5%), lynx killed 2 (7.4%), and 3 (11.1%) died from nonpredation. Both animals killed by lynx were < 1 year old. All but 2 of the deaths occurred from November through April.

We deployed 50 radiocollars on newborn Fortymile caribou calves in May and June 1994. By January 1995, 31 calves (62%) had died. The major cause of mortality has been predators (87%), primarily grizzly bears (35%) and wolves (35%). Most grizzly bear predation occurred within the first 4 weeks (73%). Most wolf predation also occurred during the first month of the calves life but has continued through the winter. Accidents and calf abandonment accounted for the nonpredation calf mortality (13%) that occurred between May and January.

Predation was the most significant limiting factor to the FCH from 1982 to 1987 (Valkenburg and Davis 1989). In Denali National Park, Adams et al. (1989, in press) found grizzly bears to be the major predator on caribou calves during the late 1980s. However, between 1990 and 1992, wolves became the primary predator. In the FCH, wolf predation has been the major

cause of adult female mortality for at least the past 10 years and, since 1991, appears to have been the major cause of death for calves. Gasaway et al. (1992) found that wolves in Unit 20E selected moose over caribou during the early to mid 1980s but based on moose composition data and mortality data collected from radiocollared caribou, area wolves have switched to caribou during the 1990s.

The impacts of predation, other sources of mortality (drowning, abandonment, disease, etc.), and harvest by humans on the growth of the FCH were 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) the area's wolf and bear population size estimates; and 3) bear and wolf predation rates on Fortymile caribou since 1991. The model indicates that presently wolves and bears combined are removing 20% of the postcalving population while people are removing < 2%. The model predicted that the FCH would increase significantly if predators were reduced. Further reduction of harvest will have little effect on population growth.

Disease has not been a factor in limiting the FCH based on the results of periodic blood testing. In 1992 we tested Fortymile caribou for exposure to 6 types of respiratory diseases and found none.

Habitat and Nutritional Status

Assessment: Range condition was evaluated by determining the % lichen fragments in relation to the % moss in Fortymile caribou fecal samples. During 1991 and 1992 range conditions were excellent as evidenced by high proportions of lichen fragments (72%-81%) and a low proportion of mosses (8%). Fecal samples from overgrazed winter ranges contain a relatively high proportion of mosses (Boertje 1981).

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, clear nutritional stress has not been detected (Boertje et al., in press). In 1993 low pregnancy rates (66%, n = 47) likely resulted from the short growing season in 1992. Also, high adult mortality during 1989-1992 may have been related in part to stress from adverse weather.

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

CONCLUSIONS AND RECOMMENDATIONS

The FCH increased through the 1980s at an annual rate of 5%-10%. Since 1990 the herd has declined by 2.9% and in July 1994 22,104 caribou were counted. We initiated a study to evaluate harvest by humans, range quality, predation, disease, and weather as possible factors limiting herd growth. We found that predation by wolves was the primary limiting factor. Wolves were the primary cause of death for Fortymile caribou > 4 months old (81.5%) and a major cause of calf mortality. Predators, primarily wolves, were estimated to kill about 22% of the postcalving population annually, while harvest removed less than 2% annually. However, between 1989 and 1993 unfavorable weather conditions and associated nutritional stress also likely contributed to reduced herd growth.

Hunters have harvested < 2% of the Fortymile caribou population for 18 of the past 21 years. During this period of reduced caribou harvest the herd declined in some years and grew slowly (< 10%) in others. These minor fluctuations have been driven by weather and predation. Hunting has had an insignificant influence on herd size and a minor influence on composition. Even under current hunting regulations the possibility exists that harvest could affect the FCH if the illegal taking of cows increases. Because of the restrictive caribou hunting regulations in other road accessible parts of the state, many first time caribou hunters are participating in the Fortymile hunt. Inexperienced caribou hunters are the most likely to misidentify caribou and accidently shoot a cow. To reduce the possibility of an excessive cow harvest, I recommend we require hunters with less than 3 years of Alaskan residency to pass a caribou identification test prior to hunting Fortymile caribou.

A complicated management situation has developed because of the increased interest in the FCH. Because the annual harvest quota is low and most other Interior herds are closed, competition between hunters for Fortymile caribou has increased significantly. Hunters remain supportive of management designed to restrict harvest to benefit the herd but are becoming dissatisfied with how the harvest quota is allocated. The hunters most dissatisfied are residents of the herd's range. Federal subsistence regulations give these residents some benefits but there is no significant amount of accessible federal land within the herd's range.

A Fortymile Caribou Management Team has been created to develop recommendations concerning herd growth, harvest management, and acceptable management techniques. The team is made up of representatives from the state, federal, and Yukon agencies and 19 members of the public. The team's goal is to present an interim harvest management plan to the BOG and to the FSB in April 1995 and a completed comprehensive management plan by November 1995. The boards have been briefed on the team's direction and objectives and are expected to delay any major management decisions concerning the FCH until the plan is completed.

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Table 1. Fortymile caribou fall composition counts and population size, 1986-1994.

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

Table 2. Fortymile caribou mid to late June composition counts[a], 1985-1994.

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.

Table 3. Seasons and bag limits for the Fortymile Caribou Herd, 1987-1994.

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

Table 3. Continued.

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

Table 3. Continued.

Regulatory year	Unit 20B SE of Steese		Unit 20D N of Tanana R.		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
					WEST: 8/10-9/20 1 bull 8/10-9/30[e] 12/1-2/28[e] 1 caribou			
1993-1994	8/10-9/20[c] 1 bull	No open season	8/10-9/20 1 bull	No open season	8/10-9/30[ce] 1 bull 12/1-2/28[ce] 1 bull	8/10-9/30[f] 1 bull 12/1-2/28 1 bull[f]	8/10-9/30[ce] 1 bull 12/1-2/28[ce] 1 bull	8/10-9/30[f] 1 bull 12/1-2/28[f] 1 bull
1994-1995	8/10-9/20[c] 1 bull	No open season	8/10-9/20[c] 1 bull	No open season	8/10-9/30[ce] 1 bull 12/1-2/28[ce] 1 bull	8/10-9/30[f] 1 bull 12/1-2/28 1 bull[f]	8/10-9/30[ce] 1 bull 12/1-2/28[ce] 1 bull	8/10-9/30[f] 1 bull 12/1-2/28[f] 1 bull

[a] No separate season.
[b] Subsistence hunters or residents domiciled in communities or units in rural areas as defined by joint game boards.
[c] Registration hunt.
[d] Drawing permit for resident hunters only.
[e] Definition of subsistence hunter changed to include any resident of the state, December 1989.
[f] Registration hunt for federal subsistence users only.

Table 4. Reported Alaskan Fortymile caribou harvest by type of hunt, 1989-1994.

Hunt number	Regulatory year	Permits issued	% Did not hunt	% Successful hunters	% Unsuccessful hunters	Harvest Bulls	Harvest Cows	Harvest Unk	Total harvest[a]	Notes
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	1990-1991	1478	29	25	75	238	18	8	265	
permit	1991-1992	1864	21	23	77	335	1	1	337	
	1992-1993	973	17	34	66	262	10	0	272	
	1993-1994	2809	22	15	85	325	10	0	335	
	1994-1995[d]	2406	15	16	84	214	12	0	226	
General	1987-1988			25	75	142	0	0	142	561 hunter reports
hunt	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
Federal	1991-1992	20				4	0	0	4	
hunt	1992-1993	244	18	39	61	59	12	11	82	
(575)	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 Bulls	Cows	Unk	Total harvest[a]	Notes
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[e]	2406	15	16	84	214	12	0	226	

[a] Total harvest does not include harvest occurring in Canada. Canadian harvest since 1973 has been less than 20 caribou per year.
[b] Hunt 575 renamed RC865 in 1993.
[c] Harvest may include 44 Nelchina/Mentasta caribou taken from southern portion of Unit 20E and 1 Macomb caribou from northern Unit 12.
[d] Canadian harvest was estimated to be 50 additional caribou.
[e] Preliminary harvest results.

Table 5. Fortymile caribou harvest and accidental death, 1985-1994.

Regulatory year	Hunter harvest							Yukon harvest	Total
	Reported[a]				Estimated				
	M	F	Unk	Total	Unreported[b]	Illegal	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[d]	214	0	0	214	0	12	226	7	233

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

Table 6. Fortymile caribou hunter residency and success of hunters reporting residency, 1989-1994.

Regulatory year	Successful				Unsuccessful				Total hunters
	Local[a] resident	Nonlocal resident	Nonresident	Total (%)	Local[a] resident	Nonlocal resident	Nonresident	Total (%)	
1989-1990	291	56		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[b]	31	121	11	163 (11)	210	1136	9	1355 (89)	1518

[a] Residents of Unit 12 north of Wrangell/St. Elias Unit 20E or Unit 20D.
[b] Results from fall hunt only.

Table 7. Fortymile caribou fall harvest by time period, 1987-1994.

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

[a] Between 1 September and 10 September 189 caribou were harvested.
[b] Data from registration permit only.
[c] An additional 231 caribou were harvested between 1 October and 31 December.
[d] Closed by Emergency Order.
[e] State season was closed by Emergency Order 14 August 1992.

Table 8. Fortymile caribou harvest percentage by transport method, 1987-1994.

Regulatory year	Percent of harvest									
	Airplane	Horse	Boat	3-or 4-wheeler	Snowmachine	ORV	Highway vehicle	Walking	Unknown	*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[e]	22	0	1	46	2	9	15	0	5	150

[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 Unit: 20F, 21C, 21D, and 24 (48,000 mi^2)
Herd: Galena Mountain, Ray Mountains, Wolf Mountain
Geographical Description: Galena Mountain, Kokrines Hills, and Ray Mountains

BACKGROUND

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

The origin of these herds is unknown, but some residents believe these animals are feral reindeer from a commercial reindeer operation in the Kokrines Hills. The reindeer venture ended around 1935, but there is no evidence of reindeer characteristics in the population. Others believe the herd originated from the Western Arctic Caribou Herd (WACH), which occasionally migrates to this area during winter. The mid May calving dates indicate that the animals are caribou. Local residents have been aware of these *Rangifer* herds for many years, but the herds were not surveyed by ADF&G until 1977.

There are 3 distinct calving areas and 3 recognized herds. Each herd is associated with and named for a mountain peak or mountains where the animals calve. The western group of approximately 250-500 animals typically calves east of Galena Mountain and winters west of the mountain. The middle group calves on Wolf Mountain and winters to the north and east in the Melozitna and Little Melozitna River drainages, overlapping with the Galena Mountain Herd. The Wolf Mountain Herd contains approximately 250-500 animals. The eastern group calves on the north side of the Ray Mountains and winters throughout the Ray Mountains but primarily in the Kanuti-Kilolitna drainage. The 1990 population estimate for the Ray Mountains Herd was 500-1000 animals.

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

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

MANAGEMENT DIRECTION

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

Management Goals

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

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

Management Objectives

Ray Mountains Herd:

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

- Determine major mortality factors by 1997.

Wolf Mountain Herd:

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

Galena Mountain Herd:

- Promote expansion 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 occur in the same wintering grounds.

METHODS

Caribou from the Galena Mountain Herd were monitored through a cooperative radiotelemetry study involving US Fish and Wildlife Service (FWS), US Bureau of Land Management (BLM), and ADF&G. In April 1992, 8 adult females, 2 female calves, and 10 adult male caribou were radiocollared on the winter range north of Galena. In October 1993, 4 additional female calves were collared. In October 1994, 9 female calves were captured and 8 were radiocollared. During October 1994, 20 female calves were captured and collared in the Ray Mountains and 3 female calves were collared in the Wolf Mountain area.

We conducted annual surveys with a Super Cub and a Robinson-R22 helicopter on the Galena Mountain Herd in October. A survey was conducted in the Ray Mountains in October 1994. We monitored hunting mortality from caribou harvest reports and interviews with local residents.

Standard morphometric measurements were taken on all caribou captured and blood was withdrawn for sera's antibody testing and mitrochrondrial DNA (mtDNA) analysis. M. Cronin, LGL Research Associates, Anchorage conducted the mtDNA analysis.

RESULTS AND DISCUSSION

Population Status and Trend

Population Size: The Galena Mountain Herd has never been censused but it probably contains from 300 to 500 caribou. The highest number of caribou seen was 260 in December 1991 (Table 1). Its population trend is unknown, but is suspected to be stable. Although radiocollaring caribou in this herd was expected to help locate caribou for census purposes during the October rut aggregation, use of the collars has not increased the number of caribou found. However, the use of radiocollars has revealed that during the rut the herd uses habitat composed of fairly dense black spruce where it is difficult to see caribou. Surveys or censuses of summer or postcalving aggregations may provide the best estimates of population size.

No fall composition surveys in the Wolf Mountain area have been conducted (Table 2). The highest count during June surveys was 595 caribou. Based on these counts I estimate the population of the Wolf Mountain Herd to be 600-850 caribou, which is higher than previous estimates. The population trend is unknown and the increase in estimated population could be because of better surveys.

In the Ray Mountains the previous population estimate of 500 (Robinson 1988) was based on a survey of all known upland ranges, but did not include the Caribou Mountain area. During October 1994 all caribou in the upper Kilolitna River were counted (Table 4). The weather conditions were fog and snow, thus counts are minimum numbers of caribou. We did not include the Caribou Mountain area nor any other drainages of the Ray Mountains. I estimate the present Ray-Caribou Mountain population to be 1000-1500 animals. The population trend of the herd is unknown. Harvest is low and predation is probably the main limiting factor.

Population Composition: Previous counts of the 3 herds were sometimes done with fixed-wing aircraft, and therefore not all yielded composition data (Tables 1-4). The fall surveys starting in 1992 were done with an R-22 (Robinson) helicopter. In the Galena Mountain Herd the bull:cow ratio has been declining but it may be due to failure to count segregated bull groups. The calf:cow ratio has been increasing which is an encouraging sign following years of poor recruitment (Osborne 1993; Tables 1 and 2).

Distribution and Movements:

Galena Mountain Herd. Caribou usually migrate toward alpine areas east of Galena Mountain in April. All radiocollared caribou were in alpine areas from June to September in all years. A few bulls have been seen along the Yukon River and north of Galena in September. During October caribou usually migrate from alpine areas across Galena Mountain toward the lake country around Hozatka Lakes where they winter. In 1993 and 1994 during rut, the caribou have been found farther south in either the north fork of Bear Creek or on the flats west of Hourglass Lake. After rut they wintered in their usual area (Fig 1). Figure 1 is based on 401 relocations of 26 radiocollared caribou.

No WACH were found within the range of the Galena Mountain Herd during this report period.

The mean body weights of Galena Mountain Herd calf caribou taken in October are the heaviest of any calves measured in Alaska (Valkenburg 1995). The mean weight of 9 female calves in 1994 was 143.4 lbs.

Wolf Mountain Herd. Based upon tracks encountered during surveys in the early 1980s, a general migration pattern for the Wolf Mountain Herd was hypothesized. The herd calves on the slopes of Wolf Mountain and spends most of the summer in the surrounding alpine habitat. During October it moves northward toward Lost Lakes on the Melozitna River. The location of the herd during midwinter has not been recently determined, but in 1978 caribou were seen on the mountains north of the Melozitna River. During May 1982 caribou were observed in a 30-mi long line from Gold Hills toward the calving areas on Wolf Mountain. There were old tracks leading from the middle Little Melozitna River toward the Gold Hills.

In October 1994 approximately 500 caribou were seen in the Hot Springs Creek area during collaring activities. When more caribou are collared we should have better data on their yearly distribution.

Preliminary analysis of mtDNA indicates that none of the 22 Galena Mountain Herd animals or 3 Wolf Mountain Herd animals contained any unique reindeer genotypes (M. Cronin, pers commun).

Ray Mountains Herd. Previously there have not been any radiocollared caribou in the Ray Mountains, and the movements of the Ray Mountains Herd are not well known. Robinson (1988) found them north of the Ray Mountains and on the southern slopes in the upper Tozitna River drainage. Based on the trails he found, he suspected that this herd makes seasonal migrations between the 2 areas. During late October 1991, several hundred caribou were seen along the Dalton Highway near Old Man. Small groups of 10-20 male caribou are regularly seen in March near Sithylemenkat Lake. In March 1991, 200 caribou were seen in the Kanuti Lake area, but it is unknown if they were from the Ray Mountains Herd or Western Arctic Herd.

From October 1994 to January 1995 the newly collared caribou stayed within the Kilolitna River drainage.

Mortality

Harvest: During the 1992-1994 hunting seasons caribou were reported taken (Table 5) from each of the herds but mostly from Ray Mountains. 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 has been closed during this time to limit the potential for a serious overharvest. The Wolf Mountain Herd is almost never accessible for hunting because of the scarcity of aircraft landing areas. A guide using horses was able to access a limited part of the herd's range and harvest slightly increased. Success of hunters in all 3 herds is limited (Table 6).

The total 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. These caribou are usually bulls that occasionally wander to the river during September. In addition, 5-7 caribou are thought to be taken by hunters using snowmachines from Tanana.

Season and Bag Limit.

Units and Bag Limits	Subsistence/ Resident Open Seasons	Nonresident Open Seasons
Unit 20(F) Tozitna River drainage.		
Subsistence and Resident Hunters: 1 caribou; however, only bull caribou may be taken during the 10 Aug-30 Sep season.	10 Aug-30 Sep 1 Dec-30 Dec 1 Mar-15 Mar	10 Aug-30 Sep 1 Mar-15 Mar
Nonresident Hunters: 1 bull.		10 Aug-30 Sep
Units 21B, 21C and that portion of Unit 21(D) north of the Yukon River and east of the Koyukuk River. 1 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. 1 bull.	10 Aug-30 Sep	10 Aug-30 Sep
Unit 25D, drained by the west fork of the Dall River, west of 150° W. Long. One bull.	10 Aug-30 Sep	10 Aug-30 Sep

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

Board of Game Actions and Emergency Orders. In March 1991 the Alaska Board of Game issued Emergency Order authority to the Department of Fish and Game to open a portion of Unit 21D when WACH are present. A bag limit of 2 caribou was established. This action allows hunters the opportunity to take caribou while protecting the smaller Galena Mountain Herd which may be intermixed with the WACH. During this report period this authorization was not used.

Other Mortality: Judging from fall calf percentages (Tables 1-4), natural mortality of caribou calves is high in all 3 herds. Black bears are probably the primary calving grounds' predators as they are often seen during calving surveys in the Galena Mountain area. Grizzly bears are found throughout the calving ranges of all 3 herds. In 1992-1994, there were 80-100 wolves in 11-12 packs in Units 24, 21C, and 21D Galena and Wolf Mountain caribou ranges. In the Ray Mountains within southern Units 24 and 20F are at least 2 packs of wolves with 16 members.

We collared 20 caribou north of Galena in April 1992. Of those, 3 were killed by wolves in the first month and 1 died of unknown causes in September. In 1993, 3 more caribou were killed by unidentified predators in June in the alpine tundra. In 1994, 2 more collared caribou were killed by unknown predators; 1 in April in black spruce and the other in October. Lack of helicopter availability during the late summer hinders our ability to positively identify the predators responsible.

CONCLUSIONS AND RECOMMENDATIONS

The mountains between Galena and the upper Hodzana River on the north side of the Yukon River contain from 1800 to 2750 caribou in 3 herds centered around 3 main calving areas. Although open caribou hunting seasons exist, due to limited access few caribou are taken by hunters. The management objectives for these caribou herds include expansion of the herds until they are large enough that their movements make them more accessible to hunters during

fall. Predation is probably restricting herd growth; 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. The large body size and heavy weight of calves and adults in the Galena Mountain Herd also indicate they are not limited by nutrition.

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

I recommend that the portion of Unit 25D that is set aside to limit harvest on any Ray Mountains caribou that might be found within the area be deleted from the regulations. No caribou have been harvested from the area in the last 10 years and there have been no reports of caribou in the area. If some Ray Mountain caribou would stray into the area the bow hunt only regulations along the Dalton Highway would prevent anyone from taking the limit, 10 caribou as in the remainder of Unit 25.

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Table 1. Galena Mountain Herd caribou fall composition counts, 1991-1994.

Date	Bulls:100 cows	Calves:100 cows	Calves	Cows	Bulls	Total
12/91	--	--	--	--	--	260
10/92	40	7	9	123	49	181
10/93	32	25	41	165	53	259
10/94	22	40	46	115	25	211

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

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

Table 3. Aerial counts of caribou from Wolf Mountain Herd, 1991-1994.

Date	Cows	Calves (%)	Bulls	Total
6/91	117	18 (12)	11	146
6/92	--	--	--	595
1993[a]	--	--	--	--
5/94	337	121	16	474
1/95	--	--	--	194

[a] No surveys.

Table 4. Ray Mountains Herd caribou composition counts, 1991-1994.

Date	Bulls:100 cows	Calves:100 cows	Calves (%)	Cows	Bulls	Total
6/91	--	31	93 (21)	--	--	446
6/91	--	--	58 (19)	--	--	303
10/91	--	--	--	--	--	140[a]
10/94	--	--	--	--	--	652
10/94	37	19	78 (12)	403	148	629
1/95	--	--	--	--	--	684

[a] Caribou Mountain portion only.

Table 5. Reported harvest of caribou by herd in Units 20F, 21C, and 24, 1990-1994.

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

Table 6. Galena Mountain, Wolf Mountain, and Ray Mountains caribou hunter residency and success, 1990-1994.

	Successful				Unsuccessful				
Regulatory year	Local resident	Nonlocal resident	Nonresident	Total	Local resident	Nonlocal resident	Nonresident	Total	Total hunters
1990-1991	0	4	0	4	3	23	3	29	33
1991-1992	0	3	0	3	2	28	0	30	33
1992-1993	0	2	2	4	1	7	2	10	14
1993-1994	1	8	1	10	0	15	2	17	26
1994-1995	1	3	2	6	1	15	0	16	22

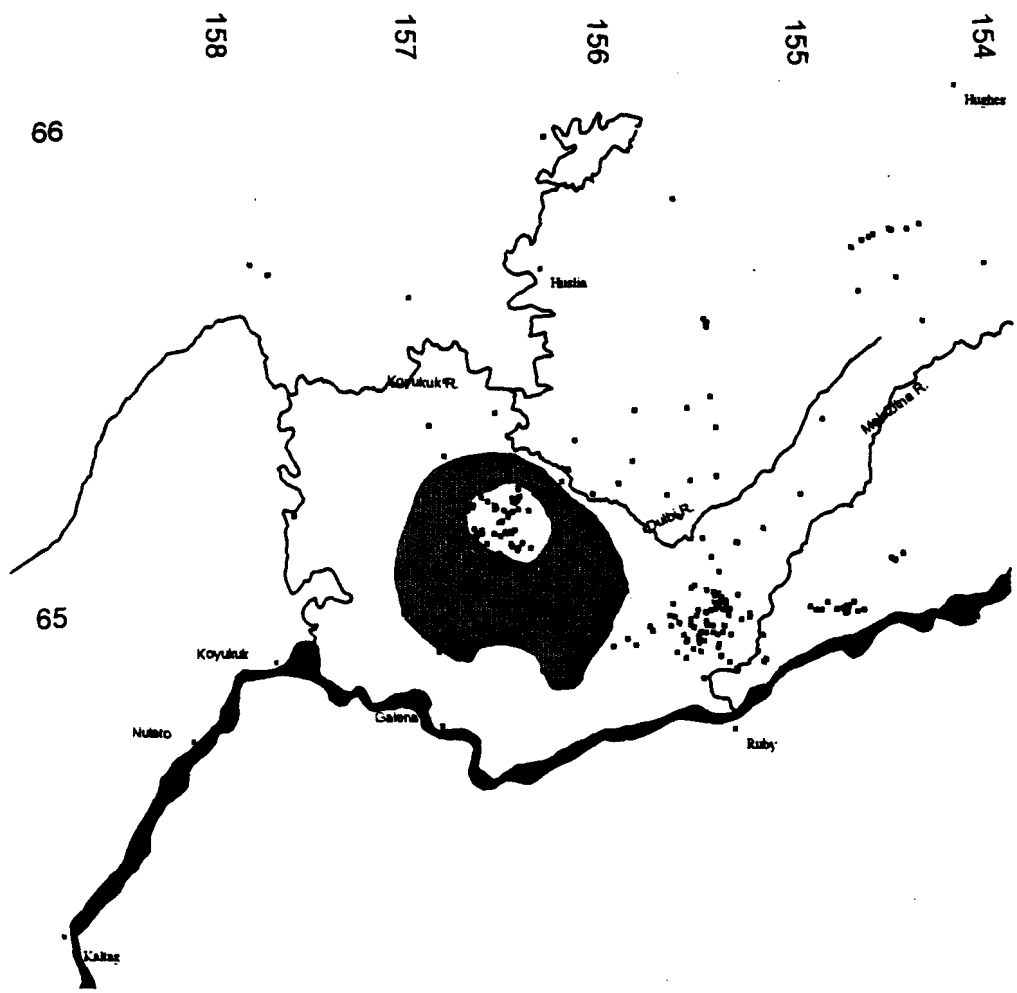

Figure 1. Galena Mountain Herd caribou range, Alaska 1986-1994, wintering area shaded.

LOCATION

Game Management Unit: 21D, 22A, 22B, 23, 24, and 26A (140,000 mi^2)
Herd: Western Arctic
Geographical Description: Northwest Alaska

BACKGROUND

The Western Arctic Herd (WAH) currently ranges over approximately 140,000 mi^2 of remote mountainous, boreal, and tundra habitats in northwest Alaska. The main body of the herd has continued to calve north of the Brooks Range in Unit 26A, and large numbers of WAH animals have ranged into Units 21D, 23, 24, and the eastern portion of Unit 22 during the remainder of the year.

Historically, the WAH has fluctuated greatly in size. Herd size was estimated at 240,000 caribou during the early 1970's (Hemming 1971). However, herd size had declined to about 75,000 caribou by 1976 (Davis and Valkenburg 1978). Results of biennial photocensuses since 1976 indicate that the WAH has grown in size at rates varying from 7 to 22% annually (Machida 1991, Larsen et al. 1990). Results of the most recent photocensus conducted during July 1993 indicated that the herd numbered at least 450,000 caribou. Although hunter harvest reporting rates have remained low in recent years, we believe that harvests have remained below sustained yield limits.

MANAGEMENT DIRECTION

1 To maintain a post-calving population of at least 200,000 caribou.

2 To minimize conflicts with the reindeer herding industry.

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

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

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

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

7 To develop a co-management program for managing the herd involving the Department, federal agencies and local organizations.

METHODS

As reported in past progress reports, conventional VHF radiotelemetry was the primary means of collecting most WAH survey and inventory data. We have attempted to maintain a minimum of 100 functioning VHF radiocollars on living WAH caribou since 1987. During this reporting period, all but 5 of the VHF collars were equipped with a model 600 conventional transmitter manufactured by Telonics, Inc. (Mesa, AZ). The other 5 collars were equipped with model LMW conventional transmitters manufactured by AVM Instrument Co. (Livermore, CA). All VHF transmitters were equipped with a 5-hour delay mortality mode. All VHF radiocollars were deployed at Onion Portage on the Kobuk River during this reporting period. Details concerning collaring procedures were described by Larsen and Machida (1989). Costs of the conventional radiotelemetry program were largely paid by the Department with assistance from the National Park Service (NPS), U.S. Fish & Wildlife Service (FWS), and Bureau of Land Management (BLM).

Twelve radio collars were also equipped with a platform satellite transmitter (PTT) manufactured by Telonics, Inc. Six of these PTT's were deployed during 1992 (4 at Onion Portage and 2 near Anaktuvuk Pass), and 6 at Onion Portage during 1993. All PTT's were deployed on cow caribou. Costs of the PTT's were shared by the Department, NPS, FWS, and the North Slope Borough.

During early September 1992, 44 caribou (14 bulls and 30 cows) were radio-collared, and blood samples (approximately 30 cc each) were collected from 61 caribou (40 bulls and 21 cows). During early September 1993, 31 caribou cows were radio-collared, and blood samples were collected from 62 caribou (26 bulls and 36 cows). Serum was collected from each blood sample to be analyzed for antibodies of selected pathogens.

Since 1992, elementary through high school students from the NANA region and the North Slope Borough have participated in the collaring project at Onion Portage. This has involved presentations to the students on radiotelemetry techniques, the biology and management of WAH caribou, educational requirements for becoming a wildlife biologist, the state wildlife regulatory system, and many other topics. In addition, the students have actively participated in collaring caribou. Two schools have had local elders or active hunters chaperone the students and teach them traditional aspects of hunting caribou. So far, students from Noorvik, Selawik, Kiana, Ambler, Barrow, and Nuiqsuit have participated in the collaring program.

During late April and early May of 1992 and 1993, Department staff completed short yearling composition surveys in Unit 23 using a Piper PA-18 aircraft while caribou were migrating from wintering areas in Units 22 and 23 to the calving grounds in Unit 26A. Radiotelemetry was used to locate collared animals, and up to 200 caribou in the immediate vicinity of the collared animal were classified as either adults or short yearlings. The use of radiotelemetry

allowed us to allocate sampling effort among the many thousands of migrating caribou encountered. However, sampling has never been objectively distributed throughout the entire herd because of logistical constraints.

We completed calving ground surveys using a Cessna 185 aircraft during early June of 1993 and 1994 to assess parturition rates and identify calving areas. Radio-collared female caribou were located using radiotelemetry, and each was classified by the presence/absence of hard antlers and whether she was accompanied by a newborn calf. In addition, up to 200 caribou (except large bulls) in the immediate vicinity of each collared animal were classified as either adults or calves.

Fall composition counts were completed during October of 1992 and 1993. A Department aircraft flew at altitudes of 4,000 to 10,000 feet and directed a Robinson R-22 helicopter with 1 observer into the general area where radio collars were heard. A variable "grab sample" of caribou from each area were identified as bulls, cows or calves. Poor weather hampered sampling during 1993, and relatively few collars were located. Composition was recorded only near Galena and a portion of the Nulato Hills.

At periodic intervals during the fall and winter, Department staff conducted radiotelemetry flights to assess herd distribution on winter ranges. In most cases, we flew at altitudes of 8,000 to 10,000 feet to obtain maximum signal reception range, and only general locations were obtained. Flights were completed in Units 21D, 22A, 22B, 23, 24, and 26A.

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

RESULTS AND DISCUSSION

Population Status and Trend

Population Size: The WAH increased dramatically since 1976 when the herd was estimated to contain a minimum of 75,000 caribou (Table 1). From 1979 to 1990, the annual growth rate of the WAH averaged 14%. In contrast, the annual growth rate was $\leq$3% from 1990 to 1993. In fact, the WAH may not have grown at all between 1990 and 1993. During the 1993 census, a new large format camera was used which produced higher quality prints than in the past. In addition, the final minimum count was adjusted to include caribou that were not photographed during the census on the basis of radio collars not found during the census which were later found on living caribou. Therefore, all or most of the "increase" of 35,000 caribou from 1990 to 1993 was probably attributable to accounting for a higher proportion of the herd in 1993 compared to 1990.

The 1993 photocensus was logistically difficult to complete because the herd did not aggregate in one day. Portions of the herd aggregated over the course of several days in

widely scattered areas on the coastal plain and in the foothills of western Unit 26A. Fortunately, animals from the different aggregations did not mix together, and we were able to photograph the aggregations as discrete units. We experienced similar problems during the 1988 and 1990 photocensuses. If the herd continues to grow in size, we anticipate that future photocensuses using current techniques may become increasingly difficult or even impossible to complete. Use of sampling procedures for estimating herd size may become a necessity in such situations.

A commonly asked question concerns how large the WAH will grow before decline occurs. Our current management objectives stipulate that we will attempt to maintain a minimum population size of 200,000 caribou, but no upper size limit is specified. We do not currently have the necessary demographic and range capacity information to accurately predict an upper population size limit.

Even if we could adequately predict an upper size limit for the WAH, we could not effectively reduce herd size using the management tools currently available due to the large size and remoteness of the herd. Hunting seasons and bag limits are already extremely liberal, and there is some concern among managers and users that increasing hunter harvest opportunity will also increase the incidence of wanton waste.

Population Composition: We completed short yearling surveys in portions of Unit 23 during late April and early May 1993 while caribou were migrating north to the calving grounds, and 5210 caribou were classified yielding a composition ratio of 19 short yearlings per 100 adults (Table 2). We completed short yearling surveys during the same period in 1994 yielding a count of 9956 caribou, and a recruitment ratio of 19 short yearlings per 100 adults. The areas surveyed included the Kobuk River and some associated drainages (Ambler, Redstone, Shungnak, and Kogoluktuk Rivers), portions of the Noatak River drainage and the Baird Mountains, portions of the Selawik drainage, the Selawik Hills, and the western Purcell Mountains. Survey conditions were good to excellent during both years.

We believe the data indicate that short yearling survival may have gradually declined since the early 1980's. However, some investigators have pointed out that several factors affect the usefulness of short yearling composition data for making year-to-year comparisons of recruitment. Variations in the proportion of bulls occurring in the sample, and how the sample units are selected can cause variations in the size of the ratios and percentages observed (McLean and Heard 1988). Although short yearling composition data is probably inadequate for detecting small changes in recruitment, it does appear useful for detecting large-scale changes in recruitment, and as a red flag identifying areas where more refined demographic data are needed. The George River caribou herd which attained high population densities similar to the WAH experienced a decline in short yearling recruitment (8%) which apparently was measurable using standard techniques (Couturier et al. 1988).

Areas surveyed during the 1993 calving surveys included the Noatak River drainage west of Howard Pass, the Wulik and Kivalina drainages, the Kobuk River drainage downriver of Shungnak, the Squirrel River drainage, Baird Mountains, Selawik Flats, and the North Slope

between the Lisburne Hills and Kuna River. We did an exceptionally thorough job of locating radio-collared caribou during the 1993 calving surveys because we needed to account for as many collars as possible in preparation for the photocensus. Caribou appeared to be more dispersed, and a higher proportion of caribou calved east of the Carbon/Disappointment Creek area, during the 1993 calving season than in previous years.

Areas surveys during the 1994 calving surveys included only the North Slope between the Lisburne Hills and Kuna River, western Baird Mountains, Noatak River downstream of the Nimiuktuk River, and the DeLong Mountains west of the Nimiuktuk River. Although approximately 25% of the radio-collared cows were not located, mechanical difficulties with the survey aircraft precluded searching the remainder of the DeLong Mountains or areas further south. Cow caribou which are absent from the calving grounds during the calving period are normally barren. Because we failed to sample these animals, we may have overestimated the parturition rate during 1994. As in 1993, calving appeared to be more dispersed and occurred further east than reported in previous years. Our subjective impression was that many of the caribou located on the calving grounds during the surveys were pregnant but had not yet given birth to their calf. This suggest that calving may had occurred somewhat later in 1994 than in previous years.

In both 1993 and 1994, the parturition rate appeared to be at the low end of the range we have previously observed (Table 3). However, no clear trend is apparent. Given the limitations of the data, the main value of the calving surveys is in delineating important calving areas and providing a red flag for identifying large changes in parturition rates rather than providing rigorous productivity data for population modeling.

Distribution and Movements: During October 1992 through April 1993, we completed 10 radiotelemetry flights to assess the winter distribution of WAH caribou in Unit 22, and in the southern portion of Unit 23. As observed during the previous 5 years, most of the collared animals were concentrated in the Ungalik, Inglutalik, and Shaktoolik River drainages in eastern Unit 22. Caribou remained in this area during the winter before moving north during early April 1993.

We completed 9 radiotelemetry flights in Units 21D, 22, 23, and 24 from October 1993 through March 1994 to assess the winter distribution of caribou. Unlike previous years, high numbers of caribou wintered in eastern Unit 22 and southern Unit 23. Significant numbers migrated south of the Unalakleet River into Units 21E and 18 for the first time in many years.

During the reporting period, 12 collared animals were also instrumented with PTT's. Two animals were collared during the previous reporting period, and the remaining 10 were collared during the fall of 1992 and 1993. We will report the status of 5 collared animals who either died during the reporting period or whose collar went off the air in this report. An update on the status of the remaining PTT's will be provided in the next project report.

We collared a cow caribou (PTT 7870) at Onion Portage during September 1991, and the animal subsequently wintered in the Nulato Hills (Figure 1 and 2). After calving in the Cape

Lisburne area, the animal wintered in the Nulato Hills and in the Koyukuk drainage. The PTT later went off the air while in the Brooks Range north of the Noatak drainage.

We collared another cow caribou (PTT 10905) at Onion Portage during September 1992, and the animal subsequently wintered in the Koyukuk River drainage and Nulato Hills (Figure 3). The animal died north of Galena during mid-winter of 1993.

We collared a cow caribou (PTT 10903) at Onion Portage during September 1992, and the animal subsequently wintered in the Nulato Hills (Figure 4 and 5). As observed for the other animals, this caribou calved in the Cape Lisburne area during June 1993, and wintered in the Koyuk and Buckland River area during 1993-1994 winter. After calving again in the Cape Lisburne area, the animal died north of the Colville River drainage.

We collared another cow caribou (PTT 10914) at Onion Portage during September 1992, and the animal subsequently wintered in the Kugruk, Kiwalik, and Buckland drainages (Figure 6). After calving in the Cape Lisburne area, the animal died in the Baird Mountains of Unit 23 during 1993.

We collared a cow caribou (PTT 10900) at Onion Portage during September 1992, and the animal subsequently wintered in the Buckland and Koyukuk River drainage (Figure 7 and 8). During the following year, the animal wintered in the Nulato Hills, and in Unit 18 south of the villages of Stebbins and St. Michael. This is the farthest south that we have observed a collared WAH animal migrate during recent years.

At the end of the reporting period, approximately 140 WAH radio collars were believed to be functional. Only about 3 caribou per 10,000 animals were radio-collared if we assume a herd size of 450,000. If we wish to improve our ability to assess caribou distribution, particularly during the winter, we should consider collaring additional animals.

Mortality

Harvest:

Seasons and Bag Limits. The hunting season for bulls in Units 22A, 22B, 23, 24, 26A and western 21D was open all year. The season for cows in the same area was open only from July 1 to May 15. The bag limit for Alaska residents was 5 animals per day, and the bag limit for nonresidents was 5 animals.

Human-induced Mortality. The 1992-1993 reported harvest is 2,213 caribou, 64% more than the 1,346 caribou reported in 1991-1992 and 45% less than the high harvest of 4,047 caribou reported in 1985-1986. During the 1993-1994 season, a harvest of 1,485 caribou was reported, a 33% decline from the previous year. We believe that the decline in reported harvest was caused by the unusual distribution of caribou which occurred during the winter months. We cannot be certain whether declines in reported harvests represent an actual harvest decline or poorer reporting rates because harvest reporting rates have remained poor

throughout northwest Alaska. A large proportion of the herd wintered in the southern portion of their range in Units 21 and 22, and were not readily available to many hunters residing in Units 23, 24 and 26.

The number of caribou annually harvested is normally related more to caribou distribution and weather and snow conditions than population size. Harvests normally tend to increase when caribou move near population centers and travel conditions are favorable. Caribou may not have always been available to hunters at opportune times because caribou have wintered further south and east than previously reported.

Hunter Residency. As reported in the last progress report, 80% or more of the harvest reported on the WAH registration system is attributable to local hunters residing within the range of the WAH. The proportion of the harvest taken by local hunters is likely much higher than 80%. Harvests reported by non-local hunters through the statewide harvest ticket system have remained stable during the past 5 years.

Harvest Chronology. Because harvest dates are not requested on the WAH harvest report form, we do not have data concerning harvest chronology. However, we believe that harvest patterns documented in past progress reports have not changed significantly. Caribou taken during the fall are harvested primarily during late August through early October, and caribou taken during the winter are harvested primarily during January through April.

Natural Mortality: The overall adult mortality rate determined from radio-collared caribou between October 1992 and September 1993 was roughly 17-22%. This range is not a statistical confidence interval. Instead, it represents the uncertainty of determining the specific year when a collared caribou perished, and of determining how many radio collars are active on living caribou during any specific time period. Between October 1, 1992 and September 30, 1994, as many as 137 collars were active on living caribou at the start of this period (radio collars are considered active up to 2 years after last being located). Twenty-three caribou were known to have died during this period. An additional 7 collared caribou were first found dead during this period, but may have died during the previous year. More effort was invested in accounting for all active radio collars 1-week prior to the 1993 photocensus than during other years. This may explain the higher mortality rate during 1992-93 compared with prior years. Between October 1, 1993 and September 30, 1994, the adult mortality rate was 12-16%. From 1984-1985 through 1993-1994, the mean mortality rate determined from radio-collared caribou was 15% (SD=5, n=10). The overall mortality rate (all years combined: 138 mortalities in 920 "caribou years") was also 15% with a 90% binomial confidence interval of 13-17%.

Results of the serology tests from blood samples in 1992 and 1993 gave no indication that disease was affecting the population dynamics of the WAH. However, no serum samples have yet been analyzed for the incidence of *Brucella sius*. Trends in levels of incidence for various pathogens, if present, will not be evident for at least several more years of sampling.

Habitat

Assessment: As the WAH continues to increase in size, many individuals are concerned about the possibility of deteriorating habitat conditions. Reports of sporadic starvation among caribou wintering on the North Slope during recent years heightens our concerns of deteriorating range conditions. Due to the enormous expense involved and the remoteness of most WAH ranges, extensive range inventory work has not been conducted in recent years. However, staff from the U. S. Bureau of Land management do plan to complete preliminary range assessment work in the Nulato Hills during the next project period.

Assessment of animal body condition could provide data for monitoring herd nutritional status, and, indirectly, range condition. A body condition research study for the WAH was initiated during 1992, and a progress report will be published separately this year.

While radiocollaring caribou during early September 1993, we observed roughly 25-50% of adult male and female caribou with no subcutaneous fat and little or no internal fat, and some very small calves. For caribou in poor condition, even muscle tissue was less developed than in previous years. In contrast, some caribou were very fat. Our observations agreed with many observations by local hunters throughout the region. Since at least 1988, virtually no thin mature bulls were observed during the fall collaring operations, and there were no reports of thin bulls from local hunters. The high incidence of thin caribou prior to rut, especially for bulls, indicates that caribou left their summer range in poor condition. Because caribou rely heavily on emergent forbes and green vegetation during summer, and because WAH caribou occupy a large expanse of tundra and mountainous habitat during summer, it is hard to imagine that summer range condition was poor. The effects of intense within-group competition for food and of severe trampling of all vegetation that occurs when caribou form very large aggregations may more likely be responsible for the poor body condition than summer range deterioration. Weather indirectly affects the magnitude and duration of caribou aggregations and behavior by mediating activity levels of mosquitoes (*Adedes* spp.) and oestrid flies (Oestridae) (Dau 1986). Levels of insect harassment during the summer of 1993 were unknown.

CONCLUSIONS AND RECOMMENDATIONS

The WAH has continued to grow at a rate of 3 to 22% annually since 1976. A photocensus conducted in 1993 indicated that the herd attained a minimum size of 450,000 caribou, and survey and anecdotal information collected during the reporting period indicates the herd may be stabilizing in size. If short yearling surveys indicate that recruitment is beginning a long-term decline, we may need to go back to a biennial photocensus schedule to more adequately monitor population size.

A management problem that has not been adequately resolved is continued poor harvest reporting. Anderson and James (1986) estimated that reported harvest may account for as little as 25% of the actual harvest. Reports from our Subsistence Division staff indicate that

only 11% of the harvest is reported. If herd size declines substantially, accurate harvest data will be required for making meaningful management decisions. Additional efforts to improve harvest reporting rates are recommended.

As the WAH has increased in size, conflicts with the reindeer herding industry have become more substantive. Reindeer herds near Buckland and Koyuk were essentially wiped out by WAH animals despite intensive efforts by herders to protect their herds. Department staff should continue to work with the herders and industry representatives to minimize conflicts between caribou and reindeer by informing them of known significant caribou movements in and adjacent to reindeer ranges.

Nutrition and range status are becoming important concerns as herd size increases. Because range studies have traditionally been conducted by various federal land management agencies, the Department should continue to encourage the development of an adequate range assessment program by these agencies. These types of studies tend to be costly, and a range assessment program will probably need to be a multi-agency effort. In addition, continued development of cost-effective techniques to track body condition of WAH animals are recommended.

As previously mentioned, use of radio-collared animals has greatly enhanced our ability to conduct survey/inventory work on the WAH. Collaring additional animals will improve our ability to conduct the photocensus if herd size continues to increase. Additional collared animals will also improve our assessment of winter range distribution. If we wish to better account for use of winter ranges in northern Unit 23 and the North Slope, and to better evaluate mortality rates of collared animals, additional tracking flights are recommended.

Current hunting seasons and bag limits for the WAH are extremely liberal, and we believe most hunters who wish to harvest caribou have adequate hunting opportunity. Although the herd can sustain additional harvests, further liberalization of the regulations will probably not significantly increase the number of caribou harvested. No changes in seasons or bag limits are recommended at this time.

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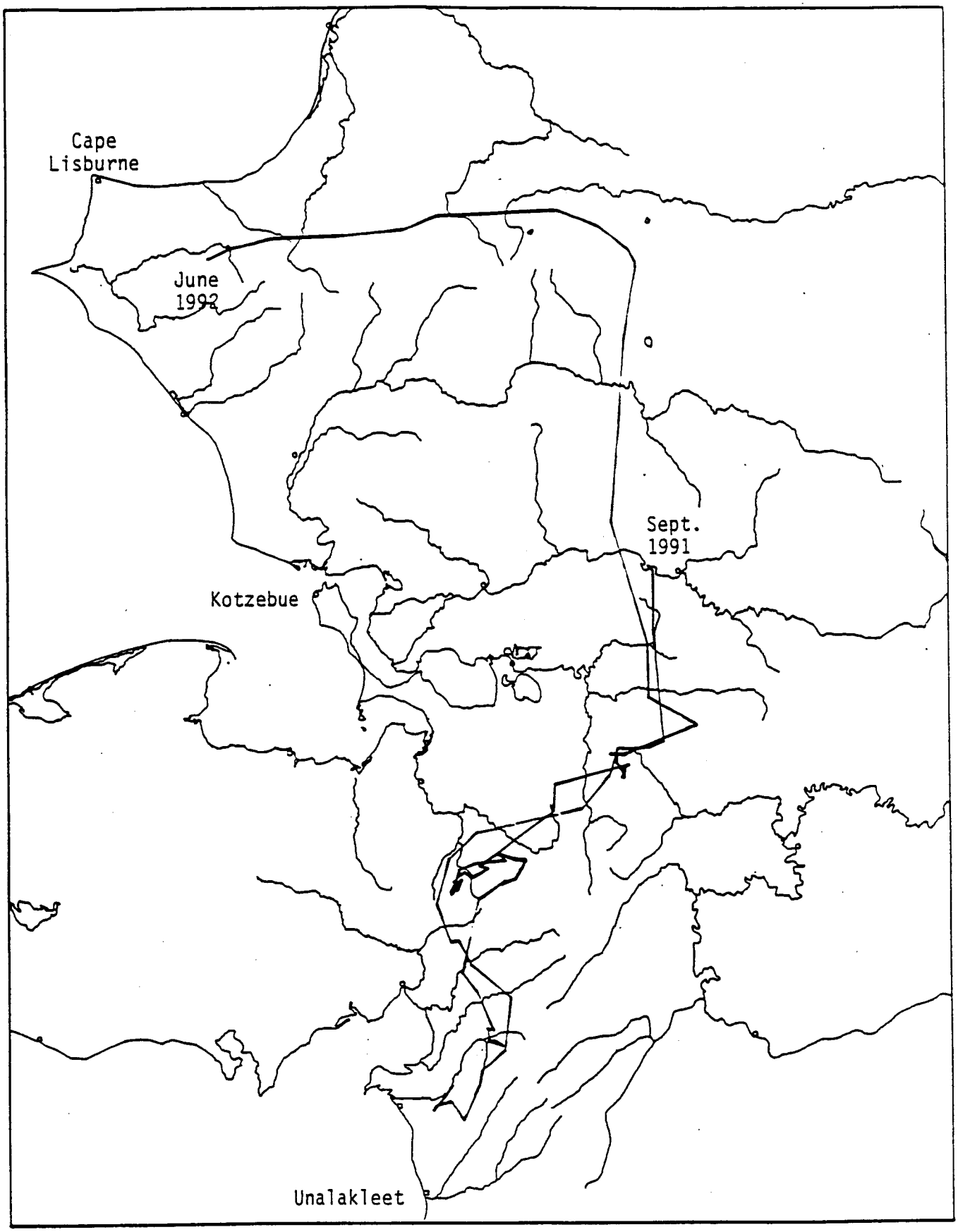

Figure 1. Movement of satellite-collared cow caribou (PTT 7870) from early September 1991 through June 1992.

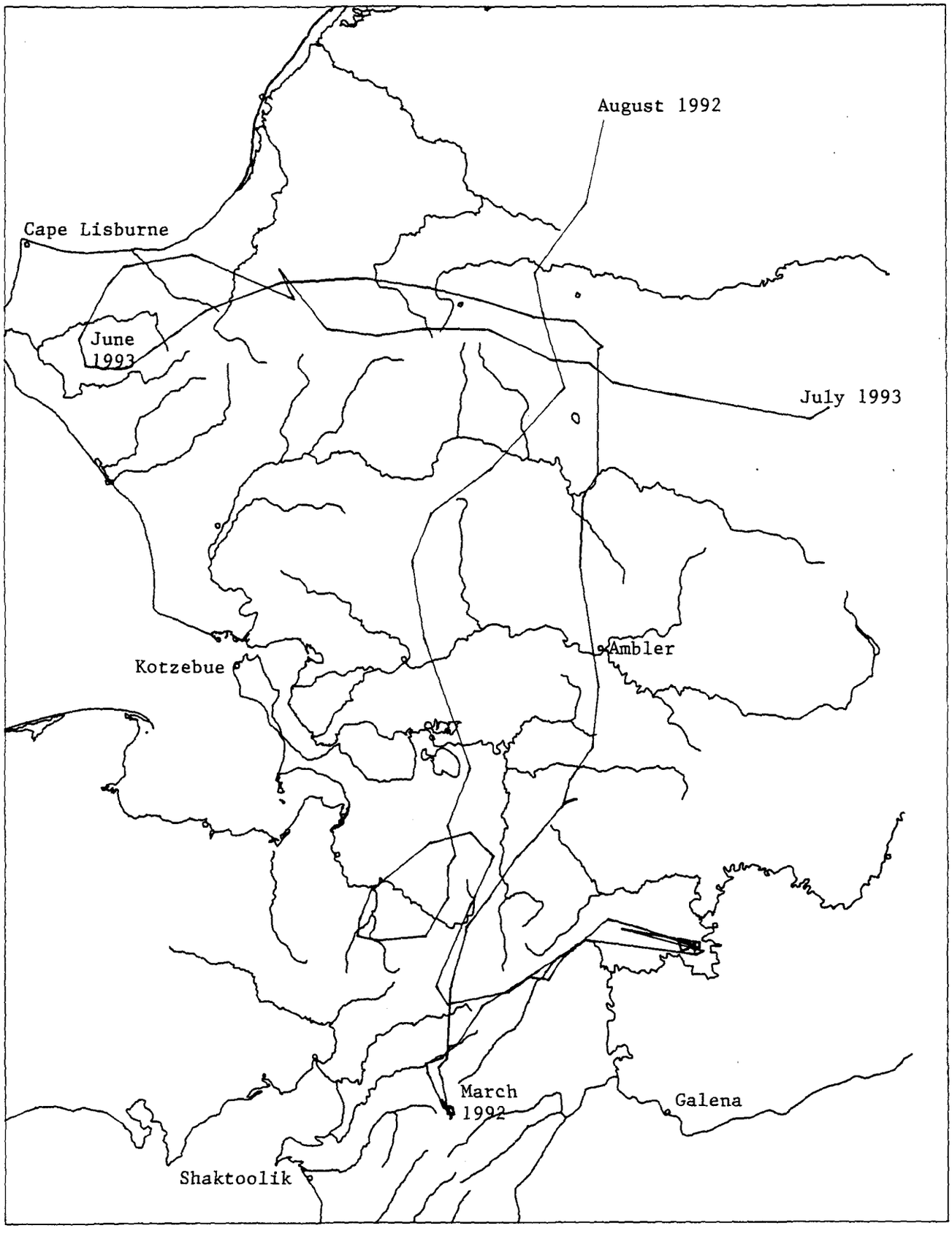

Figure 2. Movement of satellite-collared cow caribou (PTT 7870) from early August 1992 through mid-July 1993.

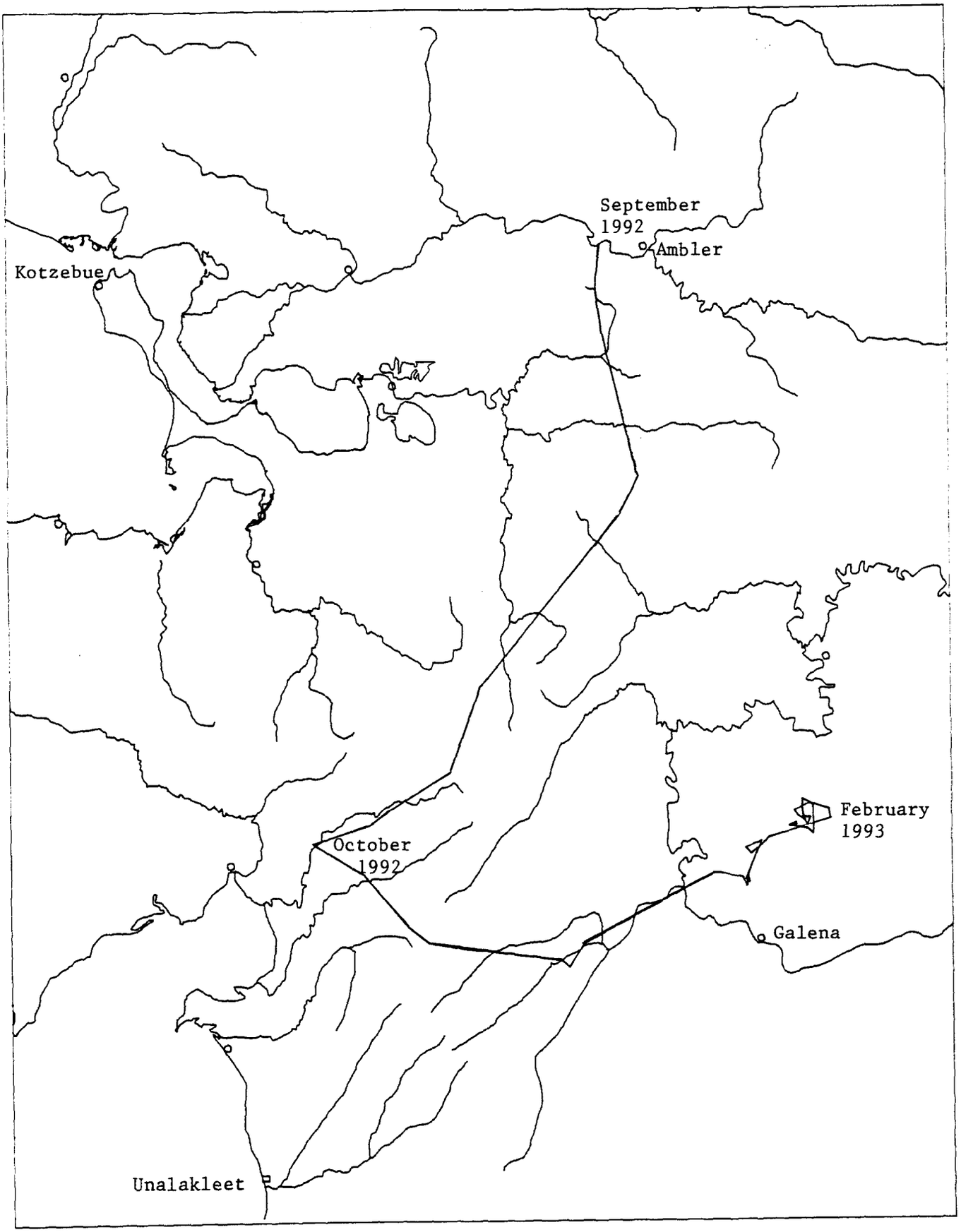

Figure 3. Movement of satellite-collared cow caribou (PTT 10905) from early September 1992 through February 1993.

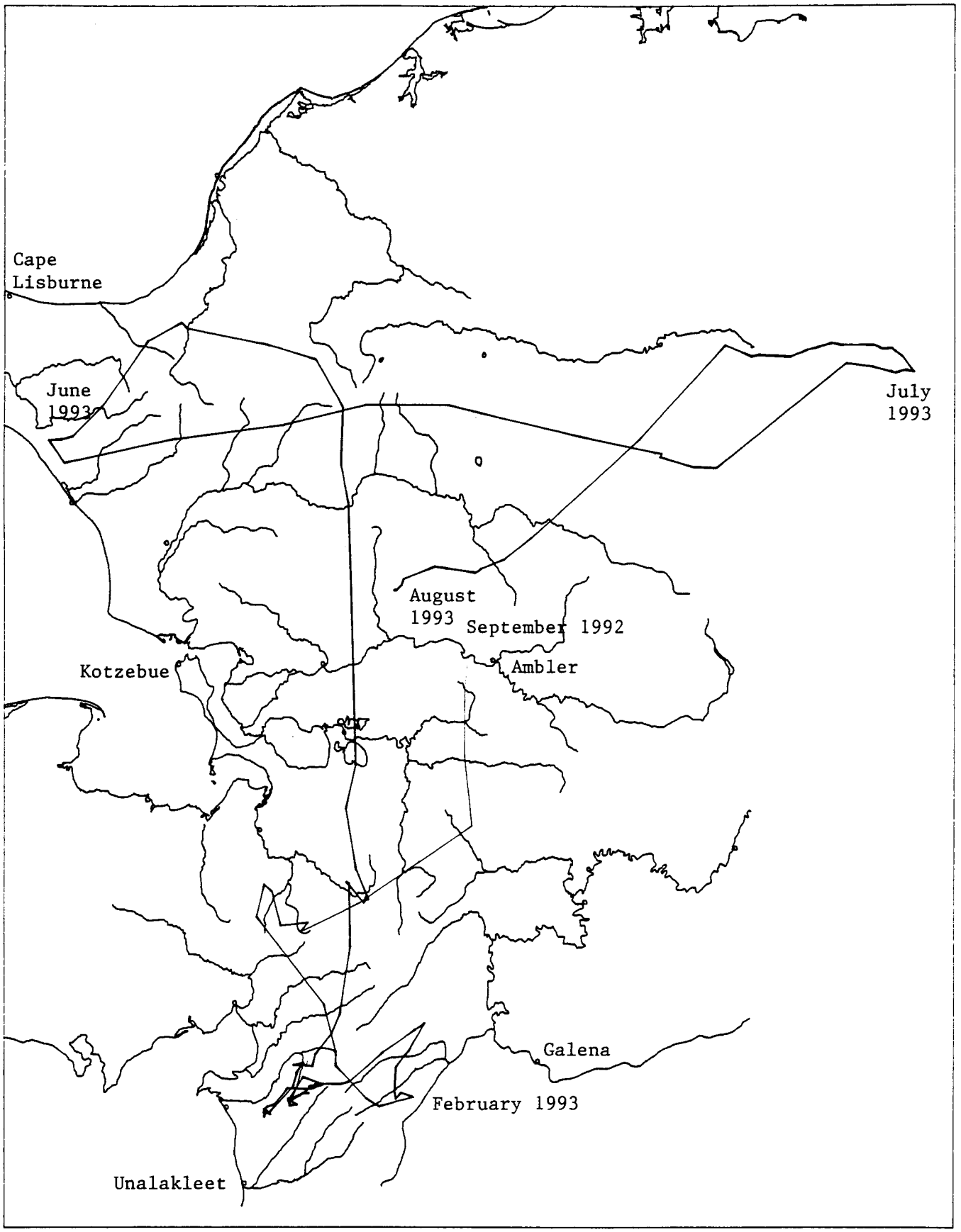

Figure 4. Movement of satellite-collared cow caribou (PTT 10903) from early September 1992 through August 1993.

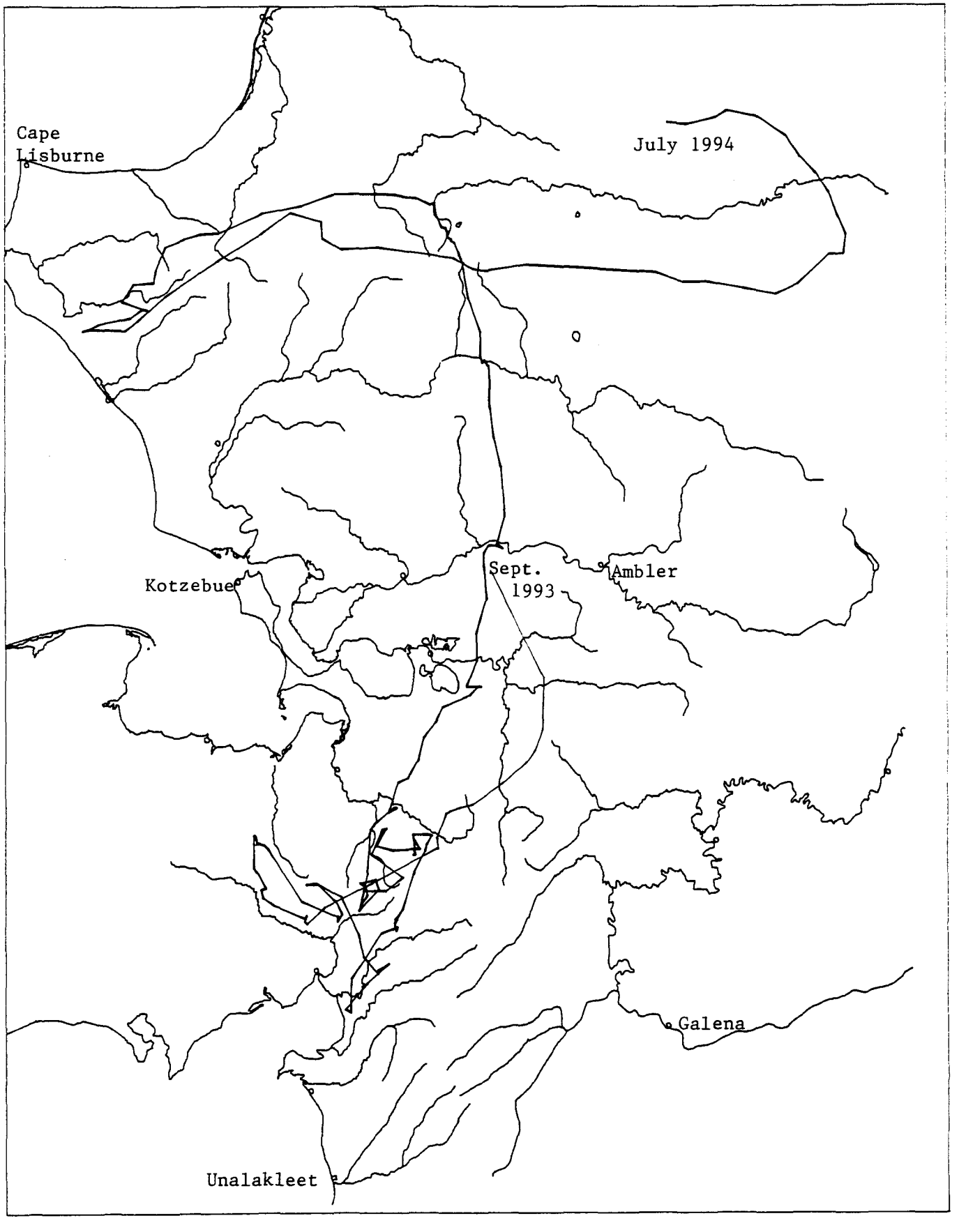

Figure 5. Movement of satellite-collared cow caribou (PTT 10903) from early September 1993 through July 1994.

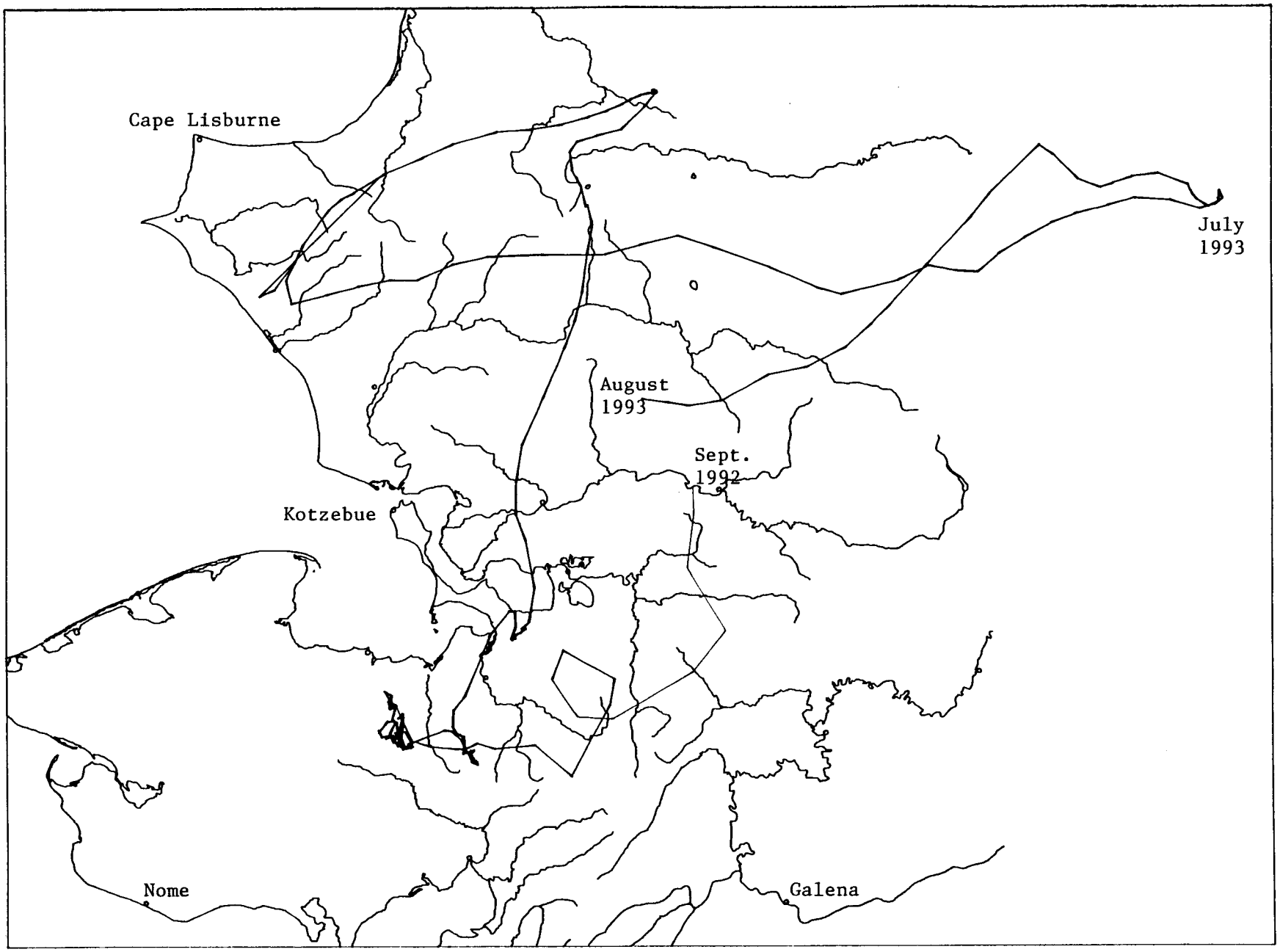

Figure 6. Movement of satellite-collared cow caribou (PTT 10914) from early September 1992 through early August 1993.

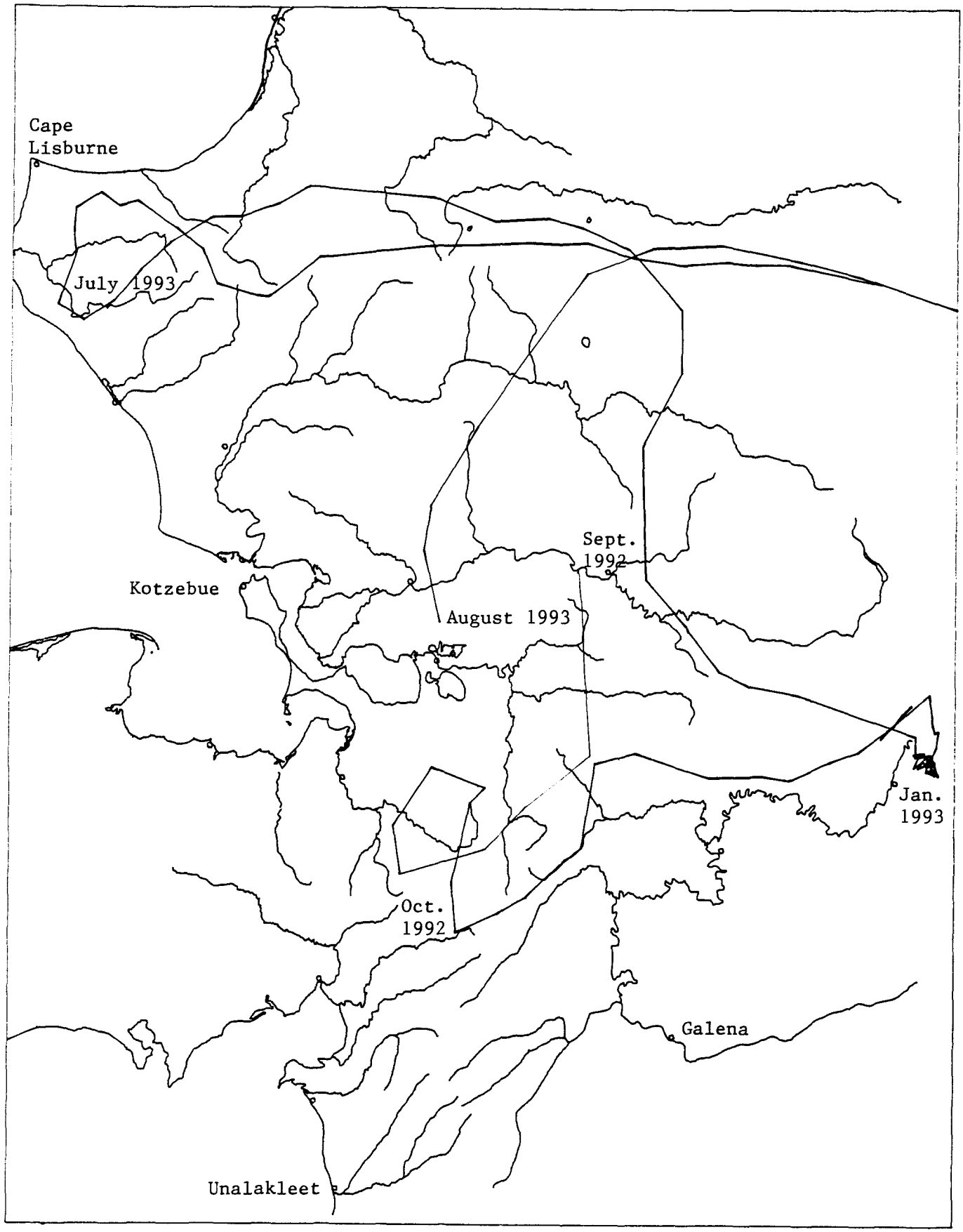

Figure 7. Movement of satellite-collared cow caribou (PTT 10900) from early September 1992 through August 1993.

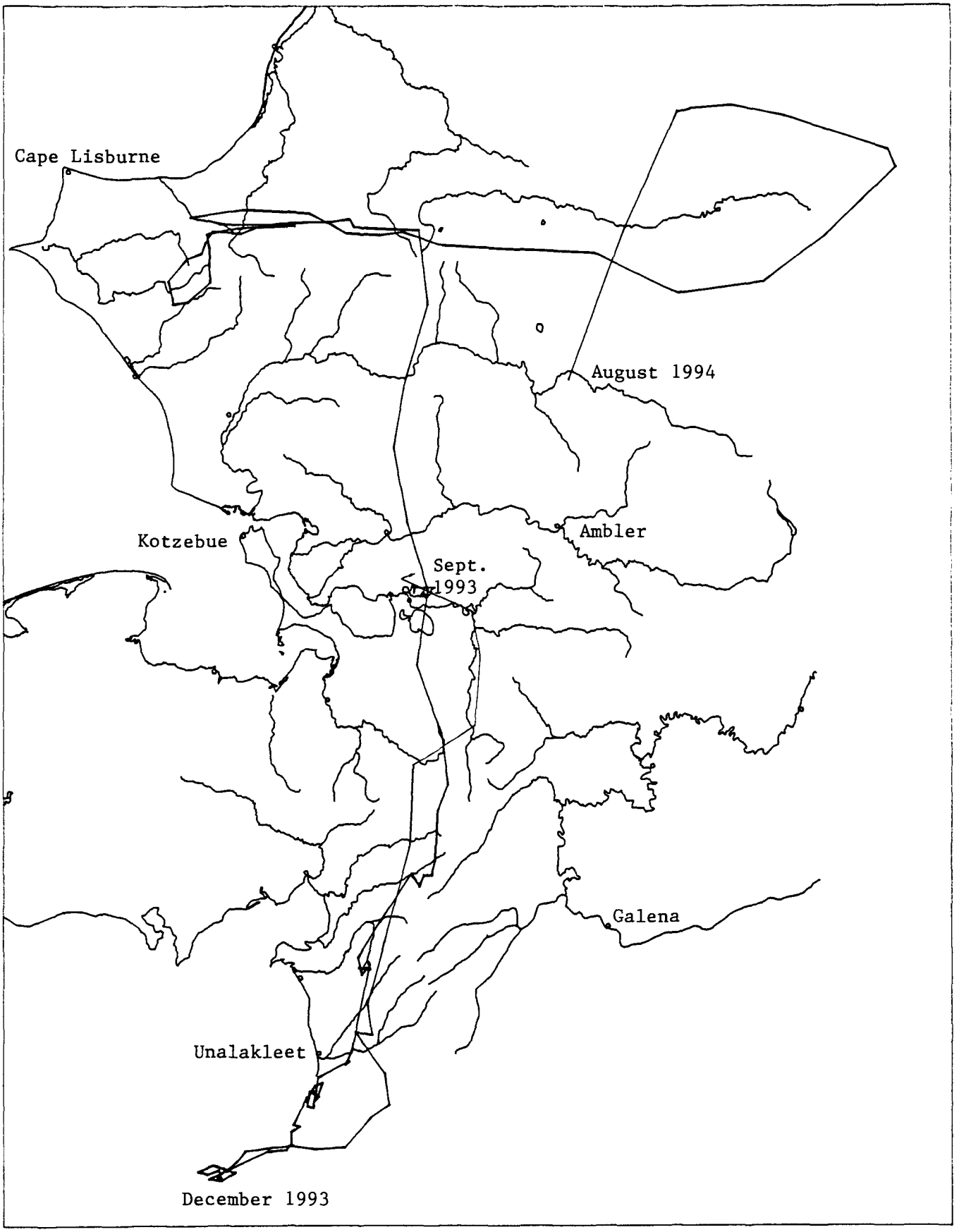

Figure 8. Movement of satellite-collared cow caribou (PTT 10900) from early September 1993 through August 1994.

Table 1. Population estimates, average annual rates of change, and density of the Western Arctic caribou Herd, 1976-1993.

Year	Population estimate	Average annual rate of change (%)[a]
1976	75,000[b]	
1978	106,635	19.5
1980	138,000	13.8
1982	171,699	11.5
1986	229,433	7.5
1988	343,167	22.3
1990	415,692	10.0
1993	450,000	2.7

[a] $\frac{\ln[Nt + t_1 1] - \ln [Nt]}{t} = r \quad e^r$ = annual rate of change.

[b] Davis and Valkenburg 1978.

Table 2. Spring composition data for the Western Arctic caribou Herd, 1986-1994.

Year	Adults	Short yearlings	Total	Short yearlings: 100 adults
1986	5,372	1,227	6,599	23
1987	7,981	2,150	10,131	27
1988	6,047	1,312	7,359	22
1989	5,330	1,718	7,048	32
1990	5,231	1,198	6,429	23
1991	7,111	1,371	8,482	19
1992	7,660	1,678	9,338	22
1993	4,396	814	5,210	19
1994	8,369	1,587	9,956	19

Table 3. Number of radiocollared cows visually observed with calves during calving ground surveys, 1988-1994.

Year	Cows w/calf	Cows wo/calf	Total cows	No. cows per 100 cows
1988	26	27	53	49
1989	34	16	50	68
1990	51	20	71	72
1992	52	12	64	81
1993	38	41	79	48
1994	42	38	80	52

LOCATION

Game Management Unit: 25A, 25B, 25D, and 26C (59,400 mi^2)

Herd: Porcupine

Geographical Description: Eastern portions of the Arctic Slope, Brooks Range, and northeastern Interior Alaska

BACKGROUND

The Porcupine Caribou Herd (PCH) migrates between Alaska and the Yukon and Northwest territories of Canada. Most of its range of approximately 130,000 mi^2 is remote, roadless wilderness. The most heavily utilized portion of the PCH calving ground lies on the coastal plain of the Arctic National Wildlife Refuge (ANWR), which is also the most promising onshore petroleum prospect in the United States (Clough et al. 1987). Both industry and government have an interest in developing potential oil resources in the coastal plain. Therefore various state and federal agencies and their Canadian counterparts are cooperating on baseline ecological studies of the PCH. These studies are expected to provide the basis for mitigation of any adverse effects of petroleum development on caribou.

In 1987 the United States and Canada established the International Porcupine Caribou Board to coordinate management and research among governmental and user groups. Board recommendations, research studies, and actions of Congress regarding the opening of ANWR to petroleum development will influence how the herd is managed to provide for a variety of uses.

The PCH remained more stable than other Alaskan herds during the 1960s and 1970s at about 100,000 caribou (Table 1). In 1979 the population began a steady increase and reached 178,000 caribou by 1989. Annual rates of growth averaged about 5% from 1979 to 1989. The PCH then decreased to 160,000 caribou in 1992, probably in response to lower yearling recruitment after harsh winters.

MANAGEMENT DIRECTION

Until the early 1970s the PCH was a low priority for management and research because of its remote location and the small number of people who harvested it. Then increasing pressure for oil development in northeast Alaska and growing international interest in the herd resulted in a higher management priority and heightened attention from biologists (Garner and Reynolds 1986). The Alaska Department of Fish and Game's (ADF&G) management goals are to provide for optimal harvest and the greatest opportunity to participate in caribou hunting. These goals may be modified or expanded if a joint Canada/Alaska management plan is adopted. The following goals were proposed by the International Porcupine Caribou Board.

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

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

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

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

METHODS

We estimated population size by an aerial photocensus conducted in July 1994, using counting methods described in previous reports (Whitten 1993). We monitored radiocollared caribou to determine movements, productivity, mortality, and seasonal distribution of the herd. We estimated overwinter survival of calves from composition counts conducted in March 1993 and 1994.

Harvest ticket report cards submitted by nonsubsistence hunters provided most data on harvest in Alaska. We gathered additional data on subsistence harvest from field interviews, reports by Subsistence staff, and reports by the Council of Athabascan Tribal Governments (CATG). We also obtained Canadian harvest figures from the Yukon Department of Renewable Resources.

RESULTS AND DISCUSSION

Population Status and Trend

Population Size: We counted 146,536 caribou (95% CI = 145,261-147,809) on aerial photographs taken in July 1994. We also counted 272 caribou directly during the census. We accounted for all but 1 of 137 radiocollared adult caribou known to be in the PCH, but we were unable to photograph several large groups along the Canning River which contained 4 radiocollared cows from the PCH and numerous collared animals from the Central Arctic Herd. Therefore, we adjusted the photographic and direct count by the proportion of radiocollared caribou not photographed (i.e., 5/137) to come up with a round number estimate of 152,000 caribou in the Porcupine Herd.

The 1994 count was lower than the 160,000 caribou estimated from a similar census in 1992. However, local weather and terrain conditions forced the photo plane to fly higher than usual in 1994, and calves were difficult to see on some photos. In 1992 the calf:cow ratio from

ground composition counts during the census was 55 calves:100 cows and we counted 19% calves on photos. In 1994 the calf:cow ratio among radiocollared cows was 70 calves:100 cows, yet we counted only 14% calves on photos. Therefore, we probably undercounted calves in 1994, and we actually counted more adult caribou than in 1992. The 1994 estimate of 152,000 should be considered a minimum number for the herd.

Population Composition: Calf:cow ratios in March 1993 and 1994 were 33:100 and 32:100, respectively (D. Cooley, Yukon Department of Renewable Resources, pers. commun.). These ratios exceed the 22:100 classified in March 1992, but are still lower than the approximately 40 calves:100 cows estimated during the 1980s, when the herd was growing (Fancy et al. 1994).

No other general population composition counts were conducted this reporting period. The calf:cow ratio among radiocollared cows at the end of June was 45:100 in 1993 and 70:100 in 1994. These figures are not directly comparable to the calf:cow ratios in Table 2 because younger cows, with generally lower parturition rates, are underrepresented in the radiocollared cow sample. Nevertheless, the radiocollared cow data suggest relatively poor calf survival in 1993 and excellent productivity and survival in 1994.

Distribution and Movements: Previous movements and distribution of the PCH have been summarized by Garner and Reynolds (1986), Whitten (1987), Whitten and Regelin (1988), Fancy et al. (1989), Golden (1989, 1990), Whitten and Fancy (1991), and Whitten (1993). In late summer and fall 1992 most Porcupine Herd caribou left Alaska and moved into the northern Yukon Territory. Caribou reached the Dempster Highway by late fall, but most then moved back to the west or southwest, where they remained inaccessible to most Canadian hunters through the rest of the winter. Some caribou stayed all winter in Alaska, especially near Arctic Village.

In 1993 the herd calved in the traditional calving area on the ANWR coastal plain. Fall and winter movements were roughly similar to the previous year. Exceptions were that more caribou in the Yukon remained accessible from the Dempster Highway, and most caribou in Alaska stayed too far east to be accessible from Arctic Village.

Calving again occurred on the ANWR coastal plain in 1994, although many cows calved farther west than in most years. Calving extended as far west as the Katakturak River.

Mortality

Harvest:

Season and Bag Limit. The state of Alaska hunting season for all hunters during this report period was 1 July-30 April and 23-30 June; hunters could take only bull caribou during the 23-30 June period. The bag limit for nonresidents was 5 caribou. The bag limit for all Alaska residents was 10 caribou, provided that no more than 5 could be transported out of Units 25A, 25B, 25D, and 26C per regulatory year, during the 1992-1993 season. This transport

restriction was determined by the Department of Law to be inconsistent with state law and was discontinued prior to the 1993-1994 season.

Board of Game Actions and Emergency Orders. The board took no actions regarding the PCH during this reporting period.

Hunter Harvest. Total harvest for the PCH has ranged from about 1500 to 4800 over the past few years (Table 3), or about 1%-3% of estimated population size (Table 1). Although a few PCH animals may have wintered in Unit 26B during this report period, that area is inhabited predominantly by Central Arctic Herd caribou. Therefore, only caribou reported taken in Units 26C, 25A, 25B, and 25D were considered to be from the PCH in 1992-1993 and 1993-1994.

Harvests by local residents and nonlocal hunters in Alaska are reported differently. Nonlocals use statewide caribou harvest ticket report cards. Harvest by nonlocal hunters has typically been a minor part of the overall PCH harvest and has shown no definite trend over the past 5 years. Nonlocal hunters have never killed many PCH cows. Most nonlocal hunters are Alaska residents (Table 3).

Standardized reporting of harvest by hunters living north of the Yukon River was not required after 1989, and in previous years local residents did not report even though it was required. Subsistence harvests have therefore always been estimates. Caribou were available to Kaktovik residents primarily in early summer during this report period. Caribou were briefly available to most villages south of the Brooks Range during late summer and fall, and fair numbers remained near Arctic Village during the winter of 1992-1993. Subsistence harvest in Alaska reflected the relative availability of caribou. Harvest in Canada was relatively high because caribou moved through the Old Crow area several times each year and also spent time in the Richardson Mountains or along the Dempster Highway, where residents of Aklavik, Ft. McPherson, and many road-connected communities had easy access (Table 3). The CATG harvest reports for 1993-1994 corroborate low harvest by Alaskan communities south of the Brooks Range that year; only 54 of the 250 caribou in the estimated unreported harvest for Alaska came from CATG villages (Table 3).

Hunter Success. Nonlocal hunter effort and success varies by game management unit and depends on herd distribution (Table 4). Word travels quickly when the PCH is scarce in Alaska. When this happens, few hunters travel to the PCH range. Perhaps because of its uncertain distribution and the difficulty and expense of traveling to its range, the PCH has never become very popular with nonlocal hunters.

Local subsistence hunter success during this report period was probably normal for Kaktovik (i.e., near historical averages of 150-200), good for Arctic Village and other CATG communities in 1992-1993, and poor for CATG communities in 1993-1994.

Harvest Chronology. Nearly all nonlocal harvest of the PCH in Alaska occurs during August and early September. This pattern reflects when hunters prefer to be afield. During this report

period caribou were available both winters in very sparsely populated eastern Unit 25A, but nonlocal hunters made little or no use of them. Subsistence harvest chronology depends on availability of caribou near villages, and harvest occurs whenever caribou are present. The exception is during June at Kaktovik, where caribou may be present but inaccessible because travel conditions are poor.

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

Other Mortality: The pregnancy rate among 78 radiocollared adult PCH females in June 1993 was about 76%, with calf mortality during June about 41%. In 1994, 90% of 98 collared cows gave birth, and June calf mortality was 22%. Annual mortality of adult females was about 21% in 1992-1993 and 15% in 1993-1994.

Habitat

Assessment: Carrying capacity of the PCH range is not known. Population density is approximately 1.3 caribou per mi^2 (0.5/km^2). Several studies are currently assessing habitat availability and quality, primarily on the calving grounds and summer ranges. Preliminary results of studies by the National Biological Service (NBS) on calving ground habitat use suggest that calving caribou select areas with rapid plant growth rather than specific sites or habitats. Rapid plant growth occurs in different areas annually, but those areas tend to occur most frequently in the same region designated by previous researchers as the primary calving area of the PCH. The implication of the NBS study is that, over time, all of the traditional calving area is important for caribou. Preserving or protecting only portions of the calving area may not adequately protect the herd.

Enhancement: No habitat enhancement programs are under way or planned on the PCH's range. Much of the herd's range within Alaska is designated wilderness, and the northern portion of the Yukon Territory is national park.

CONCLUSIONS AND RECOMMENDATIONS

Routine annual monitoring of natality, early calf survival, and adult female mortality gave little indication that the PCH had stopped growing between 1989 and 1992. However, we failed to collect adequate data on overwinter calf survival and yearling recruitment during the period of decline. Recruitment data collected over the past 2 years, coupled with other routine monitoring data, suggest that the herd is probably no longer declining as rapidly as it did from 1989 to 1992 and may even be showing signs of recovery. Nevertheless, the fact remains that confidence intervals around estimates of most population parameters are large enough to mask subtle changes which can combine synergistically to cause unanticipated changes in population trajectory. Thus we should still consider that routine composition surveys and

radiocollar data may not be sufficient for detecting small or short-term changes in population size and trend. Periodic censuses are necessary to confirm population trajectory.

The PCH remains lightly hunted, and harvest has not influenced recent population changes. The current rise in calf productivity and survival and the generally good physiological condition of animals in the herd is probably a response to mild climatic conditions. If mild weather continues, the herd should increase again.

The ADF&G is cooperating with NBS and Canadian government agencies to assess importance of the ANWR coastal plain to the PCH. The department has previously identified a portion of the ANWR coastal plain between the Hulahula and Aichilik rivers as being of special value to calving and postcalving caribou and has recommended that area should receive special consideration in any plans to develop ANWR. However, more recent data gathered by NBS suggest all of the ANWR coastal plain and adjacent areas in Canada may be important to the herd over longer time periods. The department should continue to work with other agencies to identify potential risks associated with developing the coastal plain. We should seek methods to avoid or mitigate impacts to caribou and other wildlife wherever they are found, rather than applying special restrictions or even complete protection to smaller areas.

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Table 1. Population estimates of the Porcupine Caribou Herd, 1961-1994.

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

[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 postcalving composition counts and estimated population size, 1971-1992.

Approximate survey date	Bulls: 100 cows	Calves: 100 cows	% calves	% cows	% yrlgs	% small bulls (% of bulls	% large bulls (% of bulls)	% 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[a]	95	43	15	36	15	--	46	34	19,718
7/83	9	73	38	52	5	61	39	5	2,583
7/86[a]	57	52	22	42	12	--	--	24	19,499
7/87[a]	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[a]	--	--	--	--	--	--	--	--	--
7/91	36	46	28	46	10	--	--	17	16,060
7/92	27	55	27	49	10	62	38	13	18,217

[a] Only these surveys sampled all portions of the herd, including bull groups.

Table 3. Porcupine Caribou Herd harvest, 1984-1994.

Regulatory year	Hunter harvest							
	Reported				Estimated unreported			
	M	F	Unk	Total	Alaska	Canada	Total	Total
1984-1985	49	4	0	53	500-700	4000	4500-4700	4553-4753
1985-1986	52	12	1	65	500-700	4000	4500-4700	4565-4765
1986-1987	70	14	0	84	1000-2000	500-1000	1500-3000	1584-3084
1987-1988	106	22	1	129	<500	2000-4000	2500-4500	2629-4629
1988-1989	82	7	0	89	<500	2000-4000	2500-4500	2589-4589
1989-1990	104	8	0	112	500-700	2000	2500-2700	2612-2812
1990-1991	19	1	0	20	100-150	1680	1780-1830	1800-1850
1991-1992	101	3	0	104	100-150	2774	2874-2904	2978-3028
1992-1993	78	1	0	79	658	1657	2315	2394
1993-1994	77	5	0	82	250	2934	3184	3266

Table 4. Hunter success in the Porcupine Caribou Herd from 1989-1990 to 1993-1994.

Hunters	Unit 25A	25B	25D	Total 25	26C	Total 25 & 26C
1989-1990						
Total hunters	71	3	7	81	32	113
Successful	53	2	3	58	24	82
% Successful	75	67	43	72	75	73
1990-1991						
Total hunters	--	--	--	--	--	29
Successful	--	--	--	--	--	13
% Successful	--	--	--	--	--	45
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

LOCATION

Game Management Unit: Western half of Unit 25C and small portions of northern Unit 20B and eastern Unit 20F

Herd: White Mountains

Geographical Description: White Mountains Area north of Fairbanks

BACKGROUND

Historically the Fortymile Caribou Herd calved in the White Mountains and moved southeast across the Steese Highway to wintering areas (Davis et al. 1978). As recently as 1960, 30,000 Fortymile caribou crossed the Steese Highway to summer in the White Mountains (Jones 1961). As the Fortymile Herd declined throughout the 1960s they abandoned the traditional White Mountains calving area and remained southeast of the Steese Highway. However, in the late 1970s, public reports and incidental observations by biologists confirmed the year-round presence of caribou in the White Mountains, implying a small resident herd had existed for many years (Valkenburg 1988). White Mountains Herd (WMH) caribou now maintain a distinct calving area mostly east of Beaver Creek and are considered a separate herd.

The White Mountains National Recreation Area is managed by the Bureau of Land Management (BLM) and was created by Alaska National Interest Lands Conservation Act in 1980. In 1982 BLM and ADF&G initiated a cooperative project to determine the identity and distribution of caribou in the White Mountains. Caribou radiocollared during that project provided information on movements and distribution of the herd. The herd also provides a low-density comparison population for the long-term Delta Herd research project.

From 1987 to 1993 reported harvests averaged 17 bull caribou annually. Public use of the White Mountains is increasing especially during early and late winter. The BLM continues to improve access and increase recreational opportunities through development and implementation of its recreational plans.

In 1990, 2 drawing permit hunts (877 and 878) were established to give people an opportunity to hunt caribou during winter in the White Mountains. One hunt (877) is a motorized access hunt and the other hunt (878) is a nonmotorized access only hunt. Although 100 permits were issued for the first 3 seasons (50 per hunt), success was low (6 caribou total). In 1993 we issued 150 permits (75 per hunt), but the reported harvest was zero. Plans to change the winter hunt to increase success are being formulated.

MANAGEMENT DIRECTION

Management Goals:

- Ensure that increased recreational use and mining development do not adversely affect the White Mountains Herd.
- Provide the greatest sustained opportunity for hunting caribou.
- Provide an opportunity to view and photograph caribou.

Management Objectives:

- Establish population and harvest objectives by 1995.
- Conduct aerial surveys of the White Mountains Herd to estimate population size, distribution, and population composition.
- Monitor anticipated increases in recreational use and mining development and ensure such development does not adversely affect the White Mountains Herd.
- Estimate harvest quotas for winter caribou hunts 877 and 878 by 1994.

METHODS

On 6 July 1992 J. Herriges (BLM) estimated herd size using a radiocensus technique (Valkenburg et al. 1985) with extrapolation for missing radios. He recorded locations of caribou and counted smaller groups. He photographed all groups of caribou too large to count precisely using a 35-mm camera. He used direct counts combined with photo counts to develop a minimum population estimate. No population censuses were conducted during 1993 or 1994.

We flew fall sex and age composition surveys in 1993 and 1994 using a fixed wing aircraft to locate radiocollared caribou. A Robinson R-22 helicopter was used to classify individuals by sex and age. We classified caribou into 6 categories: cow, male calf, female calf, small bull, medium bull, and large bull.

During 1993 and 1994 BLM monitored the pregnancy rate of radiocollared WMH calves with fixed-wing aircraft. A cow was considered to be pregnant if she was followed by a newborn calf or if she had a distended udder or hard antlers.

We estimated harvest using data from returns of harvest report cards and drawing permit report cards. Caribou harvested north of the Steese Highway were considered 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.

RESULTS AND DISCUSSION

Population Status and Trend

Population Size: The WMH appears to be stable or increasing slowly (Table 1). In 1992 BLM counted 832 caribou including all the radiocollared caribou. No photocensuses were done in 1993 or 1994. We believe the herd contained between 1000 and 1200 animals in 1994, based on 1993 and 1994 composition data, harvest data, and the 1992 estimate. To meet our census objective we are planning to census the herd during summer 1995. We also plan to census the herd every third year.

Population Composition: In fall 1993 we classified 497 caribou in 7 groups, including 6 of 14 radiocollared individuals. In fall 1994 we classified 418 caribou in 10 groups containing 11 of 12 radiocollared caribou.

Fall calf:cow ratios in the WMH declined from 36:100 in 1989 to 22:100 in 1993 and increased slightly to 25:100 in 1994 (Table 1). The WMH has maintained higher calf:cow ratios than other Interior herds in recent years.

Estimates of the fall bull:cow ratio varied from 39:100 in 1992 and 1994 to 48:100 in 1993. These variations may reflect unrepresentative sampling because of segregation of bulls after the rut. Early surveys (i.e., 29 Sep-6 Oct) yielded higher bull:cow ratios than later surveys (Table 1).

Natality: The peak of calving in 1993 was prior to 24 May. During the 1993 calving period 17% (1/6) of the radiocollared 2-year-old cows observed were pregnant. All (7/7) of the radiocollared 5-year-old cows calved.

In 1994 the peak of calving was judged to be 21 May. During the calving period 86% (6/7) of the 3-year-old cows and all (6/6) of the 6-year-old cows observed were pregnant.

Distribution and Movements: The WMH caribou calve primarily in the higher parts of the White Mountains east of Beaver Creek including the Nome, Fossil, Cache, and Preacher creek drainages. Some scattered calving occurs west of Beaver Creek (Durtsche and Hobgood 1990). Postcalving aggregations occur from mid June to late July as far east as Mt. Prindle (Fig. 1). In August or September most caribou cross Beaver Creek and winter in upper Hess and Victoria creeks and the upper Tolovana River drainages. In 1992-1993, however, many WMH caribou wintered in the Preacher Creek drainage west of Circle. In addition, in October 1994 at least half the herd had not yet crossed Beaver Creek. During winter 1994-1995, the winter distribution was similar to most years, although in February there were some groups of

wintering caribou as far south as the Colorado Creek trail and near the Colorado Creek cabin. In addition, some caribou again wintered in the Preacher Creek drainage.

Board of Game Actions and Emergency Orders: No Board of Game actions were taken during this reporting period.

Mortality

Harvest:

Season and Bag Limit. The fall hunting season was 10 August-20 September throughout the herd's range (Units 20B, 20F south of the Yukon River, and 25C) with a bag limit of 1 bull.

The winter drawing permit hunts were open for caribou hunting north and east of the Elliott and Dalton highways, and north and west of the Steese Highway. Hunt 877 was open 15-28 February and Hunt 878 was open 1-15 March. There were 50 permits available for each hunt (100 total) in 1993 and 75 permits available for each hunt (150 total) in 1994. Use of motorized vehicles for hunting was prohibited for Hunt 878. The bag limit for both winter hunts was 1 caribou.

Human-Induced Mortality. Fall harvest appears to be increasing but remains relatively low. The reported fall harvest of WMH caribou has ranged from 14 to 21 over the last 5 years (Table 2).

Only 3 hunters took caribou during winter permit hunts in 1993 and none were reported taken during the 1994 hunts. The level of interest is high, judging from the number of drawing permit applications (537 in 1993 and 615 in 1994) (Table 3). Winter hunt participation is significantly influenced by bad weather and poor traveling conditions. The other factor that effects winter participation is the ineligibility of hunters who have already harvested a caribou earlier in the season.

To estimate a harvest quota for the winter hunt we utilized a spreadsheet computer population model designed by P. Valkenburg and D. Reed. The model estimates the WMH could easily sustain a winter harvest of 25 caribou, while still sustaining a fall harvest of 40 bulls.

Other Mortality: During the fall 1994 composition count, 2 radiocollared 6-year-old cows were found dead. The causes of death were unknown. The White Mountains has both black and grizzly bears and wolves which probably contribute to most calf and adult mortality. During the 1980s the WMH experienced slow population growth with low adult mortality and low calf survival. From 1990 to 1994 when most other herds declined in Interior Alaska from high adult and calf mortality, the WMH remained stable.

Hunter Residency and Success. Most hunting pressure on the WMH during fall is from Fairbanks area residents. In 1992, 73% (11/15) of successful hunters were from the Fairbanks area, 20% (3/15) were nonresidents, and 7% (1/15) were other Alaska residents. In 1993 most

successful hunters were from the Fairbanks area 76% (16/21), 10% (2/21) were other Alaska residents, 10% (2/21) were nonresidents, and 4% (1/21) were of unknown residency. In 1992 and 1993 overall general season success rates were 13% and 18%, respectively (Table 4).

Success during the winter drawing hunt has been low since it began (Table 3). Success is highly dependent on caribou location, distribution, weather conditions, and permittee eligibility. As the area becomes better known, the success rate and level of participation will probably increase.

Transport Methods. During the 1992 fall hunting season, 80% (12/15) of successful hunters used either highway vehicles, 3- or 4-wheelers, or ORVs to transport them afield. In addition, 13% used airplanes and 7% used an unknown mode of transport. During the 1993 fall hunting season, 76% (16/21) of successful hunters primarily used 3- or 4-wheelers or highway vehicles to transport them afield. In addition, 19% (4/21) utilized airplanes, and 5% (1/21) used other or unknown methods of transportation (Table 5).

In the 1992-1993 winter season, 2 of the successful permittees used snowmachines, and 1 used a dog team. During the 1993-1994 season there were no successful hunters for either permit hunt. Although 12 hunters used snowmachines during the motorized hunt and 14 hunters used dogsled or skis/snowshoes during the nonmotorized hunt.

Winter travel in the White Mountains can be difficult for hunters. Expansion of developed trails and cabins provided by BLM is making winter access easier, but so far access trails have not been well developed in caribou wintering areas.

Habitat

Fecal pellet samples collected during April 1992 were indicative of an abundance of lichens available to caribou in the White Mountains (Valkenburg 1995).

CONCLUSIONS AND RECOMMENDATIONS

The WMH is probably stable or increasing. Harvests are below the sustainable yield. Remoteness and inaccessibility are the major contributors to low harvest. Increased hunter effort and harvest during fall may occur because of the decline of other Interior caribou hunting opportunities.

The 1995-1996 winter season should be lengthened to increase hunter participation and success rates for the winter drawing hunts. Each hunt (877 and 878) should be 1 month in length. This would make the season for hunt 877 1-28 February and for hunt 878 1-31 March. This season expansion would allow eligible hunters more opportunity to participate in this hunt.

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

We have made progress toward meeting our objective to establish population and harvest objectives. We have established a winter harvest quota of 20 caribou with a corresponding fall harvest of 40. Utilizing Valkenburg's model and inputting the worse case scenario, an all cow winter harvest, it predicts that the herd could withstand that harvest and maintain a growth rate of at least 6% a year. We have not yet met our objective to establish population goals. Before setting population objectives I would like to gather input from the local advisory committee and staff.

We are currently meeting our objective to estimate population composition on a yearly basis. In summer 1995 we will complete a photocensus and begin our 3-year census rotation schedule. The BLM has been collecting the distribution and movement data with monthly radiotracking flights as part of our cooperative efforts on the WMH. We will be deploying an additional 20 radiocollars during April 1995. This will allow us to better estimate all population parameters and collect more distribution and movement data.

We are meeting our objective to monitor increases in recreational uses and development by working closely with BLM. We have attended meetings regarding the Nome Creek development, which is currently the BLM's main development project.

We have met our objective to establish a winter harvest quota of 20 caribou for the 1995-1996 season. This is a conservative quota, taking into account the "1 caribou" bag limit and a potentially increasing fall harvest. This quota should be flexible as it may need to be adjusted annually based on the census data and fall composition counts.

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Table 1. White Mountains caribou fall composition counts and estimated population size 1983-1994.

Date[a]	Bulls: 100 cows	Calves: 100 cows	Calves (%)	Cows (%)	Small bulls (% of bulls)	Medium bulls (% of bulls)	Large bulls (% of bulls)	Total bulls (%)	Composition sample size	Estimate of herd size
9/29/83	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[b]	--	--	15	--	--	--	--	--	324	761[c]-1000
10/13/92	39	23	14	62	52	18	30	24	247	832[c]-1000
9/27/93	48	22	13	59	34	23	43	28	497	1000-1200
10/4/94	39	25	15	61	34	24	42	24	418	1000-1200

[a] No composition count for 1984, 1986, 1987, and 1990.
[b] Fixed wing aircraft.
[c] Actual count of herd size.

Table 2. White Mountains Herd caribou harvest 1987-1993.

Regulatory year	General season				Permit hunts 577 & 578				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

Table 3. Results of White Mountains Caribou Herd late winter (Feb/Mar) drawing hunts 577 and 578, regulatory year 1990-1993.

Regulatory year	Number of permits available	Number applicants	Number of permits issued	Harvest			Hunted unsuccessful	Did not hunt	Did not report
				Cow	Bull	Total			
1990-1991	100	229	89	1	2	3	18	66	2
1991-1992	100	409	100	0	0	0	12	88[a]	
1992-1993	100	537	100	2	1	3	19	76	2
1993-1994	150	615	150	0	0	0	26	120	4

[a] Includes those that did not report.

Table 4. White Mountains Caribou Herd hunter residency and success during the fall hunting season, 1985-1993.

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

Table 5. Fall White Mountains caribou harvest by transport method 1988-1993[a].

Regulatory year	Airplane	Horse	Boat	3- or 4-wheeler	Snowmachine	ORV	Highway vehicle	Other/ unknown	*n*
1988-1989	4	0	0	4	0	2	2	0	12
1989-1990	0	0	0	4	0	4	4	2	14
1990-1991	1	0	1	10	0	1	4	1	18
1991-1992	3	1	0	8	0	4	3	0	19
1992-1993	2	0	0	4	0	2	5	1	14
1993-1994	4	0	0	11	0	0	5	1	21

[a] Excludes winter permit hunts 577 and 578.

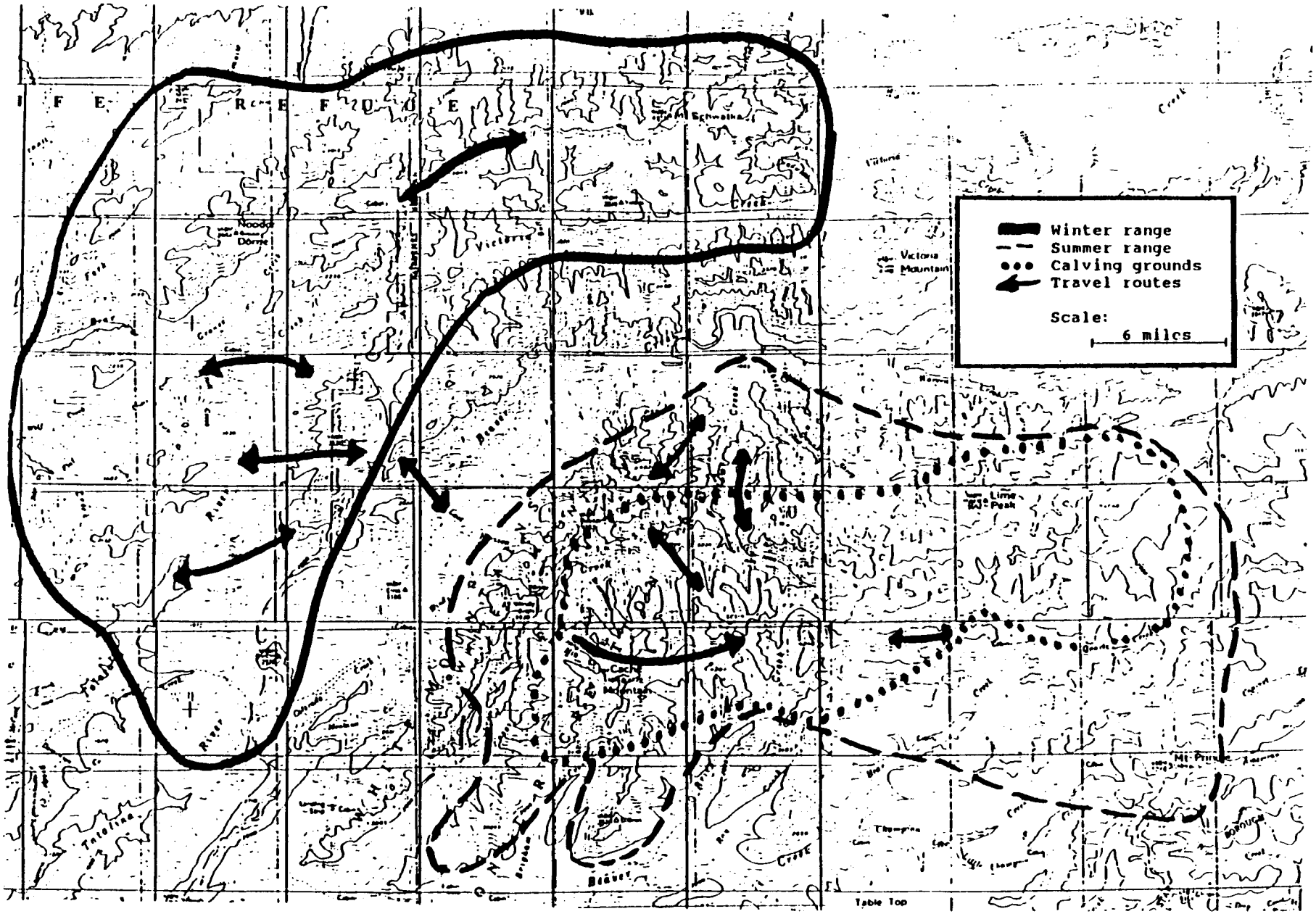

Figure 1. Approximate range of the White Mountains Caribou Herd (based on Durtsche and Hobgood 1990; Hobgood, pers. commun.).

LOCATION

Game Management Unit:	26A (56,000 mi^2)
Herd:	Teshekpuk Lake
Georaphical 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 1930's and 1940's, and local residents report observing caribou in the area throughout the year since the 1930's. The Teshekpuk Lake caribou herd (TLH) was documented in the mid-1970's as a separate herd from the Central Arctic (CAH) and the Western Arctic (WAH) caribou herds by Davis and Valkenburg (1978).

The Department and U. S. Bureau of Land Management (BLM) staff completed visual counts during 1978-1982, and estimated that 3,000-4,000 caribou inhabited the Teshekpuk Lake area (Davis and Valkenburg 1979, Reynolds 1981, and Silva 1985). In an effort to better assess the size and distribution of the TLH, 12 cows and 8 bulls were instrumented with radio collars in 1980, and monitored jointly by the Department and BLM. The Department and BLM conducted the first photocensus using a modified aerial photo-direct count-extrapolation (APDCE) technique during July 1984, and counted 11,822 animals. Trent and Toovak made a visual count in 1985, and counted 13,406 caribou (ADFG files). As part of a joint project, the Department, North Slope Borough Department of Wildlife Management (NSB), and BLM collared 17 cow caribou with VHF collars during 1986. During July 1989, we again completed a photocensus, and counted 16,649 caribou (Carroll 1992).

The TLH is an important subsistence resource to hunters from several North Slope villages. Collection of TLH harvest data has traditionally been incorporated into the WAH harvest reporting system because of range overlap between the two herds.

MANAGEMENT OBJECTIVES

The overall population management goal is to maintain stable or increasing numbers of caribou in the TLH, and provide for continued hunting opportunity on a sustained yield basis.

Operational management objectives defined in a draft cooperative management agreement between the Department, NSB, and BLM are as follows:

1 Determine the herd population size every 2 to 3 years;

2 Determine the percentage of calves surviving their first winter;

3 Delineate the boundaries of the calving grounds annually;

4 Identify and map the herd's movements and distribution throughout the year using survey and radiotelemetry data;

5 Develop a system to capture caribou for radio-collaring without the use of drugs;

6 Encourage local participation in research and management decisions;

7 Determine the extent of the harvest using methods that are acceptable to hunters as well as the participating agencies;

8 Determine sources of significant, nonhunter mortality.

METHODS

We completed a photocensus during 1993, using a modified APDCE technique (Davis et al. 1979), in cooperation with the NSB and BLM. Photographs were taken from a Beaver aircraft and a Cessna 206 was used for radio-tracking to determine how many radio-collared TLH animals were in the photographed groups and if there were any other instrumented WAH caribou in the area. Photographs were taken 9 July and counted the following winter.

Short yearling recruitment surveys were completed using a Cessna 185 during April of 1993 and 1994. We used radio-telemetry to locate collared animals and classified up to 200 animals in the vicinity as adults or short yearlings.

We conducted calving ground surveys in 1993 and 1994 during the first 3 weeks of June using a Piper PA-18 aircraft. Collared cows were observed at 2 to 3-day intervals to determine if, when, and where they had calves. We also flew transects looking for pregnant and postparturient cows to determine the extent of the calving area. We used a Global Positioning System (GPS) receiver to delineate the boundaries of the calving areas.

We completed postcalving composition surveys during July of 1992 and 1993 using a Hughes 500 helicopter. Caribou with radio collars were located, and we categorized approximately 150 animals near each radio-collared animal as cows, calves or bulls.

Through a cooperative project with the NSB and BLM, female caribou were captured using a Hughes 500 helicopter equipped with a skid-mounted net gun during July 1992 and 1993. Platform Transmitter Terminal collars (satellite radio collar transmitters or "PTT's") and standard VHF collars were attached to the caribou to aid in population, productivity, and movement studies. During 1992, 11 females were captured, PTT's were attached to 6 and VHF collars were attached to 5 caribou. During 1993, 18 caribou were captured and we attached PTT's to 5 caribou and standard VHF collars to 13 caribou. We measured, weighed, and assessed the body condition of all captured caribou. We collected blood, fecal, and hair

samples to evaluate the presence of diseases, parasites, trace elements, contaminants, and nutrient deficiencies.

For the PTT's, we chose a 6-hour per 48-hour transmission duty cycle. We received satellite location data from the Argos Data Collection and Location System computer in Landover, Maryland in 2 ways. Current location information could be retrieved at any time using a computer modem, and microcomputer diskettes were sent monthly with information for the preceding month. In addition to receiving caribou locations from Argos, we completed periodic VHF radio-tracking flights to obtain caribou movements and distribution information.

When Argos data indicated that 4 caribou with PTT's attached were not moving during early January of 1993, we flew to the indicated locations in a ski-equipped Cessna 185. VHF Telemetry equipment was used to find the animals and confirm that they had died. We examined the carcasses to try to determine cause of death. In order to determine if mortality among a large segment of satellite-collared animals was indicative of a large die-off, we completed a radio-tracking survey of the entire TLH range to determine how many VHF collared animals had died. We also attempted to do a visual survey of the area where the animals collared with PTT's had died. However, a snow and wind storm had covered the carcasses with drifted snow and made them impossible to see from the air. In order to do ground surveys, we traveled to the area by dog sled and ran transects, turning 1 or 2 dogs loose at a time to wander and find carcasses buried in the snow. We were able to visually locate some carcasses and some were found by the dogs.

RESULTS AND DISCUSSION

Population Status and Trend

Population Size: From census photographs taken on 9 July 1993, Department and NSB staff counted 27,686 caribou. This is an increase of 14% per year since the last count of 16,649 in 1989 (Table 1).

Population Composition: We completed short yearling recruitment surveys on 22 April 1993 and 26 April 1994 (Table 2). During 1993 we counted 22 short yearlings:100 adults (n=1462), and in 1994 we counted 16 short yearlings:100 adults (n=1486).

We conducted calving surveys on 5-18 June 1993 and 5-14 June 1994. Calving occurred much later in 1993 than in previous years. Most of the calving occurred after June 12 and some cows still had not calved by 18 June. During previous years, most calving had occurred prior to 10 June. Of the 13 radio-collared cows, only 4 had surviving calves with them on June 18. Calving success improved during 1994. Ten of 20 radio collared cows had surviving calves and most calving occurred before 10 June. Most calving occurred east, northeast, and southeast of Teshekpuk Lake during both 1993 and 1994 (Figure 2).

We completed composition surveys using a helicopter during July 1992 and 1993. Of 3,047 caribou observed on 19 July 1992, 1,036 were categorized as bulls, 1,118 as cows, and 893 as calves. The composition ratios were 80 calves per 100 cows; 41 calves per 100 adults; and 93 bulls per 100 cows.

We observed 2959 caribou on 15-17 July 1993 and categorized 1095 as bulls, 1126 as cows, and 441 as calves. The composition ratios were 39 calves per 100 cows, 18 calves per 100 adults, and 97 bulls per 100 cows.

Distribution and Movements: Radio collars and direct observations have been used during the last decade to develop a generalized description of movement patterns of TLH caribou. During mid-May to late June, most calving occurred northeast, east, and southeast of Teshekpuk Lake during early June. Most males are south and west of the lake during this time period. 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. During the fall and winter, the herd disperses as small groups in all directions. The TLH does not appear to follow any clearly defined migration routes, particularly during the fall and winter (Silva 1985, ADFG files). However, critical areas to the east and north of Teshekpuk Lake are utilized by caribou each year for calving, migrating, and insect relief (Philo et al. 1993).

During 1992-93, movements of 6 satellite-collared caribou were monitored throughout the year. Four animals remained north and east of Teshekpuk Lake during summer and fall and southeast of the Lake during the winter. These four animals all died during the winter. Of the other 2 caribou, 1 spent the summer northeast of Teshekpuk Lake and near the Colville River Delta, and the other near Dease Inlet and south of Teshekpuk Lake. Both traveled to the northern foothills of the Brooks Mountain Range during the fall where one died. The remaining caribou traveled back to the north and wintered in the upper Ikpikpuk River area, and traveled back to the area to the east of Teshekpuk Lake in the spring where we recaptured her (Fig. 1).

We attached PTT's to 5 caribou during July 1993, and have since monitored their movements. Four caribou spent the summer north and northwest of Teshekpuk Lake, and one summered northeast and south of the lake. All 5 caribou traveled south after wet snow and freezing rain created a thick layer of ice over much of the coastal plain during September, and remained in the foothills and mountains of the Brooks Range during winter. Some of these animals traveled as far east as the Sagavanirktok River in Unit 26B. Two of the collared caribou died during the winter. Of the 3 remaining caribou, 1 traveled west and calved near the Utukok River in the WAH calving grounds, 1 calved in the Teshekpuk Lake calving area, and 1 traveled well to the southwest of Teshekpuk Lake and did not calve.

Mortality

Season and Bag Limit:

Subsistence/Resident Hunters:	Five caribou per day; however, cow caribou may not be taken May 16-June 30.	1 July-30 June
Nonresident Hunters:	Five caribou; no cow caribou may be taken May 16-June 30.	1 July-30 June

Harvest:

Human-Induced Mortality. At this time, it is impossible to precisely determine how many TLH caribou are harvested because: 1) most hunters that harvest TLH caribou also harvest caribou from other herds, and there is no easy way to distinguish between animals from different herds; 2) the TLH harvest is reported using the WAH harvest reporting system, and it is impossible to determine whether the reported Subunit 26A harvest is from the TLH or the WAH; and 3) only a small proportion of North Slope hunters actually report their harvest.

Local subsistence hunters accounted for most of the TLH harvest because the area is remote and largely inaccessible to non-local hunters. Hunting pressure comes primarily from several North Slope villages.

Telemetry information indicated that a large proportion of the caribou harvested from 1992-1994 near Atqasuk, Wainwright, Nuiqsut, and Barrow, as well as during 1993-1994 near Anaktuvuk Pass were TLH caribou. Accurate subsistence harvest information has not been available in Barrow since 1990. If current harvest patterns are similar to previous years, the total harvest of caribou from the TLH was probably around 2500 animals per year. Harvest levels of TLH caribou are strongly influenced by where they are distributed during the fall and winter.

Carroll (1992) used subsistence harvest data from Braund (1991) and Pedersen (1991), and radio-tracking information to estimate that approximately 808-1,084 TLH caribou were harvested during 1989-90.

Hunter Residency and Success. Most hunters were local residents of Unit 26A. A small proportion of TLH caribou were taken by non-local resident and nonresident hunters, primarily from the Colville River drainage. No quantitative data are available on hunter success, but we believe success rates were high.

Harvest Chronology. Most of the harvest occurred during July through October. Few caribou were taken during the early winter, but harvests increased during February and March. Braund

and Associates (1989) have summarized harvest chronology for Barrow (Table 4), and the harvest pattern for other villages is believed to be similar. However, more spring caribou hunting occurred in Nuiqsut and Atqasuk because hunters are not occupied with spring whaling as they are in Barrow.

Transportation. Caribou hunters in Unit 26A used a wide variety of transport methods. Most people used boats to hunt TLH caribou during July, August, and September, and snowmobiles were used during the remainder of the year. Some use of aircraft and ATV's occurs throughout the year. Hunters occasionally used highway vehicles when caribou moved near the limited road systems, particularly the gas well road near Barrow.

Natural Mortality: A sizeable die-off occurred during the winter and spring of 1992-1993, and a total of 5 out of 6 satellite-collared caribou died during that period. Between 20 and 23 January, 3 of the 6 satellite collared caribou died within 10 miles of one another west of Teshekpuk Lake and south of the Kogru River. One of these caribou had been killed by wolves, 1 appeared to have starved, and the other 1 died of unknown causes. Weather conditions were very cold and windy during that time, and the snow was deep and very hardpacked. In surveys conducted by dog team, we found 9 carcasses within approximately 100 meters of an east/west transect on a line between Fish Creek and the west end of the Kogru River (a distance of 24 miles). We also made a north/south transect traveling 5 miles to the south of the Kogru River and found 3 carcasses in that distance. If those transects were an accurate indication of the density of dead caribou in the area, I believe that at least several hundred caribou died in that area. Another satellite-collared caribou died in the Kogru River area later in the spring, and 1 died in the foothills of the Brooks Mountain Range. Of the caribou which had VHF radio collars, 36% died during the 1992-1993 winter.

Mortality rates for caribou instrumented with VHF collars for other years has been between 11% and 16%. During the winter of 1993-1994, 2 out of 6 caribou with satellite radio collars died and 12% of the caribou with VHF collars died.

Habitat

Assessment: No efforts were made to quantitatively assess the quality of TLH range. As mentioned above, many caribou appeared to die as a result of weather and poor nutrition east of Teshekpuk Lake during 1992-1993 suggesting that the area may have been overgrazed or that snow conditions blocked access to food. Most of the herd left the coastal plain and wintered in the foothills of the Brooks Range during 1993-1994, and appeared to be in good condition at the end of the winter.

Oil development is the main threat to habitat within the range of the TLH. Extensive development has taken place a short distance to the east, and portions of the TLH range may eventually be developed for drilling or transporting oil. Much of the TLH calving area is within an area that BLM has designated as the Teshekpuk Lake Special Area which will be given a greater level of protection than the surrounding area. However, we need to complete

more survey and telemetry work to evaluate other critical habitat areas that require additional protection.

CONCLUSIONS AND RECOMMENDATIONS

Surveys indicated that the TLH was nutritionally stressed and sustained high levels of mortality during the winter of 1992-1993. A larger proportion of collared caribou died during the winter, parturition occurred later, and calf survival was lower than in any previous year that surveys were done. However, the photocensus completed during the summer of 1993 indicated that the TLH population increased from 16,649 to 27,686 caribou, an increase of 13.5% per year. We attempted a census in 1992, but the camera malfunctioned. Field counts indicated that there were probably more caribou present in 1992 than in 1993.

The amount of range overlap between the TLH, CAH, and WAH is presently unknown. If considerable exchange is occurring among the herds, changes in population size of the TLH may reflect immigration or emigration rather than actual productivity. Long-term studies, particularly telemetry surveys, of all 3 herds are needed to better understand how much exchange actually occurs.

As discussed previously, it is difficult to accurately assess harvest levels for the TLH. It will be even more difficult in the future because the North Slope Subsistence Study ended after the 1989-1990 season. The Department is currently working with the NSB to develop a harvest monitoring system, which would involve hiring local village residents as harvest monitors.

Satellite radiotelemetry has been very useful in increasing our understanding of TLH movements. Some of the extensive movements would have been impossible to track using standard VHF radiotelemetry. Satellite telemetry has clearly illustrated that there is great variability in movements among years, particularly among winters. We have also learned that critical areas east and north of the Teshekpuk Lake are used by the herd for calving, migration, and insect relief each year, and it would be very detrimental to the herd to block access to these areas. VHF collars have been very useful in completing censuses and composition surveys. We need to continue using both satellite and VHF collars to monitor herd status.

In keeping with the goal to capture caribou without the use of drugs, we used a helicopter with a skid-mounted net gun to capture caribou in 1992 and 1993. We used hobbles and masks to control the caribou. No sedatives were used even when measuring, weighing, and collecting blood from the animals. Each year we had 1 mortality when the caribou fell and broke their necks after becoming tangled in the net. The carcasses were donated to the Senior Citizen's Center in Barrow. Although the skid-mounted net gun is an effective alternative to using tranquilizer darts, it would be desirable to find an area where caribou could be captured while making a water crossing to eliminate the cost of a helicopter and reduce the number of mortalities.

Because the TLH population appears to be increasing in number, we do not recommend any regulatory changes. However, the TLH is relatively small compared to some arctic caribou herds and receives substantial hunting pressure. If hunting pressure increases, or oil exploration or development affects the population size of the TLH, or if the population number declines due to natural causes, regulatory restrictions may be necessary in the future. Because the TLH mixes with caribou from the WAH and CAH, it would be impossible to create regulations that would impact the TLH only. However, if a separate bag limit and/or season was established and enforced for the core area of the TLH between Dease Inlet and the Colville River, the TLH harvest could be significantly reduced.

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

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]

[a] Derived from visual estimate.
[b] Derived using aerial photocensus.
[c] Rate of change calculated using only numbers derived from photocensus.

Table 2. Spring composition data for the Teshekpuk Lake caribou herd, 1990-1993.

Year	Adults	Short Yearlings	Total	Short Yearlings: 100 Adults
1990	278	74	352	27
1991	532	168	700	24
1992	635	223	858	26
1993	1197	265	1462	22
1994	1281	205	1486	16

Table 3. Teshekpuk Lake caribou herd postcalving composition counts, June-July, 1991-1994.

Date	Bulls: 100 Cows	Percent Bulls	Calves: 100 Cows	Percent Calves	Percent Cows	Composition Sample Size
1991[a]	25	13	66	35	52	3673
1992[a]	93	34	80	29	37	3047
1993[a]	98	37	39	15	38	2959
1994[b]				39		1681

[a] Survey conducted using a helicopter.
[b] Survey conducted using a fixed wing aircraft.

Table 4. Percent annual caribou harvest and chronology among Barrow residents.

Year	March April	May June	July Aug	Sept Oct	Nov Dec	Jan Feb	Annual Harvest
1987/88	5%	5%	40%	44%	1%	5%	1595
1988/89	5%	6%	38%	41%	4%	6%	1533
1989/90	6%	2%	49%	29%	3%	11%	1656

[a] Braund, 1991.

LOCATION

Game Management Unit: 26B and 26C (26,000 mi^2)
Herd: Central Arctic
Geographical Description: Central Arctic Slope and Brooks Range

BACKGROUND

The Central Arctic Caribou Herd (CACH) was first recognized by biologists as a discrete herd in the mid-1970s (Cameron and Whitten 1979). Much of the herd's summer range lies within, or adjacent to, the industrial area near Prudhoe Bay. The CACH winters to the south and southeast of the oilfield; from the northern foothills to the southern slopes of the Brooks Range. Variable mixing 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 has occurred. However, no permanent exchange of caribou has been documented.

The CACH grew from an estimated 5000 caribou in 1975, to over 23,000 in 1992 (Cameron and Whitten 1979; Whitten 1988; Whitten and Cameron 1983*a*; Valkenburg 1993; ADF&G files). The present herd size is unknown. The rate of herd growth has decreased steadily since 1985 (Valkenburg 1993), and the herd size has probably stabilized or even declined the last few years. Cameron (1993) suspects the herd may have reached or even exceeded carrying capacity.

Oil exploration and development on the North Slope which began in the late 1960s provided the impetus for long-term Alaska Department of Fish and Game (ADF&G) studies of the population dynamics, distribution, movements, and effects of development on the CACH. In recent years calving activity has been rare in the Prudhoe Bay oilfield (Whitten and Cameron 1985) where it was known to occur before development. Additionally, cows and newborn calves have been underrepresented along the Trans-Alaska Pipeline corridor and around oil production facilities (Cameron et al. 1992, Cameron and Smith 1992). Major movements of CACH caribou through the Prudhoe Bay oilfield no longer occur in summer (Whitten and Cameron 1983*b*), and caribou distribution and movements within the Kuparuk oilfield have been altered substantially (Smith and Cameron 1983, 1985*ab*, Curatolo and Murphy 1986).

This report summarizes harvest data, population size, sex and age composition, and movement data from July 1992 through June 1994. During this reporting period, 3 scientific papers (Cameron et al. 1993, Cameron 1994, and Cameron and Ver Hoef 1994) and several technical reports (Cameron 1993, Smith 1994) were completed. In December 1992 a poster on "The Importance of Summer Weight Gain to the Reproductive Success of Caribou in Arctic Alaska" was presented by Raymond D. Cameron (ADF&G) and Robert White (Univ. of Alaska, Fairbanks) at the Fifth Australasian Wildlife Management Society Conference, Brisbane. In 1992 and 1993 an interagency hunter check station was operated (Smith 1994) along the Dalton Highway.

MANAGEMENT DIRECTION

Based on the hypothesis that displacement, if of sufficient magnitude, would be harmful to the CACH (Cameron 1983), ADF&G proceeded with 2 management approaches. We worked with the oil industry to minimize disturbance to caribou movement from barriers created by oil development. Acting on the assumption that stress is cumulative, ADF&G has also curtailed hunting in areas adjacent to the oilfield and the pipeline haul road. The current management objectives reflect these concerns.

Management Goals and Objectives

1. Minimize the adverse effects of development on caribou.

    a. Work with industry to prevent the construction of barriers to the free passage of caribou.

    b. Work with industry and other agencies to minimize disturbance to caribou in proximity to developments, except where caribou constitute a hazard.

    c. Maintain necessary restrictions on caribou hunting.

2. Provide for continued caribou hunting at a level which does not significantly affect population dynamics of the CACH, especially in areas away from developments.

    a. Determine the influence of current harvest levels on the CACH.

    b. Minimize harvest of cows from the CACH.

    c. Maintain a bull:cow ratio of at least 40:100.

3. Maintain opportunities for people to see caribou along the Dalton Highway and in the oilfields.

    a. Work with industry and other agencies to minimize disturbances to caribou in proximity to developments, except where caribou constitute a hazard.

    b. Regulate hunting along the Dalton Highway so conflicts between hunters and consumptive users are minimized, and caribou are not displaced from the vicinity of the road by hunting.

METHODS

Population Size

Population size was estimated in July 1992 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 Fairchild T-11 9x9-inch camera mounted in a Dehavilland Beaver. Caribou were counted directly from the photographs.

Population Composition

Herd composition was estimated from counts conducted from a helicopter. Observed caribou were classified as cows, calves, and small, medium, or large bulls.

Harvest

Harvest of caribou by nonlocal hunters was estimated from returns of harvest ticket report cards during 1992-1994 and from a check station in place on the Dalton Highway during most of August and September in 1992 and 1993. Alaska residents residing north of the Yukon River are not required to obtain the standard caribou harvest tickets or harvest report cards. The Division of Subsistence has estimated caribou harvest at Kaktovik and Nuiqsut, which provides the best available information on caribou harvest from the CACH by local residents. All caribou reported on harvest ticket report cards from Unit 26B were assumed to be CACH caribou, although it is known some mixing with the Porcupine Herd occasionally occurs in the southeast corner of the subunit during fall and winter.

Movements and Distribution

Movements of the CACH 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: The estimated size of the CACH was 23,444 in July 1992 based on the photocensus conducted during the postcalving aggregation. The photocensus scheduled for July 1994 did not occur because of mixing of the CACH with the Porcupine Caribou Herd. It is generally believed that herd growth of the CACH has leveled off. Present herd size is unknown, but numbers may have declined slightly since the 1992 estimate.

Population Composition: Composition data for the CACH indicate a general decline in recruitment beginning with the 1986 cohort (Table 1). Since 1988, fecundity in radiocollared

cows has been relatively low (e.g., 75% in 1992; Cameron 1993; ADF&G files). Survival of calves to 2 weeks has varied but was particularly low in 1989. Variability in calf numbers and fecundity is apparently related to nutrition (Cameron et al. 1993). Wolf and grizzly bear predation is low because wolves and bears are rare within the summer range of the CACH. No summer composition counts were conducted in 1993, and mixing with the Porcupine Herd prevented a composition count in July 1994.

Fall 1992 composition data for the CACH indicate the bull:cow ratio continues to be high (Table 2). Bulls from the Western Arctic Herd may mix with the CACH during fall. In any event, harvest of bulls could be increased within the range of the CACH. No fall composition count was conducted in 1993, and adverse weather conditions prevented a composition count in October 1994.

Distribution and Movements: Calving and summer distribution of CACH caribou has been similar to previous years on the coastal plain. In early fall the herd gradually moves toward the northern foothills of the Brooks Range. The herd has occupied areas further south, often on the southern slopes of the Brooks Range, during the past several winters. Variable numbers of Western Arctic caribou have ranged as far east as the pipeline in fall, and it is not uncommon for CACH caribou to be mixed with caribou from the Western Arctic, Porcupine, and Teshekpuk herds at various times during the winter, and with Porcupine Herd caribou during July. Since 1975 no radiocollared caribou have calved in 1 herd and subsequently moved to and calved in an adjacent herd.

Mortality

Harvest: Most of the harvest of the CACH occurs in Unit 26B. Occasionally the herd winters in the northern portions of Units 24 and 25A, mixing with the Western Arctic and Porcupine caribou herds.

Season and Bag Limit.

Units and Bag Limits	Subsistence/ Resident Open Seasons	Nonresident Open Seasons
Unit 24 (other than Kanuti drainage)	1 Jul-30 Jun	
Resident Hunters: 5 caribou per day; however, cow caribou may not be taken 16 May-30 June.		
Nonresident Hunters: 5 caribou; however, cow caribou may not be taken 16 May-30 June.		1 Jul-30 Jun
Unit 25A.		
Resident Hunters: 10 caribou; however, no more than 5 caribou may	1 Jul-30 Apr	

be transported from this unit per regulatory year. (Transport restrictions deleted for 1993-1994 season).		
Nonresident Hunters: 5 caribou.		1 Jul-30 Apr
Unit 26B: that portion north of 69°30¢ and west of the east bank of the Kuparuk River to a point at 70°10¢N lat. 149°04¢W long., then west approximately 22 miles to 70°10¢ lat. 149°56¢W long., then following the east bank of the Kalubik River to the Arctic Ocean.		
Resident Hunters: 10 caribou.	1 Jul-30 Apr	
Nonresident Hunters: 5 caribou.		1 Jul-30 Apr
Remainder of Unit 26B.		
Resident Hunters: 2 caribou; however, only 1 bull may be taken from 1 July-30 September, and cow caribou may be taken only from 1 October-30 April.	1 Jul-30 Apr	
Nonresident Hunters: 1 bull.		1 Jul-30 Apr
Unit 26C.		
Resident Hunters: 10 caribou; only bull caribou may be taken 23 June-30 June.	1 Jul-30 Apr	
Nonresident Hunters: 5 caribou.		1 Jul-30 Apr

Additional regulations affecting the taking of CACH caribou include special restrictions on hunting in the Dalton Highway Corridor Management Area (DHCMA); 5 miles either side of the Dalton Highway between the Yukon River and the Prudhoe Bay Closed Area. The DHCMA is closed to hunting except with bow and arrow. Hunters must possess a valid International Bowhunter Education Program card when hunting within the corridor. In addition, motorized vehicles, except aircraft, boats and licensed highway vehicles, may not be used to transport game or hunters within the DHCMA. Any hunter traveling on the Dalton Highway must stop at check stations operated by the department within the Dalton Highway Management Area.

Federal subsistence hunting regulations during the 1992-1993 hunting season allowed the use of firearms for hunting on federal land within the DHCMA by rural subsistence hunters, including rural residents from south of the Yukon River. Federal regulations for the 1993-1994 hunting season allowed firearms for hunting on federal land within the corridor only by residents of the corridor and nearby villages.

Board of Game Actions and Emergency Orders. Effective with the 1993-1994 regulatory year, the season and bag limit for caribou in Unit 26B southwest of the Kalubik and Kuparuk Rivers was changed to 1 July through 30 June and 10 caribou for residents and 5 for nonresidents. Restrictions on transport from the unit were removed by the Department of Law prior to the 1993-1994 season. No emergency orders were issued during this reporting period. Ownership of 2 tracts of land along the DHCMA was transferred from the Bureau of Land Management to the state in August 1992. With transfer to the state, federal subsistence hunting regulations no longer applied in those areas.

Hunter Harvest. To curtail a rapidly increasing harvest of CACH caribou, more restrictive regulations were adopted in 1986. This resulted in a steadily declining harvest until the 1991-1992 season (Table 3). At that time, interest in hunting CACH caribou increased, especially within the DHCMA, largely because of reduced opportunities to hunt caribou in the Delta, Macomb, and Fortymile herds beginning in fall 1990.

Estimated harvest of caribou by residents of Kaktovik and Nuiqsut was similar to that in previous years and, as in the past, was highly dependent on herd distribution. Despite the lower recruitment in recent years, the bull:cow ratio in the CACH is high and summer predation losses are relatively low. The herd could sustain a harvest of at least 1000 bulls or more.

Hunter Success. During the 1992-1993 regulatory year 655 hunters reported taking 427 caribou (58% success; Table 3). During the 1993-1994 regulatory year 618 hunters reported taking 372 caribou (54% success; Table 3). In 1992, 126 (33.1%) successful hunters reported using bows for taking caribou, and 77 (23%) in 1993. Harvest from the returned harvest ticket report cards includes both hunters passing through the check stations and those accessing Unit 26B by methods other than driving the Dalton Highway.

The number of caribou hunters interviewed at the 1993 check station who used firearms (593) has more than doubled since 1991 (244), though the success rates were similar (44.3% and 49.1%, respectively; Smith 1991, 1994). The number of hunters interviewed who used bows to hunt caribou increased from 291 in 1991 to 341 in 1993, but the success rate dropped from 46.1% to 23.5%. Data from the 1992 check station are not available.

Caribou hunter success in Unit 26B can be high because visibility is good, caribou are numerous, and the Dalton Highway provides access to a large area. Because of hunting restrictions on other caribou herds in Interior Alaska, interest in hunting the CACH increases each year, resulting in increased numbers of caribou hunters in Unit 26B.

In 1993 a positive "Customarily and Traditional" use finding by the Federal Subsistence Board restricted the eligibility for subsistence hunting of the CACH to only those residents of Anaktuvuk Pass, Kaktovik, Nuiqsut, and Wiseman, qualifying those residents to use firearms for caribou on federal lands in the DHCMA. Rural residents from other than those communities who had previously used firearms to hunt caribou on federal lands within the DHCMA were restricted to bow only. This regulation change probably contributed to the

increase in bowhunters from 1991 to 1993. The decrease in success is likely a result of the lack of experience by these new bowhunters in using bows for hunting caribou, or varying caribou distribution.

Harvest Chronology. Although caribou may be taken in Unit 26B during any month except May or June, the greatest proportion of the harvest occurs from August through October (Table 4).

Transport Methods. The Dalton Highway north of Dieterich Camp is officially closed to private vehicles, and after August 31 the corridor north of the Yukon River is also officially closed to private vehicles. However, in recent years, few people have obeyed these closures, and the statute is not enforced. In fact, the ADF&G no longer relies on these restrictions to limit the take of caribou, and management decisions presume that the Dalton Highway is totally open.

Because of restrictions on the use of off-road vehicles within the DHCMA and the remoteness of Unit 26B, hunters use either aircraft, highway vehicles, and/or boats for access (Table 5). Check station and/or harvest report data may underestimate the use of aircraft because many Fairbanks-based hunters fly directly to the subunit. Rifle hunters were likely to use either aircraft or highway vehicles, while most bow hunters used only highway vehicles. Use of boats on the Ivashak and Sagavanirktok rivers continues to increase. Some hunters have started to trailer airboats up the Dalton Highway to use in the Sagavanirktok and tributaries.

Natural Mortality. Summer natural mortality of CACH caribou (especially calves) is low, primarily because calving takes place in relatively wolf-free and bear-free areas near the coast. Until 1990 most CACH caribou wintered in the northern foothills and arctic coastal plain. Wolves in this area have been hunted effectively by Nuiqsut residents for many years and by aircraft hunters before 1987. Wolf numbers have probably been periodically reduced below natural levels. Since 1990 many CACH caribou have wintered in the central Brooks Range and winter mortality may now be higher. Radiocollared caribou are tracked infrequently during winter, making it difficult to estimate adult mortality.

Habitat

Assessment: Habitat of the CACH has been more intensively studied than any other Alaskan arctic herd. Caribou/habitat/development relationships are the subject of ongoing long-term research by ADF&G and the US Fish and Wildlife Service (FWS). The FWS has ongoing habitat mapping and assessment projects, but no final reports are available.

CONCLUSIONS AND RECOMMENDATIONS

Although growth rate of the CACH has decreased in recent years, the low level of summer predation on calves and high bull:cow ratio will make it possible to harvest at least 1000 caribou/year for several years. The presence of Western Arctic and other caribou in Unit 26B

in some years in fall and winter may also relieve harvest pressure on the CACH. Harvest (particularly of bulls) could be liberalized without compromising management goals and objectives. Interest in hunting CACH caribou will probably continue to increase, especially if the Dalton Highway is officially "opened."

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Table 1. Central Arctic Herd caribou calving composition counts and estimated population size, regulatory years 1978-1994.

Survey date	Yearlings: 100 cows	Bulls: 100 cows	Calves: 100 cows	Percent calves	Percent yearling	Percent cows	Percent bulls	Composition sample size	Population size
6/78	--	19	68	36	--	53	10	950	5000
6/79	24	6	80	38	12	47	3	1865	--
6/80	48	4	69	31	22	45	2	787	--
6/81	22	9	87	40	10	46	4	3337	8537
6/82	--	20	62	34	--	55	11	1101	--
6/83	--	16	86	42	--	50	8	1879	12,905
6/12/84	25	9	89	40	11	45	4	2692	--
6/13-14/85	35	16	88	37	14	42	7	2357	--
6/12-13/86	33	7	56	29	16	51	4	891	--
6/13/87	19	4	74	37	10	51	2	4839	--
6/10-15/88	32	7	66	32	16	49	3	4892	--
6/11-15/89	16	6	48	28	9	59	4	2520	--
6/11-15/90	11	31	75	35	5	46	14	6543	--
6/17-20/91[a]	29	73	45	18	12	40	30	2500	19,046[b]
6/11-14/92	12	6	73	38	6	53	3	5556	23,444[c]
1993[d]	--	--	--	--	--	--	--	--	--
1994[d]	--	--	--	--	--	--	--	--	--

[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.

Table 2. Central Arctic herd caribou fall composition counts, regulatory years 1976-1994.

Survey date	Bulls: 100 cows	Calves: 100 cows	Percent calves	Percent cows	Percent small bulls (% of bulls)	Percent medium bulls (% of bulls)	Percent large bulls (% of bulls)	Percent bulls	Composition sample size
10/76	122	44	17	38	--	--	--	46	1223
10/77	118	55	20	37	--	--	--	43	628
10/78	96	58	23	39	--	--	--	38	816
10/80	132	49	18	35	--	--	--	47	1722
10/81	81	64	26	41	22	41	36	33	1712
10/16-18/92	96	47	19	41	37	27	40	40	2469
1993[a]	--	--	--	--	--	--	--	--	--
1994[a]	--	--	--	--	--	--	--	--	--

[a] No survey.

Table 3. Harvest of caribou and hunter success in Unit 26B, 1984-1994.

Regulatory year	Reported harvest[a]				No. of hunters	Percent Successful hunters	Estimated unreported harvest[b]	Total harvest
	Male	Female	Unk	Total				
1984-1985	313	55	0	368	--	--	100-200	468-568
1985-1986	482	177	3	662	--	--	100-200	762-862
1986-1987	311	34	0	345	287	76	100-200	445-545
1987-1988	176	2	3	181	225	77	100-200	281-381
1988-1989	179	7	0	186	255	73	100-200	286-386
1989-1990	132	8	0	140	221	63	100-200	240-340
1990-1991	96	16	0	112	173	55	100-200	196-296
1991-1992	383	24	1	408	618	57	100-200	508-608
1992-1993	391	32	4	427	655	58	100-200	527-627
1993-1994	347	23	2	372	618	54	100-200	472-572

[a] Based on returned harvest reports. Does not include numbers from registration hunt or unreported harvest.
[b] Estimate by area biologist based on distribution of caribou.

Table 4. Harvest chronology of caribou in Unit 26B, 1992-1994[a].

Year	Month												Unk	Total
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
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

[a] Includes only harvest from harvest reporting cards.

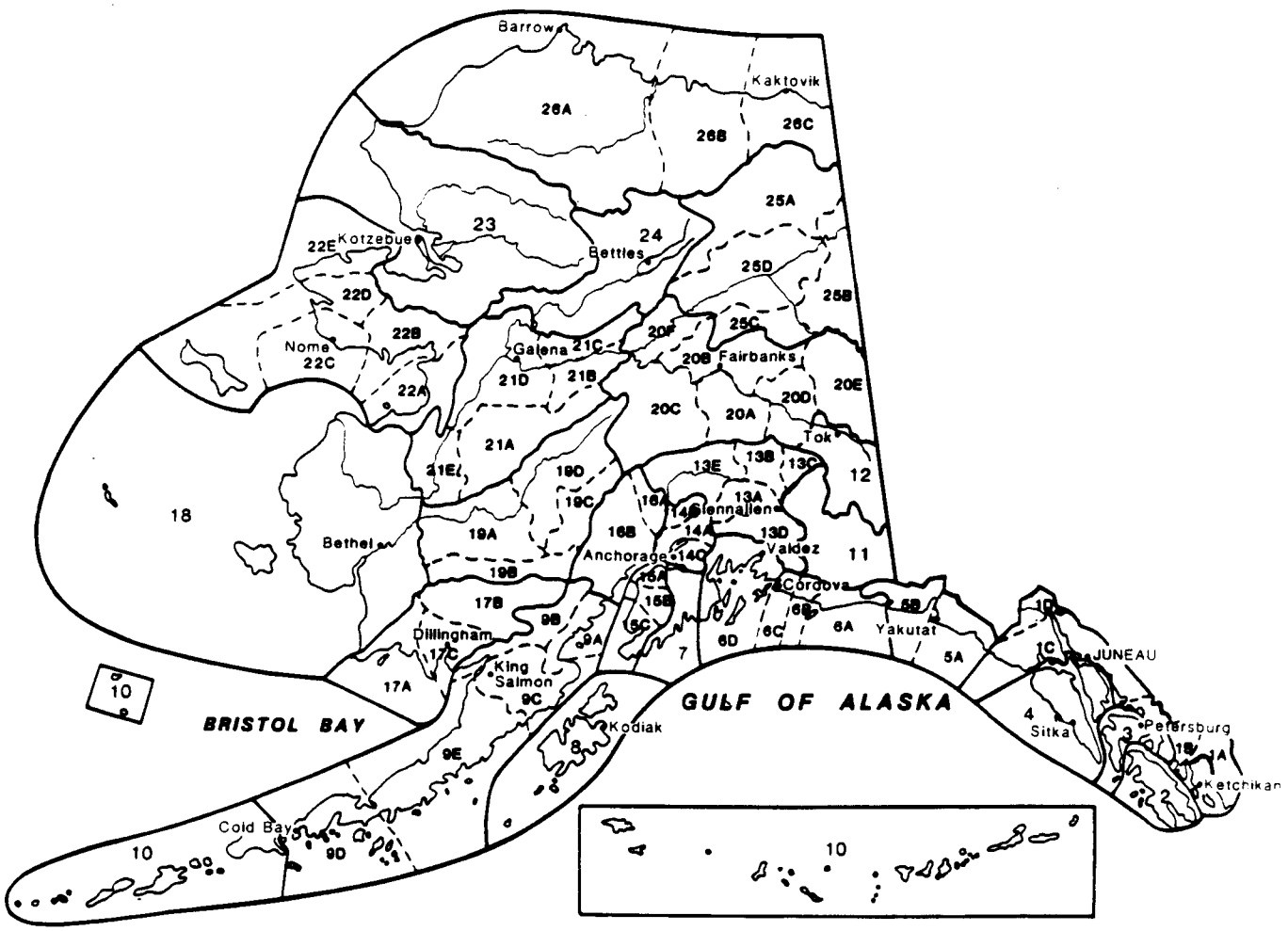
Table 5. Transport methods of successful caribou hunters reporting from Unit 26B, 1984-1994.

Regulatory year	Airplane	Horse	Boat	3-4-Wheeler	Snowmachine	Off-road vehicle	Highway vehicle	Unk	Total[a]
1984-1985	40	--	--	--	--	--	140		180
1985-1986	61	--	--	--	--	--	22		283
1986-1987	85	--	--	--	--	--	133		218
1987-1988	83	1	11	--	2	1	71		169
1988-1989	69	1	17	--	0	1	88		176
1989-1990	--	--	--	--	--	--	--		--
1990-1991	--	--	--	--	--	--	--		--
1991[b]-1992	56	3	110	--	--	16	343		528
1992-1993	89	7	17	6	0	0	243	18	380
1993-1994	49	4	20	4	2	0	242	12	333

[a] Total hunters reporting.
[b] Check station data only.

NOTES

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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