Species Management Report, ADF&G/DWC/SMR-2013-3

Caribou Management Report of Survey-Inventory Activities, 1 July 2010–30 June 2012

Patricia Harper, editor

2013 Set

Alaska Department of Fish and Game Division of Wildlife Conservation

Species Management Report, ADF&G/DWC/SMR-2013-3

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Alaska Department of Fish and Game
Division of Wildlife Conservation
P.O. Box 115526
Juneau, Alaska 99811-5526

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Species management reports provide information about species that are hunted or trapped and management actions, goals, and recommendations for those species. Detailed information is prepared for each species every two or three years, depending on the species, by the area management biologists for game management units in their areas. Reports are not produced for species that are not managed for hunting or trapping or for areas where there is no current or anticipated activity. The individual unit reports are compiled in this statewide report. Unit reports are reviewed and approved for publication by regional management coordinators.Any information taken from this report should be cited with credit given to authors and the Alaska Department of Fish and Game. Authors are identified at the end of each unit section.

If this report is referenced in its entirety, please reference as follows:

Harper, P., editor. 2013. Caribou management report of survey-inventory activities 1 July 2010–30 June 2012. Alaska Department of Fish and Game, Species Management Report ADF&G/DWC/SMR-2013-3, Juneau.

Please note that this report was released as a complete set in 2015, but is part of the 2013 set of species management reports. We encourage referencing this report as a 2013 report to maintain understanding of when reports were written and ease of locating this particular set of reports.

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Cover Photo: Two caribou in northwestern Alaska. ©2013 AD&FG. Photo by Jim Dau.

CARIBOU MANAGEMENT REPORT

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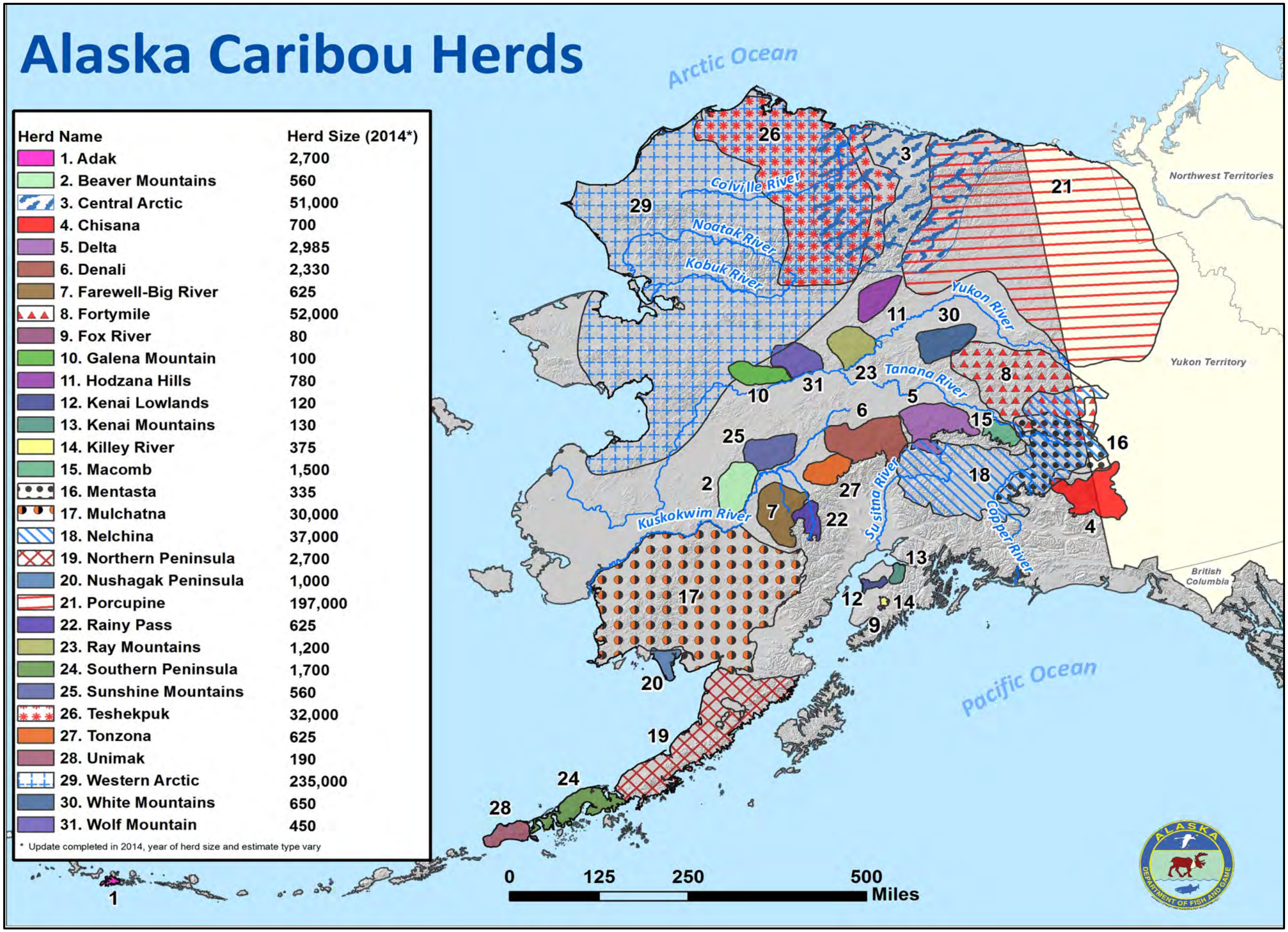
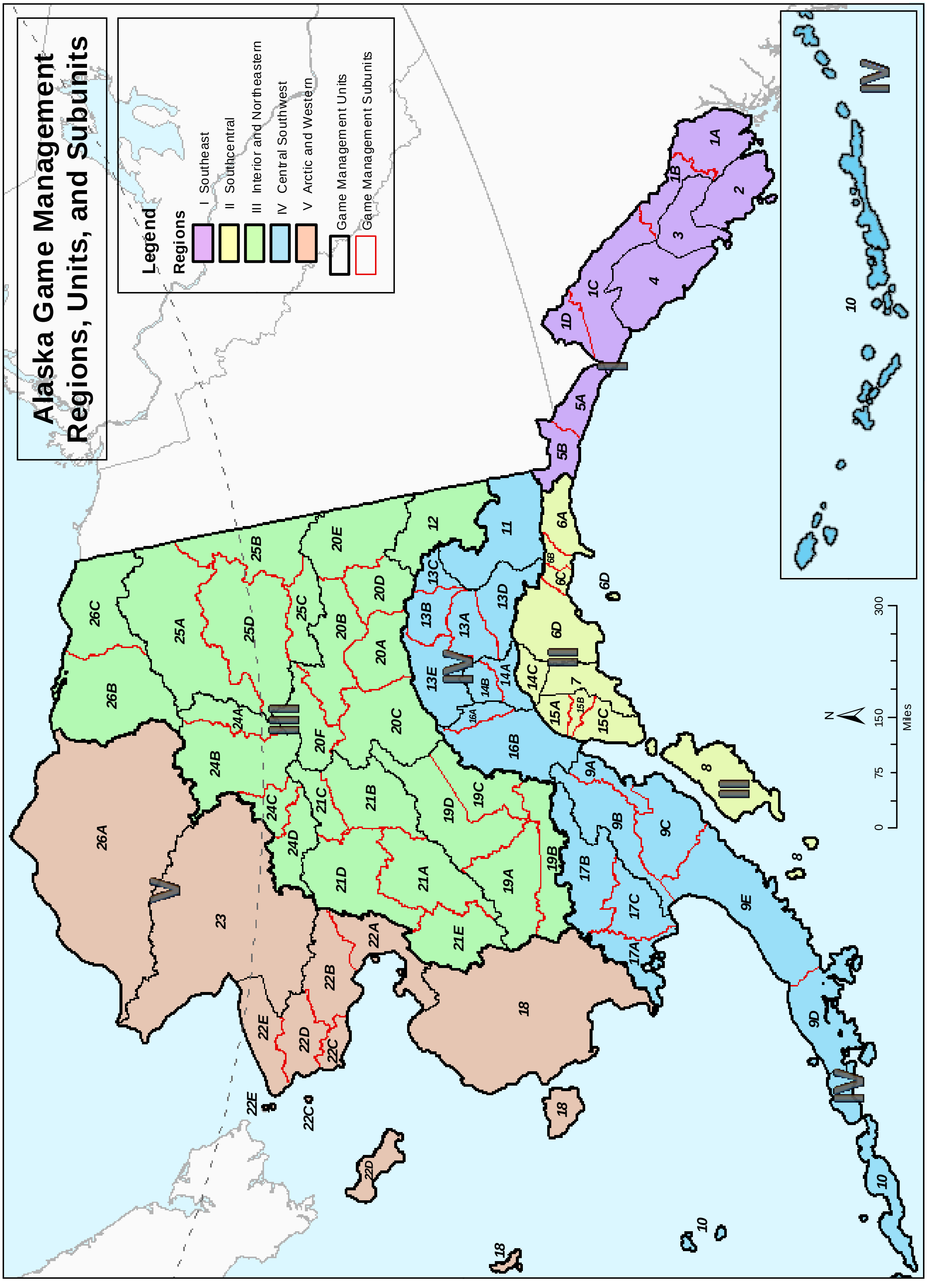
To: 30 June 2012


Alaska Caribou Herds
Arctic Ocean
Pacific Ocean
Herd Name
Herd Size (2014*)
1. Adak 2,700
2. Beaver Mountains 560
3. Central Arctic 51,000
4. Chisana 700
5. Delta 2,985
6. Denali 2,330
7. Farewell-Big River 625
8. Fortymile 52,000
9. Fox River 80
10. Galena Mountain 100
11. Hodzana Hills 780
12. Kenai Lowlands 120
13. Kenai Mountains 130
14. Killey River 375
15. Macomb 1,500
16. Mentasta 335
17. Mulchatna 30,000
18. Nelchina 37,000
19. Northern Peninsula 2,700
20. Nushagak Peninsula 1,000
21. Porcupine 197,000
22. Rainy Pass 625
23. Ray Mountains 1,200
24. Southern Peninsula 1,700
25. Sunshine Mountains 560
26. Teshekpuk 32,000
27. Tonzona 625
28. Unimak 190
29. Western Arctic 235,000
30. White Mountains 650
31. Wolf Mountain 450
* Update completed in 2014, year of herd size and estimate type vary
Colville River
Noatak River
Kobuk River
Yukon River
Tanana River
Kuskokwim River
Susitna River
Copper River
Northwest Territories
Yukon Territory
British Columbia
0
125
250
500
Miles
ALASKA
DEPARTMENT OF FISH AND GAME


Alaska Game Management
Regions, Units, and Subunits
Legend
Regions
I Southeast
II Southcentral
III Interior and Northeastern
IV Central Southwest
V Arctic and Western
Game Management Units
Game Management Subunits
N
0 75 150 300
Miles

Alaska Department of Fish and Game
Division of Wildlife Conservation
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CARIBOU MANAGEMENT REPORT

From: 1 July 2010
To: 30 June 2012

LOCATION

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

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

GEOGRAPHIC DESCRIPTION: Kenai Peninsula

BACKGROUND

Historical reports say caribou were abundant on the Kenai Peninsula before a series of large fires in the late 1800s, including a massive fire in 1883 (Sherwood 1974). This large-scale disturbance may have destroyed much of the lichen forage used by caribou and, due to long regeneration times for this important winter forage, may have influenced their population decline. Additionally, Allen (1901) reported that "caribou are already very scarce on the Kenai Peninsula, and will doubtless soon be exterminated….native hunters kill the Moose and Caribou for their heads, disposing of them at good prices for shipment to San Francisco." It is likely that large-scale fires coupled with unregulated hunting caused caribou to be extirpated from the Kenai Peninsula by the early twentieth century. Currently there are 4 recognized herds on the peninsula, which were recently established through reintroduction efforts. Reintroductions in 1965 and 1966 established the Kenai Mountain (KM) and Kenai Lowlands (KL) herds. Additional reintroductions in 1985 and 1986 established the Killey River (KR) and Fox River (FR) herds.

The KM herd in Unit 7 currently numbers around 200 animals and ranges over 1,400 km^2 in the drainages of Chickaloon River, Big Indian Creek, and Resurrection Creek. The herd grew to more than 200 animals 7 years after the 1965 reintroduction and numbered more than 400 by the mid-1980s. The population declined twice after it exceeded 400 animals. The herd has been hunted since 1972. From 1972 to 1976, the department issued an unlimited number of registration permits, and the season was closed by emergency order when the harvest exceeded sustainable limits. In 1977, a limited drawing permit system was implemented and remains in place. Past fluctuations in population size suggest the carrying capacity for this herd is 200–400 caribou, due to limited winter range.

The KL herd summers in Subunit 15A north of the Kenai airport to the Swanson River and in the extreme western portion of Subunit 15B. The population winters on the lower Moose River to the outlet of Skilak Lake and in the area around Browns Lake. Its range encompasses about 1,200 km^2 in and around the communities of Soldotna, Kenai, and Sterling. This herd has shown the slowest growth of the 4 Kenai herds. Numbers slowly increased to more than 100 caribou 20 years after the reintroduction in 1966, and presently the herd numbers about 100–130 individuals. Growth in this population has been limited by predation rather than by habitat. Free-ranging domestic dogs and coyotes kill calves in summer and wolves prey on all age classes during winter. Hunts were held in 1981, 1989, 1990, 1991, and 1992, but no permits have been issued since.

The KR herd inhabits over 600 km^2 including the upper drainages of Funny and Killey Rivers and north to the Skilak River in Subunit 15B. The KR herd now numbers around 200–300 individuals. This herd grew steadily to more than 700 animals until 2001, when avalanches killed over a quarter of the population. Due to the nature of the habitat, avalanches may be a significant limiting factor for KR caribou and caribou may compete with Dall sheep for winter range. The KR herd has been hunted since 1994 under a limited drawing permit system.

The FR herd has the smallest range of all Kenai herds at about 120 km^2 south of the Tustumena Glacier between upper Fox River and Truuli Creek in Subunit 15C. The FR herd peaked in 1998 at nearly 100 caribou. Recent surveys in 2010 counted about 75 caribou in the herd. A limited number of hunting permits were issued for this herd 1995–2003 when the population could sustain a harvest. From 2004 to 2010, no hunting permits were issued due to the low number of caribou counted, but numbers increased sufficiently and we have issued 10 drawing permits to hunt this herd each year since 2011.

MANAGEMENT DIRECTION

MANAGEMENT OBJECTIVES

Kenai Mountains caribou: to maintain a posthunt population of 300–400 animals.

Kenai Lowlands caribou: to increase the herd to a minimum of 150. Hunting will be allowed once this objective is reached.

Killey River and Fox River caribou: to maintain viable caribou populations throughout suitable habitat and to provide for opportunities to hunt these herds when deemed sustainable.

METHODS

We attempt to conduct aerial surveys in fixed winged aircraft to determine the number, distribution, and composition of caribou herds. Surveys for the KM, KR, and FR herds typically occur in the fall. Unfortunately, there are years where we have been unable to conduct flights due to other priorities or inclement weather. KL surveys typically occur post-calving in the spring. We also capture animals from the separate herds periodically to maintain a sample of collared animals to assist with our management efforts, and collect harvest data through a mandatory reporting requirement of the drawing permit hunts.

POPULATION STATUS AND TREND

Population Size and Composition

<u>Kenai Mountains:</u> The herd currently numbers around 200 animals (Table 1). No composition counts have been conducted during the reporting period.

Kenai Lowlands: The current population size is about 100–130 caribou; 23% calves were tallied during the last 3 surveys (Table 2).

Killey River: The population was estimated at about 250 caribou following a survey in the fall of 2008 (Table 3).

Fox River Caribou: Surveys conducted in 2009, 2010, and 2011 produced minimum counts of 47, 75, and 46 caribou (Table 4).

MORTALITY

Harvest

Season and Bag Limits.

Kenai Mountains: The season for resident and nonresident hunters in Unit 7 north of the Sterling Highway and west of the Seward Highway has been August 10 – December 31 since 1999. The bag limit has been 1 caribou by drawing permit (DC001) with 250 permits issued each year since 1996 (Table 5).

Kenai Lowlands: The season has been closed since 1993.

Killey River: The season for resident and nonresident hunters in Subunit 15B south and west of Killey River in the Kenai National Wildlife Refuge was August 10 – September 20. Since 2004, the bag limit has been 1 bull by drawing permit (DC608) with 25 permits issued (Table 6).

Fox River: The season for resident and nonresident hunters in a portion of Subunit 15C south of Tustumena Glacier is August 10 – September 20. Drawing permits (DC618) were issued for the 2011 season for the first time since 2003. Ten permits were issued and the bag limit was 1 caribou. Only 2 permit holders reported hunting and 1 bull was harvested (Table 7).

Board of Game Actions and Emergency Orders

There were no Board of Game actions regarding Kenai Peninsula caribou during this report period.

Hunter Residency and Success

Residency and success rates for the KM, KR, and Fox caribou hunts are shown in Tables 8, 9 and 10.

Harvest Chronology

Harvest chronologies for the KM, KR, and Fox caribou hunts are shown in Tables 11, 12 and 13.

Transport Methods

Transport methods for the KM, KR, and Fox caribou hunts are shown in Tables 14, 15, and 16. Caribou in these populations are well off the road system and in areas with restricted access methods. Therefore, access to the hunting grounds requires long hikes, horseback trips, or access via float plane on limited lakes.

HABITAT

Habitat was assessed indirectly through measurements of 10-month old calf weights. The KM caribou had calf weights decreasing each year from 1996 through 2002, but were still generally above the weights of Nelchina calves (Bruce Dale, ADF&G wildlife biologist, personal communication). It is not known if the decline in weights was due to decreasing summer or winter forage quality, a series of deep snow winters, or other factors. Winter range is limited to windswept ridges and restricts the expansion of this herd. The KR caribou calf weights decreased in the late 1990s but were still heavier than KM caribou. Mean adult female weights on the KL herd (130 kg) were significantly greater than KM caribou (108 kg) measured in April of 1991 (t = 4.7, P < 0.01). High body weights and high calf counts directly after parturition indicate the KL caribou are not limited by range. Caribou have been recently reported east of the Harding Icefield near Seward; these may be dispersing FR or KL individuals. Although caribou inhabited the Seward area more than 100 years ago (Porter 1893), it is unknown if the small number of dispersing caribou is enough to establish a population.

Department and Kenai National Wildlife Refuge biologists conducted preliminary habitat assessments for the Killey and Fox River herds before reintroduction in the mid-1980s. These results indicated the KR caribou winter range (516 km^2) should sustain a herd of 400–500 caribou, and the FR caribou winter range (85 km^2) could sustain approximately 80 animals. Calf recruitment for these herds has been moderately low, and habitat may be limiting the growth of the Killey River, Fox River, and Kenai Mountains herds.

CONCLUSIONS AND RECOMMENDATIONS

Caribou studies on the Kenai have been conducted through cooperative efforts of the Alaska Department of Fish and Game, Kenai National Wildlife Refuge, and the U.S. Forest Service. Each herd has unique limiting factors impacting its growth. Basic monitoring and research decreased due to other work obligations and limited staffing. However, with recent hires and increased funding we plan to increase our capture and monitoring efforts for all the Kenai Peninsula caribou herds.

In 2010, the Federal Subsistence Board determined customary and traditional use of the KM herd by residents of Hope and established a Federal season. This determination was made although over 80% of the caribou taken by Hope hunters since 1980 were harvested outside of the Kenai Peninsula. Furthermore, the “long-term use” determination for customary and traditional use was given to Hope residents despite caribou being extirpated from the peninsula from 1915–1965 with limited hunting starting only in 1972. Federal seasons may challenge the successful management of small caribou herds on the Kenai if additional communities obtain customary and traditional use qualification by the Federal Subsistence Board.

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Allen, J. A. 1901. Description of a new caribou from Kenai Peninsula, Alaska. Bulletin of the American Museum of Natural History. Volume 14, Article 10, pp. 143-148.

Porter, R.P. 1893. Report on population and resources of Alaska at the Eleventh Census: 1890. U.S. Dept. of Interior. Census Office.

Sherwood, M. 1974. The Cook Inlet collection, two hundred years of selected Alaskan history. Alaska Northwest Publishing Company, Anchorage, Alaska.

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Please cite any information taken from this section, and reference as follows:

Selinger, J. 2013. Units 7 and 15 caribou management report. Pages 1–12 [*In*] P. Harper, editor. Caribou management report of survey and inventory activities 1 July 2010–30 June 2012. Alaska Department of Fish and Game, Species Management Report ADF&G/DWC/SMR-2013-3, Juneau.

Table 1. Kenai Mountains caribou composition counts and estimated population size, regulatory years 2007–2012.

Regulatory year	Bulls:100 cows	Calves: 100 cows	% Calves	Composition sample size	Minimum Count	Estimated herd size
2007			-no surveys conducted-			
2008			-no surveys conducted-			
2009				N/A	264	300
2010			-no surveys conducted-			
2011				N/A	200	200–250

Table 2. Kenai Lowlands caribou composition counts and estimated population size, regulatory years 2007–2012.

Regulatory year	Bulls:100 cows	Calves: 100 cows	% Calves	Composition sample size	Minimum Count	Estimated herd size
2007			23	98	98	135
2008			-no surveys conducted-			
2009	N/A	N/A	23	102	102	135
2010			-no surveys conducted-			
2011			-no surveys conducted-			

Table 3. Killey River caribou composition counts and estimated population size, regulatory years 2007–2012.

Regulatory year	Bulls:100 cows	Calves: 100 cows	% Calves	Composition sample size	Minimum Count	Estimated herd size
2007			-no surveys conducted-			
2008				N/A	200	250
2009			-no surveys conducted-			
2010			-no surveys conducted-			
2011			-no surveys conducted-			

Table 4. Fox River caribou fall composition counts and estimated population size, regulatory years 2007–2012.

Regulatory year	Bulls:100 cows	Calves: 100 cows	% Calves	Composition sample size	Minimum Count	Estimated herd size
2007			-no surveys conducted-			
2008			-no surveys conducted-			
2009				N/A	47	50–75
2010				N/A	75	75–100
2011				N/A	46	50–75

Table 5. Kenai Mountains caribou harvest (DC001, either sex), regulatory years 2007–2012.

Regulatory year	Permits issued	Permittees that hunted	Harvest			Total harvest
			bulls	cows	unknown	
2007	250	99	9	9	1	19
2008	250	99	15	4	0	19
2009	250	111	13	5	0	18
2010	250	86	13	6	0	19
2011	250	47	21	5	0	26

Table 6. Killey River caribou harvest (DC608, bull only), regulatory years 2007–2012.

Regulatory year	Permits issued	Permittees that hunted	Harvest			Total harvest
			bulls	cows	unknown	
2007	25	12	4	0	0	4
2008	25	12	3	0	0	3
2009	25	12	6	0	0	6
2010	25	15	5	0	0	5
2011	25	12	6	0	0	6

Table 7. Fox River caribou harvest (DC618, either sex), regulatory years 2007–2012.

Regulatory year	Permits issued	Permittees that hunted	Harvest			Total harvest
			bulls	cows	unknown	
2007			No Season			
2008			No Season			
2009			No Season			
2010			No Season			
2011	10	2	1	0	0	1

Table 8. Kenai Mountains caribou, hunter residency and success (DC001), regulatory years 2007–2012.

	Successful					Unsuccessful				
Regulatory year	Local [a] resident	Nonlocal resident	Non-resident	Total	Percent success	Local [a] resident	Nonlocal resident	Non-resident	Total	Total hunters
2007	2	16	1	19	19	7	71	2	80	99
2008	2	17	0	19	19	9	70	1	80	99
2009	4	14	0	18	16	1	89	3	93	111
2010	2	17	0	19	22	5	62	0	67	86
2011	3	23	0	26	28	6	59	1	66	92

[a] Local = resident of Unit 7.

Table 9. Killey River caribou, hunter residency and success (DC608), regulatory years 2007–2012.

	Successful					Unsuccessful				
Regulatory year	Local [a] resident	Nonlocal resident	Non-resident	Total	Percent success	Local [a] resident	Nonlocal resident	Non-resident	Total	Total hunters
2007	3	0	1	4	33	2	4	2	8	12
2008	0	2	1	3	25	7	2	0	9	12
2009	3	2	1	6	50	1	5	0	6	12
2010	1	4	0	5	33	4	6	0	10	15
2011	2	3	1	6	50	2	4	0	6	12

[a] Local = resident of Unit 15.

Table 10. Fox River caribou, hunter residency and success (DC618), regulatory years 2007–2012.

Regulatory year	Successful					Unsuccessful				
	Local [a] resident	Nonlocal resident	Non-resident	Total	Percent success	Local [a] resident	Nonlocal resident	Non-resident	Total	Total hunters
2007			No Season					No Season		
2008			No Season					No Season		
2009			No Season					No Season		
2010			No Season					No Season		
2011	1	0	0	1	50	0	0	1	1	2

[a] Local = resident of Unit 15.

Table 11. Kenai Mountains caribou, harvest chronology (DC001), regulatory years 2007–2012.

Regulatory year	Harvest Periods				Harvest
	8/10–8/31	9/01–9/30	10/01–10/31	11/01–12/31	
2007	11	5	3	0	19
2008	13	4	2	0	19
2009	10	6	2	0	18
2010	10	6	2	1	19
2011	13	11	2	0	26

Table 12. Killey River caribou, harvest chronology (DC608), regulatory years 2007–2012.

Regulatory year	Harvest Periods				Harvest
	8/10–8/15	8/16–8/31	9/01–9/15	9/16–9/30	
2007	2	2	0	0	4
2008	2	1	0	0	3
2009	1	2	3	0	6
2010	1	2	0	0	3
2011	1	1	4	0	6

Table 13. Fox River caribou, harvest chronology (DC618), regulatory years 2007–2012.

Regulatory year	Harvest Periods				Harvest
	8/10–8/15	8/16–8/31	9/01–9/15	9/16–9/30	
2007	No Season				
2008	No Season				
2009	No Season				
2010	No Season				
2011	0	1	0	0	1

Table 14. Kenai Mountains caribou, harvest (DC001) by transport method, regulatory years 2007–2012.

Regulatory year	Airplane	Horse	Boat	3/4 wheel-ATV-ORV	Highway vehicle	Snow-machine	Other-Unknown	Foot	Harvest
2007	0	0	0	0	15	0	4	0	19
2008	0	2	0	0	11	0	6	0	19
2009	2	3	0	1	10	0	2	0	18
2010	1	5	0	0	11	0	2	0	19
2011	3	3	0	0	18	0	1	1	26

Table 15. Killey River caribou, harvest (DC608) by transport method, regulatory years 2007–2012.

Regulatory year	Airplane	Horse	Boat	3/4 wheel-ATV-ORV	Highway vehicle	Snow-machine	Other-Unknown	Foot	Harvest
2007	2	0	2	0	0	0	0	0	4
2008	1	2	0	0	0	0	0	0	3
2009	5	0	1	0	0	0	0	0	6
2010	4	0	0	0	0	0	1	0	5
2011	4	0	2	0	0	0	0	0	6

Table 16. Fox River caribou, harvest (DC618) by transport method, 2007–2012.

Regulatory year	Airplane	Horse	Boat	3/4 wheel-ATV-ORV	Highway vehicle	Snow-machine	Other-Unknown	Foot	Harvest
2007					No Season				
2008					No Season				
2009					No Season				
2010					No Season				
2011	1	0	1	0	0	0	0	0	1

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CARIBOU MANAGEMENT REPORT

From: 1 July 2010
To: 30 June 2012

LOCATION

GAME MANAGEMENT UNIT: 8 (5,097 mi^2)

GEOGRAPHIC DESCRIPTION: Kodiak and adjacent islands

BACKGROUND

All of the caribou on Kodiak originate from the introduction of 32 domestic reindeer in 1924. The reindeer were brought to Lazy Bay on the south end of Kodiak Island as part of a U.S. Department of the Interior program that began in 1892 to bring reindeer into western Alaska from Siberia to provide Native Alaskans additional commercial and subsistence opportunities. Prior to the introduction, a local village resident spent three years in Cantwell, Alaska as an apprentice in the Alaska Reindeer Service, learning herding practices from other Alaska Natives who had originally been taught by nomadic Scandinavian reindeer herders (Saami) who were hired to teach husbandry (Alutiiq Museum archives, Kodiak, Alaska).

The reindeer herd was managed by residents of Akhiok, under a contract with the U.S. Reindeer Service. The herd ranged in the Alitak and Olga Lakes area, in tundra vegetation that provided the best reindeer habitat on Kodiak. As the herd grew, provisions were made to teach new apprentices to provide more opportunities for local villagers (Lantis 1950), and by 1931, 8 Native stockholders took ownership of the herd by forming the Alitak Native Reindeer Corporation (Corporation) and obtained a federal grazing lease. By 1938, there were 11 stockholders in the reindeer corporation and 24 Akhiok households – most if not all of the community – participated in the business. Herding also became a family tradition, as sons accompanied their fathers to learn the trade (Alutiiq Museum archives, Kodiak, Alaska).

The Reindeer Act passed on September 1, 1937 restricted ownership of domestic reindeer in Alaska to Natives only, and provided the administrative machinery for the eventual declaration and federal purchase of all non-Native owned deer. Statewide, the industry was beleaguered by political and bureaucratic bungling and overgrazing of many of the prime ranges. By the early 1940s, many of the herds had crashed and reindeer raising in Alaska was “a very sick industry” (Hanson 1952). In spite of that, reindeer on Kodiak were thriving and reached a peak of about 3,000 animals by 1950.

The herd declined in size following a catastrophic fire in the early 1950s, which destroyed hundreds of acres of prime reindeer forage. The fire was started by a stove in the herders’ cabin and forced Akhiok residents to evacuate until firefighters from the Kodiak naval base could control the blaze. The herd escaped during the fire, releasing an estimated 1,200 animals into the wild. After the fire, most herders did not attempt to reclaim the reindeer and took better paying jobs in the fishing industry. Active management of the herd ended in 1961, although reindeer meat continued to be sold to the canneries and individual hunters were allowed to kill reindeer for $25 a head. In 1964 the federal grazing lease expired. The lease was never renewed and a certified letter from the U.S. Bureau of Sport Fisheries and Wildlife (June 10, 1963) stated that "Any property that has not been removed from the leased area or disposed of on or before July 1, 1964 will become the property of the United States Government." The reindeer were not removed and were declared feral by the State of Alaska the next year.

Shareholders of the Alitak Native Reindeer Corporation continued to claim ownership of the herd and sought to sell the remaining animals to the government throughout the 1960s. Letters were exchanged between shareholders, Native leaders, and state and federal bureaucrats all the way to President Dwight Eisenhower. By 1968, it appeared that an agreement had been reached for the Corporation to sell all of the reindeer to the State of Alaska for $10 per head. Remaining shareholders or their heirs were identified and a joint aerial survey of the herd was conducted to estimate the population size. Unfortunately, the deal was never sealed, perhaps due to legal complications with the sale of live reindeer to non-Natives or because of negotiations associated with the pending Alaska Native Claims Settlement Act.

In the 1970s and the 1980s, there were again attempts to negotiate compensation for the herd, but the issue was never settled. Interest in the fate of the herd and the legal aspects of ownership were resurrected in 2010 when descendants of the shareholders of the Alitak Native Reindeer Corporation began inquiries on how to obtain reindeer to restart commercial reindeer herding operations on Native lands near Akhiok and other villages.

Throughout the 1960s–2000s, state and federal management of the herd was passive, neither attempting to sustain or eliminate it. By having no closed season or bag limit, all hunters, including former owners of the herd, could take as many animals as they wanted as long as they obtained a caribou harvest ticket before hunting, salvaged all the meat for human consumption, and did not hunt on the same day they had been flying. During that time the herd settled into favored range along the Ayakulik and Sturgeon rivers and stabilized at about 250–350 animals.

In 2002, the Alaska Board of Game authorized same-day-airborne hunting and the reported harvest of feral reindeer increased as some lodges and transporters began marketing hunts. This increased pressure on the herd prompted concern that the herd would be seriously depleted. In 2009 the board passed a proposal that not only reinstated the prohibition on same-day-airborne hunting, but also established a management objective to sustain the herd at 200–500 animals. These feral reindeer were officially classified as "caribou" for management purposes.

MANAGEMENT DIRECTION

MANAGEMENT OBJECTIVE

The management objective is to maintain a population of 200–500 caribou for use by all user groups.

METHODS

Each year we conduct opportunistic aerial surveys and collect incidental information from hunters and air-taxi operators. We collected data on harvest and hunting effort from mandatory hunting reports and periodic monitoring of hunting activity through aircraft-based observations.

RESULTS AND DISCUSSION

POPULATION STATUS AND TREND

Population Size

Opportunistic aerial surveys indicated a stable population of 300 – 375 caribou in Unit 8 during this reporting period (Table 1). Kodiak National Wildlife Refuge (Kodiak NWR) staff systematically aerially surveyed most of southwest Kodiak caribou habitat in October 2010, but only 64 animals were seen. Poor sightability and weather conditions plagued the survey (McCrea Cobb, Kodiak NWR biologist, personal communication). Although there were public concerns of a decline in the herd size as a result of increased harvest from 2003–2008, our survey methods were not robust enough to detect such a trend. Recent evidence suggests the herd size is stable to slightly increasing.

Population Composition

We have never collected information on the sex or age composition of this herd.

Distribution and Movement

Reindeer were originally imported to the Alitak region south of the village of Akhiok. During the time the herd was actively managed, animals were either kept in large corrals in that area or allowed to graze in the vicinity of Olga Lakes. After they became feral, the herd moved gradually to the west. In recent times, the primary range has been the upper Ayakulik and lower Sturgeon River drainages. They also occasionally range as far as the Karluk River drainage and the Olga Lakes area.

MORTALITY

Harvest

Season and Bag Limits	Resident and Nonresident Open Seasons
Unit 8:	
One caribou (either sex)	August 1 – January 31

Board of Game Actions and Emergency Orders: There were no Board of Game or emergency actions during this reporting period.

Hunter Harvest: The annual caribou harvest during this reporting period was 14 (11 males, 3 females) in regulatory year (RY) 2010 (a regulatory year runs 1 July through 30 June; e.g., RY10

= 1 July 2010–30 June 2011) and 15 (12 males, 3 females) in RY11, down from the mean of 18.6 (13.4 males, 5.2 females) during the previous 5 years (RY05 through RY09; Table 2)

Hunter Residency and Success: Most successful caribou hunters were Alaska residents, accounting for 78.6% of the reported harvest in RY10 and 66.7% in RY11, up from the annual mean during the previous 5 years (64.8%; Table 3). Hunter success, based on the harvest reports received, was 37.8% in RY10 and 40.5% in RY11.

Harvest Chronology: During this reporting period, most of the reported caribou harvested were taken in September and October (Table 4).

Transportation Methods: Aircraft were the predominant method of transportation for caribou hunters in Unit 8 (Table 5).

Other Mortality

Documenting mortality from sources other than hunting is seldom possible because of the remote setting of the caribou range. Predation by brown bears undoubtedly occurs, but it is probably not common. We rarely received reports of caribou that died of starvation or hypothermia during the winter. We estimate that wounding loss and illegal harvest contribute additional mortality equivalent to 15% of the reported harvest.

HABITAT ASSESSMENT

The Kodiak caribou herd ranges within an area that has little or no anthropogenic influence. There are no permanent human settlements and no infrastructure or resource extraction activities. Hunters and fishermen frequent the river corridors and coastal areas seasonally, but they have only localized impacts on the habitat. A small fire was accidently started at a hunter camp on Halibut Bay in 2009, but it was naturally extinguished after burning less than 10 acres.

NONREGULATORY MANAGEMENT PROBLEMS/NEEDS

In 2010, descendants of the shareholders of Alitak Native Reindeer Corporation requested information from the Alaska Department of Fish and Game (ADF&G) on the history of how the reindeer on Kodiak were declared feral. They also solicited assistance from local legislators on how to obtain reindeer to restart commercial reindeer herding operations on Native lands near Akhiok and other villages. While it would be difficult to capture and domesticate reindeer from the current herd on Kodiak, it may be feasible to obtain animals from other sources. Reestablishment of domestic herds would require careful planning to avoid potential problems with disease transmission, bear predation, and escapement onto adjacent state and federal lands.

CONCLUSIONS AND RECOMMENDATIONS

Introduction and establishment of feral reindeer/caribou on to Kodiak Island followed a different course than the other introduced species on the archipelago. They began as a domestic animal as part of an economic enterprise, transitioned into a feral animal that was not managed, and ultimately ended up as a big game animal that is managed for sustained yield. While we have not actively managed the herd for most of the past 50 years since statehood, the population seems to have reached equilibrium in size (300–375), and the animals range in what appears to be the most suitable caribou habitat on the archipelago. There is a notable lack of objective information on population dynamics and movements, and harvest data are sketchy at best, being totally reliant on hunters knowing that they had to pick up a harvest ticket and remembering to report on a harvest that had no closed season or bag limit.

The decision to manage the herd as a sustainable population raised interest in it and concurrently resurrected controversies that had not been discussed for decades. Heirs to the original owners of the reindeer worked with local Native tribes and corporations to again raise the question of compensation for reindeer that were declared feral and to explore avenues to revitalize reindeer herding on the island. At the same time, staff from Kodiak National Wildlife Refuge raised concerns about the impacts on indigenous vegetation and wildlife caused by encouraging a nonnative ungulate population to remain and increase within the confines of the refuge.

To address these concerns and better manage the caribou herd, we recommend the following:

- More closely monitor the population status of the herd by initiating annual post-calving aggregation (late June-early July) surveys in conjunction with staff from Kodiak NWR.
- Improve harvest monitoring to ensure that all hunters know to obtain harvest tickets and work with ADF&G staff and Alaska Wildlife Troopers to improve harvest reporting.
- Develop study plans and implement a joint ADF&G/ Kodiak NWR research program that incorporates GPS radiotelemetry and habitat assessment techniques to acquire population dynamics, movements, and habitat use information on the herd.
- Work closely with local Native tribes, corporations and shareholders to find practical ways to address their desire to regain reindeer herding opportunities in ways that enhance their chances for success without jeopardizing existing natural resources including, but not limited to, bears, deer, and native vegetation.

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Table 1. Unit 8 aerial caribou composition counts and estimated population, 1924 through regulatory year 2011.

		Classified caribou							
Herd	Regulatory year(s)	Bulls	Cows	Calves	(%)	Bulls: 100 cows	Calves: 100 cows	Total caribou observed[a]	Estimated population
Unit 8	1924	--	--	--	--	--	--	32	32[b]
	1930s	--	--	--	--	--	--	--	500[c]
	1940s	--	--	--	--	--	--	--	1,400[c]
	1950s	--	--	--	--	--	--	--	3,000[c]
	1960s	--	--	--	--	--	--	--	700[c]
	1970s	--	--	--	--	--	--	--	500[c]
	1980s	--	--	--	--	--	--	--	300[d]
	1990s	--	--	--	--	--	--	--	250–300[d]
	2000	--	--	--	--	--	--	--	250–300[d]
	2001	--	--	--	--	--	--	--	250–300[d]
	2003	--	--	--	--	--	--	--	250–300[d]
	2004	--	--	--	--	--	--	--	250–300[d]
	2005	--	--	--	--	--	--	--	250–300[d]
	2006	--	--	--	--	--	--	--	250–300[d]
	2007	--	--	--	--	--	--	--	250–300[d]
	2008	--	--	--	--	--	--	260	250–350[d]
	2009	--	--	--	--	--	--	325	250–350[d]
	2010	--	--	--	--	--	--	336	250–350[d]
	2011	--	--	--	--	--	--	353	300–375[d]

[a] Maximum number observed.

[b] Original transplant of domestic reindeer.

[c] Estimates recorded in ADF&G, Alutiiq Museum, and Kodiak NWR files (Actual number of caribou observed include: 1957 – 740; 1963 – 768; 1965 – 553; 1977 – 250; 1978 – 129; 1979 – 140; 1980 – 225; 1981 – 41; 1982 – 202; and, 1983 – 176).

[d] Based on ADF&G staff estimates.

Table 2. Unit 8 caribou harvest data by permit hunt, regulatory years 2002 through 2011.

Hunt Area	Regulatory Year	Bulls	(%)	Cows	(%)	Unknown	Total harvest[a]
Unit 8	2002	16	(89)	2	(11)	0	18
	2003	14	(74)	5	(26)	0	19
	2004	12	(55)	9	(41)	1	22
	2005	12	(71)	5	(29)	0	17
	2006	10	(56)	8	(44)	0	18
	2007	24	(77)	7	(23)	0	31
	2008	13	(72)	5	(28)	0	18
	2009	8	(89)	1	(11)	0	9
	2010	11	(79)	3	(21)	0	14
	2011	12	(80)	3	(20)	0	15

[a] Totals do not include illegal/unreported harvest data.

Table 3. Unit 8 caribou hunter residency and success, regulatory years 2002 through 2011.

	Successful					
Regulatory Year	Local[a] resident	Nonlocal resident	Nonresident	Unknown	Total Hunters	Total Harvest[b]
2002	7	2	6	0	15	18
2003	7	3	1	1	12	19
2004	7	5	1	1	14	22
2005	4	6	4	0	14	17
2006	5	5	4	0	14	18
2007	13	7	3	0	23	31
2008	4	4	8	0	16	18
2009	3	1	5	0	9	9
2010	9	2	3	0	14	14
2011	8	2	5	0	15	15

[a] "Local resident" includes hunters who live in GMU 8.
[b] Totals do not include illegal/unreported and unknown harvest data.

Table 4. Unit 8 caribou harvest chronology by month (percent in parentheses), regulatory years 2002 through 2011.

Area	Regulatory Year	Harvest periods (percent) August	September	October	November	December	January	Other[a]	*n*
Unit 8	2002	0 (0)	1 (6)	10 (56)	4 (22)	0 (0)	0 (0)	3 (17)	18
	2003	0 (0)	8 (42)	6 (32)	1 (5)	0 (0)	0 (0)	4 (21)	19
	2004	1 (5)	2 (9)	17 (77)	1 (5)	0 (0)	0 (0)	1 (5)	22
	2005	1 (6)	1 (6)	11 (65)	2 (12)	0 (0)	0 (0)	2 (12)	17
	2006	1 (6)	7 (39)	9 (50)	0 (0)	0 (0)	0 (0)	1 (6)	18
	2007	3 (10)	15 (48)	7 (23)	5 (16)	0 (0)	0 (0)	1 (3)	31
	2008	2 (11)	9 (50)	5 (28)	1 (6)	0 (0)	0 (0)	1 (6)	18
	2009	1 (11)	4 (44)	1 (11)	1 (11)	2 (22)	0 (0)	0 (0)	9
	2010	0 (0)	1 (7)	7 (50)	2 (14)	4 (30)	0 (0)	0 (0)	14
	2011	1 (7)	6 (40)	7 (47)	1 (7)	0 (0)	0 (0)	0 (0)	15

[a] Includes February – July and all unknown harvest dates.

Table 5. Unit 8 caribou harvest by transport method (percent in parentheses), regulatory years 2002 through 2011.

Regulatory Year	Airplane		Horse		Boat		ORV		Highway vehicle		Unknown		*n*
2002	15	(83)	0	(0)	3	(17)	0	(0)	0	(0)	0	(0)	18
2003	16	(84)	0	(0)	3	(16)	0	(0)	0	(0)	0	(0)	19
2004	18	(82)	0	(0)	4	(18)	0	(0)	0	(0)	0	(0)	22
2005	13	(76)	0	(0)	4	(24)	0	(0)	0	(0)	0	(0)	17
2006	14	(78)	0	(0)	3	(17)	0	(0)	0	(0)	1	(6)	18
2007	28	(90)	0	(0)	2	(6)	0	(0)	0	(0)	1	(3)	31
2008	18	(100)	0	(0)	0	(0)	0	(0)	0	(0)	0	(0)	18
2009	7	(78)	0	(0)	2	(22)	0	(0)	0	(0)	0	(0)	9
2010	11	(79)	0	(0)	2	(14)	0	(0)	0	(0)	1	(7)	14
2011	12	(80)	0	(0)	3	(20)	0	(0)	0	(0)	0	(0)	15

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CARIBOU MANAGEMENT REPORT

From: 1 July 2008
To: 30 June 2010

LOCATION

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

HERD: Mulchatna

GEOGRAPHIC DESCRIPTION: Drainages into northern Bristol Bay and Kuskokwim River

BACKGROUND

There was little objective information available on the Mulchatna caribou herd (MCH) before 1973. The first historical accounts of caribou in the area are contained in the journals of agents of the Russian-American Fur Company (Van Stone 1988). In 1818, while traveling through areas now included in Game Management Units 17A and 17C, Petr Korsakovskiy noted that caribou were "plentiful" along Nushagak Bay, and there were "considerable" numbers of caribou in the Togiak Valley. Another agent, Ivan Vasilev, wrote that his hunters brought "plenty of caribou" throughout his journey up the Nushagak River and into the Tikchik Basin in 1829. Skoog (1968) hypothesized that the caribou population at that time extended from Bristol Bay to Norton Sound, including the lower Yukon and Kuskokwim drainages as far inland as the Innoko River and the 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.

Reports indicate that caribou numbers in the Mulchatna River area began to increase again in the early 1930s (Alaska Game Commission Reports, 1925–39), then began declining in the late 1930s (Skoog 1968); however, no substantive information was collected between 1940 and 1950 to support this theory.

Reindeer were brought into the northern Bristol Bay area early in the twentieth century to supplement the local economy and food resources. Documentation of the numbers and fate of these animals is scarce, but local residents remember a thriving, widespread reindeer industry before the 1940s. Herds ranged from the Togiak to the Mulchatna river drainages, with individual herders following small groups throughout the year. Suspected reasons for the demise of the reindeer herds include wolf predation and the expansion of the commercial fishing industry, which increased dependence upon a cash-based local economy and decreased interest in herding reindeer. Local residents also suggest 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. 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, no major movements of this herd were observed until the mid- 1990s. An estimated 6,030 caribou were observed during a survey in June 1973. In June 1974 a major effort was made to accurately census this herd. That census yielded 13,079 caribou, providing a basis for an October estimate in 1974 of 14,231 caribou.

We used photo censuses to monitor the herd as it declined through the 1970s. Seasons and bag limits were reduced continuously during that decade. Locating caribou during surveys was difficult, and biologists often underestimated the herd size. Twenty radio transmitters were attached to MCH caribou in 1981, providing assistance in finding postcalving aggregations. During a photo census in June 1981, 18,599 caribou were counted, providing an extrapolated estimate of 20,618 caribou. Photocensus estimates of the MCH since then have been used to document population size. The aerial photo census in July 2008 provided a minimum estimate of 30,000 caribou in the MCH.

MANAGEMENT DIRECTION

MANAGEMENT OBJECTIVES

- To maintain a population of 30,000–80,000 with a minimum bull:cow ratio of 35:100.

Additional objectives include:

- Manage the MCH for maximum opportunity to hunt caribou.

METHODS

We conducted a photo census of the MCH during the postcalving aggregation period in late June or early July in most years from 1980 to 1992. From 1993 through 2003 the censuses were scheduled on alternate years. Since then, censuses have been planned for each year, with the realization a successful census would likely occur about 2 out of 3 years. The last successful photo census was conducted in July 2008. Alaska Department of Fish and Game (ADF&G) coordinates censuses out of the Dillingham area office in cooperation with staff from the Bethel, McGrath, Palmer, and Fairbanks ADF&G offices; and personnel from Togiak National Wildlife Refuge (TNWR), Yukon Delta National Wildlife Refuge (YDNWR) and Lake Clark National Park and Preserve (LCNPP); with additional funding provided by the Bureau of Land Management (BLM). Biologists, using fixed-wing aircraft, radiotrack and survey the herd's range, estimate the number of caribou observed, and photograph discrete groups. Since 1994 we have photographed large aggregations with an aerial mapping camera mounted in a DeHavilland Beaver (DH-2) or Cessna C-206 aircraft flown by ADF&G staff. We estimate herd size by adding 1) the number of caribou counted in photographs; 2) the number of caribou observed but not photographed; and, 3) the estimated number of caribou represented by radiocollared caribou not located during the census.

We conducted aerial surveys to estimate the sex and age composition of the herd each October, using fixed-wing aircraft and helicopters. Groups of caribou are located by radiotracking with the fixed-wing aircraft. Then the helicopter is used to herd small groups while the number of caribou in each of the following classifications is tallied: calves, cows, small bulls, medium bulls, and large bulls. Classification of bulls is subjective and based on antler and body size.

We captured and radiocollared MCH caribou from 1980 to the present. Caribou are captured using drug-filled darts fired from a helicopter. These are usually cooperative efforts between ADF&G, TNWR, and YDNWR.

In October 2010, 5 adult female caribou were captured and radiocollared: 2 in Unit 17B north of Koliganek, 1 in Unit 18 near Chagvan Bay, 1 in Unit 18 near Spein Mountain, and 1 in Unit 18 northeast of Heart Lake. In April 2011, 27 caribou were captured and radiocollared: 10 ten-month-old female calves and 6 adult males in the eastern side of the herd's range, from north of King Salmon in Unit 9C north to Tundra Lake in Unit 19A; and 10 ten-month-old females and 1 adult male in the western side of the herd's range between Three Step Mountain and NYAC in Unit 18. In April 2012, 17 caribou were captured and radiocollared: 6 ten-month-old female calves and 2 adult females in Unit 9B near Supply Lake; and 7 ten-month-old female calves and 2 adult females in Unit 18 near the Great Ridge. All adult females captured were radiocollared with transmitters capable of being tracked by satellite.

Beginning in May 2000, intensive radiotracking surveys during calving were flown to determine the proportion of adult females calving. A fixed-winged aircraft was used to find calving concentrations and locate individual radiocollared adult females. Daily flights to relocate these individuals occurred until we could determine whether the individual collared cows were accompanied by a calf or had hard antlers. Presence of hard antlers prior to calving is generally considered evidence the adult cow is pregnant. These flights continued until all collared cows were observed or until so late in the calving period that absence of a calf could possibly be attributed to predation or other loss.

We conducted periodic radiotracking flights throughout this reporting period. Data recorded during these flights included location of radiocollared caribou, numbers of caribou observed, caribou activity, and habitat.

We monitored the harvest from data collected from statewide harvest reports. Hunter "overlay" information prior to regulatory year (RY) 1998 (RY08 = 1 July 1998 through 30 June 1999) has not been entered into the statewide harvest information system. Beginning in and since RY98, reminder letters have been sent to hunters who failed to report their caribou hunting activity.

RESULTS AND DISCUSSION

POPULATION STATUS AND TREND

Between 1981 and 1996, the MCH increased at an annual rate averaging 17%. From 1992 to 1994, the annual rate of increase appeared to be 28%, but this was probably an artifact of more precise survey techniques. The dramatic growth of the herd is attributed to a succession of mild winters, movements onto previously unused range, relatively low predation rates and an estimated annual harvest rate of less than 5% of the population since the late 1970s. The summer 1999 photo census indicated the herd had declined from the peak, which probably occurred in 1996 or 1997. Subsequent photo censuses indicated the herd continued to decline.

Population Size

The last photo census of the MCH was conducted on 7 July 2008. Based on results of this survey, the minimum population estimate for the MCH for summer 2008 was 30,000 (Table 1). The MCH has declined, as indicated by the summer estimates, and caribou distribution during the summer and fall has become more widespread, making the herd more difficult to count.

Population Composition

We conducted sex and age composition surveys in the upper Nushagak and Mulchatna river drainages (Unit 17B) and near Lime Village (Units 19A and 19B) on 10 October 2010; near the Slug River and Chagvan Bay (Unit 18) on 11 October 2011; and in the upper Kisaralik and Kwethluk river drainages (Unit 18), upper Salmon River (Unit 19B), east of Tundra Lake (Unit 19A), upper Hoholitna and South Fork Hoholitna river drainages (Unit 19B) and upper Nushagak and Mulchatna river drainages (Unit 17B) on 13 October 2010.

In 2011 composition surveys were conducted in the lower Mulchatna River drainage and Tikchik River basin (Unit 17B) on 9 October; the upper Eek, Kwethluk, Kisaralik, and Salmon river drainages (Units 18 and 19B) on 10 October; and the Nushagak Hills (unit 17B) and upper Hoholitna and South Fork Hoholitna river drainages on 11 October.

During the fall 2010 surveys, only 12.8 bulls:100 cows were observed in the sample of 2,581 caribou found in the eastern part of the herd's range (Units 17B, 17C, eastern 19A and eastern 19B), and 22.7 bulls:100 cows were counted in the sample of 2,011 caribou in the western part of the herd's range (Units 17A, 18, and western 19B). Because of the great deal of mixing of the herd throughout the rest of the year that we have observed during recent years, composition data for the 2010 survey were pooled for an overall bull:cow ratio of 16.8 bulls:100 cows (Table 2).

During the fall 2011 surveys, 17.6 bulls:100 cows were observed in the sample of 2,649 caribou in the eastern part of the herd's range, and 34.1 bulls:100 cows were counted in the sample of 1,995 caribou in western part of the herd's range. An additional 638 caribou in the Tikchik River basin were surveyed with 7.7 bulls:100 cows. Composition data for the 2011 surveys were again pooled for an overall bull:cow ratio of 21.7 bulls:100 cows (Table 2).

The fall 2010 calf:cow ratios observed were 16.9 calves:100 cows in the eastern portion of the herd's range and 23.4 calves:100 cows in the western part of the herd's range. Pooled counts for both areas gave a calf:cow ratio of 19.5 calves:100 cows in fall 2010 (Table 2). The fall 2011 calf:cow ratio in the eastern part of the herd's range was 14.3calves:100 cows, with 28.1 calves:100 cows in the western part of the herd's range, and 15.4 calves:100 cows in the Tikchik River basin. Pooled counts from all areas gave a calf:cow ratio of 19.0 calves:100 cows for the Mulchatna herd in fall 2011 (Table 2).

Productivity Surveys

Productivity surveys were flown in May in 2011 and 2012. A total of 56 radiocollared female caribou of calf-bearing age were located in May 2011: 13 two-year-olds (collared as 10-month-old calves in spring 2010); 3 three-year-olds (collared as 10-month-old calves in spring 2009); 11 four-year-old (collared as 10-month-old calves in spring 2008); and 29 five-years-old or older. Of the 56 caribou, 34 were accompanied by calves or had hard antlers. None of the 2-year-olds were accompanied by calves or had hard antlers. Two of the 3 three-year-olds, 10 of the 11 four-year-olds, and 22 of 29 5-year-old or older cows were accompanied by calves or had hard antlers (Table 3).

A total of 61 radiocollared female caribou of calf-bearing age were located in May 2012: 12 two-year-olds (collared as 10-month-old calves in spring 2011); 15 three-year-olds (collared as 10-month old calves spring 2010); 2 four-year-olds (collared as calves in spring 2009); and 32 of the 5-year-old or older cows. Of the 61 caribou, 40 were accompanied by calves or had hard antlers. None of the 2-year-old females were observed with hard antlers. Ten of the 15 three-year-olds, 1 of the 2 four-year-olds, and 27 of the 32 five-year-old or older cows were accompanied by calves or had hard antlers (Table 3).

Calf Weights

Body weights are recorded for all 10.5 month old female caribou captured and radiocollared. Female calf weights from spring 2011 and 2012 were 10 to 20 pounds heavier than calves at the peak of the population and during the rapid decline of the herd (Table 4).

Distribution and Movements

Wintering Areas. The most significant wintering area for the MCH during the 1980s and early 1990s was along the north and west side of Iliamna Lake, north of the Kvichak River. While there, MCH animals appeared to intermingle with caribou from the Northern Alaska Peninsula caribou herd (NAP). Analysis of radiotelemetry data indicated the MCH had been moving its winter range to the south and west during most of the late 1980s and early 1990s (Van Daele and Boudreau 1992). Starting in the mid-1990s, caribou from the MCH began wintering in Unit 18 south of the Kuskokwim River and southwestern Unit 19B in increasing numbers.

During midsummer 2010, and again in 2011, approximately half of the Mulchatna caribou traveled westerly through western Unit 17B into the Kuskokwim Mountains, and eventually into Unit 18 south of the Kuskokwim River. The remainder of the caribou during those same falls traveled through the Nushagak drainage.

During the winter of 2010–2011, a large part of the herd wintered in Unit 18, south of the Kuskokwim River, with the remainder of the herd ranging from the lower Nushagak and Kvichak drainages (western Units 9B and 9C, eastern Units 17B and 17C) north to the Lime Village and Tundra Lake area (eastern Units 19A and 19B). Movement into these wintering areas probably has decreased pressure on the winter forage supply in the formerly used wintering areas. Distribution during winter 2011–2012 was about the same as the previous winter; with about half the herd traveling west during summer and fall to spend the winter in Unit 18 and the rest of the herd remaining in the eastern part of the herd's range. The eastern portion of the herd spent that winter between the lower Nushagak River (eastern Unit 17C and southwestern Unit 17B) and Iliamna Lake (southwestern Unit 9B).

Calving Areas. There has been considerable change in the area used by the MCH for calving 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. Small groups also were observed in the Jack Rabbit and Koktuli Hills, along the Mosquito River, and in the Kilbuck Mountains.

In 1992 only 10,000–15,000 adult female caribou were found along the upper Mulchatna River and fewer than 1,000 were in the Bonanza Hills. During that year, the Mosquito River drainages contained about 20,000 calving females, and an estimated 20,000 adult females were located near Harris Creek, north of the village of Koliganek.

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

In May 1999 the drainages of the King Salmon River and Klutuspak Creek were still covered with snow, and the caribou continued to move south to the edge of the snow, between Klutuspak Creek and the Nuyakuk River, where many of them calved. Calving during the springs of 2000, 2001, and 2002 occurred in two distinct areas: the lower Nushagak River, and the headwaters of the South Fork of the Hoholitna River. In May 2003 calving also occurred in two distinct areas, with a large part of the herd between Kemuk Mountain and the Nushagak River and another large part of the herd in the northeastern Nushagak Hills and the South Fork of the Hoholitna River.

Calving in May 2004 was very different from what had been observed in the past. Calving caribou were spread through a vast area from just outside of Dillingham, north to the confluence of the Holitna and Hoholitna rivers. There were no large aggregations of calving caribou, but rather caribou scattered throughout that area. In addition, numerous cow caribou with young calves were observed scattered through southern Unit 18 in late May and early June.

Calving in May 2005 and 2006 was similar to previous years, in that a large part of the herd calved between Kemuk Mountain and the Nushagak River, with most of the rest of the caribou calving to the north between the Stoney River and Hoholitna River. The greatest concentration of these northern animals in 2005 was in the Stink River drainage, an area included within the Game Mangement Unit (GMU) 19A predator control program. Calving in May 2007 and 2008 was similar to the previous 2 years, with the caribou split between the Kemuk Mountain area in the south and Tundra Lake/Stink River area to the north. Calving in May 2009, 2010, 2011, and 2012 was similar to the previous years, with most of the herd split between the northern and southern calving areas. However in May 2010 eleven radiocollared females stayed out west in the southern Kuskokwim Mountains (eastern Unit 18), where scattered groups of at least several thousand caribou with newborn calves were observed. In May 2011, 8 radioed females and in May 2012, 19 radioed females were observed in the southern Kuskokwim Mountains with scattered groups of caribou with newborn calves.

Seasonal Movements. The MCH generally does not move en masse as a distinct herd, nor do individuals move to predictable places at predictable times. However, during recent years the herd basically splits, with part of the herd moving to the eastern side of its range during the summer and the rest of the herd traveling to the western side; caribou then aggregate for the fall rut and winter in these respective areas. In late winter/early spring most of the caribou travel back to the middle and northern part of the herd's range for calving. During the last several years, some caribou that wintered in the western side remained in Unit 18 to calve.

After calving in mid to late May, caribou from the southern calving area move west through the Tikchik Lakes (from south of Nuyakuk Lake to north of Nishlik Lake) into the headwaters of the Kanektok, Eek, Kwethluk, and Kisaralik river drainages and become widely scattered. Caribou in the northern calving area start moving southeast, towards the headwaters of the Mulchatna River before calving is completed. These caribou then disperse and become widely scattered throughout the area between the Nushagak Hills and Lake Iliamna. If dry, warm weather conditions occur, they tend to form tight postcalving aggregations as a form of avoidance from insect harassment. In the fall, the caribou again begin forming into large groups in the eastern and western parts of the herd's range, where they will spend the winter.

Cool, wet conditions throughout summer 2010 kept the caribou widely scattered. By mid to late July 2010, caribou on the east side of the herd's range were scattered between the Nushagak Hills and Lake Iliamna. Caribou that had moved west from the southern calving area were also widely scattered, throughout the headwaters of the Eek, Kwethluk, and Kisaralik rivers. There was no photo census accomplished for summer 2010.

During fall 2010 and winter of 2010–11, Mulchatna caribou were scattered throughout Unit 18 south of the Kuskokwim River, with an additional 10,000–20,000 moving around from the lower Mulchatna River drainage to the area between the lower Nushagak and Kvichak rivers. Later in the winter, caribou traveled southeast in Unit 9C to the Naknek River, milled around in that area for a while, then moved northwest to the area between the Nushagak and Kvichak rivers. Other caribou were scattered as far north as Lime Village in Unit 19A.

In May 2011 the caribou returned from being scattered throughout their range to calve in the middle Nushagak River/Kemuk Mountain area and also the Tundra Lake/Lime Village area south of the Stony River. Of note, that part of Unit 19A was within a predator control area. Some of the western caribou remained in western Unit 18, calving in the headwaters of the Eek, Kwethluk, and Kisaralik rivers.

Caribou movements during summer 2011 were much the same as summer 2010, with approximately half the herd on the eastern side of the herd's range, with the other half in GMU 18 south of the Kuskokwim River. Aggregations sufficient for a photo census did not occur during summer 2011.

During fall 2011 and winter of 2011–2012 Mulchatna caribou were again scattered throughout Unit 18 south of the Kuskokwim River, as well as the area between the lower Nushagak and Kvichak rivers. By late April 2012, Mulchatna caribou started moving toward the general vicinities of calving areas used the previous 2 years. Postcalving aggregations during summer 2012 were again widely scattered, occurring between the Nushagak Hills and Lake Iliamna, and in the upper Eek, Kwethluk and Kisaralik drainages. An attempt was made at a photo census using a method described by Rivest, et. al. (1998), but results were not available at the time of report preparation.

Based on observation of movements of radiocollared caribou from 2000 through 2008, it did not appear that individual caribou had any particular affinity to either of the two calving or wintering areas. One individual radiocollared caribou might winter on the western side of the herd's range one year and on the east side the next. It might use the northern calving area one year and the southern calving area the next. Nor did it appear that all animals using one wintering area had any affinity to a particular calving area, or vice versa. Of the caribou wintering on the western side of the range, some would travel to the Kemuk Mountain area to calve and some would travel to the Tundra Lake area. The caribou wintering on the east side of the range would do the same, with some traveling north to calve and some remaining in the Nushagak drainage and calving near Kemuk Mountain.

This type of mixing was not evident in spring 2009 through 2011. All the radiocollared cows that wintered on the east side of the range traveled north to calve in the Tundra Lake area. All the radiocollared cows that wintered in the west traveled east to the Kemuk Mountain area, with the exception of several thousand caribou observed calving in eastern Unit 18 beginning May 2010. This was the first documented use of that area for a substantial number of caribou since the mid-1990s.

Similarly, all the radiocollared caribou that calved in the Kemuk Mountain area traveled west to winter in Unit 18, and all the caribou that calved near Tundra Lake wintered on the east side of the herd's range. There was no evidence of seasonal mixing from 2009 through 2011. However, in spring 2012, several radioed caribou that wintered with the eastern caribou in the lower Nushagak and Kvichak river areas were with caribou in the southern calving area in May 2012, then moved west with those caribou during midsummer, and wintered in Unit 18.

In the past, several large peripheral groups appeared to be independent from the main MCH. A group of about 1,300 caribou resided between Portage Creek and Etolin Point until about 1999. Caribou in the Kilbuck Mountains (Seavoy 2001) and the upper Stuyahok and Koktuli river drainages (Van Daele and Boudreau 1992, Van Daele 1994) seemed distinct from the MCH until the mid-1990s. These subsidiary herds periodically intermingled with the main herd but remained within their traditional ranges. As the MCH grew in size and seasonally moved through the areas used by these groups, they eventually ceased to exist as discrete groups of caribou (Hinkes, et. al. 2005).

During the past several years it appears that small groups are again being found in various parts of the Mulchatna herd's range, some remaining distinct from the larger groups with others intermingling during calving.

MORTALITY

Harvest

Season and Bag Limit	Resident Open Season	Nonresident Open Season
Unit 9A, 9B, and that portion of 9C within the Alagnak River drainage:		
Resident Hunters: 2 caribou, no more than 1 bull, no more than 1 caribou taken 1 Aug–31 Jan	1 Aug–15 Mar	

Season and Bag Limit	Resident Open Season	Nonresident Open Season
Nonresident Hunters:		No open season
Unit 9C, that portion north of the Naknek River and south of the Alagnak River drainage:		
Resident Hunters: 3 caribou by permit	Season may be announced	
Nonresident Hunters		No open season
Unit 17A, all drainages east of Right Hand Point:		
Resident Hunters: 1 caribou	Season may be announced	
Nonresident Hunters:		No open season
Remainder of Unit 17A:		
Resident Hunters: 2 caribou, no more than 1 bull, no more than 1 caribou taken 1 Aug–31 Jan	1 Aug–15 Mar	
Nonresident Hunters:		No open season
Unit 17B, that portion within the Unit 17B Nonresident Closed Area:		
Resident Hunters: 2 caribou, no more than 1 bull, no more than 1 caribou taken 1 Aug–31 Jan.	1 Aug–15 Mar	
Nonresident Hunters:		No open season
Remainder Unit 17B and a portion of 17C east of the Wood River and Wood River Lakes:		
Resident Hunters: 2 caribou, no more than 1 bull, no more than 1 caribou taken 1 Aug–31 Jan.	1 Aug–15 Mar	
Nonresident Hunters:		No open season

Season and Bag Limit	Resident Open Season	Nonresident Open Season
Remainder of Unit 17C		
Resident Hunters: 1 caribou	Season may be announced	
Nonresident Hunters:		No open season
Unit 18:		
Resident Hunters: 2 caribou, no more than 1 bull, no more than 1 caribou taken 1 Aug–31 Jan	1 Aug–15 Mar	
Nonresident Hunters:		No open season
Unit 19A and 19B, within the Nonresident Closed Area:		
Resident Hunters: 2 caribou, no more than 1 bull,no more than 1 caribou taken 1 Aug–31 Jan	1 Aug–15 Mar	
Nonresident Hunters:		No open season
Remainder of Unit 19A and Unit 19B:		
Resident Hunters: 2 caribou, no more than 1 bull, no more than 1 caribou taken 1 Aug–31 Jan.	1 Aug–15 Mar	
Nonresident Hunters:		No open season

Board of Game Actions and Emergency Orders.

During its spring 2011 meeting, the Alaska Board of Game established the Mulchatna Caribou Herd Predation Management Area in Units 9B, 17B, and 17C. Aerial wolf control was to be directed specifically to the caribou calving areas in Units 17b and 17C. During the spring 2012 meeting, the Board of Game added Units 19A and 19C to the predation management area. An emergency order opening for a winter caribou hunt in Unit 9C was issued in RY11.

Hunter Harvest. The reported harvest from returned harvest report cards for the MCH was 474 caribou during the RY10 hunting season and 482 during RY11 (Table 5). These totals and the number of hunters reporting hunting Mulchatna caribou continue to decline from previous years. Sex ratio of the animals reported taken varies considerably from year to year.

The unreported harvest has been estimated at an additional 1,500 to 2,500 caribou during past years. This number should be viewed with some caution. Some years, this unreported harvest could be considerably more, or less. Changes in distribution from year to year and snow cover adequate for winter travel can greatly affect the number of caribou killed. Caribou distribution during some winters has resulted in increased hunting effort by village residents of Unit 18, who might be less likely to use harvest cards. Most of the unreported harvest was attributed to local and other Alaska residents. Subsistence Division household surveys conducted in local villages from RY83 to RY89 indicated an estimated annual harvest of 1,318 caribou (P. Coiley, ADF&G-Subsistence, Dillingham, personal communication). However, during that time hunting for caribou from some of those villages was from herds other than the Mulchatna. The number of caribou harvested by local residents undoubtedly has changed since the subsistence surveys because of changes in the size and range of the herd, as well as increases in the number of people living within the range of the herd. Unreported harvest by other Alaska residents is even more difficult to quantify.

From the early 1980s through RY99, the number of people reporting hunting for Mulchatna caribou increased steadily, yet reported harvest levels remained less than 5% of the total population. Harvests did not appear to be limiting herd growth or range expansion. In the mid to late 1990s, unpredictable caribou distribution led to hunting effort being spread more throughout the range of the herd than had traditionally occurred. As the size and range of the herd increased, commercial operators providing transportation to hunters expanded into areas previously not hunted, as well as based their hunts from additional communities located throughout the range of this herd. With the decline in size of the herd, the number of hunters that traveled to this area to hunt the Mulchatna herd also declined..

<u>Hunter Residency and Success</u>. Local Alaska residents (living within the range of the Mulchatna herd) made up 75% of those hunters who reported hunting during the RY10 season and 73% during RY11. Nonlocal Alaska residents accounted for 21% of the reporting hunters during RY11 and 24% during RY11. The area was not open for nonresident hunters. Of the reporting hunters, 58% successfully harvested at least one caribou in RY10; in RY11, 70% were successful (Table 6).

<u>Harvest Chronology</u>. Prior to RY06 much of the reported annual harvest occurred during August and September. However, the percentage of the reported annual harvest during those fall months declined to 10% in RY10 and 11% in RY11. The reported harvest in February and March has been increasing in recent years, accounting for 63% of the reported harvest in RY10 and 61% in RY11. A large portion of unreported harvest by hunters living locally also probably occurred in February and March. These data indicate an increase in the proportion of caribou taken during late winter as compared to the harvest chronology reported for previous years (Table 7).

<u>Transport Methods</u>. Aircraft were traditionally the most common means of transportation for hunters in the Mulchatna herd, but have been replaced in recent years by snowmachines. During the RY10 hunting season 9% of the hunters reported using aircraft, in the RY11 season 10%. Snowmachines were used by 85% of the hunters reporting in RY10, and 79% reporting for the RY11 season (Table 8). This increasing use of snowmachines is reasonable considering the change in reported harvest chronology to the late winter months.

Other Mortality

The MCH declined 85% between 1996 and 2008. Annual survival of adult cows, 2 years of age or older), averaged 90% during the period, but was less than 80% in 6 of 13 years. Annual population sex/age composition surveys indicate markedly reduced calf survival beginning with the 1999 cohort. A calf mortality study was conducted during May 2011 and May 2012 in 2 calving areas, the Kemuk Mountain area in Subunits 17B and 17C; and the Tundra Lake area in Subunits 19A and 19B. Survival rate of calves from birth to 4 months of age for calves collared in May 2011 was 54% in the Kemuk Mountain area (n = 78) and 0% in the Tundra Lake area (n = 7). Despite the disparity in the sample sizes, calf survival in the Tundra Lake area is suspected to be significantly lower, with zero of 7 calves surviving to 4 months of age and the low calf:cow ratios observed there during fall in recent years (Table 2). Survival rate of calves from birth to 4 months of age for calves collared in May 2012 was 74% in the Kemuk Mountaina area (n = 52) and 27% in the Tundra Lake area (n = 65).

The specific causes for lower survival rates and the subsequent population decline are poorly understood, but they likely result from a combination of intrinsic (e.g., nutrition, disease, pregnancy rates, survival rates, etc.) and extrinsic (e.g., weather, predation, etc.) factors. Because other caribou herds in southwest Alaska experienced similar population declines and reduced survival rates during the same period, it is possible that density independent factors (i.e., weather/climate) may have been a contributing factor. Also, the range of the MCH expanded significantly during the mid-1990s. At that time the herd was at peak population levels, and the range expansion may be indicative of habitat limitations in traditional seasonal ranges. During this period density dependent factors are likely to have resulted in deteriorated forage conditions on traditional ranges resulting in decreased nutritional condition of animals. This scenario would make them more susceptible to disease (foot rot, pneumonia, parasites) and predation, and thus contribute to lower survival rates.

There were several observations and reports of wolf and brown bear predation on caribou during this reporting period. Predation rates on MCH are thought to have increased as the herd grew and provided a more stable food source for wolves. Many local residents report increasing wolf numbers. A growing number of hunters throughout the area used by the MCH report having encounters with brown bears, including bears on fresh kills, on hunter-killed carcasses, and on raids in hunting camps. It is likely that individual bears learned to capitalize on this newly abundant food supply.

HABITAT

Assessment

We have not objectively assessed the condition of the MCH winter range. Taylor (1989) reported the carrying capacity of traditional wintering areas had been surpassed by the winter of 1986–1987, and it was necessary for the MCH to use other winter range to continue its growth. The herd has been using different areas at an increasing rate since that time.

Portions of the range used by the Mulchatna herd when the herd was at its peak population size show signs of heavy use. Extensive trailing is evident along travel routes. Some of the summer and fall range in the Nushagak Hills and elsewhere is trampled and heavily grazed. A range survey conducted in September 2010 by the Natural Resources Conservation Service (unpublished report by Karin Sonnen, Range Specialist, obtained from Michael J. Mungoven, NRCS, Homer, Alaska) in the southern calving area (and former wintering area) showed lichens had been heavily grazed and trampled in the past. Some areas showed signs of regrowth, other areas showed little recovery. Villagers from Nushagak River villages have also commented that lichens in some areas heavily used by caribou during the years of peak numbers seem to be showing recovery.

Traditional winter range on the north and west sides of Iliamna Lake also shows signs of heavy use, even though few caribou are now present in that area through the winter. Many of the areas that the MCH started using in the mid-1990s had not been used by appreciable numbers of caribou for more than 100 years, or reindeer for 50 years. While these areas appear to have vast quantities of lichen communities, whether they will continue to be used by many caribou remains to be seen.

CONCLUSIONS AND RECOMMENDATIONS

The minimum postcalving population estimates increased from 18,599 in 1981 to 200,000 in 1996 and declined to a minimum of 30,000 by summer 2008. Distribution of this herd continued to be widespread throughout this period. Fall composition count ratios have varied in recent years, but generally have been lower than during the period of rapid herd growth.

The total reported harvest and the number of hunters afield steadily increased until the late 1990s; since then, both have declined. Despite efforts to increase reporting of harvest, reported hunting effort during this reporting period indicates harvests remain at less than 5% of the herd. However, a better assessment of unreported harvest would be important to develop. The MCH has been an important source of meat and recreation for hunters throughout southcentral and southwest Alaska. Establishment of the 5 caribou bag limit, coupled with the reputation for large antler and body sizes, made this herd popular with hunters. However, as the herd declined, adjustments to the season and bag limit were warranted.

During the past 30 years, the MCH has made dramatic changes in its range. In the early 1980s, the herd spent most of the year east of the Mulchatna River between the Bonanza Hills and Iliamna Lake. Its range now encompasses more than 60,000 square miles, and large portions of the herd pioneered winter and summer ranges in what was considered good to excellent caribou habitat. There is evidence of overuse of habitat in some portions of the range. Whether areas previously underused will prove to be important to the herd remains to be seen.

The tremendous growth rate of this herd continued until at least 1996, and then the population declined. Possible signs of stress in this herd include an outbreak of foot rot in 1998 and low calf:cow ratios in fall 1999 (Woolington 2001). Caribou in the adjacent NAP had a high incidence of lungworms in 1995 and 1996. Six of 10 calves examined in October 2000 showed evidence of bacterial pneumonia, and 1 of 6 fecal samples from the calves revealed lungworm larvae (Woolington 2003). The degree to which disease and parasitism might be affecting herd dynamics is unknown; however, we should continue to monitor the herd closely to watch for indications of what might contribute to continued population decline.

The MCH continues to present new management challenges as its size and range change. Since the main portion of the herd is migratory and uses areas from the western slopes of the Alaska Range to the Kuskokwim River, it seasonally occupies ranges used by smaller resident caribou herds. These subsidiary herds, and new ones that establish themselves, may be the key to a quicker recovery from any future crash of the MCH. The MCH also overlaps with other established herds as it moves into the southern fringes of the Western Arctic caribou herd range and the northern portion of the NAP range. We should strive to recognize the impacts on these potentially unique demographic components when setting management objectives and proposing regulatory formulas.

Recommended management actions for the next few years include:

1. Conduct an annual photo census during postcalving aggregations.

2. Conduct annual October composition surveys in at least two distinct areas.

3. Conduct calving surveys in May of each year.

4. Monitor movements by locating radiocollared caribou periodically throughout the year.

5. Attempt to maintain at least one active radio collar per 1,000 caribou.

6. Develop an improved method of collecting harvest data, including unreported harvest.

7. Continue to work with other land and resource management agencies and landowners.

8. Work with local advisory committees and the state and federal boards to coordinate hunting regulations for adjacent herds and develop contingency plans for managing the herd if the population declines to low levels.

9. Assess impact of predation on newborn calves.

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Table 1. Mulchatna caribou herd estimated population size, calendar years 1991–2011.

Calendar Year	Date	Preliminary estimate[a]	Minimum count[b]	Extrapolated estimate[c]
1991	2 July	60,851	--	90,000
1992	7–8 July	90,550	110,073	115,000
1993	--	--	--	--
1994	28–29 June	150,000	168,351	180,000
1995	--	--	--	--
1996	28 June–3 July	200,000	192,818	200,000
1997	--	--	--	--
1998	--	--	--	--
1999	8 July	160,000–180,000	147,012	175,000
2000	--	--	--	--
2001	30 June 2002	--	121,680	147,000
2002	--	--	--	--
2003	--	--	--	--
2004	7 July	--	77,303	85,000
2005	--	--	--	--
2006	11 July	--	40,766	45,000
2007	--	--	--	--
2008	July 7	--	20,545	30,000
2009	--	--	--	--
2010	--	--	--	--
2011	--	--	--	--

[a] Based on estimated herd sizes observed during the aerial census.
[b] Data derived from photo-counts and observations during the aerial census.
[c] Estimate based on observations during census and subjective estimates of the number of caribou in areas not surveyed.

Table 2. Mulchatna caribou fall composition counts and estimated population size, calendar years 1974–2011.

Calendar Year	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]
1974	55.0	34.9	18.4	---	---	---	---	---	1,846	14,000
1978	50.3	64.5	27.6	---	---	---	---	---	758	7,500
1980	31.3	57.1	30.0	---	---	---	---	---	2,250	--
1981	52.5	45.1	22.8	---	---	---	---	---	1,235	20,600
1986	55.9	36.9	19.2	---	---	---	---	---	2,172	--
1987	68.2	60.1	26.3	---	---	---	---	---	1,858	52,500
1988	66.0	53.7	24.4	---	---	---	---	---	536	--
1993	42.1	44.1	23.7	53.7	---	---	---	22.6	5,907	--
1996	42.4	34.4	19.5	56.6	49.8	28.5	21.7	24.0	1,727	200,000
1998	40.6	33.6	19.3	57.4	27.8	43.7	28.5	23.3	3,086	--
1999	30.3	14.1	9.8	69.3	59.9	26.3	13.8	21.0	4,731	175,000
2000	37.6	24.3	15.0	61.8	46.6	32.9	20.4	23.2	3,894	--
2001	25.2	19.9	13.7	68.9	31.7	50.1	18.3	17.7	5,728	--
2002	25.7	28.1	18.3	65.0	57.8	29.7	12.5	16.7	5,734	147,000
2003	17.4	25.6	17.9	69.9	36.2	45.3	18.5	12.2	7,821	--
2004	21.0	20.0	14.2	71.0	64.2	28.9	6.9	14.9	4,608	85,000
2005	13.9	18.1	13.7	75.8	55.3	33.3	11.5	10.6	5,211	--
2006	14.9	25.5	18.1	71.3	57.5	33.7	8.9	10.6	2,971	45,000
2007	23.0	15.8	11.4	72.1	52.7	36.0	11.3	16.6	3,943	--
2008	19.3	23.4	16.4	70.1	46.8	36.1	17.1	13.5	3,728	30,000
2009	18.5	31.0	20.7	66.9	39.7	43.9	16.3	12.4	4,595	--
2010	16.8	19.5	14.3	73.3	30.0	43.7	26.3	12.4	5,282	--
2011	21.7	19.0	13.5	71.1	32.2	41.3	26.5	15.4	4,853	--

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

Table 3. Mulchatna caribou calving surveys conducted in May, calendar years 2000 through 2012.

Calendar Year	2-yr-old		3-yr-old		4-yr-old		5+ yrs old		Total caribou located
	No. Radios [a]	No. Pregnant	No. Radios [a]	No. Pregnant	No. Radios [a]	No. Pregnant	No. Radios [a]	No. Pregnant	
2000	5	0	0	0	0	0	22	21	27
2001	6	0	4	3	0	0	11	8	21
2002 [b]	4	0	7	4	1	0	5	2	17
2003	4	0	8	2	6	5	9	9	27
2004	9	0	2	0	3	3	13	12	27
2005	4	0	5	2	8	6	13	11	30
2006	7	0	0	0	3	2	14	12	24
2007	10	0	5	0	1	1	15	12	31
2008	10	1	10	4	9	7	14	11	43
2009	10	0	6	5	10	9	10	10	36
2010	5	1	13	9	9	5	19	16	46
2011	13	0	3	2	11	10	29	22	56
2012	12	0	15	10	2	1	32	27	61

[a] Number of radiocollared female caribou of that age located and observed during survey.

[b] Survey incomplete because of weather.

Table 4. Mulchatna caribou female calf weights.

Year	Season[a]	Weight (lbs)	No.
1994	Spring	130.5	2
1995	Spring	110.6	10
1996	Spring	98.0	1
1997			
1998	Fall	106.6	10
1999			
2000	Spring	103.5	11
2001	Spring	109.4	13
2002	Spring	109.2	22
2003	Spring	106.7	19
2004			
2005	Spring	115.9	19
2006	Spring	118.9	21
2007	Spring	121.8	15
2008	Spring	119.7	15
2009	Spring	95.5	6
2010	Spring	128.3	15
2011	Spring	124.1	20
2012	Spring	119.1	13

[a] Late March, early April, or October.

Table 5. Mulchatna caribou reported harvest, from harvest report cards. Regulatory years 1991 through 2011.

Regulatory	Reported Hunter Harvest			
Year	Male	Female	Unk.	Total[a]
1991-92	1,353	203	17	1,573
1992-93	1,184	149	269	1,602
1993-94	2,268	523	13	2,804
1994-95	2,631	651	19	3,301
1995-96	3,345	1,076	28	4,449
1996-97	1,845	497	24	2,366
1997-98	2,277	411	16	2,704
1998–99[b]	3,936	809	25	4,770
1999–00	3,411	1,019	37	4,467
2000–01	3,272	789	35	4,096
2001–02	2,771	1,042	17	3,830
2002–03	1,875	646	16	2,537
2003–04	2,047	1,103	32	3,182
2004–05	1,223	997	16	2,236
2005–06	1,044	1,118	13	2,175
2006–07	508	406	7	921
2007–08	404	353	10	767
2008–09	256	253	1	510
2009–10	213	102	6	321
2010-11	250	220	4	474
2011-12	233	240	9	482

[a] Includes only reported harvest from harvest cards.
[b] First year that reminder letters were sent to caribou hunters.

Table 6 . Mulchatna caribou annual hunter residency and success, regulatory years 1991 through 2011.

Regulatory Year	Successful				Unsuccessful				Total hunters[b]
	Local resident[a]	Nonlocal resident	Nonresident	Total (%)	Local resident[a]	Nonlocal Resident	Nonresident	Total (%)	
1991–92	89	562	599	85	9	136	69	15	1464
1992–93	82	542	651	91	12	82	26	9	1391
1993–94	47	718	725	85	5	171	77	15	2394
1994–95	61	812	896	83	11	227	124	17	2954
1995–96	52	1035	928	87	15	188	86	13	3127
1996–97	56	647	824	85	25	139	101	15	1822
1997–98	85	564	1277	84	33	178	152	16	2301
1998–99	178	1130	1877	78	142	320	414	22	4131
1999–00	174	1024	1697	72	120	453	553	28	4039
2000–01	188	817	1713	68	148	427	691	32	3989
2001–02	270	843	1377	74	159	351	368	26	3406
2002–03	169	556	1028	63	210	383	450	37	2831
2003–04	312	762	1111	71	181	352	378	29	3129
2004–05	256	573	764	62	133	357	501	38	2634
2005–06	418	427	485	56	229	322	497	44	2405
2006–07	207	208	273	53	182	207	226	47	1312
2007–08	334	148	125	58	184	163	105	42	1084
2008–09	269	130	61	54	165	140	85	46	850
2009–10	180	63	0	49	197	82	0	53	540
2010-11	270	58	0	58	174	66	0	42	589
2011-12	305	87	0	70	115	53	0	30	575

[a] Includes residents of communities within the range of the Mulchatna caribou herd.

[b] From harvest report cards. Includes hunters of unknown residency who would not be tallied under the column headings, as well as hunters who reported killing more than one caribou...

Table 7. Mulchatna caribou annual harvest chronology percent by month[a], regulatory years 1991 through 2011.

Regulatory Year	Harvest Periods										
	July	August	September	October	November	December	January	February	March	April	Total[b]
1991–92		29	43	6	0.4	2	1	4	12	0	1573
1992–93		30	54	5	1	0.3	0.2	1	8	0	1602
1993–94		36	50	5	0.4	1	1	1	5	2	2804
1994–95		35	50	5	0.4	1	1	1	5	2	3301
1995–96		33	50	6	1	2	1	1	5	2	4449
1996–97		25	52	5	1	1	1	2	11	2	2366
1997–98		33	53	4	0.3	0.4	1	3	4	0.3	2704
1998–99		25	55	6	0.6	0.6	2	2	7	1	4770
1999–00	0.1	24	52	5	0.5	1	3	5	8	2	4467
2000–01	0.2	27	55	6	0.3	0.3	2	3	4	1	4096
2001–02	0.2	23	49	3	1	2	2	4	9	5	3830
2002–03	0.2	23	55	4	0.6	1	3	2	6	2	2537
2003–04	0.2	19	45	4	0.5	4	5	5	12	2	3182
2004–05	0.2	20	46	2	1	2	2	2	10	9	2236
2005–06	0.2	15	32	2	4	2	3	6	25	7	2175
2006–07		13	38	1	3	5	4	10	21	1	921
2007–08		3	26	2	2	6	7	28	26	1	767
2008–09		3	23	3	5	4	6	25	30		510
2009–10		7	12	7	17	5	9	10	30		328
2010–11		3	7	1	3	14	7	19	44		474
2011–12		2	9	2	4	2	18	18	43		482

[a] July opening date for Unit 9B established starting 1 Jul 1999. Starting 2006, opening date Aug 1. Starting 2008, all closing dates March 15.

[b] From harvest report cards. Includes unknown harvest date.

Table 8. Mulchatna caribou harvest percent by transport method, regulatory years 1991 through 2009.

Regulatory Year	Percent of reported harvest: Airplane	Horse	Boat	3- or 4-Wheeler	Snowmachine	ORV	Highway vehicle	Unknown	Total caribou[a]
1991–92	81	0.2	9	1	9	0.1	0.2	2	1573
1992–93	88	0.2	8	3	3	0.1	0.1	0	1602
1993–94	86	1	10	1	2	0.3	1	0	2804
1994–95	85	0.2	12	1	2	0	0.2	0.2	3301
1995–96	88	0.2	9	1	2	0.1	0.1	0	4449
1996–97	82	0.4	10	2	3	0.3	0.7	1	2366
1997–98	86	0.4	8	1	2	0.1	0.2	2	2704
1998–99	82	0.1	10	2	3	0.1	1	1	4770
1999–00	85	0.3	6	2	5	0.2	0.7	1	4467
2000–01	87	0.2	6	1	5	0.1	0.1	0.6	4096
2001–02	79	0.1	7	2	11	0.2	0.2	0.8	3830
2002–03	82	0.2	8	3	5	0	0	0.2	2537
2003–04	73	0	6	2	19	0.1	0	0.7	3182
2004–05	74	0	7	1	17	0	0	0.9	2336
2005–06	55	0.4	6	3	34	0.2	0.3	1	2175
2006–07	61	0.4	7	4	27	0.2	0.3	0.5	921
2007–08	27	0.1	4	9	58	0.5	1	0.6	767
2008–09	23	0	3	10	63	0	0	1	510
2009–10	16	0	7	1	71	1	0	2	328
2010–11	9	0	4	2	85	0.4	0	0.4	474
2011–12	10	0.4	4	4	79	0.1	0	0.4	482

[a] From harvest report cards. Includes harvest by unknown transport method.

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CARIBOU MANAGEMENT REPORT

From: 1 July 2010
To: 30 June 2012

LOCATION

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

HERD: Northern Alaska Peninsula

GEOGRAPHIC DESCRIPTION: Alaska Peninsula

BACKGROUND

The Northern Alaska Peninsula caribou herd (NAP) ranges throughout Subunits 9C and 9E. Historically, the population has fluctuated widely, reaching peaks of up to 20,000 at the beginning of the twentieth century in the early 1940s, and again in the mid-1980s. The last population low was during the late 1940s, with about 2,000 caribou. By 1963 the herd had increased to more than 10,000 animals (Skoog 1968). The first radiotelemetry-aided census in 1981 estimated 16,000, and by 1984 the herd had increased to 20,000.

There was a noticeable depletion of lichens over the next few years, and decreased seasonal movements of the NAP across the Naknek River. Both of these were evidence the traditional wintering area was overgrazed. In 1986 significant numbers of NAP animals began wintering between the Naknek River and Lake Iliamna, and there was reason to believe that excellent forage conditions in this region would sustain the NAP within the population objective of 15,000–20,000. However, at about the same time up to 50,000 Mulchatna caribou also began using this area. The two herds intermingled near Naknek and King Salmon. Given this change in winter distribution of both herds, and the increasing competition for winter forage, by the late 1980s it was decided that the NAP should be maintained at the lower end of the management objective (i.e., 15,000). During regulatory year (RY) 1993 (RY93 = 1 July 1993 through 30 June 1994), a record harvest of 1,345 caribou and natural mortality estimated at >30% combined to reduce the herd population of the NAP to 12,500.

In response to increasing concern, in 1999 the Alaska Board of Game evaluated intensive management options for this population and concluded no viable solutions existed to alter the status of this herd. A Tier II hunting program was instituted the same year to manage human harvest. The herd experienced extremely poor recruitment from 2003 through 2008 as a result of poor calf production and survival, and continued to decline until 2008. Although indications of nutritional limitations were still evident in 2007, predation became increasingly important in the status of this herd, particularly as herd numbers decreased. Recruitment began improving in 2009, and both ratios of calves:100 cows and bulls:100 cows began slowly improving 2009–2011.

MANAGEMENT DIRECTION

MANAGEMENT OBJECTIVES

Based on the history of this herd and the long-term objective of trying to maintain the NAP at a relatively stable level, we recommend a population objective of 12,000–15,000 caribou with an October sex ratio of at least 35 bulls:100 cows.

METHODS

Population Size

Postcalving population count surveys were conducted in late June or early July when weather allowed. Caribou groups were located by fixed-winged aircraft equipped with radiotelemetry equipment. Oblique photos of large groups (≥ 20 caribou) were taken to allow accurate enumeration. Survey comprehensiveness was assessed using the proportion of radiocollared caribou encountered relative to total radiocollared caribou. Population estimates were calculated by dividing the minimum caribou count number by the proportion of radiocollared caribou encountered. Calf percentages were calculated from direct enumeration of caribou in close-up photos of larger herds.

Population Composition

Sex and age composition surveys were conducted during the month of October between the Naknek River and Port Moller. Caribou were classified from a helicopter as calves, cows, small bulls, medium bulls, and large bulls.

Parturition Surveys

In late May or early June a helicopter was used to classify caribou on the calving grounds as parturient cow (with calf, hard antlers, or distended udder), nonparturient cow, yearling, or bull (Whitten 1995). We also observed radiocollared females to document age-specific pregnancy rates.

Radiotelemetry Data

We scheduled capture operations in cooperation with the U.S. Fish and Wildlife Service (USFWS) to maintain 25–30 functioning radio collars. During each capture we recorded standardized measurements and took blood samples when feasible. We conducted radiotelemetry flights periodically to monitor herd movement and survival rates of collared caribou.

Mortality

The harvest was monitored by use of state Tier II and federal subsistence permits beginning in RY99. Survival rates of radiocollared females were estimated with the Kaplan-Meier method (Pollock et al. 1989).

RESULTS AND DISCUSSION

POPULATION STATUS AND TREND

Minimum counts from photo censuses during 1981–1993 ranged between 15,000 and 19,000 caribou. Annual variations in counts were caused by actual changes in herd size and/or sampling error (restricted coverage due to poor weather or errors in visual estimates). Because of concerns regarding winter range quality, in the late 1980s we decided to keep the herd at the lower end of the management objective. The herd began to decline below desired levels in 1993. Despite a series of hunting restrictions implemented starting in 1994, which significantly reduced harvests, the herd continued to decline through 2008. Vital rates 2008–2011 suggest a trend of slow improvement.

Population size

The size of the NAP has been reported in two ways: the actual number of caribou counted during the postcalving photo census, 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. Since 1995, staff of the Alaska Peninsula/Becharof Refuge has surveyed portions of the Aleutian Mountains and Pacific drainages. This area had not been counted since the early 1980s, so counts after 1995 represent more complete "minimum counts" than those obtained from photo censuses in previous years. Cooperative counts conducted during 1999–2002 resulted in estimates of 8,600, 7,200, 6,300, and 6,660, respectively (Table 1). Since 2003 weather conditions and funding have limited our ability to complete the population surveys in a timely manner that ensures no caribou are missed or double counted during the survey. In addition, caribou have failed to form large aggregations in recent years, remaining widely scattered across their range. However, based on the number of caribou observed during fall composition surveys the population size of the NAP in RY11 was estimated to be 2,300 caribou.

Population Composition

During 1970–1980, when the NAP was growing, the average fall ratio was 50 calves:100 cows (range = 45–56). The fall ratio averaged 39 calves:100 cows (range 27–52) between 1981 and 1994, when the population was near management objectives. During the decline the ratio averaged 26 calves:100 cows (range 18–38 between 1995 and 2002). Fall calf ratios 2003–2009 were the lowest ever recorded for this herd, with an average of 9 calves:100 cows (range 7–16, Table 1). Fall calf ratios 2010–2011 have averaged 19 calves:100 cows (range 18–20, Table 1).

The bull:cow ratio 1990–2004 averaged 41:100 (range 34–49), but the ratio dropped to an average of 23 bulls:100 cows 2005–2009 (range 19–27, Table 1) despite hunting closures. It is likely that poor calf recruitment 2003–2008 and the relatively short lifespan of bulls compared to cows decreased the bull:cow ratio in this herd. Bull:cow ratios 2010–2011 averaged 26 bulls:100 cows (range 25–26); this increase is in part due to maturation of bull calves from the recent and continued increased calf recruitment.

Distribution and Movements

Traditionally, the NAP's primary calving grounds are in the Bering Sea flats between the Cinder and Bear rivers, and the herd has wintered between the Ugashik and Naknek rivers. Beginning in 1986 many caribou wintered between the Naknek River and the Alagnak River. Since 2000, this extended wintering range appears to have become less important for the NAP. No radiocollared NAP caribou have wintered north of the Naknek River since the winter of 2000–2001, with the exception of one during the winter of 2003–2004. Since 2004 calving has been increasingly dispersed with decreased use of traditional calving grounds. A greater portion of the herd calves in mountainous terrain between the Meshik River Drainage and Katmai National Park.

MORTALITY

Harvest

Season and Bag Limits. State and federal hunts were closed in RY05 due to concerns for the herd's status and have not been reopened.

Board of Game Actions and Emergency Orders. In March 2010 the Board of Game authorized a wolf control program in Subunits 9C and 9E to reduce predation on NAP caribou.

Hunter Harvest. The Board of Game authorized up to 1,500 Tier II permits, and the Federal Subsistence Board authorized an additional 10%. No Tier II permits have been issued since RY04. Six bull caribou were harvested under ceremonial permits issued 2010–2011. Harvests from state hunts are presented in Table 2.

Hunter Residency and Success. Four of the ceremonial permits resulted in harvest of 6 caribou (3 in 2011, 3 in 2012; Table 3). All permits were requested at a time when caribou were reported to be in the village.

Harvest Chronology. September was historically the most important month for harvest, especially for nonresidents, because of the combination of relatively good weather, the best chance to harvest a trophy bull, and relatively easy access by boat and aircraft. Under the Tier II permit hunt, harvests were more spread out through the hunting season, with early fall and late winter accounting for most of the harvest (Table 4). The subsistence harvest was primarily opportunistic, and chronology of harvests varied among villages depending on caribou availability.

Transportation Methods. Prior to RY99 airplanes were the most important method of transportation reported from harvest tickets, but under Tier II most hunters used 4-wheelers, snowmachines, or boats (Table 5). The level of snowmachine use varied annually depending on snow conditions.

Other Mortality

Telemetry flights to monitor survival rates were sporadic and precluded precise dating of natural mortalities or determining the cause of death. There appears to have been a higher rate of natural mortality of adult females since the population reached peak size in 1984. From October 1980 through March 1984, the average annual mortality rate was approximately 7%. Annual mortality rate averaged 18% from 1985 to 1989 and averaged 25% from 1992 to 1998. Since 1998 annual adult mortality has remained high at an average of 21%.

Illegal harvests of caribou are known to occur, but are thought to be at low levels. In April 2008, a dead caribou was found within a mile of Port Heiden with a bullet wound. The meat had not been salvaged. While there is general acceptance of closing the caribou hunting season for the NAP, some local residents still feel entitled to harvest a caribou. The general philosophy behind these actions falls into two categories. These hunters think that if somebody else has an opportunity to shoot a caribou they should also be able to harvest a caribou, and if wolves and bears are eating caribou they should also be able to eat caribou.

We reported the results of the calf mortality study conducted during June 1998 in Sellers et al. 1998*a* and the results of the 2005–2006 calf mortality study in Butler et al. 2006. During the 1998 study 35% of radiocollared calves (n = 37) died during their first month of life. Predators, primarily brown bears (*Ursus arctos*), bald eagles (*Haliaeetus leucocephalus*), and wolves (*Canis lupus*) caused most of the mortality of calves less than 2 weeks old, but disease apparently was an important mortality factor in calves greater than 3 weeks old. During the 2005–2007 study, 60% of the radiocollared calves died during the first 2 weeks of life, primarily due to predation by wolves and brown bears. Calf mortality remained high between 2 weeks and 4 months of age (66% mortality) though the cause of the late calf mortality is unknown. Evidence that large predators were present at mortality sites was found, but scavenging could not be distinguished from predation due to the large time interval between calf mortality and site investigation (typically ≥1 month).

Habitat and Animal Condition

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

Based on our preliminary analysis of data (i.e., weights and body size) from the caribou translocated to the Nushagak Peninsula in 1988 and from animals captured in April 1990, 1992, and 1994, NAP adult females are intermediate in body size and condition between the Southern Alaska Peninsula herd and Mulchatna herd animals (Pitcher et al. 1990). Progeny of the translocated caribou on the Nushagak Peninsula are larger than animals from the parent NAP (ADF&G unpublished data, and Hinkes and VanDaele 1994).

During 1998 and 1999 neonate calves averaged 8.4 kg (n = 41) for males and 7.2 kg (n = 42) for females at the time of capture. Neonates captured between 2005 and 2007 averaged 8.6 kg for males (n = 74) and 8.0 kg for females (n = 69) at capture. These weights are intermediate compared to other herds in the state.

Between 1995 and 1998 we captured female calves and collected female calves every October to further assess body condition, looking for differences over time and to make comparisons with other herds. Weights and percent bone marrow fat of female calves collected in October were also intermediate, but a high percentage of these caribou showed lesions from lungworms. In October 1999, 11 captured female calves weighed an average of 114.2 pounds. Female calves captured in April averaged 120.3 pounds in 2001 and 110 pounds in 2004.

Age-specific productivity has also been monitored between 1997 and 2000. This work was reported by Valkenburg et al. (1996) and Sellers et al. (1998*a*, 1998*b*, 1999 and 2000). Overall, this work demonstrates that the NAP is under moderate nutritional stress. No 2-year-old females produced calves (n = 32), and only 33% of 3-year-olds (n = 18) had been pregnant. Overall pregnancy rates were low but have improved steadily for cows over 2 years of age. Pregnancy rates were 57%, 63%, 74%, 78%, and 84% 2005–2009, respectively.

In 2005 a herd health assessment identified heavy parasite loads, the presence of bovine respiratory disease complex, poor immune response, low levels of micronutrients, and chronic dehydration in animals examined. An experimental study to investigate the effects of parasite removal on body condition and calf production was conducted between 2005 and 2007. Preliminary analysis showed that parasite removal increased pregnancy rates. However, effects of parasite removal on body condition (body weight, muscle mass, and fat deposits) were not significant, and the treated animals did not recruit calves at a higher rate than untreated animals.

NONREGULATORY MANAGEMENT PROBLEMS/NEEDS

A few encouraging signs of improved nutrition were noted in 2001 and 2002, including renewed fidelity to traditional winter range. In addition, neonate calf weights observed in 2005–2007 were similar to those observed in the late 1990s. However, important population parameters such as calf ratio and herd size have remained below those observed in the late 1990s. While there was noticeable improvement in several key parameters 2009–2012, calf:cow ratios remain low with only a slowly improving trend, making herd recovery unlikely in the next few years.

CONCLUSIONS AND RECOMMENDATIONS

In spite of improvements observed since 2007, NAP survival and recruitment remain low. Hunting restrictions and closures were implemented to minimize any negative human influence on the population, but were never expected to reverse the population trend. Currently there is no intention of reopening the hunts until the herd begins to recover. Biologists evaluated intensive management options for this population in 1999, 2004, 2005, 2007, 2008, and 2009 and concluded that no viable solutions existed to alter the status of this herd. The major impediments to creating a successful intensive management plan include nutritional limitations, which are not fully understood but appear to be improving, and limitations imposed by federal lands and how they are managed. With increasing frustration surrounding the decline of this population and the perceived influence of predators, pressure to manage predators is increasing steadily in local communities. In March 2009 the Board of Game adopted a proposal to develop a predator management plan. During the spring 2010 Board of Game meeting, the board authorized a wolf management plan for the NAP with the goal of increasing the survival rate of any caribou utilizing state lands.

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Table 1. Northern Alaska Peninsula caribou herd fall composition counts and estimated population size, 1984–2011.

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
1984	39	39	22	56	67	16	17	22	1,087	20,000
1990	41	29	17	59				24	1,484	17,000
1991	42	47	25	53	54	34	12	22	1,639	17,000
1992	40	44	24	54	44	38	19	22	2,766	17,500
1993	44	39	21	55	52	29	19	24	3,021	16,000
1994	34	34	20	59	58	28	14	20	1,857	12,500
1995	41	24	15	60	49	29	22	25	2,907	12,000
1996	48	38	19	54	71	19	10	26	2,572	12,000
1997	47	27	16	57	54	31	14	27	1,064	10,000
1998	31	30	19	62	57	28	15	19	1,342	9,200
1999	40	21	13	62	58	30	12	25	2,567	8,600
2000	38	18	12	64	59	24	18	24	1,083	7,200
2001	49	28	16	57	61	24	15	28	2,392	6,300
2002	46	24	14	59	57	19	24	27	1,007	6,600
2003	36	11	8	68	46	30	24	24	2,776	-
2004	34	7	5	71	40	34	25	24	1,355	3,400
2005	23	7	6	77	37	41	22	18	1,914	-
2006	26	14	10	72	26	43	31	18	1,725	-
2007	27	7	5	75	29	38	33	20	1,719	-
2008	19	10	8	77	33	25	43	15	1,841	2,000[a]
2009	19	16	12	74	30	35	35	14	2,126	2,300[a]
2010	25	18	13	70	30	31	39	17	1,795	-
2011	26	20	13	69	26	37	37	18	2,395	-

[a] Minimum population estimate based on fall composition surveys that were not designed to estimate population size.

Table 2. Northern Alaska Peninsula caribou herd harvest, 2003–2011.

Regulatory Year	Hunter Harvest						
	Reported				Estimated Unreported	Illegal	Estimated Total[a]
	M (%)	F (%)	Unk.	Total			
2003–04	118 (95)	6 (5)	0	124	75	-	200
2004–05	31 (94)	2 (6)	1	34	30	-	60
2005–06[b]	-	-	-	0	-	-	0
2006–07[b]	1	-	-	1	0	15	16
2007–08[b]	1	-	-	1	0	15	16
2008–09[b]	-	-	-	0	0	15	15
2009–10[b]	-	-	-	0	0	15	15
2010–11[b]	3	-	-	3	0	15	18
2011–12[b]	3	-	-	3	0	15	18

[a] Estimated total is rounded off.

[b] No Tier II permits issued

Table 3. Northern Alaska Peninsula Caribou Herd annual hunter residency and success, 2003–2011.

Regulatory Year	Successful				Unsuccessful				
	Local Resident[a]	Nonlocal Resident	Nonresident	Total[b] (%)	Local Resident[a]	Nonlocal Resident	Nonresident	Total[b] (%)	Total Hunters[b]
2003–04	111	13	0	124 (72)	39	10	0	49 (28)	173
2004–05	34	0	0	34 (69)	13	2	0	15 (31)	49
2005–06[c]	-	-	-	0	-	-	-	0	0
2006–07[c]	1	-	-	1 (100)	-	-	-	0	1
2007–08[c]	1	-	-	1 (100)	-	-	-	0	1
2008–09[c]	-	-	-	0	-	-	-	0	0
2009–10[c]	-	-	-	0	-	-	-	0	0
2010–11[c]	3	-	-	3	-	-	-	0	3
2011–12[c]	3	-	-	3	-	-	-	0	3

[a] Local residents are residents of subunits 9A, 9B, 9C and 9E.
[b] Includes hunters of unspecified residency
[c] No Tier II permits issued

Table 4. NAP caribou annual harvest chronology percent by month, 2003–2011.

Regulatory Year	Percent of Harvest									
	August	September	October	November	December	January	February	March	April	*n*
2003–04	17	18	1	5	24	7	10	6	11	124
2004–05	21	14	0	7	28	7	0	0	24	29
2005–06[a]	-	-	-	-	-	-	-	-	-	0
2006–07[a]	-	-	-	-	-	100	-	-	-	1
2007–08[a]	-	-	-	-	-	100	-	-	-	1
2008–09[a]	-	-	-	-	-	-	-	-	-	0
2009–10[a]	-	-	-	-	-	-	-	-	-	0
2010–11[a]	-	-	-	-	-	-	-	33	67	3
2011–12[a]	-	-	-	33	-	-	67	-	-	3

[a] No Tier II permits issued

Table 5. NAP caribou harvest percent by transport method, 2003–2011.

Regulatory Year	Percent of Harvest							
	Airplane	Horse	Boat	3- or 4-Wheeler	Snowmachine	ORV	Highway Vehicle	Other
2003–04	8	-	16	35	23	13	3	2
2004–05	-	-	18	44	26	6	6	-
2005–06[a]	-	-	-	-	-	-	-	-
2006–07[a]	-	-	-	-	-	-	-	100
2007–08[a]	-	-	-	-	-	-	-	100
2008–09[a]	-	-	-	-	-	-	-	-
2009–10[a]	-	-	-	-	-	-	-	-
2010–11[a]	-	-	-	-	100	-	-	-
2011–12[a]	-	-	-	-	100	-	-	-

[a] No Tier II permits issued.

Alaska Department of Fish and Game
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CARIBOU MANAGEMENT REPORT

From: 1 July 2010
To: 30 June 2012

LOCATION

GAME MANAGEMENT UNITS: 9D (3,325 mi^2)

HERD: Southern Alaska Peninsula

GEOGRAPHIC DESCRIPTION: Southern Alaska Peninsula

BACKGROUND

The range of the Southern Alaska Peninsula caribou herd (SAP) extends from Port Moller to False Pass. There have been reports of caribou moving between the Alaska Peninsula and Unimak Island, including what may have been a substantial immigration from Unimak in 1976. Nonetheless, genetic studies have determined that caribou on Unimak Island are genetically isolated from mainland caribou with sufficient fidelity to calving areas on the island to be designated a separate herd from the SAP. Both radiotelemetry and genetic studies indicate the SAP is also separate from the Northern Alaska Peninsula caribou herd (Mager 2012, Zittlau et. al 2009). Skoog (1968) speculated that the Alaska Peninsula was marginal habitat for sustaining large caribou populations because of severe icing conditions and ash from frequent volcanic activity affecting food supply and availability. Mager (2012) indicates the genetic differentiation of the SAP is due in part to geographic barriers and isolation. The SAP has been characterized by wide population fluctuations, ranging from 500 to more than 10,000. Recent herd history includes growth from 1996 to 2002, decline from 2002 to 2007, and renewed growth from 2008 to 2011.

Harvest of the SAP was fairly high from regulatory year (RY) 1980 (RY80 = 1 July 1980 through 30 June 1981) to RY85, probably exceeding 1,000 in several years. Starting in RY86 restrictive regulations reduced harvests as the herd continued to decline. By RY93 the herd was below 2,500 and all hunting was closed. Poor nutrition appears to have played a major role in the decline of the SAP in the 1980s and early 1990s. Predation by wolves and brown bears, and human harvest may also have contributed to the decline (Pitcher et al. 1990). A survey by Izembek National Wildlife Refuge (INWR) staff early in 1997 showed a substantial increase in numbers, and a federal subsistence season was opened that fall. The herd continued to grow slowly, and in 1999 a general state hunt was opened. Herd size grew to 4,100 caribou by 2002. Following this brief recovery, calf recruitment decreased and population size began to decline. Little data were collected during the initial decline to assess the underlying cause, but recent investigations have shown that wolf predation on the calving grounds significantly reduced calf survival and recruitment. State and federal hunts were closed in RY07 due to increasing concern for the status of the herd, and a predator control program was initiated in 2008 to reduce wolf predation on caribou calves. Selective wolf removal during calving improved calf survival immediately upon implementation.

MANAGEMENT DIRECTION

MANAGEMENT OBJECTIVES

The cooperative, interagency, i.e., Alaska Department of Fish and Game (ADF&G) and U.S. Fish and Wildlife Service (USFWS), management plan was revised and adopted by the 2 agencies in March 2008. This plan sets the following population and management objectives:

1. Sustain a total population with a minimum of 3,000 caribou and a maximum of 4,000 caribou.

2. Maintain a fall bull:cow ratio of 35:100.

3. Provide limited harvest of bulls when the herd exceeds 1,000 caribou.

4. Cow harvests may be authorized when the population exceeds 2,000 caribou and population size is increasing.

METHODS

Population Size

Postcalving population count surveys were conducted in late June or early July when weather allowed. Caribou groups were located by fixed-winged aircraft equipped with radiotelemetry equipment. Oblique photos of large groups (≥ 20 caribou) were taken to allow accurate enumeration. Survey comprehensiveness was assessed using the proportion of radiocollared caribou encountered relative to total radiocollared caribou. Population estimates were calculated by dividing the minimum caribou count number by the proportion of radiocollared caribou encountered. Calf percentages were calculated from direct enumeration of caribou in close-up photos of larger herds. Staff of INWR periodically conducted winter aerial counts along systematic transects.

Population Composition

Sex and age composition surveys were conducted during the month of October between Port Moller and Isanotski Strait. Caribou were classified from a helicopter as calves, cows, and small, medium, and large bulls.

Parturition Surveys

Surveys have been conducted since June 1997 when funding was available. In late May or early June a helicopter was used to classify caribou on the calving grounds as parturient cow (with calf, hard antlers or distended udder), nonparturient cow, yearling, or bull (Whitten 1995). We also observed radiocollared females to document age-specific pregnancy rates.

Radiotelemetry Data

Our goal is to maintain 30 VHF radio collars on adult female caribou to aid in locating the herd during surveys and to obtain basic information about the animal's condition. Caribou were captured and marked with radio collars with the help of funding provided by USFWS, Office of Subsistence Management. During each capture we recorded standard measurements and took blood samples when feasible. Herd distribution and survival rates are monitored periodically by radiotracking collared animals.

Mortality

The harvest was monitored by use of state harvest tickets and federal subsistence permits until 2008, when all hunting was closed. Caribou calf mortality studies were conducted in 1989–1990 (Pitcher et al. 1990), 1999 (Sellers et al. 1999) and 2008–2010 (Butler, unpublished data), and range conditions were studied in 1991 and 1992 (Post and Klein 1999).

RESULTS AND DISCUSSION

POPULATION STATUS AND TREND

Following a peak of more than 10,000 caribou in 1983, the SAP began a precipitous decline. By 1993 the herd was below the 2,500 threshold at which all hunting was to be closed. The population stabilized during the mid-1990s and grew slowly to 4,100 caribou by 2002. From 2002 to 2007 estimates of calf recruitment were chronically low, and population size declined rapidly. Calf recruitment increased dramatically in 2008, 2009, and 2010 following selective wolf removal on the calving grounds.

Population Size

A partial survey by USFWS in February 2002 counted only 1,700 caribou, but a more complete USFWS survey in November 2002 counted 4,100. USFWS counted 1,800 caribou in December 2004 during 2 surveys of the SAP and 1,651 caribou in February 2006. In 2007 ADF&G reinitiated efforts to count caribou in July when the animals are grouped in postcalving aggregations to confirm the low population size. ADF&G surveys utilized radiotelemetry to locate animals to obtain a more accurate count of the herd. Counts conducted 2007–2009 estimated the minimum population size to be 600, 700, and 800 caribou, respectively. In February, 2012, the USFWS counted a minimum of 1,060 caribou in the SAP.

Population Composition

Fall composition surveys conducted 2000–2007 identified a declining trend in the calf:cow ratios, reaching a record low of 0.5 calves:100 cows in 2007 (Table 1). During 2008, 2009, and 2010 calf survival was improved by reducing wolf predation in the calving area. The calf ratio increased to 39 calves:100 cows in 2008 and 43 calves:100 cows in 2009.

Bull:cow ratios averaged 45 bulls:100 cows from 1997 to 2001 and decreased to an average of 36 bulls:100 cows during 2002–2005. In 2006, 2007, and 2008 bull:cow ratios dropped below management objectives to 16, 15, and 10 bulls:100 cows, respectively. The decrease in the bull:cow ratio was a product of the population's age structure becoming increasingly skewed towards older age animals due to the low calf recruitment observed 2002–2007 and the relatively short life-span of bulls compared to cows. In response to improved calf recruitment from 2009 through 2011 the bull ratio increased to 21, 28, and 40 bulls:100 cows, respectively.

Distribution and Movements

Data from radiotracking surveys indicate that the SAP has 2 main calving areas. Approximately 40% of the herd calves on the Caribou River flats. Many of these animals are relatively sedentary and remain in the area throughout winter. However, some have been located during the winter near Cold Bay. The remainder of the herd calves in the Black Hills/Trader Mountain area and winters near Cold Bay. Additionally, a few caribou calve in the mountains east of the Caribou River flats and in the mountains at the headwaters of the Joshua Green River.

In October 1998, 6 caribou in the extreme southeastern corner of Unit 9E and 8 caribou in the northeastern portion of Unit 9D were fitted with satellite collars to further investigate whether interchange between herds occurred in this area. None of these caribou moved from the unit in which they were captured. Genetic testing for interbreeding among caribou in 9E, 9D, and Unimak Island also confirms relatively little genetic interchange between these herds.

MORTALITY

Harvest

Season and Bag Limits. There was no state hunt in Unit 9D during RY93–RY98. In RY99 a state hunt with a 1 caribou limit was resumed in 9D with a resident season 1–20 September and 15 November–31 March. In RY01 fall seasons were again lengthened for residents (10 August–30 September) and nonresidents (1–30 September during odd-numbered years and 1 September–10 October during even-numbered years). Between RY99 and RY04 the bag limit was 1 caribou for residents and 1 bull for nonresidents. In RY05 the resident bag limit went from 1 caribou to 1 bull in the fall portion of the season or 1 antlerless caribou during the winter. State and federal hunts were closed in RY08 due to concerns for the herd’s status.

Board of Game Actions and Emergency Orders. In March 2007 the Board of Game restricted caribou hunting in Unit 9D by instituting a Tier I registration hunt for the SAP with a bag limit of 1 bull. The season was closed by emergency order in July 2007 after postcalving counts confirmed low population size (600 caribou) and calf survival to 1 month of age was found to be less than 1% during that year. In March 2008 the Board of Game approved a predation reduction plan that allowed ADF&G staff and agents to remove wolves from the calving grounds of the SAP.

Federal Subsistence Board (FSB) Actions. In July 2007, the Federal Subsistence Board approved an emergency petition to close federal subsistence hunting of SAP caribou.

Hunter Harvest. No permits were issued during this reporting period. It’s estimated 10 caribou were taken illegally each year (Table 2).

Other Mortality

In 2007 more than 99% of calves died prior to reaching the age of 1 month. Based on adult female body condition, high pregnancy rates, and blood serology, nutrition was not implicated as an important factor in this calf mortality. Field observations and general knowledge of the area wolf populations suggested wolf predation as a factor. A wolf predation reduction plan was successfully implemented during the summers of 2008, 2009, and 2010 in conjunction with a caribou calf mortality study. Department staff removed 28 wolves in 2008 from key packs affecting caribou calf survival. An additional 8 wolves were removed in 2009, and 2 more were removed in 2010. Caribou calf survival was significantly improved by the wolf removal. Calf mortality rates from birth to one month of age decreased from >99%, prior to the wolf removals, to 40%, 29%, and 37% during 2007–2009, respectively. Similarly, fall calf ratios increased from 1 calf:100 cows, to 39, 43, 47, and 20 calves:100 cows during 2007–2011, respectively. In 2008, predation accounted for 80% of the calf mortalities investigated (n = 20) when calves were <15 days of age. Predation accounted for 87% of calf mortalities investigated (n = 23) when calves were <15 days of age in 2009, and 80% (n = 8) in 2010. During this period wolves continued to be one of the primary predators of caribou calves, despite the removal of wolves and subsequent increase in calf survival. The 2011 drop in the calf:100 cow ratio is in large part due to the increase in young, nonproductive cows to the population since the 2008 wolf predation control program.

HABITAT

Assessment

Adult caribou in the SAP appear to be in good overall condition based on evaluation of adult females captured 2006–2011. During 2008 and 2009 neonate calf weights averaged 7.9 kg (n = 71) for males and 7.5 kg (n = 57) for females at capture. These weights are intermediate compared to other herds in the state.

Pregnancy rates were relatively good in SAP cows greater than 2 years in age. Of those cows observed 2007–2012, 79% (n = 235), 86% (n = 202), 90% (n = 143), 91% (n = 193), 85% (n = 157), and 93% (n = 192) were pregnant, respectively.

CONCLUSIONS AND RECOMMENDATIONS

The short duration of the recovery from the population low in the 1990s is not fully understood because little data were collected at the time. Recent studies offer evidence that predation by wolves is currently the primary limiting factor for the herd. Brown bears, though abundant in the area, preyed on calves to a lesser extent than wolves. During the same period other caribou herds throughout Southwest Alaska were also declining, and herds on the Alaska Peninsula and Unimak Island experienced similarly low calf recruitment. The similarity in timing may be coincidental or it may imply that a common regional factor is affecting caribou populations in this portion of the state. While it is possible the initial decline of the SAP involved some unknown environmental factor, nutritional stress is not apparent at this time. Similarly, no weather anomalies or changes in vegetative patterns have been observed in recent years. A possible explanation of the initial decline is that the caribou range had not recovered sufficiently following the population high in the 1980s and the caribou were presented with a range with reduced carrying capacity in the 2000s.

Currently the bull ratio is above the management objective, and appears to be increasing as new calves are recruited into the population and hunt seasons remain closed. The population of the SAP also exceeds the management minimum objective. As the population continues to increase, a surplus of caribou will exist. Harvestable surplus of bulls currently exists, resulting in opportunity for opening hunt seasons. Department staff should continue efforts to survey population size, composition, productivity, and survival to document how the population continues to respond to the wolf control program.

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Table 1. Southern Alaska Peninsula caribou herd composition and survey results, 1986–2011.

Regulatory year	Bulls: 100 cows[a]	Calves: 100 cows[a]	% Calves Summer[b]	Fall[a]	% Cows[a]	% Bulls[a]	Small bulls (% of bulls)[a]	Medium bulls (% of bulls)[a]	Large bulls (% of bulls)[a]	Composition sample size[a]	Postcalving Count[b]	INWR Count[c]
1986	32	20	17	13	66	21	59	28	13	2,307		4,543
1987	36	26	12	16	62	22	54	25	21	1,769	4,067	6,401
1988	41	19	16	12	59	29	61	37	4	886	3,407	
1990	19	12	14	9	76	15				1,051	3,375	
1991	28	19	18	13	68	19	53	33	14	883	2,287	2,830
1992	22	22	15	15	70	15	46	32	21	746	2,380	
1993	30	24	16	16	65	19	59	24	17	745	1,495	1,929
1994	29	28	21	18	64	18	46	27	27	531	2,137	1,806
1996			10									1,403
1997	42	19	15	12	62	26	36	36	27	546	1,844	3,243
1998	32	35		21	60	19	42	23	36	987		3,127
1999	51	25	26	15	57	28	48	30	22	1,049	3,612	
2000	42	37	24	21	56	23	50	24	26	982		
2001	57	38		19	51	30	57	26	17	1,313		
2002	38	16		10	65	25	44	34	23	932		4,100
2003	40	8		5	68	27	40	26	33	1,257		
2004	36	7		5	70	25	24	38	38	966		1,872
2005	30	6		5	73	22	27	46	28	1,040		1,651
2006	16	1		1	86	13	26	24	50	713		770
2007	15	1[e]	1	1	87	12	20	47	33	431	600[b]	
2008	10	39	27	26	67	7	3	30	68	570	700[b]	
2009	21	43		26	61	13	50	16	34	679	800[b]	
2010	28	47		27	57	16	28	53	19	532		
2011	40	20		13	62	25	28	52	20	920		790

[a] Estimates based on October composition surveys.
[b] Estimates based on July post-calving counts and the proportion of radiocollared caribou encountered.
[C] Estimates based on winter (conducted between January and April) counts by Izembek National Wildlife Refuge staff.
[e] This data is rounded up from 0.5.

Table 2. Southern Alaska Peninsula caribou herd harvest, 2001–2011.

Regulatory Year	Hunter Harvest						
	Reported				Estimated Unreported	Illegal	Estimated Total[a]
	M (%)	F (%)	Unknown	Total			
2001–2002	52 (93)	4 (7)	0	56	30	-	90
2002–2003	61 (91)	6 (9)	3	70	30	-	100
2003–2004	47 (96)	2 (4)	1	50	30	-	80
2004–2005	68 (89)	8 (11)	1	77	30	-	110
2005–2006	58 (95)	3 (5)	0	61	30	-	90
2006–2007	56 (97)	2 (3)	0	58	30	-	90
2007–2008[b]	-	-	-	-	-	10	10
2008–2009[b]	-	-	-	-	-	10	10
2009–2010[b]	-	-	-	-	-	10	10
2010–2011	-	-	-	-	-	10	10
2011–2012	-	-	-	-	-	10	10

[a] Estimated total is rounded off to the nearest 10.
[b] No permits issued.

Table 3. Southern Alaska Peninsula caribou herd annual hunter residency and success, 2001–2011.

	Successful				Unsuccessful				
Regulatory Year	Local resident[a]	Nonlocal resident	Nonresident	Total[b] (%)	Local resident[a]	Nonlocal resident	Nonresident	Total[b] (%)	Total Hunters
2001–2002	26	13	12	56 (70)	12	2	6	24 (30)	80
2002–2003	29	8	25	70 (71)	12	14	2	29 (29)	99
2003–2004	9	13	25	50 (70)	10	6	5	21 (30)	71
2004–2005	24	24	29	77 (73)	14	8	6	29 (27)	106
2005–2006	30	9	20	61 (64)	20	6	8	34 (36)	95
2006–2007	37	4	17	58 (45)	44	6	19	70 (55)	128
2007–2008[c]	-	-	-	-	-	-	-	-	-
2008–2009[c]	-	-	-	-	-	-	-	-	-
2009–2010[c]	-	-	-	-	-	-	-	-	-
2010–2011	-	-	-	-	-	-	-	-	-
2011–2012	-	-	-	-	-	-	-	-	-

[a] Local residents are residents of Subunit 9D.
[b] Includes hunters of unspecified residency.
[c] No permits issued.

Table 4. Southern Alaska Peninsula caribou herd annual caribou harvest chronology percent by month, 2001–2011.

Regulatory Year	Percent of Harvest								
	August	September	October	November	December	January	February	March	*n*
2001–2002	4	41	2	12	16	20	5	0	56
2002–2003	1	39	13	22	18	5	0	2	67
2003–2004	2	63	2	8	15	0	4	6	49
2004–2005	0	36	6	16	33	5	1	3	77
2005–2006	0	46	0	28	13	5	5	3	61
2006–2007	0	2	13	15	31	13	4	22	58
2007–2008[a]	-	-	-	-	-	-	-	-	-
2008–2009[a]	-	-	-	-	-	-	-	-	-
2009–2010[a]	-	-	-	-	-	-	-	-	-
2010–2011	-	-	-	-	-	-	-	-	-
2011–2012	-	-	-	-	-	-	-	-	-

[a] No permits issued.

Table 5. Southern Alaska Peninsula Caribou Herd harvest percent by transport method, 2001–2011.

	Percent of Harvest						
Regulatory Year	Airplane	Boat	3- or 4-wheeler	Snowmachine	ORV	Highway Vehicle	Foot
2001–2002	23	23	30	0	4	20	0
2002–2003	35	25	23	0	0	17	0
2003–2004	56	6	26	0	0	12	0
2004–2005	39	16	13	1	7	23	1
2005–2006	42	6	20	0	0	32	0
2006–2007	29	31	22	0	2	16	0
2007–2008[a]	-	-	-	-	-	-	-
2008–2009[a]	-	-	-	-	-	-	-
2009–2010[a]	-	-	-	-	-	-	-
2010–2011	-	-	-	-	-	-	-
2011–2012	-	-	-	-	-	-	-

[a] No permits issued

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CARIBOU MANAGEMENT REPORT

From: 1 July 2010
To: 30 June 2012

LOCATION

GAME MANAGEMENT UNIT: 10 (6,435 mi^2)

HERD: Unimak

GEOGRAPHIC DESCRIPTION: Unimak Island

BACKGROUND

There have been historical and more recent (i.e., in 2013) reports of caribou moving between Unimak Island and the mainland, including what may have been a substantial emigration in 1976. Based on this interchange, the Unimak Island caribou herd (UCH) was originally considered a segment of the Southern Alaska Peninsula caribou herd (SAP). However, recent evaluation of genetic information indicated the UCH is genetically isolated from mainland caribou, and due to prolonged isolation and sufficient fidelity to calving grounds on the island should be designated a separate herd (Mager 2012, Zittlau et al. 2009). Caribou numbers on Unimak Island have varied substantially, ranging from 5,000 in 1975 to 300 during the 1980s. Emergency orders closed state and federal hunts on Unimak Island in 1993. The federal subsistence season reopened in regulatory year (RY) 2000 (RY00 = 1 July 2000 through 30 June 2001), and the state general season reopened in RY01 when the herd was at or above the maximum population size, i.e., 1,000, recommended by ADF&G biologists for Unimak Island. In 2005 calf recruitment for the herd decreased dramatically and has remained low in subsequent years. A similar decrease in bull ratio was observed in 2008. A count by Izembek National Wildlife Refuge (INWR) staff in 2009 estimated 400 caribou on the island. State and federal hunts were closed in RY09.

MANAGEMENT DIRECTION

MANAGEMENT OBJECTIVES

No formal management objectives are in place for the UCH, and practically speaking, there is little opportunity to actively manage this herd given formidable logistics involved in reaching the island. Given poor access for management, and the relatively limited habitat, the herd should be kept below 1,000 animals.

METHODS

Population Size

Staff of INWR periodically conduct winter aerial counts along systematic transects to estimate population size.

Population Composition

Sex and age composition surveys were conducted during the month of October on Unimak Island. Caribou were classified from a helicopter as calves, cows, small bulls, medium bulls, or large bulls.

Parturition Surveys

Parturition surveys were initiated in 2008. In early June a helicopter was used to classify caribou on the calving grounds as parturient cow (with calf, hard antlers, or distended udder), nonparturient cow, yearling, or bull (Whitten 1995).

Radiotelemetry and Satellite Collar Data

We captured female caribou for VHF radiocollaring in 1997, 1999, 2009, 2010, 2011 and 2012. We included satellite collars in 2011 and 2012. During each capture we recorded standardized measurements and took blood samples when feasible. Occasional radiotracking flights and satellite collar data are used to monitor herd distribution and movements.

Mortality

The harvest was monitored by use of state harvest tickets and federal subsistence permits until 2009, when all hunting was closed.

RESULTS AND DISCUSSION

POPULATION STATUS AND TREND

Following a peak of more than 5,000 caribou in 1975, the UCH began a precipitous decline, apparently initiated by a sizable emigration. By the early 1980s the herd numbered just several hundred animals. By 1997 the herd had grown to at least 600 and continued to increase. After reaching the recommended population size of no more than 1,000 caribou in 2000, the herd size remained relatively stable through 2005. The population is currently declining and has experienced very low calf recruitment since 2005.

Population Size

In January 1997 the INWR counted 603 caribou on Unimak Island. This was the first comprehensive survey of Unimak Island in more than two decades. In May 2000 Rod Schuh, a registered guide who had hunted on Unimak for several years, counted 983 caribou on the north and west sides of the island. That count and subsequent INWR counts suggest there were close to 1,000 caribou on Unimak between 2000 and 2006 (Table 1). In 2009 INWR estimated a population size of 400 caribou based on the results of their winter count. Based on data from its ADF&G 2011 parturition survey, the department estimated the population size at 220 caribou.

Population Composition

Fall composition surveys in 1999 showed a ratio of 46 calves:100 cows on Unimak, but only 126 caribou were classified. Fall calf ratios remained at acceptable levels until 2002, but had dropped to very low levels by 2005 and have remained low since that time (Table 1). While it is unclear when the poor calf recruitment started, the lack of calf recruitment in recent years is undoubtedly having an effect on key population parameters, including population size, age structure, and the bull ratio. From 2000 to 2005 bull ratios were above management objectives set for most herds in Alaska (between 40 and 54 bulls:100 cows). The bull ratios since 2008 have ranged from 5 bulls:100 cows to 9 bulls:100 cows, and likely resulted from poor calf recruitment. Human harvest of caribou from this population is low and does not explain the decrease in the bull ratio.

Distribution and Movements

The UCH has typically calved on the western portion of Unimak Island in the Urilia Bay and Pogromni River flats areas. Calving for the UCH is generally more dispersed than for other caribou herds. Although movement of caribou between Unimak Island and the mainland was not documented in recent years, it likely occurs occasionally, involving varying numbers of caribou.

MORTALITY

Harvest

Season and Bag Limits. There were no state or federal hunts on Unimak Island RY93–RY99. In RY00 a federal subsistence hunt (RC101) was resumed. In RY01 a general state hunt was established with a 1 caribou bag limit, with seasons of 1–30 September for nonresidents and 10 August–30 September and 15 November–31 March for residents. State and federal hunts were closed in RY09 due to concerns for the herd's status.

Board of Game Actions and Emergency Orders. The Board of Game closed the caribou hunting season on Unimak Island during the March 2009 board meeting and it was not reopened for the remainder of this report period. In March 2010 the board authorized a wolf management area for Unimak Island.

Federal Subsistence Board Actions. The Federal Subsistence Board decreased the bag limit for the federal subsistence hunt from 4 caribou to 2 caribou in RY07. The subsistence caribou hunting season on Unimak Island has remained closed since its closure in RY09 by the federal board.

Hunter Harvest. Hunters reported harvesting 9 caribou in RY08 (Table 2). No hunting has been authorized since RY09.

Hunter Residency and Success. Nonresident hunters had an average success rate of 88% and accounted for 78% of the reported harvest in RY08 (Table 3). Success rate for nonlocal residents was 67% (n = 3) during the same regulatory year. Participation in the hunt by local residents may have been underreported, both because of noncompliance with state harvest ticket requirements and use of federal permits.

Harvest Chronology. All reported caribou harvest since RY01 occurred in September with the exception of 1 caribou taken in November of 2002 and 1 taken in December of 2006.

Transportation Methods. The main form of access to Unimak is small aircraft from Cold Bay. Local residents likely use off-road vehicles (ORVs) and boats to hunt caribou, but have not reported these activities.

Other Mortality

The sample size of active radio collars on caribou in this herd is too small to allow reliable calculation of survival rates.

HABITAT

Assessment

Adult caribou collared on Unimak in 2012 appeared to be in excellent overall condition. The pregnancy rate for cows greater than 2 years in age remained lower than other Alaska caribou herds in 2011, at 69% (n = 164). These low pregnancy rates were attributed to the low bull ratios observed rather than habitat or nutritional limitation.

CONCLUSIONS AND RECOMMENDATIONS

The UCH is managed as a separate and independent caribou herd even though some interchange with the mainland may occur, particularly at high population sizes. Managing this herd to dampen population fluctuations may not be possible given the logistics involved in accessing Unimak Island. The recent population decline, resulting from poor calf recruitment, and possibly a preponderance of senescing individuals, is of concern. Calves have not been surviving to the fall in adequate numbers to replace older individuals dying off since at least 2005. Predation on caribou calves is believed to be the cause of the poor calf survival. Pregnancy rates of adult cows greater than 2 years of age have remained low since 2009 (from 67% pregnant to 70% pregnant). The low bull ratios since 2008 are believed to have reduced the likelihood of cows encountering a bull while in estrus, thus reducing the pregnancy rate. Given the herd's declining population size and poor calf survival, the Alaska Department of Fish and Game recommended implementing a wolf removal program in 2009. During peak calving, wolves were to be removed on the calving grounds using the same strategy employed for wolf removal on the SAP's calving grounds (Butler 2009). As nearly all of the calving grounds are on federal lands, this program was not implemented due to lack of support from the predominant landholder, the U.S. Fish and Wildlife Service. Because of the UCH's small population size and isolation from mainland herds, it is believed caribou could be extirpated from Unimak Island without such management intervention. The department deploys radio collars on adult cows and calves to assess body condition, health, age, and survival, and to aid biologists in locating caribou during survey flights. Biologists should continue to monitor population size, composition, productivity, and survival of the UCH.

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Table 1. Unimak Island caribou herd fall composition counts and estimated population size, calender years 2000 through 2011.

Calendar Year	Total bulls:100 cows	Calves: 100 cows	Calves (%)	Cows (%)	Total bulls (%)	Small bulls (% of bulls)	Medium bulls (% of bulls)	Large bulls (% of bulls)	Composition sample size	Estimate of herd size
2000	40	21	13	62	25	34	32	33	406	983[a]
2002	54	31	17	54	29	50	22	29	392	1,262[b]
2004										1,006[b]
2005	45	7	5	66	29	24	37	39	730	1,009[b]
2006										806[b]
2007	31	6	4	73	23	28	34	38	433	
2008	9	6	5	86	9	33	33	33	260	
2009	5	3	3	92	5	30	30	40	221	400[b]
2010	8	8	7	86	7	21	42	37	284	
2011	6	7	6	89	5	50	33	17	117	224[c]
2012	10	3	2	89	8	14	71	14	83	164[d]

[a] Count by Rod Schuh, registered guide, in May.
[b] Winter count by Izembek National Wildlife Refuge staff.
[c] Spring count by Izembek National Wildlife Refuge and Alaska Department of Fish & Game staff.
[d] May 2012 Parturition Survey by Alaska Department of Fish and Game

Table 2. Unimak Island caribou herd harvest, regulatory years 2002 through 2011.

Regulatory	Hunter Harvest						Estimated
	Reported				Estimated		
Year	M (%)	F (%)	Unknown	Total	Unreported	Illegal	Total
2002–03	11 (92)	1 (8)	0	12	-	-	12
2003–04	10 (100)	0	0	10	-	-	10
2004–05	15 (100)	0	0	15	-	-	15
2005–06	15 (100)	0	0	15	-	-	15
2006–07	12 (92)	1 (8)	0	13	-	-	13
2007–08	13 (100)	0	0	13	-	-	13
2008–09	9 (100)	0	0	9	-	-	9
2009–10	-	-	-	-	-	-	-
2010–11	-	-	-	-	-	-	-
2011–12	-	-	-	-	-	-	-

Table 3. Unimak Island caribou herd annual hunter residency and success, regulatory years 2002 through 2011.

	Successful				Unsuccessful				
Regulatory Year	Local Resident[a]	Nonlocal Resident	Nonresident	Total[b] (%)	Local Resident[a]	Nonlocal Resident	Nonresident	Total[b] (%)	Total Hunters[b]
2002–03	0	5	7	12 (92)	0	1	0	1 (8)	13
2003–04	0	1	9	10 (77)	0	2	1	3 (23)	13
2004–05	0	3	12	15 (71)	0	5	1	6 (29)	21
2005–06	0	4	11	15 (94)	0	0	1	1 (6)	16
2006–07	0	3	10	13 (87)	0	0	2	2 (13)	15
2007–08	2	1	10	13 (100)	0	0	0	0 (0)	13
2008–09	0	2	7	9 (75)	0	1	1	3 (25)	12
2009–10	-	-	-	-	-	-	-	-	-
2010–11	-	-	-	-	-	-	-	-	-
2011–12	-	-	-	-	-	-	-	-	-

[a] Local residents are residents of Unimak Island.
[b] Includes hunters of unknown residency.

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CARIBOU MANAGEMENT REPORT

From: 1 July 2010
To: 30 June 2012[1]

LOCATION

GAME MANAGEMENT UNIT: 12 (3,300 mi^2) and adjacent Yukon, Canada (500–1,000 mi^2)

HERD: Chisana

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

BACKGROUND

The Chisana caribou herd (CCH) is a small, nonmigratory herd inhabiting eastcentral Alaska and southwestern Yukon, Canada. Skoog (1968) assumed the CCH derived from remnant groups of Fortymile caribou that used the Chisana's range during the late 1920s and early 1930s. However, in Canada the Chisana herd has been classified as *Rangifer tarandus caribou,* grouped under the Northern Mountain ecotype of woodland caribou. Behaviorally, the Chisana herd is typical of other mountain herds, particularly with respect to calving, where, rather than aggregating, they disperse up in elevation and away from other calving females (Farnell and Gardner 2002). In Alaska, the Alaska Department of Fish and Game (ADF&G) has classified the Chisana herd as *Rangifer tarandus grantii caribou* along with all other caribou herds in Alaska. Genetic analysis conducted by Zittlau et al. (2000) supports the classification of Chisana caribou as woodland caribou and found that the genetic distance between the CCH and 5 other nearby caribou herds is large, suggesting the herd has been unique for thousands of years. The difference in classification between Canada and the U.S. has not influenced management of the herd.

Little is known about CCH population trends before the 1960s. Skoog (1968) estimated the CCH at 3,000 animals in 1964. By the mid to late 1970s, the herd declined to an estimated 1,000 caribou. Similar declining trends were reported in other Interior caribou herds. During the 1980s environmental conditions were favorable and the herd increased to about 1,900 caribou by 1988. The herd then declined to an estimated low of 315 caribou by 2002 (Table 1). Weather and predation were likely the primary causes for the decline (Farnell and Gardner 2002). However,

[1] At the discretion of the reporting biologist, this unit report may contain data collected outside the report period.

following a more intensive population survey by the U.S. Geologic Survey (USGS) in 2003, the CCH population was estimated at 720 caribou, substantially higher than the 2002 estimate.

During the early 1900s the CCH was an important food source for area residents. However, subsistence use of the herd declined from the 1930s through the mid-1950s (Record 1983). Since the mid-1950s few people in Alaska or Yukon have depended on Chisana caribou for food (Chisana Caribou Herd Working Group 2012). Guided hunting was the primary use of the CCH from the mid-1950s through 1994. Primarily, 5 guide–outfitters hunted the herd (4 operated in Alaska and 1 in Yukon). Due to limited access, use of the CCH for wildlife viewing is negligible.

Between 1979 and 1994 the bag limit in Alaska was 1 bull caribou, and harvest was limited (Table 2). By 1991 declining bull numbers became a concern and harvest was reduced through voluntary compliance by guides and local hunters. In 1994 the bull portion of the population declined below the management objective of 30 bulls:100 cows, and all hunting of Chisana caribou was stopped in Alaska.

In 1980 the Wrangell–St. Elias National Park and Preserve was created and the preserve boundaries encompassed most of the Chisana herd's range. During 2003–2006 a captive rearing program was conducted by the Yukon Department of Environment (YDE) in Yukon. Twenty to 50 pregnant female caribou were captured annually in March–April, held in a holding facility in Yukon, and released from the holding facility after calves were 5 weeks old. This program successfully increased the number of calves recruited into the population during 2003–2006. Based on abundance surveys and population models for 2004–2010, the population appears to be stable at 694–766 animals (Adams and Roffler 2005 and 2007; Bentzen 2011).

A cooperative draft CCH Management Plan was developed in 2001, and a Yukon CCH Recovery Plan was developed in 2002. Both plans were designed to aid herd recovery. The management and recovery plans were in effect during 2002–2007. A process to update the cooperative CCH Management Plan began in 2008 (Chisana Caribou Herd Working Group 2012).

MANAGEMENT DIRECTION

During 1 July 2010–30 June 2012, CCH management and research was cooperatively developed to aid herd recovery. Activities that met the different mandates and philosophies of ADF&G, NPS, and YDE were assigned to the respective agencies, and the management objective matches the minimum requirements for a sustainable harvest set in the cooperative management plan.

The Chisana management goal and objective are:

MANAGEMENT GOAL

- Manage the Chisana herd for the greatest benefit of the herd and its users under the legal mandates of the managing agencies and landowners.

MANAGEMENT OBJECTIVE

- Cooperatively with YDE and NPS, develop and implement management strategies to maintain a stable or increasing herd with calf recruitment above 15 calves:100 cows on a 3-year average, and a bull to cow ratio above 35 bulls:100 cows.

METHODS

In 2005, the USGS developed a method to estimate the Chisana population (Adams and Roffler 2005, 2007). This technique uses observers in a helicopter to visually search the herd range for caribou while a fixed-wing aircraft with radiotelemetry equipment is used to determine numbers of radiocollared caribou missed by the helicopter crew. In this way, a sightability correction factor can be obtained, making it possible to estimate the population size from observed caribou.

Since 2003 ADF&G has participated in a cooperative (USGS, NPS, YDE and ADF&G) research project to evaluate the population dynamics and effects of recovery efforts on the CCH. ADF&G, NPS, and YDE conducted herd composition counts during fall 2008–2011. In fall 2010 ADF&G, NPS, and YDE used methods described by Adams and Roffler (2005, 2007) to collect data for a new population estimate. The 2010 survey used the known herd range during rut and the general location of all radiocollared caribou based on a radiotracking flight a week before the census, and included all the areas surveyed in both 2005 and 2007. In 9 hours of survey time ADF&G and NPS staff searched the herd range within Alaska, including the Beaver Creek drainage, Carl Creek, Ophir Creek, and Solo Creek Flats to the White River. The Horsefeld area, Skolai Pass, and Eucre Mountain were also searched but no caribou were found. An additional 5.5 hours of survey time was spent in the Yukon portion of the CCH range, primarily between the White and Donjek rivers directly east of the Alaska border.

Harvest data were summarized by regulatory year (RY), which begins 1 July and ends 30 June (e.g., RY10 = 1 July 2010 through 30 June 2011). Although ADF&G did not issue permits during RY10–RY12, harvest data since 1990 are included in this report (Table 2) to clarify herd population and composition trends.

RESULTS AND DISCUSSION

POPULATION STATUS AND TREND

Population Size, Population Composition, and Herd Distribution and Movements

Herd status and movements during RY04–RY08 are summarized in unpublished USGS progress reports (L. Adams, USGS, personal communication, 2011). Preliminary data indicated that age structure was skewed toward old animals and recruitment of wild-born calves remained chronically low. The USGS population survey in October 2007 indicated that the CCH numbered approximately 766 caribou with 13 calves:100 cows and 50 bulls:100 cows (Table 1).

The 11–15 October 2010 abundance survey yielded an estimated 697 caribou (651–743; 90% CI) based on 622 caribou (including 96 with radio collars) sighted by observers in the helicopter and the fixed-wing aircraft (Table 1, Figure 1).

October 2008–2011 composition surveys indicated the CCH has been relatively stable since 2008 (Table 1). In 2008 we estimated 44 bulls:100 cows, a substantial increase from the low of 17 bulls:100 cows in 1999. Bull:cow ratios were 48:100 in 2009, and 42:100 in 2010 and 2011.

The fall 2008 estimate of 21 calves:100 cows is consistent with most mountain caribou herds in Canada, (20–25 calves:100 cows; Northern Mountain Caribou Management Planning Team 2010). Following winter 2008–2009, which included prolonged severe cold and ice on top of deep snow (Alaska Snow Survey report, 1 April 2009, http://ambcs.org/aksnow/bor_ak.html, accessed 15 August 2013), the 2009 ratio declined to 15 calves:100 cows. However, 2010 recruitment was back up to 23 calves:100 cows. In 2011 recruitment again dropped to 16 calves:100 cows (Table 1).

Preliminary analysis of RY04–RY12 radiotracking data indicate the herd primarily used historic range in the White River drainage between the Alaska Highway bridge in Yukon and the Solo Creek Flats in Alaska, with some movements as far east as the Donjek River in Yukon. During RY04 and RY05, a larger portion of the herd moved into Alaska in early summer but moved back to Yukon in early winter, where the majority of the herd remained until spring to early summer. No Chisana caribou were observed west of the Nabesna River during RY10–RY11. Results of this research will be summarized in a final USGS research report in 2013 (L. Adams, USGS, personal communication, 2012).

Due to funding limitations no spring parturition surveys were conducted during July 2010–June 2012. Therefore, we are unable to compare spring birth rates to fall calf:cow ratios to further examine herd condition or summer mortality. Previous surveys indicated high parturition rates (Farnell and Gardner 2002), implying that summer nutrition was likely adequate.

MORTALITY

Harvest

There was no legal harvest of Chisana caribou in Alaska during RY93–RY11. All harvest in Yukon stopped in 2002.

Alaska Board of Game Actions and Emergency Orders.

During its February–March 2010 meeting, the Board of Game (board) established a joint state–federal drawing permit hunt for the Chisana caribou herd starting in RY11. This hunt uses guidelines set in the *Management Plan for the Chisana Caribou Herd: 2010–2015* (Chisana Caribou Herd Working Group 2012), which recommends a bulls-only harvest of 2% of population, split 50:50 between Yukon and Alaska as long as the herd is stable or increasing and ratios remain above 15 calves:100 cows (based on a 3-year average), and 35 bulls:100 cows. These harvest guidelines were similar to guidelines used for other small caribou herds in Yukon and deemed appropriate for management of the CCH (Northern Mountain Caribou Management Planning Team 2010). As part of the 2010 proposal the board reviewed whether the CCH is associated with significant long-term customary and traditional use and found no requirement for a state subsistence allocation.

In May 2010 the Federal Subsistence Board voted to defer a similar proposal for the joint state–federal hunt until more information could be gathered and the 2012 management plan was completed and signed by all participating groups and agencies. In January 2012 the Federal Subsistence Board authorized limited harvest of the CCH consistent with the management plan (Chisana Caribou Herd Working Group 2012). Because the Alaska portion of the CCH range lies entirely on federal lands within the Wrangell–St Elias National Preserve, permits have only been available to federally qualified subsistence hunters. Due to the limited allowable harvest, an ANILCA Section 804 analysis was conducted and only residents of Chisana, Northway, Tetlin, Tok, Mentasta Lake, and Chistochina were identified by the Federal Subsistence Board as eligible to hunt Chisana caribou.

Human-induced Mortality. ADF&G has not issued registration hunt permits for the CCH since RY94 (Table 2). Past reports from local residents and incidences of radiocollared caribou that were harvested indicate little or no illegal harvest in Alaska during RY10–RY11. In Yukon during 1996–1999 First Nation members killed 3–20 Chisana caribou annually along the Alaska Highway. Beginning in 2002, Yukon First Nation members voluntarily stopped harvesting Chisana caribou. Because the herd is inaccessible most of the year in Alaska, illegal or incidental harvest was not a management concern during RY10–RY11.

NPS staff issued a total of 9 CCH harvest permits in fall 2012 for a September 1–30 hunting season. All permit recipients reported hunting and 2 bull caribou were reported harvested.

Other Mortality

ADF&G conducted no activities to evaluate other causes of mortality on the CCH during RY10–RY12. However, as summarized by Gardner (2003), predation by wolves was identified as the primary factor limiting herd growth. The limiting role of disease and parasites on the CCH is poorly understood; however, disease has not been considered to be a factor influencing long-term population trends (Farnell and Gardner 2002, Bentzen 2011).

No wolf surveys have been conducted in the area since 2001. At that time it appeared that wolves were not limited by decreases in Chisana caribou, possibly due to the availability of moose and Dall's sheep in the area. The low numbers of wolves taken by trappers and hunters in the CCH range are generally not sufficient to limit wolf density. Gardner (2003) observed 89–97 wolves in 18 packs (2–13 wolves/pack). Ten of these packs (30–36 wolves) were in the Alaska portion of the survey area. The fall 2000 density estimate was 15.8 wolves/1,000 mi^2 (6.1 wolves/ 1,000 km^2). Similar densities were recorded in the Canada portion of this area in 1987 (Sumanik 1987) and 1989 (YDE, unpublished data, Whitehorse), which is below the average for most Alaska and Yukon study sites (23 wolves/1,000mi^2; 9 wolves/1,000 km^2; Gasaway et al. 1992).

Increasing numbers of moose could support larger numbers of wolves, which also prey on Chisana caribou (Hayes et al. 2003). Although data on moose in the CCH range are limited, reports from area residents suggest numbers are increasing. During the 2010 CCH census, 99 moose were observed in the Alaska portion of the herd range and another 20 were observed in Yukon. Moose numbers will continue to be monitored in the area.

HABITAT

Assessment

No habitat assessment activities were conducted during RY10–RY12. Gardner (2003), Lenart (1997), and Boertje (1984) provided information about habitat within the CCH range. Fecal samples containing high proportions of mosses and evergreen shrubs relative to lichens may indicate much of the range may be suboptimal (Farnell and Gardner 2002).

Enhancement

No habitat enhancement activities were conducted during RY10–RY11.

NONREGULATORY MANAGEMENT PROBLEM/NEEDS

The process to update the cooperative CCH Management Plan began in 2008. Participating members in this international planning process included the YDE, White River First Nation, Kluane First Nation, Canadian Wildlife Service, NPS (Wrangell–St. Elias), FWS (Tetlin Refuge) and ADF&G. In July 2012, these members of the Chisana Caribou Herd Working Group completed the Management Plan for the Chisana Caribou Herd: 2010–2015 (Chisana Caribou Herd Working Group 2012). This plan will guide harvest in Alaska and Yukon as long as the herd remains stable or increases. It summarizes CCH status and sets guidelines for future management with objectives, actions, and tasks associated with population monitoring, harvest, habitat, predation, research, and public awareness. It also coordinates the work of authorities to guide management of the CCH to support a stable or increasing population while balancing the differing management concerns and goals of the agencies.

CONCLUSIONS AND RECOMMENDATIONS

The CCH experienced a substantial (60%) decline during 1988–2005, primarily due to poor calf recruitment and high adult mortality associated with adverse weather and predation (Farnell and Gardner 2002). During 1991–2003 predation was the cause of 89% of the documented mortality among radiocollared cows ≥4 months old (Gardner 2003). Similar levels of predation likely occurred during RY08–RY12 (L. Adams, USGS, personal communication, 2012).

Hunting was allowed during the herd's initial decline (1989–1994); however, annual harvest was restricted to bulls and generally below 2% of the estimated population. Hunting in Alaska did not appear to limit the herd's ability to grow.

Based on data from other small caribou herds in southwestern Yukon, for the CCH to remain stable, fall calf recruitment must remain >15 calves:100 cows, cow mortality must be ≤12–15% and bull mortality ≤21–25% (Bergerud et al. 2008).

When hunting was allowed the primary users of the Chisana herd were nonresidents. During RY90–RY94 43% of hunters participating in the Chisana caribou hunt were nonresidents who took 58% of the harvest, while local subsistence users took 9% of the harvest (Fig. 2). Because this is an international herd and extensive efforts have been made to help the herd recover to sustainable levels, care must be taken to include input from all interested parties in managing harvest. As allowed under the Management Plan for the Chisana Caribou Herd: 2010–2015, hunting of the CCH was resumed in Alaska in fall 2012 with a limited number of permits available to local federally qualified subsistence users only.

We met our management objective during RY10–RY11 to develop and implement management strategies to maintain a stable or increasing herd with calf recruitment above 15 calves:100 cows and a bull to cow ratio above 35 bulls:100 cows. The Chisana herd can likely sustain the limited bulls-only harvest with little effect on the overall population. However, harvest of Chisana caribou will require careful monitoring. In October 2012, 82 active VHF radio collars remained on Chisana caribou and have functioned beyond their expected battery life. Radio collars were last deployed in 2006 and several radio collars deployed in 2003 were transmitting in 2012. As these transmitters fail it will become increasingly difficult to collect accurate information on population size, sex ratios and productivity needed to sustainably manage harvest on this small caribou herd. An effort to census the herd is planned for 2013 before all radio collars fail. Long-term monitoring will require deployment of radio collars in the near future. We will likely continue to have limited funds in the near future, but will continue to provide personnel support and participate in cooperative management activities and research efforts for the CCH during the next report period.

Based on the Management Plan for the Chisana Caribou Herd: 2010–2015 (Chisana Caribou Herd Working Group 2012), the objectives and activity for the next report period are:

MANAGEMENT OBJECTIVES

- Maintain fall calf recruitment above a 3-year average of 15 calves:100.
- Maintain a fall bull:cow ratio above 35 bulls:100 cows.

ACTIVITY

Cooperatively with YDE and NPS, develop and implement management strategies to maintain a stable or increasing herd.

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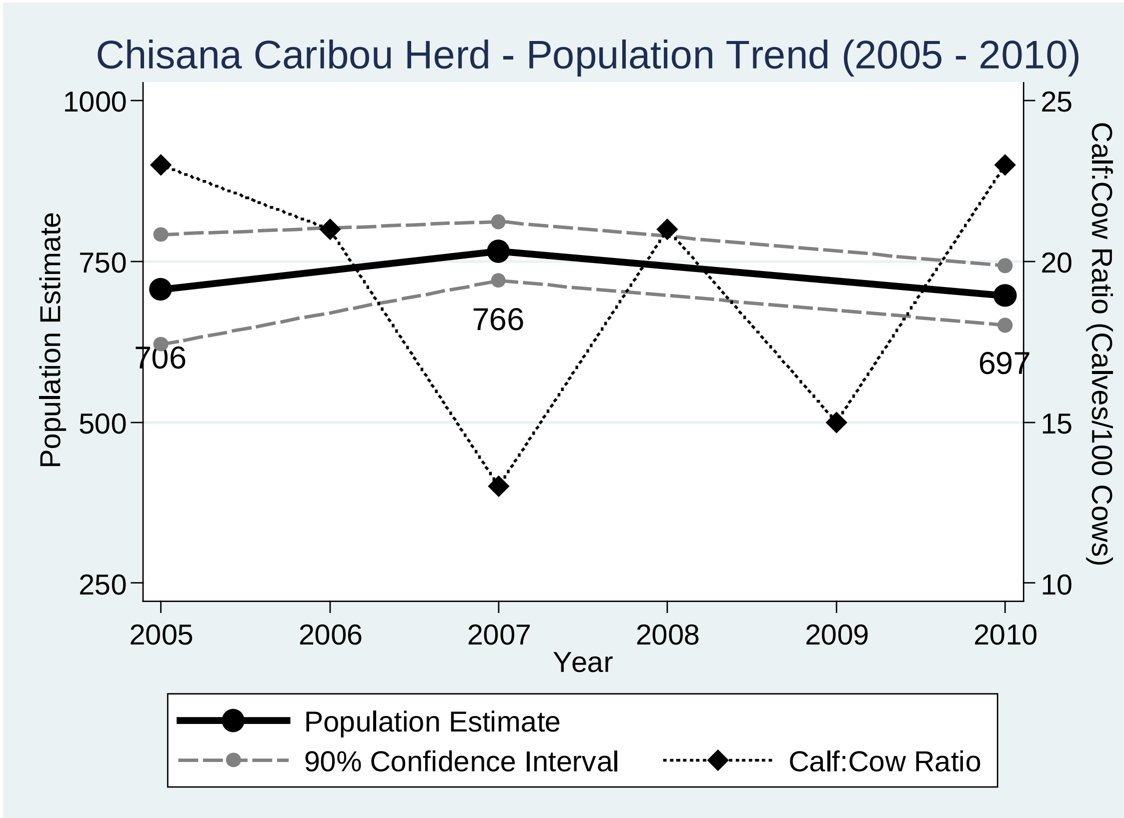

Figure 1. Chisana caribou herd population trend based on the 2005, 2007, and 2010 censuses, including 90% confidence intervals and calf: cow ratios, 2005–2010 (Chisana caribou herd working group 2012).

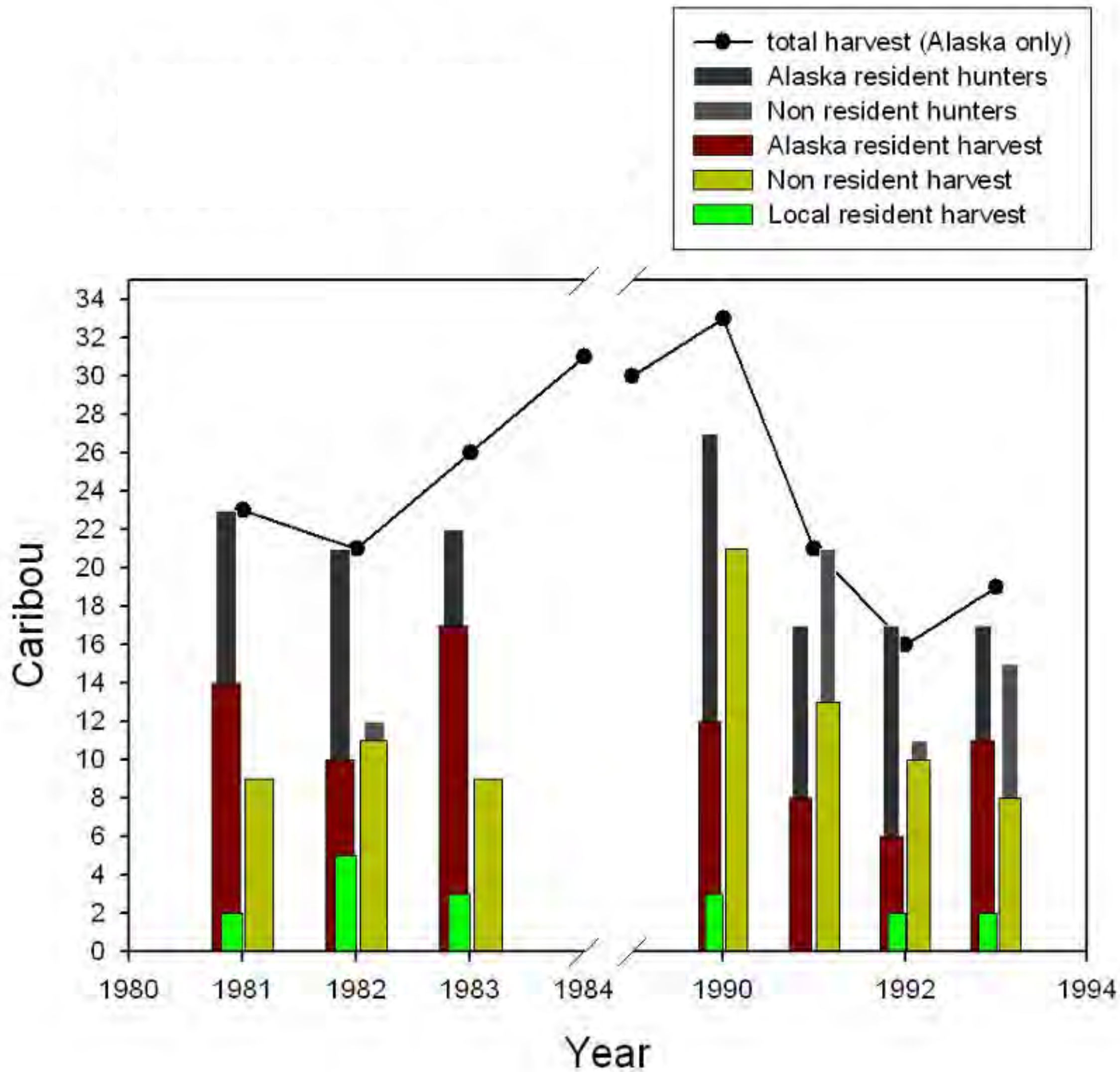

Figure 2. Chisana caribou harvest and hunter residency for regulatory years 1981–1993 in Alaska only (hunter residency data are unavailable for regulatory years 1984–1989).

Table 1. Chisana caribou fall composition counts and estimated population size, 1990–2010.

Date (mm/dd/yy)	Bulls: 100 Cows	Calves: 100 Cows	% Calves	% Cows	% Small bulls (% of bulls)	% Medium Bulls (% of bulls)	% Large bulls (% of bulls)	% Bulls	Composition Sample Size	Estimated Herd Size
10/4–5/90	36	11	7	68	37	44	19	25	855	1,680[a]
9/29/91	40	1	1	71	45	42	13	28	855	1,488[a]
9/27/92	31	0	0	76	34	43	23	24	1,142	1,270[a]
10/5/93	24	2	2	79	30	45	24	19	732	869[a]
9/29/94	27	11	8	72	20	44	35	20	543	803[a]
9/30/95	21	4	4	80	30	23	47	17	542	679[a]
9/30/96	16	5	4	83	40	18	42	13	377	575[a]
10/1/97	24	14	10	72	3	68	28	18	520	541[a]
9/28/98	19	4	3	81	49	14	37	15	231	493[a]
10/1/99	17	7	6	81	57	16	27	14	318	470[a]
9/30/00	20	6	5	80	52	25	23	15	412	425[a]
10/1/01	23	4	3	79	42	23	34	18	356	375[a]
9/30/02	25	13	10	72	28	23	49	18	258	315[a]
9/30/03	37	25	15	62	n/a	n/a	n/a	23	603	720[b]
9/30/05	46	23	14	59	n/a	n/a	n/a	27	646	706[b]
10/12/06	48	21	13	59	34	33	33	28	628	n/a[c]
10/13–14/07	50	13	8	61	n/a	n/a	n/a	30	719	766[b]
10/9/08	44	21	13	61	n/a	n/a	36	27	532	n/a[c]
10/6–10/09	48	15	9	61	31	32	37	30	505	n/a[c]
10/11–15/10	42	23	14	61	30	16	54	25	622	697[d]
10/3/11	42	16	14	66	21	27	52	25	542	n/a[c]

[a] ADF&G survey results methods described by Gross (2005).
[b] USGS survey results. Bulls were not classified to size.
[c] No sightability correction factor was determined, herd size could not be estimated.
[d] ADF&G, NPS, YDE survey results using estimation technique developed by Adams and Roffler (2005, 2007).

Table 2. Chisana caribou harvest, regulatory years 1990 through 2012.

Regulatory year	Alaska harvest						Yukon harvest		Total Harvest
	Reported				Estimated				
	M	F	Unk	Total	Illegal	Total	Reported	Unreported	
1990	34	0	0	34	0	0	11	5–20	50–65
1991	21	0	0	21	0	0	0	5–20	26–41
1992	16	0	0	16	0	0	0	5–20	21–36
1993	19	0	0	19	0	0	0	5–20	24–39
1994[a]	0	0	0	0	0	0	0	5–20	5–20
1995	0	0	0	0	3	7	0	1–3	4–6
1996	0	0	0	0	3	3	0	7	10
1997	0	0	0	0	3	3	0	3–5	6–8
1998	0	0	0	0	3	3	0	20	23
1999	0	0	0	0	3	3	0	3–5	6–8
2000	0	0	0	0	1	1	0	1–3	2–4
2001	0	0	0	0	1	1	0	1–3	2–4
2002	0	0	0	0	0–3	0–3	0	0[b]	0–3
2003	0	0	0	0	0–3	0–3	0	0	0–3
2004	0	0	0	0	0–3	0–3	0	0	0–3
2005	0	0	0	0	0–3	0–3	0	0	0–3
2006	0	0	0	0	0–3	0–3	0	0	0–3
2007	0	0	0	0	0–3	0–3	0	0	0–3
2008	0	0	0	0	0–3	0–3	0	0	0–3
2009	0	0	0	0	0–3	0–3	0	0	0–3
2010	0	0	0	0	0–3	0–3	0	0	0–3
2011	0	0	0	0	0	0	0	0	0
2012[c]	2	0	0	2	0	0	0	0	2

[a] No registration permits were issued for the Alaska hunt during regulatory years 1994 through 2008.
[b] After 2001, Yukon First Nation members in Canada voluntarily stopped harvesting Chisana caribou.
[c] Permits issued to federally qualified subsistence users only.

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CARIBOU MANAGEMENT REPORT

From: 1 July 2010
To: 30 June 2012[1]

LOCATION

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

HERD: Macomb

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

BACKGROUND

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

With increased hunting pressure on the MACH, 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 while hunting from 10 August to 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 1,357.3).

By 1975 the MACH numbered 700–800 caribou, but the apparent increase in herd size from 1972 to 1975 probably reflected increased knowledge about the herd rather than an actual increase in the number of caribou. Hunting pressure and harvest continued to increase on the MACH, despite a reduced bag limit and restrictions imposed by conditions of 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 equaled or exceeded recruitment.

In 1977, it was necessary to close the 1–15 September hunting 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 a

[1] At the discretion of the reporting biologist, this unit report may contain data collected outside the report period.

determination that harvest had to be reduced (Davis 1979). In 1978 the bag limit for the MACH was further restricted from 1 caribou of either sex to 1 bull by drawing permit. The drawing permit hunt reduced the reported harvest from 93 caribou in 1977 to 16 in 1978.

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

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

Previous management objectives for the MACH (Alaska Department of Fish and Game 1976) included maintaining a population of at least 350 caribou in Unit 20D south of the Tanana River. This population objective was based on incomplete data on herd size, movements, and identity of the MACH.

In 1987 the Alaska Board of Game made a customary and traditional (C&T) use determination for the MACH; the amounts necessary to meet subsistence needs were determined to be a harvest of 40 caribou. The C&T finding was based on use by residents of Dot Lake, Tanacross, and Tok, and other residents outside of these communities.

In 1988 herd size was estimated to be 800 caribou (DuBois 1989). Historical information from local residents indicated more caribou between the Robertson and Delta rivers than were previously estimated by the Alaska Department of Fish and Game (ADF&G). Because the population was thought to be >800 in the past, the Board of Game adjusted the population objective to agree with the anecdotal information. The adjusted objective endeavored to increase the MACH size to 1,000 caribou by 1993.

For the 1990 fall hunting season, the hunt was changed from a drawing permit hunt to a Tier I registration permit hunt because C&T use determinations precluded conducting the hunt as a drawing permit hunt.

The hunting season was closed from regulatory years (RY) 1992 (RY = 1 July through 30 June; e.g., RY92 = 1 July 1992–30 June 1993) through RY96 because the herd was below the population objective. Also, a registration permit hunt did not allow adequate control of harvest because of relatively high hunter interest and low harvest quotas.

Between 1988 and 1994, the herd size decreased from an estimated 800 caribou to approximately 500. In 1995 the Board of Game adopted a Wolf Predation Control Implementation Plan for Unit 20D (currently located in Title 5 of the Alaska Administrative Code, regulation 92.113 [5 AAC 92.113]). It established a new objective to reverse the decline of the MACH and increase the fall population to 600–800 caribou with a harvest of 30–50 caribou annually by 2002.

The herd size increased from 500 to approximately 650 during 1995–2000 and the new population objective established by the Board of Game in 1995 was met. The hunting season was reopened in RY97; the hunting season in RY97 and in RY98 was 10–20 September by registration permit. The season was closed again in RY99 and open in RY00 and RY01 during 10–20 September by registration permit. In RY02 the season dates were changed to 15–25 August to separate the season from the moose hunting season to reduce the level of opportunistic caribou harvest. Additionally, the boundary of the Delta Controlled Use Area (DCUA) was moved from the Richardson Highway, west to the Delta River. This was to include the area between the Richardson Highway and the Delta River within the DCUA (which prohibits the use of motorized vehicles and pack animals for big game hunting during 5–25 Aug) for caribou management purposes. The goal of the boundary and season change was to maintain the reasonable opportunity to hunt (at least 10 days as per C&T use determination) without exceeding the harvest quota. The harvest objective established by the Board of Game in 1995 was achieved in RY98 and RY01 and was not met in RY99 (season closed), RY00, and RY02 (Dubois and Parker McNeill, 2011).

Despite the season date and boundary change, it was necessary to close the hunting season by emergency order in RY02 and RY03, and the harvest quota was exceeded in RY03. The balance of providing reasonable opportunity to hunt with sustained yield harvest in this road-accessible caribou herd continued to be a management challenge. To address this ongoing management challenge, in RY04 ADF&G used discretionary permitting authority to move the western boundary of the MACH hunt area from the Delta River to Jarvis Creek. The Jarvis Creek boundary, due to its location several miles east of the Richardson Highway, addressed the issues of caribou accessibility in relation to rate and amount of harvest. The boundary change removed the opportunity for hunters to harvest caribou within the highway corridor; therefore, it was expected that rate of harvest would decrease and reasonable opportunity to hunt could be realized without exceeding the harvest quota.

MANAGEMENT DIRECTION

MANAGEMENT OBJECTIVE

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

METHODS

Five-month old female caribou were captured and fitted with VHF radio collars to maintain a sample size of 12–20 radiocollared females in the herd. To attach radio collars, we captured caribou in September 2010 from a Robinson R-44 helicopter by immobilizing them with darts from a Cap-Chur™ rifle or short-range pistol. Darts were loaded with 1.5 mg carfentanil citrate (Wildnil®, Wildlife Pharmaceuticals, Fort Collins, Colorado, USA) and 50 mg xylazine hydrochloride (Anased®, Lloyd Laboratories, Shenandoah, Iowa, USA). Once immobilized, we fitted the caribou with radio collars. We also weighed each animal, collected body measurements, scored the body condition (Gerhart et al. 1996), drew blood (for serology, genetics, and trace mineral analysis), and recorded sex, age, and handling time. We then gave intramuscular injections of naltrexone hydrochloride (Trexonil®, Wildlife Pharmaceuticals) at a dosage of 100 mg naltrexone citrate/mg carfentanil citrate to antagonize the carfentanil citrate and tolazoline hydrochloride (ZooPharm, Windsor, Colorado, USA) at a dosage of 1.0 mg/kg body weight to antagonize the xylazine hydrochloride.

We monitored caribou movements and distribution by locating radiocollared caribou post-calving and prior to hunting season, and by opportunistic observation during surveys of other species. Most caribou locations were obtained from fixed-wing aircraft; however, we also obtained some locations by ground tracking. A Piper Super Cub (PA-18) fixed-wing aircraft was used to conduct visual and radiotelemetry searches to locate aggregations of caribou during August 2011, and May and June 2012. The location of each aggregation was recorded. When radio signals were heard, but caribou associated with the signal were not visually acquired, a general location and the latitude and longitude were recorded.

We used a Piper Super Cub (PA-18) fixed-wing aircraft in October 2011 to conduct visual and radiotelemetry searches to locate aggregations of caribou and to count total number of caribou in the MACH range. Caribou aggregations were counted visually when possible, and groups that were difficult to count directly were photographed with a digital single lens reflex camera and counted from the photographs.

Hunting was conducted by registration permit. Hunters were required to report hunt status, kill date and location, transportation mode, and commercial services used. Harvest data were summarized by regulatory year.

RESULTS AND DISCUSSION

POPULATION STATUS AND TREND

Population Size

RY10. We conducted an aerial population estimate on 29 September 2010 that resulted in an estimate of 1,809 caribou (Table 1). Sightability was fair, as snow cover ranged from no snow over much of the area to incomplete snow cover.

RY11. We conducted a fixed-wing aerial census and radiotracking flight on 23 October that resulted in a minimum count of 1,373 caribou (Table 1). Sightability was good with complete snow cover throughout the MACH range. Weather conditions were calm and clear with bright light from the Delta River to the Robertson River. The Robertson River area was windy with low clouds and limited visibility. Telemetry indicated one of the radiocollared MACH caribou was located east of the Robertson River; however we were not able to conduct fixed-wing operations in the area due to poor weather conditions. Caribou located east of the Robertson River were not observed and enumerated, which resulted in an incomplete census.

The aerial census and radiotracking flight conducted in October cost $1,720 for 8.6 hours of Super Cub charter. This cost included 2.1 hours of Super Cub charter on 19 October 2011 to assess caribou distribution, sightability, and flight conditions.

Population Composition

RY10. We calculated population composition from a sample of 1,528 caribou classified from the helicopter. Composition results were 39 bulls:100 cows, 11 large bulls:100 cows and 27 calves:100 cows (Table 1).

RY11. Composition data were not collected in RY11 due to poor survey conditions that affected the availability and use of a helicopter.

Captures

The average weight of 5-month-old female calves captured in 2010 was 110.4 lb and the average body condition score of the amount of soft tissue at the rump, ribs, and withers was 2 (n = 7). Each calf was fitted with a VHF radio collar.

Distribution and Movements

The MACH occupies the mountains of the eastern Alaska Range from the Delta River to the Mentasta Highway. Its core range is in Unit 20D between the Robertson River and the Richardson Highway, with primary calving grounds on the Macomb Plateau. The MACH also uses the lowlands of the Tanana River valley as winter range.

<u>RY10</u>. During the 29 September 2010 population estimate, most caribou (78%) were located between the Johnson and Robertson Rivers, in the core range of the Macomb caribou herd. West of the Johnson River, a large group of 280 caribou (15%) was located in the Boulder Creek drainage, an aggregation of 94 caribou (5%) was located in the eastern Granite Mountains, and a few scattered caribou were located in the Granite Mountains.

<u>RY11</u>. The radiotracking survey on 22 August located 377 caribou distributed throughout the MACH herd range from Bear Creek on the west to the Robertson River on the east. Caribou were observed in the Bear Creek (west), Granite Creek, Jarvis Creek, McCumber Creek, Sheep Creek (west), Sawmill Creek, Bradford Creek, upper Gerstle River, upper Johnson River, Bear Creek (east), Sheep Creek (east), Berry Creek, and upper Robertson River drainages, and on the Macomb Plateau. We observed the highest number of mature bulls high in the Bear and Berry Creek drainages, and on the Macomb Plateau. Twelve of 20 radiocollared caribou were located; 8 by radio signal and visual acquisition of the animal and 4 by radio signal only. This radiotracking survey cost $840 for 4.2 hours of Super Cub charter.

Aerial surveys were conducted in May and June 2012 to document distribution of the herd on calving and summer range and to verify presence of young-of-the-year. During a 22 May radiotracking survey, we observed 316 adults and 41 calves. We located caribou in Jarvis Creek, July Creek, Daugherty Creek, upper Little Gerstle River, Bear Creek (east), Sheep Creek (east), and on the Macomb Plateau. During this survey, 86% of the located caribou were on the Macomb Plateau. All (n = 20) radiocollared caribou were located; 14 by radio signal and visual acquisition and 6 by radio signal only. Three radio collars were in mortality mode. The 22 May survey cost $1,140 for 5.7 hours of Super Cub charter.

To document general summer distribution, we completed an aerial survey on 19 June and located 761 adults and 95 calves. Approximately 50% of the caribou were located on Macomb Plateau and the rest were distributed in the Ober Creek, McCumber Creek, upper Gerstle River, upper Little Gerstle River, upper Johnson River, Bear Creek (east), and upper Robertson River drainages. Fifteen of 17 radiocollared caribou were located visually and by radio signal. The signals from 2 collars were not detected. This survey cost $1,220 for 6.1 hours of Super Cub charter.

During an aerial survey on 25 June, we searched for the 2 radiocollared caribou not detected during the 19 June survey. One of the radiocollared caribou was located on Macomb Plateau.

The signal from the other collar was not heard. This survey cost $620 for 3.1 hours of Super Cub charter.

MORTALITY

Harvest

Season and Bag Limit.

RY10 — Hunting for the MACH was conducted as Tier I registration permit hunt RC835 for resident hunters only during 10–27 August. The hunting season dates were set using ADF&G's discretionary permit authority to shorten the season from the 10 August–30 September framework. The portion of southern Unit 20D west of Jarvis Creek was closed to hunting, also using ADF&G's discretionary permit authority. The harvest quota was 50 bulls, and 2 days of hunter access by motorized vehicles and pack animals were allowed in the western portion of the hunt area during 26–27 August when the Delta Controlled Use Area had no access restrictions.

RY11 — Hunting for the MACH was conducted as Tier I registration permit hunt RC835 for resident hunters only during 10–27 August. The hunting season dates were set using ADF&G's discretionary permit authority to shorten the season from the 10 August–30 September framework. The portion of Unit 20D west of Jarvis Creek was closed to hunting, also using ADF&G's discretionary permit authority. The harvest quota was 70 bulls, and 2 days of hunter access by motorized vehicles and pack animals were allowed in the western portion of the hunt area during 26–27 August when the Delta Controlled Use Area had no access restrictions.

Harvest by Hunters. Sixty-eight caribou were harvested in RY10, and 73 were harvested in RY11. The intensive management harvest quota of 30–50 caribou harvested per year was met and exceeded (Table 2). Harvest of the MACH since RY08 continued an increasing trend in response to increases in the harvest quota.

Permit Hunts.

RY10 — Registration permits were issued to 326 people (Table 2) and 218 (67%) hunted (Table 3), killing 67 bulls for a 31% success rate. One cow was also killed (Table 3). This harvest was 17 more bulls than the harvest quota of 50 and therefore did not meet the harvest objective.

RY11 — Registration permits were issued to 312 people (Table 2) and 217 (70%) hunted (Table 3), killing 72 bulls for a 33% success rate. One cow was also killed (Table 3). This harvest was 2 bulls more than the harvest quota of 70 and slightly exceeded the harvest objective.

Hunter Residency.

RY10 — Most successful hunters (79%) were not local residents of Unit 20D (Table 3).

RY11 — The largest group of RC835 hunters was nonlocal Alaska residents (Table 3).

The ratio of local to nonlocal participants in RC835 has declined steadily for over a decade (Table 3). Two factors may explain the relative abundance of nonlocal residents participating in RC835. Unit 20D hunters were qualified to hunt in the federal subsistence hunt for the Nelchina caribou herd in nearby Unit 13 and may have preferred to hunt in Unit 13 where they could use motorized vehicles and had an any-caribou bag limit. Concomitantly, RC835 attracted nonlocal residents who did not qualify for federal subsistence hunts and were looking for a road-accessible caribou hunt.

Harvest Chronology.

RY10 —Twenty-one percent of the harvest occurred in the first 6 days of the season, 20% during the second 6 days, and 40% during 26–27 August when motorized vehicles and pack animals were allowed (Table 4).

RY11 — Sixteen percent of the harvest occurred in the first 8 days of the season, 21% during the second 8 days, and 63% during 26–27 August when motorized vehicles and pack animals were allowed in the DCUA portion of the hunt area (Table 4).

Harvest Location.

RY10 — Most of the reported caribou harvest was from the Jarvis Creek drainage (57%) with the second highest harvest area the Macomb Plateau (18%; Table 5).

RY11 — Most of the reported caribou harvest was from the Jarvis Creek drainage (55%), with the remaining harvest distributed throughout the MACH range (Table 5). The Jarvis Creek drainage continued as the area with the highest harvest due to its location and network of trails. This drainage is easily accessed by motor vehicle from the Richardson and Alaska highways. Numerous hunters sought caribou in this area during the last 2 days of the hunt when motor vehicle access into the area was allowed.

Transportation Methods.

Motorized vehicles continued to be the most common transport method for successful hunters (Table 6). Numerous hunters used 3- or 4-wheelers in the west side of the hunt area when vehicle access into the area was allowed. Horse and pack animals were the primary transport method for hunting the Macomb Plateau due to motor vehicle restriction in the MPCUA.

Other Mortality

An unknown number of caribou mortalities were caused by motor vehicle collision on the Richardson Highway in Donnelly Flats. Some mortality was likely caused by illegal killing.

HABITAT

Assessment and Enhancement

No habitat assessment work occurred for the MACH during RY10–RY11.

CONCLUSIONS AND RECOMMENDATIONS

We met our population objective of 600–800 caribou during RY10–RY11. The minimum herd sizes for RY10 and RY11 were >1,000 and the harvest quota was increased to allow for additional hunting opportunity during this time period. The increased quota allowed for a harvest that met the intensive management harvest objective in RY11 without a need to regulate the hunting season by emergency order as in many previous years. Harvest in RY11 slightly exceeded the management objective, but did not exceed the harvest quota of 50–100 caribou allowed in regulation. We also achieved the amounts necessary and reasonable opportunity to hunt for subsistence needs with the RY10–RY11 hunt structures and harvest quotas.

The rate of harvest during the 2 days of motorized access in the RC835 hunt continues to be a management challenge. Caribou distribution is monitored prior to the motorized portion of RC835. Distribution can be an indicator of rate of harvest and the distributional information is used to assess the potential for early closure of the season. Harvest is monitored frequently during these 2 days in an attempt to ensure the quota isn't exceeded.

Members of the local community and the Delta Fish and Game Advisory Committee regularly contact ADF&G to express concerns that fair chase rules and hunting ethics are violated by hunters and the landscape is being damaged by motor vehicle use during the last 2 days of the RC835 hunt. In addition, illegal take of caribou in the closed area west of Jarvis Creek accounts for a portion of the harvest quota each year. The known number of caribou taken in the closed area is low, but chronic.

Harvest monitoring and regulation will remain the primary methods used to manage the MACH. The number of caribou in this herd will likely fluctuate over time, and it will be necessary to adjust the harvest quota to sustain the intensive management objectives and amounts necessary for subsistence needs.

At this time we recommend the current registration permit hunt be continued during August 10–25. However, we recommend eliminating the August 26–27 motorized access portion of the registration hunt and will request authority from the Board of Game to replace it with a drawing permit hunt east of Jarvis Creek during August 26–September 20. This action will allow ADF&G to limit the number of hunters when motorized vehicle restrictions are lifted in the Delta Controlled Use Area, while allowing 15 days of opportunity for subsistence users under the Tier I registration hunt.

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Wildlife Biologist III

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Table 1. Macomb caribou fall composition counts and minimum count or estimated population range, 2000–2011.

Survey date	Bulls: 100 cows	Calves: 100 cows	Calves %	Cows %	Small bulls %	Medium bulls %	Large bulls %	Total bulls %	Composition sample size	Count or estimated range in herd size
10/2/00	45	11	7	64	43	29	29	29	605	650[a]
10/9/01	39	11	7	66	40	30	30	26	467	500–550[a]
11/2/02	51	21	12	58	39	43	19	30	234	Unk
10/4/03	46	19	12	60	44	22	31	28	526	550–575
10/9/04	61	40	20	50	18	37	45	30	546	600–650
10/04/05	64	17	9	55	53	16	31	35	628	630–650
10/06/06	48	31	17	56	14	45	41	27	857	857
10/09/07	68	29	15	51	53	18	29	34	951	1,305
10/18/08										754[b]
10/18/09	32	26	17	63	34	31	35	20	838	959[c]
9/29/10	39	27	16	60	41	31	28	24	1528	1,809
10/23/11										1,373[d]

[a] Estimated.
[b] Incomplete survey and no composition data collected.
[c] Poor survey conditions due to lack of snow cover.
[d] Incomplete census and no composition data collected.

Table 2. Macomb caribou harvest data by permit hunt, regulatory years (RY)[a] 2000 through 2011.

Hunt	Regulatory year	Permits issued	Percent did not Hunt	Percent successful hunters	Percent unsuccessful Hunters	Harvest			Total harvest
						Bulls (%)	Cows (%)	Unk	
RC835[b]	RY00[c]	274	31	12	88	22 (100)	0 (0)	0	22
	RY01[c]	255	32	25	75	43 (100)	0 (0)	0	43
	RY02[c]	158	41	28	73	25 (100)	0 (0)	0	25
	RY03[c]	161	27	25	75	29 (100)	0 (0)	0	29
	RY04	76	58	22	78	7 (100)	0 (0)	0	7
	RY05	117	53	33	67	18 (100)	0 (0)	0	18
	RY06	103	46	38	63	21 (100)	0 (0)	0	21
	RY07	161	47	32	68	27 (100)	0 (0)	0	27
	RY08	267	37	29	71	48 (100)	0 (0)	0	48
	RY09	242	37	37	63	54 (96)	2 (4)	0	56
	RY10	326	33	31	69	67 (99)	1 (1)	0	68
	RY11	312	30	34	66	72 (99)	1 (1)	0	73

[a] Regulatory year (RY) = 1 July–30 June, e.g., RY11 = 1 July 2011–30 June 2012.
[b] RC835 = Caribou registration permit hunt 835.
[c] Hunt closed by emergency order.

Table 3. Macomb caribou hunter residency and success of permit hunters, regulatory years (RY)[a] 2000 through 2011.

Regulatory year	Successful				Unsuccessful				Total hunters
	Local[b] resident	Nonlocal resident	Nonresident	Total (%)	Local[a] resident	Nonlocal resident	Nonresident	Total (%)	
RY00	11	11	0	22 (12)	89	75	0	164 (88)	186
RY01	13	30	0	43 (25)	67	64	0	131 (75)	174
RY02	10	15	0	25 (28)	30	36	0	66 (73)	91
RY03	7	22	0	29 (35)	29	25	0	54 (65)	115[c]
RY04	1	6	0	7 (22)	12	13	0	25 (78)	32
RY05	10	8	0	18 (33)	13	24	0	37 (67)	55
RY06	9	12	0	21 (38)	8	27	0	35 (63)	56
RY07	12	15	0	27 (32)	14	44	0	58 (68)	85
RY08	14	34	0	48 (29)	36	83	0	119 (71)	167
RY09	16	40	0	56 (37)	30	67	0	97 (63)	153
RY10	14	54	0	68 (31)	30	120	0	150 (69)	218
RY11	17	56	0	73 (34)	32	112	0	144 (66)	217

[a] Regulatory year (RY) = 1 July–30 June, e.g., RY11 = 1 July 2011–30 June 2012.
[b] Resident of Unit 20D.
[c] Success of 32 hunters was unknown.

Table 4. Macomb caribou harvest chronology during permit hunt RC835, regulatory years 2000–2011.

Harvest	Hunt year											
date	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
August												
10							4	5	2	4	3	4
11							3	0	3	3	4	1
12							1	1	6	1	2	0
13							2	3	2	0	3	4
14							2	1	4	2	0	1
15			11	18	4	2	0	1	0	3	2	0
16			4	9	0	3	0	3	1	0	1	0
17			5	1	0	2	0	0	2	2	1	2
18			1	1	0	0	2	3	3	0	0	1
19			1	0	1	1	1	1	0	0	0	2
20			3	0	0	5	1	2	0	2	3	3
21			0	0	0	3	0	0	3	2	8	2
22			0	0	0	0	0	0	0	1	2	1
23			0	0	1	0	1	4	2	1	0	1
24			0	0	0	0	2	0	1	0	5	0
25			0	0	1	1	1	3	1	3	7	5
26									12	23	17	28
27									4	8	10	18
28									1			
September												
10	9	34										
11	3	4										
12	1	5										
13	3	0										
14	5	0										
15	0	0										
16	0	0										
17	0	0										
18	1	0										
19	0	0										
20	0	0										
Unk						1	1		1	1	0	0
n	22	43	25	29	7	18	21	27	48	56	68	73

Table 5. Macomb caribou harvest location during permit hunt RC835, regulatory years (RY)[a] 2000 through 2011.

Regulatory year	Harvest location/drainage							
	Jarvis Creek	Little & Big Gerstle River	Granite Mountains	Johnson River	Macomb Plateau	Robertson River	Unit 12	Unknown
2000	18	2	0	0	0	0	0	2
2001	24	0	3	0	13	0	1	2
2002	22	0	0	0	2	0	1	0
2003	22	0	0	0	6	1	0	0
2004	2	0	1	0	2	1	0	1
2005	4	0	0	1	12	1	0	0
2006	2	0	2	1	11	0	0	0
2007	9	0	0	1	14	2	1	0
2008	21	2	2	1	15	5	2	0
2009	30	5	10	1	14	1	7	0
2010	32	5	5	0	10	1	3	0
2011	40	6	3	0	14	6	4	0

[a] Regulatory year (RY) = 1 July–30 June, e.g., RY11 = 1 July 2011–30 June 2012.

Table 6. Macomb caribou harvest percent by transport method, regulatory years (RY)[a] 1986 through 2010.

Regulatory year	Percent harvest by transport method								Unk	*n*
	Airplane	Horse	Boat	3- or 4-Wheeler	Snowmachine	other ORV[b]	Highway vehicle	Walking		
2000	0	0	0	46	0	46	5	0	5	22
2001	0	12	0	56	0	7	16	0	9	43
2002	4	0	0	0	0	8	40	0	48	25
2003	0	3	0	0	0	3	62	28	3	29
2004	0	14	0	14	0	0	57	14	0	7
2005	0	33	0	0	0	11	33	11	11	18
2006	10	24	0	0	0	5	48	5	10	21
2007	0	30	0	4	0	7	52	4	4	27
2008	8	15	0	25	0	4	31	8	8	48
2009	0	4	0	39	0	13	31	7	6	54
2010	1	12	1[c]	34	0	0	33	9	9	67
2011	0	15	1[c]	58	0	1	14	3	8	73

[a] Regulatory year (RY) = 1 July–30 June, e.g., RY11 = 1 July 2011–30 June 2012.
[b] ORV = Off road vehicle
[c] Airboat

SPECIES MANAGEMENT REPORT	Alaska Department of Fish and Game Division of Wildlife Conservation (907) 465-4190 P.O. BOX 115526 JUNEAU, AK 99811-5526

CARIBOU MANAGEMENT REPORT

From: 1 July 2010
To: 30 June 2012

LOCATION

GAME MANAGEMENT UNIT: 13 and 14B (25,525 mi^2)

HERD: Nelchina

GEOGRAPHIC DESCRIPTION: Nelchina Basin

BACKGROUND

The Nelchina caribou herd (NCH) has fluctuated in size over time, with an objective of 35,000–40,000 since the late 1990s. Maintaining a moderate objective has helped keep productivity high and the herd healthy. Harvest quotas have been developed annually with the intent of achieving maximum sustained yield.

The NCH is important to large numbers of hunters because of its accessibility and proximity to Anchorage and Fairbanks as well as residents of the Copper River Basin. Caribou hunting permits have been issued for state and federal subsistence hunts in Unit 13 since regulatory year (RY) 1990 (RY90 = 1 July 1990 through 30 June 1991), and there was a limited drawing hunt for caribou in Unit 14, which likely harvests a few Nelchina caribou moving through the hunt area. More recently, the Board of Game established new drawing hunts for Nelchina caribou in Unit 13, which have been offered since RY11. Both the number of permits issued and the allowable harvest fluctuate annually, depending on existing hunt structures and herd status. Herd management has allowed for tremendous hunting opportunity for Alaska resident hunters over the past few decades. Since 1990, more than 64,000 caribou have been harvested from the NCH, with an average of nearly 2,800 per year.

MANAGEMENT DIRECTION

MANAGEMENT OBJECTIVES

- Maintain a fall population of 35,000–40,000 caribou, with a minimum of 40 bulls:100 cows and 40 calves:100 cows.
- Provide for an annual harvest of 3,000–6,000 caribou.

METHODS

Censuses and sex and age composition counts are conducted annually. The censuses involve aerial counts of caribou observed during late June or early July in postcalving aggregations. Aerial count techniques include fixed-wing photo censuses, direct counts from fixed-wing aircraft, or a combination thereof. Aggregation of caribou and weather conditions determine the census technique. Large concentrated groups can be photographed effectively, whereas loosely aggregated caribou must be counted from the air. Composition data is collected via helicopter immediately after the census, and again in early October during the rut to determine the bull:cow ratio and to refine the estimate of calf survival and recruitment. Fall posthunt population estimates are then calculated from the summer counts and fall composition data. Population data are modeled to determine future population trends and allowable yearly harvest rates.

Radiocollared caribou are located seasonally to delineate herd distribution, determine seasonal range use, and estimate mortality rates. To accomplish this, we attempt to maintain a minimum of 40 to 60 radiocollared cow caribou in the herd. Collars are placed on 4- or 11-month-old female calves to obtain calf weights, as well as survival and parturition data for known-age females in following years. Radiocollared cows are located during the calving period to determine parturition rates and the mean calving date.

Additional collaring began in the spring of 2011 as part of a new Watana Hydroelectric study. Additional cow caribou have been captured and fitted with Argos satellite collars, and a sample of bulls have been captured as well, some were fitted with radio collars and some with Argos satellite collars.

To monitor hunt conditions and harvests, biologists use permit reports, radiotelemetry flights, and hunter field checks.

RESULTS AND DISCUSSION

POPULATION STATUS AND TREND

Population Size

Since the late 1990s, the department has attempted to manage the NCH near maximum sustained yield. This management strategy proves difficult when annual composition or count data are inaccurate or unattainable. In these years, the annual harvest quota may be set too high or too low, and corrections must be made in subsequent years.

In 1996 and 1997, the size of the NCH was intentionally reduced from 50,280 (in 1995) due to concerns about nutritional stress. In addition to high harvest quotas those years, wounding loss was likely very high given the exceptionally high hunter numbers. The herd declined rapidly. Population estimates averaged just under 33,000 caribou from 1998 to 2003. The herd slowly increased, and population estimates in 2004 and 2005 were within the objective range (average = 36,550). Due to weather conditions no count was attained in 2006. Harvest quotas were set based on available estimates of calf production and survival, along with the bull-to-cow ratio. In 2007, the herd estimate again fell below 33,000. Due to weather conditions no count was attained in 2008.

Despite conservative harvest quotas in regulatory year (RY) 2007 (RY07 = 1 July 2007 – 30 June 2008) and RY08, the 2009 herd estimate of 33,837 (Table 1) remained below objectives. Even though the 2009 count was conducted over a broad geographic area, encompassing a large portion of the eastern Talkeetna Mountains, there were indications caribou were missed. Of the radiocollared cows expected to be in this area, only 60% were located during pre-count flights.

In addition to a low herd estimate, parturition was low and calf mortality increased in 2009. The annual harvest quota was further reduced to encourage herd growth.

Survival during the winter of 2009–2010 was very good, and an exceptionally high number of calves were produced in 2010. A photo census was conducted. The final fall population estimate of 48,653 in 2010 was much higher than anticipated and was the highest estimate since the last peak in 1995. Summer survival was high as evidenced by a high fall calf ratio. The harvest quota was increased. Survival of radiocollared caribou again was high during the winter of 2010–2011, as was calf production and early calf survival the following summer. Despite the good concentration of radiocollared caribou in the traditional count area, fewer total animals were observed during the 2011 summer census than expected. The large number of yearling caribou in the herd could have partially been responsible as these young caribou often fail to concentrate on the calving grounds where the traditional summer censuses are conducted. The final fall population estimate in 2011 was 41,394. Harvest opportunity remained relatively high.

The winter of 2011–2012 was relatively severe in Unit 13 with persistent deep snow, although the majority of the herd wintered near or north of the Alaska Range where winter conditions were mild. Productivity declined somewhat in 2012, though the herd had high numbers of yearling and two-year-old caribou. For the summer census, caribou were loosely aggregated and a photo count could not be completed. Conditions, however, were very good for a traditional summer census as caribou were congregated above tree line and groups were relatively sedentary during the count. The 2012 fall estimate indicated an increase in the population, to 50,646.

Population Composition

The most important annual variable for management of the NCH is calf recruitment; a combination of productivity and calf survival. Variations in calf production generally relate to changes in body condition. Poor condition in young caribou can result in a delay in age of first reproduction. Reproductive age cows can also skip a breeding season to regain body condition if they are nutritionally stressed (Whitten 1995). While nutritional stress can occur due to annual weather fluctuations, it can also result due to overgrazing, or a combination of these factors.

The number of calves born and subsequent calf survival are the largest components in estimating the annual increment available for harvest for this herd. Parturition or birthrates of radiocollared cows provide initial spring data on the status of the herd. This data has been collected from known-age NCH cows since 1997. The typical age range of first reproduction in the NCH is 3 to 4 years old. Parturition of these young cows appears to be the most sensitive to nutritional fluctuations, and may provide a useful index of herd performance. Since 1997, annual 3-year-old parturition has averaged 40%; overall parturition for cows 3 years of age and older has averaged 73%.

With no parturition data prior to 1997, there is no way to know what immediate effects the increased herd size during the mid-1990s had on birthrates. Although the size of the herd was intentionally reduced by 1997, nearly half of the 3-year-old radiocollared cows had calves in 1997 and 1998 (50%, n = 6 and 45%, n = 11, respectively). Parturition declined from that point with 25% observed in 1999 (n = 12) and 0% in 2000 (n = 8). While deep snow in Unit 13 likely played a role in low parturition in 2000 and 2001, rates remained relatively low from 2002 to 2005 (average = 46%; n = 40). The decline in parturition, although delayed, supports the previous decision to reduce the size of the herd. The delay, however, suggests that the parameter of parturition may not be sensitive enough to indicate nutritional stress in a timely manner.

Although the annual sample of radiocollared 3-year-old cows has been small in recent years, 3-year-old parturition in 2007, 2008, and 2010 combined was relatively high, averaging 67% (n = 18). No 3-year-old parturition data was available for 2009. For comparison, parturition for cows 3 years of age and older for 2007, 2008, and 2010 combined was 85% (n = 95), well above the long-term average. The 2009 rate, while biased towards older cows (no 3-year-olds), was very low at 65% (n = 23). Overall parturition was also lower than average in 2011 and 2012, with an average 3-year-old rate of 23% (n = 23) and an average for cows 3 years of age and older of 79% (n = 78).

In addition to parturition, calf survival plays an integral role in annual herd management. While a significant number of calves are lost in the first several weeks of life, summer herd composition data (collected immediately following the census) have proven useful in estimating annual recruitment, population trajectory, and initial harvest quotas.

Nelchina calf ratios have traditionally been high compared to other Alaska caribou herds (Harper 2011). Summer ratios have averaged 49 calves:100 cows (range = 31–65; 1972–2012), with fall ratios averaging 39:100 (range = 20–55) during the same period. The lowest ratios for this herd were observed in 1999 and 2000 (average = 32:100 in the summer and 22:100 in the fall; Tobey 2001). The combination of variable weather, low parturition (average birthrate of 47% for cows 3 years of age and older), and high wolf numbers on the summer range (average fall density = 11 wolves/1,000 km^2 for Subunits 13A and 13B) were all likely responsible for the low calf recruitment.

Calf ratios have been significantly higher in recent years. For 2010 and 2011, summer ratios were exceptionally high at 65 and 63 calves:100 cows, respectively. The fall ratios were 55 and 45:100 respectively. In 2012, the summer ratio dropped to 34:100, and further to 31:100 in the fall. These ratios cannot be explained by parturition, which has trended lower in recent years. Early calf survival may be the largest contributor to higher ratios.

While calf loss between parturition and the summer composition survey is not monitored regularly, loss between the summer and fall surveys is calculated in number of calves per 100 cows or a percentage of calves lost. Since 1972 this summer-to-fall calf loss has been variable, averaging 11 calves:100 cows (range = 2–23) or 23%. The highest consecutive years of loss were 1996–2000 when an average of 13 calves:100 cows were lost (32%), coinciding with a high unitwide fall wolf density (average = 11 wolves/1,000 km^2; subunit estimates were unavailable prior to 1998). The highest years of wolf take followed in 1999–2001, though harvest rates averaged only 47% and wolf numbers were still relatively high (Tobey 2003). Notably, the summer-to-fall calf loss declined markedly to only 4 calves:100 cows each year 2001–2003. While this was a dramatic change, the pattern did not hold. Fall wolf numbers on the caribou summer range have further declined (Schwanke 2013) to a stable 4 wolves/1,000 km^2 since 2006, and summer-to-fall calf loss has increased to an average of 12 calves:100 cows (23%). The 3 years of low summer-to-fall calf loss are difficult to explain, but could have been a shock response due to the removal of certain wolves from key packs across the summer range.

The variation in calf ratios and recruitment year to year can be significant in determining population trajectory and subsequent harvestable surplus. In 2010, the exceptionally high 55 calves:100 cows that were observed in October meant over 11,000 calves made it to fall. This is in contrast to the 31 calves:100 cows observed in the fall of 2012, which represented just over 7,000 calves. These calves must go through one full winter before they can be considered recruited into the population. In each year of this reporting period, 30% of collared calves died over their first winter. An estimated 7,700 yearlings were recruited in 2011, and 4,900 in 2012.

In addition to annual calf recruitment and general herd composition, calf weights and measurements also provide indices by which overall herd health can be monitored. Four-month female NCH calves have been weighed in the fall since 1995 (average = 120 lb). Annual sample sizes have ranged from 8 to 40. Along with high parturition in 2010, fall calves were large, averaging 129 lb (range = 104–147; n = 20). For 2011 and 2012, the average weight of fall calves dropped to 117 lb (2011 range = 93–140; n = 19, 2012 range = 96–131; n = 20). While annual weather conditions such as snow depth, timing of green-up, and quality of the growing season can impact calf weights and measurements year to year, trends may indicate changing range conditions. With population estimates above objectives, and fall weights and metatarsus measurements below average 4 of the last 5 years (2008–2012), there is increasing concern for the overall health of this herd.

Herd health indices, population status, and composition data are all used to set harvest quotas annually. While initial harvest quotas must be set prior to the fall hunting season, fall calf and bull ratios are used to refine the harvestable surplus estimate in those years when hunts run past October. The fall bull ratio increased steadily after 2004, reaching 64 bulls:100 cows in 2010. Given higher bull quotas in 2010 and 2011, the ratio declined to 57:100 in 2012 (Table 1).

Bulls are also classified by antler size (classified by small, medium, and large) during the fall. Considering many caribou hunters select for large antlered bulls, hunting can impact this segment of the population in a short period of time (Milner et al. 2007). Between 1998 and 2001, only 13% of all bulls were estimated as large antlered. The harvest quota for bulls decreased from 1500 in 1999 to 1000 in 2000, and the bull quota remained 1000 until 2004. The number of bulls estimated as large antlered increased to 22% between 2002 and 2005, likely as a result of the quota reduction. The percentage of large antlered bulls has trended higher since (averaging 25% of all bulls; 2007–2012).

DISTRIBUTION AND MOVEMENTS

Calving typically takes place in the southwest portion of the herd's range in the eastern Talkeetna Mountains from the Little Nelchina River north to Fog Lakes. The core calving area extends from the Little Nelchina River to Kosina Creek. This area is also used during the postcalving and early summer period. During summer and early fall, caribou disperse to the north and east. Their fall distribution can extend across the Denali Highway, across the Alphabet Hills and the Lake Louise flats as far east as the Gulkana River.

The Nelchina herd ruts from late September through mid-October. The rut occurs in different areas depending on the year. In 2009 and 2010 rutting was concentrated in the center of the unit covering portions of Subunits 13A, 13B, and 13E. In 2011, caribou started to migrate to the northeast early. The rut occurred from Tangle Lakes east through the Chistochina River drainage in Subunits 13B and 13C, and into Drop Creek in northern Unit 11. In 2012, caribou were scattered across Unit 13 during the rut. A large group of caribou rutted in the Paxson area, with additional animals to the west between the Upper Susitna and MacLaren rivers. Another substantial group of caribou rutted in the Upper Talkeetna River drainage.

Winter habitat for the NCH extends from Cantwell in Subunit 13E, east across Subunit 13A and 13B, and northeast into Units 11, 12, and Subunit 20E. Through the 1980s and 1990s as the size of the herd increased, its range expanded. Use of Unit 13 winter range declined in the mid-1990s as caribou began to find higher quality winter range in Subunit 20E, presumably due to an abundance of lichen in older burns in the vicinity of the Taylor Highway.

In 2004 much of the preferred NCH winter range in Subunit 20E burned, such as the Upper West Fork of the Fortymile River and the Upper Dennison. While caribou have been avoiding the recently burned areas, they continue to use adjacent unburned areas. Nelchina caribou that continue to winter in Subunit 20E are now concentrated in unburned areas. There has also been documentation of increased movements to previously unused areas such as the Mosquito Fork and Kechumstuk Mountain, northwest of a large burned area, as well as east into the Yukon. Approximately 60–95% of the NCH continues to winter in Subunit 20E.

In addition to winter habitat loss in Subunit 20E, continued growth of the Fortymile caribou herd could also impact the NCH. A portion of the Fortymile herd uses this same area year round (Boertje and Gardner 2000) and winter competition has been increasing between these herds in recent years. The Fortymile herd has increased nearly 40% since 2001, now exceeds 51,000 animals, and continues to grow. With the Fortymile Caribou Herd Harvest Management Coalition membership continuing to support further herd growth (Gross pers. comm.), competition will continue to increase and this winter range could become overgrazed. With limited lichen availability and increasing winter pressure on the unburned range, movements and nutritional indicators for both herds will continue to be monitored to assess the impacts.

While the calving distribution of the NCH remains relatively constant each year, caribou do not typically show fidelity to other seasonal ranges. Annual movements and range use likely depend on resource availability as well as the persistence of snow. As in years past, as the NCH grows, larger groups of caribou start to utilize range outside the core areas. Caribou often remain in these areas year-round, though intermixing is still evident based on radio collar data. These groups are common throughout the Talkeetna Mountains and portions of the Alaska Range between the Upper Nenana River and the Upper MacLaren River. Additional groups can also be found in the Tolsona area, and to the southeast into the Tonsina River drainage. Considering the current objective is to reduce the size of the herd, it is expected that these groups will shrink as well.

MORTALITY

Harvest

Season and Bag Limit. The season dates for state subsistence caribou hunts in Unit 13 have historically been 10 August–20 September (fall) and 21 October–31 March (winter). In RY10, a limited Tier I subsistence registration hunt (RC566) was held for the fall season only. The bag limit was 1 bull caribou per household. A Tier II subsistence hunt (TC566) was held for the winter season only, with a bag limit of 1 caribou (Table 2).

In RY11, a Tier I subsistence community hunt (CC001) and a Tier I subsistence registration hunt (RC566) were held for both the fall and winter seasons; the bag limit for each hunt was 1 caribou per household. Hunters were restricted to participating in only one of the hunt options.

Also in RY11, four Unit 13 drawing hunts (DC480-483) were offered to Alaska resident hunters with a bag limit of 1 bull caribou. The season dates were 20 August–20 September and 21 October–31 March.

Since 1993 there has also been a drawing hunt (DC590) held in the Talkeetna Mountains in subunit 14B for 1 caribou with season dates of 10 August–20 September.

The Unit 13 federal subsistence hunt for rural residents (FC1302, previously FC513 and FC514) is held 1 August–30 September and 21 October–31 March (previously opening on 10 August). The federal bag limit is 2 caribou, and each hunter is issued 2 permits. The Unit 13 federal subsistence hunt is by registration, administered by the Bureau of Land Management (BLM); only residents of Units 11, 13, and 12 along the Nabesna Road, and Unit 20 residents from Delta Junction are eligible. A Unit 12 federal subsistence hunt (FC1202, previously FC412) for rural residents of Unit 12, Dot Lake, Healy Lake, and Mentasta is opened for 1 caribou by emergency order when the NCH migrate through the Tetlin Refuge during winter months.

Board of Game Actions.

In July 2010, the Board of Game held an emergency teleconference to address a decision on summary judgment made in a court case affecting the Unit 13 subsistence caribou hunts, *Manning v. State Department of Fish and Game*, 3KN-09-781 CI.

. The board rescinded the community hunt (CC001) for RY10, as well as the registration hunt (RC566) for the winter season in RY10. It stipulated that those signed up for the cancelled community hunt would be allowed to participate in the registration hunt (RC566) for the fall season. The board then established a Tier II hunt (TC566) for the winter season in RY10.

In October 2010, the board held another meeting to address the expiring emergency regulations, and to discuss additional options for management of the NCH. The board first addressed the concerns of the court pertaining to residency requirements for the community subsistence hunt, adopting new wording to allow all Alaska residents to participate. The community hunt was then reinstated for RY11. The board also addressed the concerns of the court pertaining to limitation of participants in the registration hunt (RC566). The registration hunt was then reinstated for RY11, with the understanding that the number of participants could not be limited. Finally, the board established drawing hunts for Unit 13, also to be implemented in RY11.

In March 2011, the Board of Game reconfirmed the community harvest, the registration, and the drawing hunts. No significant changes were made to the caribou hunting regulations.

Hunter Harvest and Emergency Orders. The total reported harvest from all NCH state and federal hunts varies annually depending on hunter participation, caribou availability, and annual quotas. To promote herd growth, a conservative harvest quota of 1,000 bulls was set in RY09. The quota was not met; 797 caribou were taken.

Given good calf production and an increase in overall caribou numbers in 2010, the RY10 harvest quota was increased significantly, to 2,300 caribou. During the fall, 936 state hunters participated in the Tier I hunt (RC566) taking 615 caribou. During the winter season, 2,338 state hunters with Tier II permits (TC566) took 1,289 caribou before the hunt was closed by Emergency Order on November 14. Federal hunters reported taking a total of 505 caribou (federal hunts remained open through the end of March). Including the small 14B drawing hunt (DC590), the final harvest of 2,438 caribou exceeded the quota by 138 (Table 2).

Due to high overwinter survival and good calf numbers again in 2011, the harvest quota remained high at 2,400. The state drawing hunts (DC480–483) were the first to close by Emergency Order on October 28. A total of 675 drawing hunters harvested 319 caribou. The Tier I registration hunt (RC566) was closed by Emergency Order on December 3; a total of 2,393 registration hunters harvested 1,623 caribou. The Tier I community hunt (CC001) closed by Emergency Order December 6. A total of 175 community hunters harvested 87 caribou. Federal hunters reported taking a total of 443 caribou before the end of the hunt in March. The total harvest of 2,512 caribou in RY11 exceeded the quota by 112 (Table 2).

Illegal and unreported harvests of Nelchina caribou are an additional unknown source of mortality. The most common type of illegal harvest occurs when a permittee fails to validate the permit after taking a caribou.

Wounding loss can also be high because caribou are often shot while in groups, and more than one animal can be hit with a single shot. Also, identifying a specific animal from a group is difficult, especially cows and small bulls. Wounding loss is thought to be lower under bull-only seasons. While some cows are mistakenly taken when a hunter is required to take only bulls, more care is exercised to be sure of the target, especially with subsequent shots. Wounding loss increases when high numbers of permits are issued, and when large numbers of caribou migrate across the Richardson Highway during late October.

Permit Hunts. Nelchina caribou may be harvested only under permit (Table 2). Through RY08, the Tier II subsistence hunt TC566 was the primary caribou hunt in Unit 13. No Tier II hunt was offered in RY09, though a winter season hunt was offered in RY10. Tier II hunts are no longer offered for the NCH.

To provide the maximum opportunity to participate in Unit 13 caribou hunts, two Tier I subsistence hunts are now offered (RC566 and CC001). Alaska resident hunters must apply for these hunts in November or December prior to the hunting season. The RC566 hunters and their household members are limited to hunting caribou and moose in Unit 13 for the regulatory year. The community hunters (CC001) and their household members are also limited to hunting caribou in Unit 13, though they may hunt moose anywhere within the community hunt area (Units 11, 13, and a small portion of 12) for the regulatory year. Community hunters apply in groups with the added benefit that they are allowed to use designated hunters within their group to harvest caribou. They are also required to salvage all edible meat, as well as the heart, liver, and kidneys. There were no antler specific regulations during this reporting period.

The drawing hunt in Subunit 14B (DC590) has been held each year. Beginning in RY11, four drawing hunts were offered in Unit 13 (DC480–483). The hunt boundaries were based on historical hunting areas within the unit. The DC480 hunt area covers Subunit 13D and the majority of Subunit 13A south of the Black River. The DC481 hunt area covers Subunit 13E south of the Susitna River, and 13A north of the Black River. The DC482 hunt area covers Subunit 13E north of the Susitna River, and 13B west of the MacLaren River. The DC483 hunt area covers Subunit 13B east of the MacLaren River, and 13C.

There are two federal permit hunts for rural residents, one in Unit 12 (FC1202; previously FC412) and one in Unit 13 (FC1302; previously FC513 and FC514).

Hunter Residency and Success. Only Alaska residents may hunt Nelchina caribou in Units 12 and 13, while nonresident hunters may hunt in Subunit 14B (a nonsubsistence area). Of these Subunit 14B hunters, 96% have been Alaska residents (RY07–RY11).

Table 3 lists hunter residency and success rates for local (Units 11, 13, and 12 along the Nabesna road) and nonlocal hunters. Historically, the majority of Nelchina subsistence caribou state permittees have been nonlocal Alaska residents.

In RY11, of 3,148 permits issued in the RC566 hunt, 2,322 nonlocals and 71 locals reported hunting. The nonlocal success rate was 69%, while the local success rate was only 35%. In the CC001 hunt, of 323 permits, 58 nonlocals and 117 locals reported hunting. The nonlocal success rate was 60%, while the local success rate was only 44%.

For the Unit 13 drawing hunts (DC480-483) in RY11, of those reporting hunting, 600 were nonlocal hunters, while only 7 were local. Nonlocals averaged 48% success, while locals averaged only 29%.

While nonlocal hunters experienced higher success rates on state hunts, federal hunts were exclusive to local hunters. In RY10 and RY11, 505 and 443 additional caribou respectively were taken by local hunters in federal hunts.

Harvest Chronology. The fall caribou season in August and September is the most popular time to hunt Nelchina caribou (Table 4). Hunting pressure typically increases during moose season (1–20 September) by hunters on combination hunts. Bulls also become more vulnerable in September because of the onset of the rut and movement patterns that bring caribou closer to the roadways. Winter harvest patterns are typically dependent on caribou availability, as well as emergency closures.

Transport Methods. The most common methods of transportation for Nelchina caribou hunters are highway vehicle and 3- or 4-wheeler (Table 5). For hunters using highway vehicles as their primary method of transportation, success is highest during the months of October and November when caribou are migrating across the Richardson Highway prior to snow accumulation. For the Tier II hunt in RY10, which occurred from October 21 to November 14, the majority of successful hunters (60%) reported using highway vehicles. While most Nelchina hunts are road or trail accessible, two hunts are primarily accessed by aircraft, the drawing hunt in subunit 14B (DC590) and the drawing hunt in southern subunit 13E (DC481). For DC590 and DC481, 98% and 54% of successful hunters respectively reported using aircraft during this reporting period. Of the successful DC481 hunters, 38% reported using 3- or 4-wheelers, and 8% reported using a boat.

OTHER MORTALITY

Eagles are abundant on the NCH calving grounds, and during flights monitoring survival of neonatal caribou calves born to radiocollared cows there have been numerous observations of both golden and bald eagles feeding on neonates. The number of calves taken by eagles is unknown, but predation by eagles is considered to be an important source of neonatal calf mortality.

Grizzly bears are present and considered numerous throughout the NCH summer range. Grizzlies are also known to be important predators of caribou (Boertje and Gardner 1998); however, predation rates and their effects on the NCH have not been studied. Many of the grizzlies radiocollared between 2006 and 2011 on the calving grounds were observed feeding on caribou in addition to moose.

Wolves are present throughout the NCH range, and predation by wolves is thought to be an important source of mortality. Ballard et al. (1987) reported that Unit 13 wolves preyed on caribou whenever they were available. The importance of wolf predation on caribou depends on wolf numbers, the relative availability of moose, and the size and distribution of the NCH. When moose numbers are low, caribou become a more important prey source for wolves. When the NCH range expands, encompassing more wolf territories, wolf predation can have a larger impact on herd population dynamics.

The NCH is likely benefiting from an intensive wolf management program that has been ongoing in Unit 13 since 2001, originally implemented to improve moose numbers. While calf loss over the summer months declined during the first few years of the program, it has since increased to pre-control levels despite currently low wolf numbers.

Overwinter survival in relation to the intensive management program is difficult to monitor considering large numbers of caribou move out of Unit 13 during winter months. While winter caribou mortalities are still common in northern Unit 11 and Unit 12 along the migration route, mortalities have declined in the core wintering areas in Unit 13 and Subunit 20E, based on radio collar data. The highest overwinter mortality documented in recent years was in 2008–2009, when 10 of 58 (17%) radiocollared cows died. Caribou were widely scattered and the snow was relatively deep; both factors tend to increase losses to predation.

Perhaps more important than Unit 13 wolf numbers has been the recent reduction in wolves in Subunit 20E (Gross 2009). During the winter of 2010–2011, 10 of 79 (13%) radiocollared cows died. Yearling mortality was 28% (5 of 18) and adult mortality was 8% (5 of 61). Overwinter mortality in 2011–2012 was even lower despite relatively deep and persistent snow; 5 of 74 (7%) radiocollared cows died. Yearling mortality was 29% (4 of 14), while adult mortality was only 2% (1 of 60).

HABITAT ASSESSMENT

Between 1955 and 1962, Alaska Department of Fish and Game (ADF&G) established 39 range stations, including exclosures, throughout much of the Nelchina caribou range in Unit 13. Biologists examined these stations at approximately 5- to 6-year intervals from 1957 through 1989. A complete description of the Nelchina caribou range, range station locations, and results of long-term monitoring was presented by Lieb (1994). Lieb concluded that lichen use was high during the 1960s, when caribou were abundant, and the result was an overall decline in lichens on the Nelchina range. Following a decline in caribou numbers, lichen increased over much of the fall and traditional winter range from the early 1970s until 1983. However, as the herd doubled in size between 1974 and 1983, increases in lichen biomass ceased in areas of substantial caribou use. Between 1983 and 1989, continued increases in caribou numbers resulted in a decline in lichen biomass. Lieb concluded that in 1989, 77% of the Nelchina range exhibited poor lichen production, 2% was considered to have fair production, and only 21% good production; this compared to 33% of the range in each category in 1983. On the important calving and summer range in the Eastern Talkeetna Mountains, Lieb (1994) reported the lowest lichen biomass ever recorded, with all the preferred lichen species virtually eliminated. While caribou regularly wintered in this area through the early 1970s (Bos 1974), there has been virtually no winter use of this area since then.

Considering the traditional calving grounds and summer range of the Nelchina herd have been heavily grazed for years, even slight annual variations in weather may be significantly impacting foraging conditions. Variations in spring and summer weather conditions that influence timing of plant emergence, rate of growth, and overall forage quality may be responsible for much of the variation observed in fall body condition. During hot summers, insect harassment may also be an important factor (Colman et al. 2003). During hot, dry summers, increased stress from low forage availability combined with insect harassment likely minimizes summer weight gain as some of the lowest NCH calf weights have been observed following these summers. Alternately, cool, cloudy summer conditions minimize insect activity as well as increase forage quality in terms of higher nitrogen levels in vascular plants (Lenart 1997).

ENHANCEMENT

Short-term caribou habitat enhancement depends more on weather conditions than any other factor. The Nelchina summer range has a short growing season due to the high average elevation of 1,256 m (4,122 ft). An early spring can provide caribou with abundant early nutritious forage that can have a substantial impact on lactation and summer body growth. If precipitation is adequate through the rest of the summer, range conditions usually improve. Drought summers can be devastating to both vascular and nonvascular forage plants.

Long-term caribou habitat enhancement is largely dependent on limiting herd growth to historic sustainable levels, in the range of 35,000 to 40,000 caribou versus the 45,000 to 50,000 level observed during the 1990s. Between 1999 and 2009, the herd was maintained at or below the objective range, likely allowing for range recovery. With the recent influx of calves, the herd has been slightly above the objective since 2010, averaging 43,143 (2010–2012). Harvest quotas were increased in RY11 and RY12 specifically to reduce the size of the herd, although the response has been slow likely due to high annual survival. Without a timely reduction in the size of the Nelchina herd, there is risk of long-term range damage.

Habitat diversity, which can be achieved through the return of wildfire or controlled burns, is also important for long-term habitat enhancement. The Alaska Interagency Fire Management plan (1987) provides for a natural fire regime to benefit wildlife habitat in remote portions of Unit 13, although large wildfires are rare in this area. While wildfire likely enhances summer range conditions by increasing forbs, sedges, and deciduous shrub growth, recent research has focused on the role of fire on winter range. Joly et al. (2003) found that Nelchina caribou routinely select winter habitat that is more than 50 years post burn, likely due to the slow growth of lichens. Considering wildfire may play a role in the recovery of depleted or decadent stands of lichens important for overwintering caribou, a diversity of burn mosaics and habitat types is considered ideal. Therefore, small periodic wildfires ensure the availability of preferred winter and summer caribou forage.

Long-term 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 year-round habitat availability for caribou (Joly et al. 2003). In spite of the current fire management plan and the benefits of wildfire, Unit 13 has had only one significant natural fire (the 5,000-acre Tazlina Lake burn) since 1950 because wildfire ignitions are rare in this area, and many of the small strikes that did take were suppressed. A controlled burn in the Alphabet Hills and north Lake Louise flats to improve moose and caribou habitat burned about 5,000 acres in 2003, and another 36,000 acres in 2004. The burn plan calls for additional burning in subsequent years when conditions are adequate. Despite these recent fires, there are more than 5 million acres of caribou habitat in Unit 13 that can be improved.

NONREGULATORY MANAGEMENT PROBLEMS/NEEDS

Resurrection of the Susitna-Watana Hydroelectric Project has been discussed in recent years within the core of the Nelchina caribou range. During Susitna Hydroelectric Project big game studies conducted in the 1980s, caribou were documented using the proposed site (Pitcher 1987), although not as consistently as they do now. Large numbers of caribou have spent a considerable amount of time in the Watana Creek area in recent years, perhaps associated with herd growth. A variety of new field studies commenced in this area in 2011, and will continue for 5 years or more before a decision will be made as to future development. Nelchina caribou monitoring efforts have been increased over the past year in association with this project.

To the northeast, a proposed hard-rock mine near the Tangle Lakes in commonly used caribou fall and wintering habitat may also present new challenges for the herd. In addition to this being an important rutting and migration area, in many years up to 2,000–3,000 caribou remain in this area throughout the winter. Caribou have utilized this area most recently during the winters of 2005–2006, 2006–2007, and 2009–2010, perhaps in response to the large-scale wildfires on the 20E wintering grounds. Because of the presence of caribou in this area during the fall and winter hunting seasons, this area has a history of traditional use by Alaska hunters. Open pit mining, processing, and associated development and disturbance could endanger future use of this habitat by caribou.

CONCLUSIONS AND RECOMMENDATIONS

The long-term management objective for the Nelchina caribou herd is to hold population numbers stable at 35,000-40,000, somewhat below carry capacity, to ensure maximum herd productivity and harvest opportunity. This is a management experiment, which to this point has been successful.

To achieve the desired balance between calf recruitment, overall survival, and harvest, the Nelchina caribou herd must be closely monitored and actively managed. When the herd trajectory does not follow model predictions, harvest quotas must be corrected either in-season or in subsequent years. Quotas can be quite different year to year, adding to the already complex Nelchina caribou regulatory environment. While dynamic, the current management strategy allows for the opportunity to harvest a significant number of caribou annually. Conceptually, this scenario is far preferable to the possibility of uncontrolled herd growth precipitating a herd crash followed by a period of herd recovery that could take 10 to 20 years or more.

Between 2000 and 2009 the Nelchina herd exhibited slow growth despite low harvest quotas and reduced wolf numbers across its core summer range. In 2010, a very large calf cohort boosted herd numbers significantly. With the herd above objectives since 2010, the management goal has shifted to herd reduction.

Although the population objective set for the herd has been in place for more than 20 years, annual monitoring of body condition and productivity are critical to understanding long-term herd performance. This nutritional monitoring is also used as an indirect measure of range condition.

With below average 4-month calf weights and measurements 4 of the last 5 years, there is some evidence of nutritional stress that supports the current goal of herd reduction. While overall parturition was high between 2004 and 2008, birthrates have varied since. The low 3-year-old average parturition rate of 23% for 2011 and 2012 further supports the hypothesis of increasing nutritional stress.

While trends in these parameters are important in addressing overall herd and range condition, these values are highly variable. Factors likely include sensitivity to annual weather conditions, as well as the ability of caribou to search out high quality habitat.

Maintaining the NCH at or below the current population objective will continue to be the most important management tool to maintain range quality and long-term herd stability. If the herd remains above 40,000, productivity could continue to decline. Likewise, if the Fortymile caribou herd continues to increase, there could be further negative impacts to the winter range in Subunit 20E, and both herds could suffer. Overstocking could result in a prolonged period of low herd productivity (Messier et al. 1988, Cameron and Ver Hoef 1994).

Harvest quotas will continue to be adjusted annually to ensure the population objective is maintained over the long term. Annual harvest quotas for cows and bulls should be based on annual recruitment, herd composition, and the population trend.

As the Board of Game continues to search for an acceptable long-term solution to allocation concerns, it will be important that the number of hunters in the field remains at a moderate level. If the number of Tier I registration hunt participants continues to rise, the board may have to readdress hunt management in coming years. Too many hunters in the field can lead to a large number of caribou taken in a very short period of time. Likewise, if hunting opportunity is restricted, too few hunters could lead to undesirable herd growth.

If the herd can be held at current objective levels, given current rates of natural mortality, the projected annual harvests are expected to be about 1,000–2,200 caribou each year, with some years being as high as 3,500 or more given exceptional productivity and survival. In addition to stable harvestable surpluses for hunters, herd stability should provide a consistent prey supply for wolves, and may help reduce predation pressure on moose.

The NCH may be the only moderately sized caribou herd in Alaska that can have its upper population limit controlled solely by human harvests. This is possible because the NCH is accessible by the road system from major population centers. Given hunter interest and accessibility of this herd, there is little chance that the population will increase to unsustainable levels. Other caribou herds with less hunter access may not be manageable under the same conditions. Because of this, the NCH management strategy is considered a long-term experiment. Up to this point, this management strategy has been successful; however, it is critical that management adapt to changing annual conditions and observations. Caribou population dynamics are very difficult to predict, and often change course with little warning.

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Table 1. Nelchina caribou fall composition counts and estimated herd size, calendar years 2008 through 2012.

Year	Total bulls: 100 cows	Calves: 100 cows	Calves (%)	Cows (%)	Total bulls (%)	Composition Sample Size	Total adults	Fall estimate of herd size
2008	39	40	22	56	22	3,378	26,150[a]	33,288[a]
2009	42	29	17	58	25	3,076	28,198	33,837
2010	64	55	25	46	29	5,474	36,790	48,653
2011	58	45	22	49	29	3,907	32,404	41,394
2012	57	31	16	54	30	5,249	43,386	50,646

[a] Modeled estimate.

Table 2. Nelchina caribou harvest data by permit hunt, regulatory years 2007 through 2011.

Hunt No.	RY	Permits Issued	Percent did not hunt	Percent Successful Permits	Bulls	(%)	Cows	(%)	Unk.	Total Harvest
TC566	2007	3,003	30	32	693	72	272	28	1	966
(no hunt 2009)	2008	2,500	20	42	787	75	262	25	4	1,053
(no hunt 2011)	2010	3,604	33	36	878	68	408	32	3	1,289
RC566	2009	500	15	55	274	99	3	1	0	277
	2010	1,151	17	53	462	75	153	25	0	615
	2011	3,148	22	52	1092	67	529	33	2	1,623
CC001	2009	477	35	27	127	100	0	0	0	127
(no hunt 2010)	2011	323	44	27	71	82	16	18	0	87
FC1302[a]	2007	2,409	51	16	258	67	121	31	6	385
	2008	2,536	49	11	180	66	89	33	4	273
	2009	2,576	44	14	342	98	7	2	0	349
	2010	2,853	46	16	316	70	129	29	6	451
	2011	2,980	52	13	281	71	113	29	0	394

Table continues next page

Hunt No.	RY	Permits Issued	Percent did not hunt	Percent Successful Permits	Bulls	(%)	Cows	(%)	Unk.	Total Harvest
FC1202	2007	88	38	20	11	69	5	31	2	18
	2008	147	37	19	15	54	13	46	0	28
	2009	111	43	18	18	100	0	0	2	20
	2010	120	38	45	31	57	23	43	0	54
	2011	103	41	48	37	80	9	20	3	49
DC590	2007	106	64	22	19	83	4	17	0	23
	2008	100	60	18	12	67	6	33	0	18
	2009	100	62	24	20	83	4	17	0	24
	2010	100	54	29	21	72	8	28	0	29
	2011	100	45	40	35	88	5	12	0	40
DC 480-483	2011	1,127	40	28	313	98	6	2	0	319
Totals for all permit hunts	2007	5,606	40	25	981	71	402	29	9	1,392
	2008	5,283	35	26	994	73	370	27	8	1,372
	2009	3,763	39	21	781	98	14	2	2	797
	2010	7,828	36	31	1,708	70	721	30	9	2,438
	2011	7,781	37	36	1892	73	678	27	5	2,512

[a] This federal hunt has a bag limit of 2 caribou.

Table 3. Nelchina caribou state hunt annual hunter residency and success, regulatory years 2007 through 2011.

		Successful				Unsuccessful				
Hunt	RY	Local[a] resident	Nonlocal resident	Total[b]	%	Local[a] resident	Nonlocal resident	Total[b]	%	Total[b] hunters
TC566	2007	53	913	966	47	136	933	1,069	53	2,035
(no hunt 2009)	2008	72	981	1,053	54	192	710	902	46	1,955
(no hunt 2011)	2010									
RC566	2009	13	264	277	67	10	124	134	33	411
	2010	82	533	615	66	113	206	319	34	934
	2011	25	1,598	1,623	68	46	724	770	32	2,393
CC001	2009	99	28	127	44	132	29	161	56	288
(no hunt 2010)	2011	52	35	87	50	65	23	88	50	175
DC 480-483	2011	1	318	3190	47	5	350	355	53	674

[a] Local resident is a resident of Units 11, 13, or 12 along the Nabesna Road.
[b] Total hunters include only those with known community of principal residence.

Table 4. Nelchina caribou state hunt annual harvest chronology percent by harvest period, regulatory years 2007 through 2011.

		Harvest Periods													
		Weeks[a] (fall)							Months (winter)						
Hunt	RY	1	2	3	4	5	6	7	Oct	Nov	Dec	Jan	Feb	Mar	n
TC566	2007	11	12	9	13	16	22	17	No winter hunt						937
(no hunt 2009)	2008	11	16	7	12	13	20	19	No winter hunt						1021
(no hunt 2011)	2010	No fall hunt							75	25					1276
RC566	2009	11	10	6	11	20	16	13	6	5	3	2	4	4	253
	2010	10	14	13	8	20	17	19	No winter hunt						613
	2011	13	17	10	8	16	16	11	8	1					1612
CC001	2009	0	3	14	13	13	4	13	8	16	3	2	4	6	120
(no hunt 2010)	2011	18	17	7	7	9	13	12	9	7	1				87
DC480-483	2011	-	-	25	9	16	14	17	18						310

[a] Week 1 is 8/5 to 8/11, week 2 is 8/12 to 8/18, week 3 is 8/19 to 8/25, week 4 is 8/26 to 9/1, week 5 is 9/2 to 9/8, week 6 is 9/9 to 9/15, and week 7 is 9/16 to 9/22.

Table 5. Nelchina caribou state hunt harvest percent by transport method, regulatory years 2007 through 2011.

		Percent of harvest								
Hunt	RY	Airplane	Horse	Boat	3 or 4-Wheeler	Snowmachine	ORV	Highway vehicle	Airboat	n
TC566	2007[a]	0	0	8	62	0	8	19	2	962
(no hunt 2009)	2008	3	1	11	51	0	11	22	1	1,044
(no hunt 2011)	2010	0	0	0	30	5	4	60	0	1,276
RC566	2009	5	0	9	38	7	9	31	1	272
	2010	3	0	8	44	0	11	31	1	611
	2011	3	0	10	46	0	8	32	1	1,593
CC001	2009	0	2	2	25	9	4	59	0	126
(no hunt 2010)	2011	0	0	7	40	2	9	41	-	87
DC480-483	2011	5	1	11	49	0	7	28	-	310

[a] Aircraft and vehicles weighing over 1,500 lb were illegal in RY07.

SPECIES

MANAGEMENT REPORT

Alaska Department of Fish and Game
Division of Wildlife Conservation
(907) 465-4190 PO BOX 115526
JUNEAU, AK 99811-5526

CARIBOU MANAGEMENT REPORT

From: 1 July 2010
To: 30 June 2012[1]

LOCATION

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

GEOGRAPHIC DESCRIPTION: Yukon–Kuskokwim Delta

BACKGROUND

Historically, caribou ranged throughout the Yukon–Kuskokwim Delta, including Nunivak Island, and populations probably peaked during the 1860s (Skoog 1968). By the early 1900s, there were few caribou in the lowlands of the Delta. From the 1920s to the 1930s, reindeer herds ranged throughout much of the area but declined sharply in the 1940s (Calista Professional Services and Orutsararmuit Native Council 1984). Since the decline of the reindeer herds, the abundant caribou habitat throughout Unit 18 was only lightly used until 1994, when large numbers of Mulchatna caribou herd (MCH) animals began regular, seasonal use of the Kilbuck Mountains. In more recent years, a large portion of the Mulchatna herd has spent most of the year in Unit 18 and harvest in Unit 18 has become a larger proportion of the overall harvest.

The Andreafsky caribou herd (ACH) existed in Unit 18 north of the Yukon River until the mid-1980s. The origin of this small herd is unknown, and there was disagreement whether these *Rangifer*-type animals were caribou or reindeer. Poor compliance with hunting regulations probably contributed to their disappearance.

Caribou from the Western Arctic caribou herd (WAH), the largest herd in Alaska, occasionally venture into the northern part of Unit 18. Until this reporting period, hunting regulations north of the Yukon River were liberal to allow hunters to take advantage of these infrequent hunting opportunities. However, now that MCH caribou are as likely to be present as WAH caribou in the area north of the Yukon River, caribou management throughout Unit 18 is based on MCH considerations.

The Kilbuck caribou herd (KCH), or Qavilnguut herd, was located in the Kilbuck and Kuskokwim Mountains southeast of Bethel. Their range included the eastern portion of Unit 18, encompassing the edge of the lowlands of the Delta and the montane western border of Units

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[1] This report also contains information collected outside the reporting period at the discretion of the reporting biologist.

19B and 17B. Conservative management techniques were used to protect this small, discrete, resident herd, but since 1994 large numbers of MCH caribou have used the entire range of the KCH. Our current interpretation is that the KCH has been assimilated by the MCH, and caribou hunting regulations in Unit 18 reflect that interpretation.

MANAGEMENT DIRECTION

MANAGEMENT GOALS

The caribou management goals for Unit 18 are:

- Increase the number of caribou.
- Improve compliance with caribou hunting regulations.
- Develop a better understanding of the interaction between caribou herds using Unit 18.

MANAGEMENT OBJECTIVES

The caribou management objectives for Unit 18 are:

- Gather accurate caribou harvest information in Unit 18.
- Increase compliance with caribou hunting regulations.
- Monitor caribou in Unit 18 to assess sex and age composition, numbers, distribution, and calving, and to address questions of herd identity and determine other population parameters of caribou using Unit 18.

METHODS

We continued the cooperative caribou study and participated in preparation of a manuscript being submitted for publication, though this work was primarily accomplished by other agencies. We also met with other agencies with an interest in MCH caribou to coordinate our resources and efforts more efficiently.

We assisted with fall sex and age composition surveys in the Kilbuck Mountains during October 2010. Two observers and a pilot used an R44 helicopter to sample caribou for composition. A fixed-wing Cessna 206 aircraft equipped with radiotelemetry equipment was used to locate groups of caribou throughout the area. We assisted a similar survey during October 2011 using a Maule M-7 airplane to radio track.

Harvest data were summarized by regulatory year (RY), which begins 1 July and ends 30 June (e.g., RY10 = 1 July 2010–30 June 2011). We collected harvest information using hunt reports from statewide harvest tickets.

RESULTS AND DISCUSSION

POPULATION STATUS AND TREND

Population Size

Before 1994, the KCH was small but growing. It was expanding its range when approximately 35,000 Mulchatna caribou overran it in September–October 1994. There have been annual influxes of approximately 10,000 to 40,000 Mulchatna caribou ever since.

We concluded that the MCH has assimilated the KCH because we have radiotelemetry information showing that former KCH caribou were calving with the MCH; composition surveys during spring 2001 and 2002 revealed that more than 90% of the caribou in the traditional KCH calving areas during the calving season were bulls; also, the last time a significant number of caribou were found calving in a traditional KCH calving area was in spring of 2000. Because the caribou using Unit 18 are from the MCH, the population size information for Unit 18 should be taken from the MCH caribou report (Units 9B, 17, 18 south, 19A and 19B), but in general, the MCH has declined steadily since the mid-1990s.

Population Composition

We conducted a fall sex and age composition survey among MCH caribou in Unit 18 during October 2010 and in October 2011. Complete MCH composition data will be reported in the MCH caribou management report.

Distribution and Movements

Since 1994 and continuing through this reporting period, each year approximately 10,000 to 40,000 Mulchatna caribou entered Unit 18 from the east, generally during mid-August to mid-September. They wintered throughout the eastern lower Kuskokwim River and Kuskokwim Bay drainages, extending from the Whitefish Lake area near Aniak to the southernmost portions of Unit 18, and stayed through late March to early April, when they moved eastward into Units 17A, 17B, and 19B, following trails such as those near Kisaralik Lake, along the upper Kwethluk River and Trail Creek, and other trails.

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

Caribou from the WAH occasionally use portions of Unit 18 north of the Yukon River. The number of WAH caribou using this area is small relative to the size of the entire herd. Unit 18 is on the periphery of the WAH's range, and use of this area is occasional and intermittent. We did not find nor hear of any evidence of WAH caribou in Unit 18 during this reporting period.

MORTALITY

Harvest

Season and Bag Limit

RY10 and RY11 Units and Bag Limits	Resident Open Season (Subsistence and General Hunts)	Nonresident Open Season
Unit 18		
RESIDENT HUNTERS: 2 caribou; however, no more than one bull may be taken and only 1 caribou may be taken from 1 Aug–January 31.	1 Aug–15 March	
NONRESIDENT HUNTERS:		No Open Season

Board of Game Actions and Emergency Orders. There we no Board of Game actions involving the MCH during this reporting period.

Hunter Harvest. In RY10, 388 successful hunters reported killing 398 caribou. These included 211 bulls, 184 cows, and 3 of unrecorded sex. In RY11 successful hunters reported killing 135 caribou, including 85 bulls, 48 cows, and 2 of unrecorded sex. In both years the proportion of bulls harvested in the fall is high and the winter harvest is nearly equal in bull and cows.

Harvest reporting remains poor, and the value of our reported harvest data for resident hunters is limited, except for those hunters using aircraft. Coffing et al. (2000) reported that Akiachak residents (population of 560) harvested 374 caribou during the 1998 calendar year. If we consider that a similar harvest rate is possible among approximately 10,000 residents having similar access to caribou in Unit 18 (4,792 people in 13 villages and 5,449 people in Bethel), we can grasp the extent to which the harvest is underreported.

Permit Hunts. There were no permit hunts for caribou in Unit 18 during the reporting period.

Hunter Residency and Success. During RY10 and RY11 only residents of the state were allowed to harvest caribou in Unit 18.

Harvest Chronology. Typically, most of the harvest is unreported and occurs during the winter months when caribou are available and snow conditions are favorable for travel by snowmachine. However, even though the harvest is unreported, the chronology of the unreported harvest probably parallels the reported harvest. During RY10, snow conditions were poor in the southern part of the unit near Goodnews Bay and Quinhagak. Snow conditions close to the Kuskokwim River were much better. Caribou were distributed more to the south during the early and midwinter of 2011–2012. Later in the winter the caribou moved closer to the Kuskokwim River and more hunters had access to them. The higher harvests in the late winter are probably due to better winter travel conditions and caribou movements that placed them within proximity of communities that could take day trips and successfully harvest caribou.

For many years the reported harvest has been greater during the month of September, but recently harvests in September have decreased and the highest harvests have been reported in February and March (Table 1).

Transport Methods. During the open water months, many caribou were reported taken using boats (8 in RY10 and 8 in RY11), and a declining number were reported taken using airplanes (5 in RY10 and 5 in RY11).

During the winter months, caribou were typically taken using snowmachines (380 in RY10 and 116 in RY11) after snow conditions improved enough to permit safe travel. Rarely, other modes of transportation, such as off-road vehicle or four-wheelers, have been used by hunters (2 times in RY10 and 3 times in RY11).

Other Mortality

Little direct information is available regarding other mortality of caribou in Unit 18. Caribou is an important prey species for wolves, and predation by wolves has increased in recent years. The reported wolf harvest has increased more than tenfold in the last 15 years. Most of the wolves harvested in Unit 18 are taken opportunistically by caribou hunters. In the area south and east of the Kuskokwim River, we rarely see wolf tracks when caribou are absent.

Another source of mortality is predation by brown bears. However, we do not have an estimate of predation rates on caribou in Unit 18.

HABITAT

Assessment

The lichen ranges throughout Unit 18 are in excellent condition. Before the influx of Mulchatna caribou into the KCH range, neither the Andreafsky nor the Kilbuck mountains had been substantially grazed by caribou or reindeer since the 1940s (Calista Professional Services and Orutsararmuit Native Council 1984).

Enhancement

The existing caribou habitat in Unit 18 is underused. Enhancement is not being considered.

NONREGULATORY MANAGEMENT PROBLEMS/NEEDS

Cooperative Management Plan

The KCH Cooperative Management Plan provided guidelines for management of the KCH, but now that the KCH no longer exists as a separate herd, this management plan is no longer being followed, no additional meetings are planned, and we have suggested to the working group that it disband. Funding is not available for additional meetings, and public input is being accomplished through state Advisory Committees (ACs) and federal Regional Advisory Councils (RACs). However, working group members are still consulted for public input as the need arises.

CONCLUSIONS AND RECOMMENDATIONS

Caribou found in Unit 18 are from the MCH, and management reflects that interpretation. We should continue to test this interpretation through searches for calving caribou during the calving season.

We should continue to meet with other agencies to consider our common interest in MCH caribou and to better use our limited resources. Unit 18 now harvests a significant portion of the entire harvest, especially the harvest in late winter. The interest in fall hunting has decreased, most likely due to the downward trend of the MCH. Caribou harvests in the winter are important to local subsistence hunters. Hunting effort and success are directly related to snow conditions and the proximity of caribou to communities when winter travel conditions are good.

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Perry, P. 2013. Unit 18 caribou management report. Pages 125–131 [*In*] P. Harper, editor. Caribou management report of survey and inventory activities 1 July 2010–30 June 2012. Alaska Department of Fish and Game, Species Management Report ADF&G/DWC/SMR-2013-3, Juneau.

Table 1. Chronology of reported caribou harvest, Unit 18, RY00–RY11.[a]

Regulatory	Month											
Year	July	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun
RY00		28	117	2	11	16	14	27	38	2		
RY01		35	132		10	116	56	92	131			
RY02		28	117	2	11	16	14	27	35			
RY03		35	248	1	10	116	56	92	131			
RY04		17	158	5	8	44	36	26	78	84		
RY05		4	169	19	25	54	21	14	104	88		
RY06		6	102	8	28	35	22	26	67	8		
RY07		2	44	11	10	26	42	72	155	5		
RY08		3	15	9	15	36	19	36	114	2		
RY09		3	11	10	42	39	16	43	53	4		
RY10		3	8	6	16	60	20	92	190	2		
RY11		1	8	2	5	17	14	19	67	1		

[a] Some harvest reports did not indicate month of take.

Alaska Department of Fish and Game
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CARIBOU MANAGEMENT REPORT

From: 1 July 2010
To: 30 June 2012

LOCATION

GAME MANAGEMENT UNITS: 19A, 19B, 19C, 19D, 21A, and 21E (55,343 mi^2)

MCGRATH AREA HERDS: Beaver Mountains, Sunshine Mountains, Big River–Farewell, Rainy Pass, and Tonzona

GEOGRAPHIC DESCRIPTION: Unit 19, all drainages into the Kuskokwim River upstream from a straight line drawn between Lower Kalskag and Paimiut. Unit 21A, the Innoko River drainage upstream from and including the Iditarod River drainage; Unit 21E, the Yukon River drainage from Paimiut upstream to, but not including, the Blackburn Creek drainage; and the Innoko River drainage downstream from the Iditarod River drainage.

BACKGROUND

Historically, caribou have played an important role in the McGrath area. During the 1800s, caribou occurred sporadically in far greater numbers over a greater range than at present (Murie, 1935). Discussions with village elders and reports of early explorers corroborate this, although documentation is poor (Hemming 1970).

Several small herds continue to exist in the McGrath area. Currently recognized herds south of the Kuskokwim River include the Tonzona, Big River–Farewell (previously called Big River), and Rainy Pass herds. Herds north of the Kuskokwim River include the Beaver Mountains (previously called Kuskokwim Mountains) and Sunshine Mountains herds. Hunting effort and harvest for the 5 McGrath area caribou herds has been low.

In addition to the smaller resident herds mentioned in this report, the Mulchatna caribou herd once roamed throughout the Kuskokwim basin, but as numbers dwindled in the late 1990s, the bulk of this herd retreated to the south (Whitman 1997). The Mulchatna herd declined substantially from over 200,000 animals in the mid-1990s to 30,000 by July 2008 (Woolington 2011).

Significant numbers of caribou from the Western Arctic herd have wintered in Unit 21E as recently as the early 1990s (Machida 1995). Large numbers of caribou from the Mulchatna herd also used Unit 21E during the same time (L. Van Daele, ADF&G, unpublished memo, 1998). However, coincident with the return of Western Arctic caribou to the Seward Peninsula during the mid to late 1990s, (Dau 2001) caribou became rare in Unit 21E.

MANAGEMENT DIRECTION

MANAGEMENT OBJECTIVES

Big River–Farewell herd (Unit 19)

- Provide for a harvest of up to 100 bull caribou.

Rainy Pass herd (Units 16B and 19C)

- Provide for a harvest of up to 75 bull caribou.

Sunshine and Beaver Mountains herds (Units 19A, 19D, 21A, and 21E)

- Provide for a combined harvest of up to 25 caribou from the Sunshine and Beaver Mountains herds.

Tonzona herd (Units 19C and 19D)

- Provide for a harvest of up to 50 caribou.

METHODS

We conducted minimum population counts in June 2011 and 2012 for the Sunshine and Beaver Mountains herds. Survey flights were conducted from Piper PA-18 Super Cub aircraft in late June when conditions are most likely to concentrate caribou on snow patches and on higher, open terrain where they seek insect relief. We enumerated caribou observed from the air and recorded their numbers and locations. We did not attempt minimum counts for the remaining 3 herds; however, current population size and recent trends in abundance for McGrath area caribou herds were also inferred from incidental observations and hunter information.

Population and harvest data were summarized by regulatory year (RY), which begins 1 July and ends 30 June (e.g., RY10 = 1 July 2010–30 June 2011). These data do not include Unit 19 Mulchatna herd harvest, which is reported elsewhere (Woolington in prep.)

The statewide harvest reporting system is used to estimate harvest. In RY98, the department began to send reminders to hunters who failed to report their harvests, resulting in higher reporting rates. While data with higher reporting rates are closer to actual effort and harvest figures, they should still be interpreted as minimums.

RESULTS AND DISCUSSION

POPULATION STATUS AND TREND

Population Size

Beaver Mountains and Sunshine Mountains. In June 2011, we counted 434 caribou including 72 calves within the range of both herds combined. During a June 2012 survey, 851 caribou including 113 calves were counted in an equivalent survey. Including a correction for caribou we believe we missed, we assume that the Beaver Mountains and Sunshine caribou herd combined is stable or growing, with 1,000–1,250 caribou.

Rainy Pass, Big River–Farewell, Tonzona. We have few population data for the Rainy Pass, Big River–Farewell, and Tonzona herds, but we believe each of these herds numbers about 500–750 caribou. During surveys for bison and sheep we regularly see caribou primarily in groups of 20–50, along with scattered groups numbering 1–9 caribou up to about 250 caribou. Reports from hunters, guides, and pilots of sightings of similar size groups appear to corroborate the general distribution and total number of caribou in the area. Individuals with years of experience in the area report seeing more caribou in recent years.

Population Composition

No composition surveys were conducted during RY10–RY11.

Distribution and Movements

Beaver Mountains. Current distribution of the Beaver Mountains herd is thought to include habitats from Swinging Dome in the south through the Beaver Mountains to the Innoko River in the north. Caribou are regularly found in this area during summer surveys but their annual range may extend beyond these areas. Few movement data are available but reports by the public indicate that caribou are found west of the Beaver Mountains. This information is corroborated by our observation of caribou tracks during winter surveys for other species.

In the early 1980s, Pegau (1986) radiocollared caribou in the Beaver and Sunshine Mountains. Radiocollared caribou from the Beaver Mountains ranged south almost to Horn Mountain. Calving was in the Beaver Mountains, but postcalving groups occurred throughout the herd's range. Wintering areas included the north side of the Kuskokwim Mountains from the Iditarod River east to the Dishna River.

Sunshine Mountains. The Sunshine Mountains caribou are found predominantly in the drainages of the Nixon Fork and from the Innoko River to Von Frank Mountain and in the headwaters of the Susulatna and Nowitna rivers, including Fossil Mountain and the Cripple Creek Mountains. Calving occurs throughout the range, but is common on the Nixon Flats. Wintering areas are primarily in the drainages of the Nixon Fork. In midsummer these caribou are found predominantly in the Sunshine Mountains; however, small groups were regularly observed on the Nixon Flats throughout RY10–RY11.

During surveys of the Beaver Mountain and Sunshine Mountain herd ranges in June 2011 and 2012, small groups of caribou were found continuously and it is likely that these 2 herds were mixed. However, Pegau (1986) did not document range overlap between these herds during his 4-year study.

Tonzona. We do not have current data on range, movement, or distribution of this herd. However, Del Vecchio et al. (1995) reported that the Tonzona herd was distinct from the Denali herd and ranged from the Herron River to the lower Tonzona River near Telida and north to Otter Lake. Summer concentrations were found in the northern foothills of the Alaska Range, and winter range consisted of lower elevations from Telida up the Swift River and north to the Otter Lake area.

Big River–Farewell. There is little recent information on the range of the Big River–Farewell herd. It is thought to include habitats within the South Fork Kuskokwim River drainage southwest to the Swift River. Summering areas are in the foothills of the north side of the Alaska Range. Wintering areas are in the flats north of the summer range.

Pegau (1986) radiocollared caribou in the Big River–Farewell herd near Farewell in the early 1980s. During the first year of the study, these caribou remained in the Farewell area, but some moved near the Swift River the following year and did not return for at least 2 years.

Rainy Pass. The range of the Rainy Pass herd is not well known. The herd has been found from the confluence of the Post River south through Rainy Pass to the west side of Cook Inlet. Caribou have been observed throughout the mountains in summer in both Units 16B and 19C. Identified wintering areas of radiocollared individuals included the Post Lake area, upper South Fork, and upper Ptarmigan Valley (Boudreau 2003).

MORTALITY

Harvest

Season and Bag Limit during RY10–RY11.

Herd, Unit, Bag limit	Resident open seasons	Nonresident open seasons
Mulchatna, Big River–Farewell		
Unit 19A and Unit 19B		
RESIDENT HUNTERS:		
2 caribou, not more than 1 bull may be taken and only 1 caribou may be taken 1 Aug–31 Jan.	1 Aug–15 Mar	
NONRESIDENT HUNTERS:		No open season
Tonzona, Big River–Farewell, Rainy Pass		
Unit 19C.		
RESIDENT AND NONRESIDENT HUNTERS:		
1 bull.	10 Aug–20 Sep	10 Aug–20 Sep
Beaver Mountains, Tonzona, Big River–Farewell		
Unit 19D, except the drainages of the Nixon Fork River.		
RESIDENT HUNTERS:		
1 bull;	10 Aug–20 Sep	
or 1 caribou;	1 Nov–31 Jan	
or 5 caribou.	May be announced if Mulchatna caribou are present	
NONRESIDENT HUNTERS:		
1 bull.		10 Aug–20 Sep

Herd, Unit, Bag limit	Resident open seasons	Nonresident open seasons
Sunshine Mountains		
Remainder of Unit 19D.		
RESIDENT AND NONRESIDENT HUNTERS:		
1 bull.	10 Aug–20 Sep	10 Aug–20 Sep
Beaver Mountains, Sunshine Mountains		
Unit 21A.		
RESIDENT AND NONRESIDENT HUNTERS:		
1 bull.	10 Aug–20 Sep	10 Aug–20 Sep
Beaver Mountains, Western Arctic		
Unit 21E.		
RESIDENT AND NONRESIDENT HUNTERS:		
1 caribou and 2 additional caribou during winter if season announced.	10 Aug–30 Sep	10 Aug–30 Sep

Alaska Board of Game Actions and Emergency Orders. No changes were made to caribou regulations during RY10–RY11.

Harvest by Hunters. Reported harvest remained low for local caribou herds in the McGrath area during RY07–RY11 (Table 1). Hunter effort also remained low, with an average of 97 hunters annually over this period (Table 2a). In general, harvest and effort varied by herd during RY07–RY11, but remained low (Tables 2b–2g). The average harvest during RY07–RY11 was 25 animals, of which 99% were bulls (Table 1).

Hunter Residency and Success. During RY07–RY11, local hunters, defined as hunters from Units 19C, 19D, 21A and 21E, took 3% of the reported harvest of local caribou herds. Hunters from communities within Unit 19A were not included among local hunters because they reside within the range of the Mulchatna herd. During RY07–RY11, nonlocal residents took 46%, nonresidents took 48%, and hunters with unknown residency took 2% of harvested animals (Table 2a).

Harvest Chronology. Most caribou harvested during RY07–RY11 were taken in August (34%) and September (66%; Table 3).

Transport Methods. Aircraft were the most common means of hunter transportation to access all McGrath area caribou herds. During RY07–RY11, 74% of successful caribou hunters used aircraft. Horses (13%) were the next most commonly used method of transportation followed by 4-wheelers (11%). Hunters using boats, highway vehicles, and unknown methods each accounted for less than 1% of the harvest (Table 4).

Other Mortality

No specific data were collected concerning natural mortality rates or factors during RY10–RY11.

HABITAT

Biologists have not investigated caribou range conditions in Units 19 or 21 since at least 1996, but range is probably not limiting.

CONCLUSIONS AND RECOMMENDATIONS

Harvest remained low during RY10–RY11 for all McGrath area caribou herds and management objectives were met. The Big River–Farewell herd was managed to provide for a harvest of up to 100 bull caribou and an average of 13 were harvested. The objective for the Rainy Pass herd was for a harvest of up to 75 bull caribou, and the average reported harvest was 12. The objective for the Sunshine Mountains and Beaver Mountains herds was to provide for a combined harvest of up to 25 caribou, and the average reported harvest was 1 caribou. The Tonzona herd objective was a harvest of up to 50 caribou, and the average reported harvest was 2 caribou.

During RY10–RY11 the number of caribou hunters in the area increased slightly but remained low. This amount of effort most likely reflects the small size of the McGrath area caribou herds and may be influenced by the tendency for most caribou harvest to be opportunistic during hunts for other species. No changes are recommended.

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Table 1. McGrath area[a] caribou harvest by herd, regulatory years 2007–2008 through 2011–2012.

Regulatory	Beaver Mtns			Big River			Rainy Pass			Sunshine Mtns			Tonzona			Unknown			Total harvest		
year	M	F	Total	M	F	Total	M	F	Total	M	F	Total	M	F	Total	M	F	Total	M	F	Total
2007–2008	0	0	0	10	0	10	12	0	12	0	0	0	1	0	1	0	0	0	23	0	23
2008–2009	1	0	1	7	0	7	11	0	11	0	0	0	2	0	2	0	0	0	21	0	21
2009–2010	0	0	0	12	0	12	11	0	11	0	0	0	2	0	2	0	0	0	25	0	25
2010–2011	0	0	0	11	0	11	12	0	12	1	0	1	2	0	2	0	0	0	26	0	26
2011–2012	2	0	2	14	0	15[b]	10	1	11	1	0	1	1	0	1	0	0	0	28	1	30[b]

[a] Excludes Mulchatna caribou herd animals taken in Unit 19.
[b] Includes one caribou of unknown sex.

Table 2a. McGrath area[a] caribou herds hunter residency and success, regulatory years 2007–2008 through 2011–2012.

Regulatory year	Successful: Local resident[b]	Nonlocal resident	Nonresident	Unk	Total (%)	Unsuccessful: Local resident[b]	Nonlocal resident	Nonresident	Unk	Total (%)	Total hunters
2007–2008	3	14	6	0	23 (23)	1	47	27	0	75 (77)	98
2008–2009	0	10	10	1	21 (22)	3	44	27	2	76 (78)	97
2009–2010	1	10	12	2	25 (27)	4	43	15	5	67 (73)	92
2010–2011	0	11	15	0	26 (28)	3	44	20	1	68 (72)	94
2011–2012	0	13	17	0	30 (29)	6	48	16	2	72 (71)	102

[a] Excludes Mulchatna caribou herd animals taken in Unit 19.
[b] Local resident is any resident of Units 19C, 19D, 21A, or 21E.

Table 2b. Beaver Mountains caribou herd hunter residency and success, regulatory years 2007–2008 through 2011–2012.

Regulatory year	Successful: Local resident[a]	Nonlocal resident	Nonresident	Unk	Total (%)	Unsuccessful: Local resident[a]	Nonlocal resident	Nonresident	Unk	Total (%)	Total hunters
2007–2008	0	0	0	0	0 (0)	0	8	6	0	14 (100)	14
2008–2009	0	0	1	0	1 (11)	0	5	3	0	8 (89)	9
2009–2010	0	0	0	0	0 (0)	2	1	0	0	3 (100)	3
2010–2011	0	0	0	0	0 (0)	1	7	0	0	8 (100)	8
2011–2012	0	0	2	0	2 (67)	0	1	0	0	1 (33)	3

[a] Local resident is any resident of Units 19C, 19D, 21A, or 21E.

Table 2c. Big River–Farewell caribou herd hunter residency and success, regulatory years 2007–2008 through 2011–2012.

Regulatory year	Successful					Unsuccessful					Total hunters
	Local resident[a]	Nonlocal resident	Nonresident	Unk	Total (%)	Local resident[a]	Nonlocal resident	Nonresident	Unk	Total (%)	
2007–2008	3	5	2	0	10 (23)	1	19	13	0	33 (77)	43
2008–2009	0	2	5	0	7 (16)	2	24	11	1	38 (84)	45
2009–2010	1	4	7	0	12 (23)	1	29	10	1	41 (77)	53
2010–2011	0	4	7	0	11 (24)	0	22	12	1	35 (76)	46
2011–2012	0	6	9	0	15 (33)	0	22	8	1	31 (67)	46

[a] Local resident is any resident of Units 19C, 19D, 21A, or 21E.

Table 2d. Rainy Pass caribou herd hunter residency and success, regulatory years 2007–2008 through 2011–2012.

Regulatory year	Successful					Unsuccessful					Total hunters
	Local resident[a]	Nonlocal resident	Nonresident	Unk	Total (%)	Local resident[a]	Nonlocal resident	Nonresident	Unk	Total (%)	
2007–2008	0	8	4	0	12 (32)	0	19	6	0	25 (68)	37
2008–2009	0	7	3	1	11 (31)	0	14	10	1	25 (69)	36
2009–2010	0	6	3	2	11 (38)	0	10	4	4	18 (62)	29
2010–2011	0	5	7	0	12 (48)	0	11	2	0	13 (52)	25
2011–2012	0	6	5	0	11 (27)	1	23	5	1	30 (73)	41

[a] Local resident is any resident of Units 19C, 19D, 21A, or 21E.

Table 2e. Sunshine Mountains caribou herd hunter residency and success, regulatory years 2007–2008 through 2011–2012.

Regulatory year	Successful					Unsuccessful					Total hunters
	Local resident[a]	Nonlocal resident	Nonresident	Unk	Total (%)	Local resident[a]	Nonlocal resident	Nonresident	Unk	Total (%)	
2007–2008	0	0	0	0	0 (0)	0	0	0	0	0 (0)	0
2008–2009	0	0	0	0	0 (0)	0	0	0	0	0 (0)	0
2009–2010	0	0	0	0	0 (0)	0	0	0	0	0 (0)	0
2010–2011	0	1	0	0	1 (33)	1	1	0	0	2 (67)	3
2011–2012	0	1	0	0	1 (25)	3	0	0	0	3 (75)	4

[a] Local resident is any resident of Units 19C, 19D, 21A, or 21E.

Table 2f. Tonzona caribou herd hunter residency and success, regulatory years 2007–2008 through 2011–2012.

Regulatory year	Successful					Unsuccessful					Total hunters
	Local resident[a]	Nonlocal resident	Nonresident	Unk	Total (%)	Local resident[a]	Nonlocal resident	Nonresident	Unk	Total (%)	
2007–2008	0	1	0	0	1 (25)	0	1	2	0	3 (75)	4
2008–2009	0	1	1	0	2 (50)	0	1	1	0	2 (50)	4
2009–2010	0	0	2	0	2 (67)	0	1	0	0	1 (33)	3
2010–2011	0	1	1	0	2 (29)	0	1	4	0	5 (71)	7
2011–2012	0	0	1	0	1 (25)	0	0	3	0	3 (75)	4

[a] Local resident is any resident of Units 19C, 19D, 21A, or 21E.

Table 2g. Hunter residency and success for caribou where herd identification was not known, regulatory years 2007–2008 through 2011–2012.

Regulatory year	Successful					Unsuccessful					Total hunters
	Local resident[a]	Nonlocal resident	Nonresident	Unk	Total (%)	Local resident[a]	Nonlocal resident	Nonresident	Unk	Total (%)	
2007–2008	0	1	0	0	1 (100)	0	0	0	0	0 (0)	1
2008–2009	0	0	0	0	0 (0)	1	0	2	0	3 (100)	3
2009–2010	0	0	0	0	0 (0)	1	2	1	0	4 (100)	4
2010–2011	0	0	0	0	0 (0)	1	2	2	0	5 (100)	5
2011–2012	0	0	0	0	0 (0)	2	2	0	0	4 (100)	4

[a] Local resident is any resident of Units 19C, 19D, 21A, or 21E.

Table 3. McGrath[a] area caribou harvest chronology by month, regulatory years 2007–2008 through 2011–2012.

Regulatory year	Harvest chronology by month									
	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Unk	*n*
2007–2008	8	15	0	0	0	0	0	0	0	23
2008–2009	7	14	0	0	0	0	0	0	0	21
2009–2010	7	18	0	0	0	0	0	0	0	25
2010–2011	8	17	1	0	0	0	0	0	0	26
2011–2012	12	18	0	0	0	0	0	0	0	30

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

Table 4. McGrath[a] area transportation method of successful caribou hunters, regulatory years 2007–2008 through 2011–2012.

Regulatory year	Harvest by transport method								
	Airplane (%)	Horse (%)	Boat (%)	4-Wheeler (%)	Snowmachine (%)	ORV (%)	Highway vehicle (%)	Unk (%)	*n*
2007–2008	12 (52)	5 (22)	1 (4)	5 (22)	0 (0)	0 (0)	0 (0)	0 (0)	23
2008–2009	17 (81)	2 (10)	0 (0)	2 (10)	0 (0)	0 (0)	0 (0)	0 (0)	21
2009–2010	20 (80)	3 (12)	0 (0)	2 (8)	0 (0)	0 (0)	0 (0)	0 (0)	25
2010–2011	20 (77)	4 (15)	0 (0)	1 (4)	0 (0)	0 (0)	1 (4)	0 (0)	26
2011–2012	23 (77)	2 (7)	0 (0)	4 (13)	0 (0)	0 (0)	0 (0)	1 (3)	30

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

SPECIES MANAGEMENT REPORT	**Alaska Department of Fish and Game** **Division of Wildlife Conservation** **(907) 465-4190 PO Box 115526** **Juneau, AK 99811-5526**

CARIBOU MANAGEMENT REPORT

From: 1 July 2010
To: 30 June 2012[1]

LOCATION

GAME MANAGEMENT UNIT: 20A (6,796 mi^2)

HERD: Delta (including former Yanert herd)

GEOGRAPHIC DESCRIPTION: Central Alaska Range and Tanana Flats

BACKGROUND

The Delta caribou herd (DCH) has historically occupied the foothills of the central Alaska Range between the Parks and Richardson Highways, north of the divide separating the Tanana and Susitna drainages. In recent years, the herd has also used the upper Nenana and Susitna drainages, north and south of the Denali Highway. Like other small bands of Alaska Range caribou, the herd drew little attention until population identity studies began in the late 1960s. During the early to mid-1980s, the department recognized a small group of caribou in the Yanert drainage as a separate herd. The growing Delta herd eventually mixed with the Yanert herd, and after 1986 the Yanert caribou adopted the movement patterns of the larger herd (Valkenburg et al. 1988).

By the mid-1970s the DCH rose from anonymity to a herd of local and scientific importance. Its proximity to Fairbanks and good access made it popular with Fairbanks hunters. For the same reasons, it has been the subject of intensive management and research. Long-term studies of caribou population dynamics, ecology, and predator–prey relationships resulted in numerous publications and reports. Boertje et al. (1996) and Valkenburg et al. (1996, 2002) provide summaries and citations.

Estimated at 1,500–2,500 in 1975, the herd had grown to a peak of nearly 11,000 by 1989. It declined sharply in the early 1990s, as did other central Alaska Range herds, to less than 4,000. Valkenburg et al. (1996) present a detailed analysis of the decline. The herd continued a slow decline and dropped to less than 3,000 animals by the early 2000s (Table 1).

Since statehood in 1959, 2 wolf control programs have been conducted in Unit 20A. During 1976–1982, state biologists killed wolves from helicopters to increase moose numbers and harvest. Boertje et al. (1996) summarized the influence of this program on moose, caribou, and

[1] At the discretion of the reporting biologist, this unit report may contain data collected outside the report period.

wolves. From October 1993 to December 1994 state biologists and the public reduced wolf numbers by trapping to halt the decline of the Delta caribou herd. This ground-based predation control program was terminated amid considerable controversy. Valkenburg et al. (2002) summarized the effects of this program on the Delta caribou herd.

Caribou harvest and harvest regulations have varied widely due to population fluctuations and strong hunter interest. The Alaska Board of Game suspended hunting of the DCH in 1992 in response to declining numbers, and the herd remained closed to hunting through regulatory year (RY) 1995 (RY = 1 July through 30 June; e.g., RY95 = 1 July 1995–30 June 1996). Hunting has been by drawing permit for bull caribou only since the hunt was resumed in RY96. Research and enhancement of Delta caribou was a regional priority through the late 1990s. The department initiated an experimental diversionary feeding program in 1996 to determine whether wolves can be diverted from calving areas during the peak of calving. The project was intended to evaluate the feasibility of this technique for increasing neonate survival (Valkenburg et al. 2002).

MANAGEMENT DIRECTION

MANAGEMENT GOALS

Since the mid-1970s, goals for the DCH have included providing high-quality hunts, high harvests, and trophy caribou. The decline of the herd since 1989 gave impetus to the current management goals of restoring the herd and resuming a higher level of consumptive use. The current management objectives are defined in the Intensive Management regulation (Title 5 of the Alaska Administrative Code, regulation 92.108 [5 AAC 92.108]) and the predation control regulations (5 AAC 92.110 and 5 AAC 92.125) that permitted the 1993–1994 wolf control effort to reverse the population decline. Although the wolf control program was suspended before an increase in caribou abundance was realized, regulatory authority for Unit 20A wolf predation control in 5 AAC 92.125 was transferred to 5 AAC 92.113(c) in 2012 and remains in place.

MANAGEMENT OBJECTIVES

- Maintain a bull:cow ratio of ≥30:100 and a large bull:cow ratio of ≥6:100.
- Reverse the decline of the herd and increase the midsummer population to 5,000–7,000 caribou.
- Sustain an annual harvest of 300–700 caribou.

METHODS

POPULATION STATUS AND TREND

Population Size

In 2010, a photocensus of the DCH was not attempted due to unfavorable weather. In 2011, we conducted a photocensus of the herd on 6 July using the radio-search technique (Valkenburg et al. 1985). Pilot–observer teams used radiotracking equipment to locate radiocollared caribou and associated groups. In addition, all caribou summer habitat north of the Alaska Range Divide between the Delta River to the east and the Parks Highway to the west was searched to locate groups of caribou not associated with radiocollared individuals. Photographs of caribou groups were taken between 10:19 AM and 1:26 PM with a handheld digital camera (Canon PowerShot

A550 7.1 megapixel, 4x zoom lens - 5.8–23.2 mm - f/2.6–5.5). Digital photographs were downloaded to a computer and imported into Quantum GIS version 1.7 (Quantum GIS Development Team 2011) where images could be enlarged for counting purposes.

Population Composition

We conducted composition surveys in early October using an R-44 helicopter and Bellanca Scout or Piper PA-18 fixed-wing aircraft. The biologist in the fixed-wing aircraft located the radiocollared caribou. A biologist in the R-44 helicopter classified caribou that were in groups with radiocollared animals and also classified any caribou found in a search of the surrounding area. We searched areas containing numerous radiocollared caribou for additional groups and also classified any caribou encountered while in transit between search areas. Classification categories consisted of cows; calves; and small (juvenile), medium (subadult), and large (mature adult) bulls. Observers identified bulls by the absence of vulva and classified bulls by antler characteristics (Eagan 1993). In 2010, we tallied the composition of each group on a 5-position counter and recorded the tallies on a data sheet. In 2011, we recorded composition information on a handheld digital recorder (Sony IC Recorder, model ICD-PX312) and then downloaded the digital data onto a personal computer for transcription and tabulation.

We monitored harvest characteristics through drawing permit hunt reports and summarized harvest data by regulatory year.

RESULTS AND DISCUSSION

POPULATION STATUS AND TREND

Population Size

During the 2011 photocensus, we counted 1,137 caribou in 9 groups in Unit 20A (Table 1). Groups ranged in size from 1 to 449 caribou. An additional 1,241 caribou in 4 groups were counted in Unit 13 (3 groups totaling 990 caribou in the Butte Lake area and 1 group of 251 caribou in the Upper Nenana River drainage). These caribou were not included in the Delta herd estimate because of mixing with Nelchina caribou. We accounted for 32 of 40 potentially active radio collars within the search area. However, 10 of those DCH radiocollars were associated with caribou located in Unit 13, leaving 22 of 40 radiocollars (a correction factor of 1.818) representing caribou in Unit 20A. As a result, the number of caribou estimated for Unit 20A was 2,067 animals (1,137 caribou counted x 1.818).

The Delta caribou herd declined from more than 10,000 in 1989 to less than 4,000 in 1993 (Table 1). The decline resulted from interrelated effects of adverse weather and predation, and also occurred in neighboring herds (Valkenburg et al. 1996). However, the DCH declined more than the neighboring Denali and Macomb herds. The DCH existed at a much higher density than Denali and Macomb herds, indicating that density-dependent food limitation may have influenced the magnitude of the decline (Valkenburg et al. 1996). Since that decline, abundance and trajectory of the herd have been difficult to discern because estimates of herd size and recruitment have varied considerably. Survey data indicated the herd increased slightly in 1994 and 1995, but subsequent data indicated a declining trend. The minimum herd size declined from 4,646 caribou in 1995 to 2,211 caribou in 2004 (Table 1). Weather precluded completion of a census in 2005 and 2006. By 2007 the herd increased to approximately 2,985 caribou, an increase of 774 caribou (λ = 1.11) from the 2004 census. This estimate, along with much improved fall calf:cow ratios during 2004–2007, were the first indications that the herd may have been increasing. In 2008 and 2009, the minimum herd counts indicated a possible decline. However, both of these estimates were fraught with difficulties (Seaton 2011).

Population Composition

During fall 2010 we classified 1,244 caribou: 174 small bulls, 126 medium bulls, 104 large bulls, 659 cows and 181 calves, and during 2011 we classified 926 caribou: 112 small bulls, 107 medium bulls, 96 large bulls, 469 cows and 142 calves (Table 1).

Bull:cow ratios have varied considerably since 1990, ranging 24–67:100, but have remained above 30:100 since 1998 (Table 1). The ratio of large bulls:100 cows improved once the steep population decline ended in 1993, and 2011 had the highest ratio (21:100) since 2004. These ratios imply that current harvest rates are sustainable. Most of the short-term fluctuation in bull:cow ratios is probably a result of variable behavior and distribution of bulls during counts (i.e., sampling variance rather than process variance). Weather can affect herd distribution, movements, and behavior during rut counts, and survey timing relative to rut can affect the degree of sexual segregation.

In general, calf:cow ratios were relatively low and declining through the early 2000s (Table 1). Ratios in 2000 and 2001 were the lowest observed since 1993. Calf mortality studies during 1995–1997 indicate these low calf:cow ratios were primarily the result of predation by wolves, grizzly bears, and golden eagles (Valkenburg et al. 2002). Analysis of fecal samples collected in late winter 1989 and 1993 indicated depletion of lichen in the foothills range in Unit 20A (Valkenburg 1997; Valkenburg et al. 2002). The proportion of lichens in the diet was relatively low and the proportion of mosses was high compared to caribou from other Interior herds (Valkenburg et al. 2002). Moderately strong calf:cow ratios during 2004–2011 ($\bar{x}$ = 27.6) indicates the herd was probably stable or increasing during that period.

Radio collars are deployed in the herd every year to aid in population estimation and composition surveys. Our goal is to keep 30–40 active radio collars in the herd. When we capture female calf caribou at 10 months of age in April, we weigh them and compare these weights to previous weights for the Delta herd (Valkenburg et al. 2002) to help us track nutritional status of the herd (Table 2). Weights of 10-month-old females during 2010–2011 ($\bar{x}$ = 56.1 kg) were similar to weights during 1995–2007 ($\bar{x}$ = 55.7 kg), suggesting nutritional status has not improved measurably since the population began to decline in the early 1990s (Table 1).

Distribution and Movements

Through the mid-1980s, the Delta herd showed strong fidelity to calving areas between the Delta and the Little Delta rivers in southeastern Unit 20A (Davis et al. 1991). However, as the herd increased, the area used for calving extended to the foothills between Dry Creek and the Delta River (Valkenburg et al. 1988). After 1993 the herd also used the upper Wood River, Dick Creek, upper Wells Creek, and the upper Nenana and Susitna river drainages for calving (Valkenburg et al. 2002). During the remainder of the year, the herd has typically been distributed among the northern foothills from the Delta River to the Nenana River. However, during fall and early winter 2000–2006, a significant portion of the Delta herd was located east of the Delta River near Donnelly Dome and Donnelly Flats. During 2006–2012, radiocollared caribou from the Delta herd were often found south of the Alaska Range in the Susitna River drainage as far south as Butte Lake. This range extension was problematic when conducting census and composition surveys because Delta herd animals were often mixed with portions of the Nelchina herd. Management of the Delta caribou herd could be significantly affected if the herd continues to spend an increasing amount of time in Unit 13E south of the Yanert River drainage, because harvest and herd inventory of caribou in Unit 13E is based on management objectives for the much larger Nelchina caribou herd.

MORTALITY

Harvest

Season and Bag Limit (RY10 and RY11).

	Resident open season	Nonresident open season
Unit 20A		
1 bull by drawing permit only; up to 200 permits may be issued.	10 Aug–20 Sep	10 Aug–20 Sep

Alaska Board of Game Actions and Emergency Orders. In response to a proposal at the March 1996 meeting and based on improved recruitment and large bull:cow ratios documented by the Alaska Department of Fish and Game (ADF&G), the Alaska Board of Game (board) authorized a drawing permit hunt (DC827) beginning in RY96. As noted previously, harvest had been suspended in RY92. In March 2004 the board authorized an increase from 100 drawing permits that ADF&G may issue to 200 because hunter participation had been declining and the harvest of bulls was below the recommended allowable harvest of 2–3% annually. No board actions or emergency orders for the Delta herd were issued during RY10–RY11.

Permit Hunts. We issued 75 permits annually in RY96 and RY97, 100 permits annually during RY98–RY03, and 150 permits annually during RY04–RY11. Since RY07, the percentage of permittees who did not hunt (33–45%) has been relatively high but consistent (Table 3). Similarly, success rates of those who hunted have been consistently high at ≥45% since RY09. The relatively low hunter participation, especially for a drawing permit hunt, was probably a function of the majority of the herd being distributed across the eastern and central portions of its range, which is relatively inaccessible compared to the western portion, where access by ATV is better.

Hunter Residency and Success. Beginning in RY02, harvest by nonlocal Alaska resident and nonresident hunters (22 caribou) surpassed that of local residents (15 caribou) for the first time since the hunt began in RY96 (Young 2007). During RY03–RY07 harvest between the 2 groups equalized with an average of 20 caribou taken by nonlocal resident and nonresident hunters and an average of 20 taken by local resident hunters (Seaton 2009). Again in RY08–RY09, nonlocal residents and nonresidents harvested more caribou ($\bar{x}$ = 28) than locals ($\bar{x}$ = 19; Table 4). This trend continued through RY10 (34 vs. 18), but not RY11 (31 vs. 39) or RY12 (22 vs. 24). Success rates of nonresident hunters has typically been higher than that of resident hunters in this hunt (Young 2007, Seaton 2009, Seaton 2011). A likely explanation was that nonresidents were more inclined to participate in guided hunts, which typically have higher success rates than nonguided hunts preferred by resident hunters. However, in RY10–RY11 success rates of nonresident hunters (67%) and resident hunters (64%) were similar.

Harvest Chronology. No clear trends were apparent in harvest chronology for RY07–RY12 (Table 5). Variations in harvest chronology within and among years were likely influenced by seasonal and annual variations in weather and caribou distribution.

Transport Methods. Successful hunters (RY07–RY12) primarily used 3- or 4-wheelers ($\bar{x}$ = 48%) and aircraft ($\bar{x}$ = 34%) to harvest their caribou (Table 6). All other modes of transportation combined, including horses, boats, other off-road vehicles (ORVs), and highway vehicles, were used less often ($\bar{x}$ = 18%).

Other Mortality

ADF&G research staff conducted calf mortality studies during 1995–1997, and found that wolves, grizzly bears, and eagles were primary predators of caribou in Unit 20A. Details of causes and trends in calf and adult mortality are in ADF&G research reports and publications (Davis et al. 1991; Boertje et al. 1996; Valkenburg et al. 1996; Valkenburg 1997; Valkenburg et al. 1999; Valkenburg et al. 2002). Calf and adult survival were poor during the population decline; consequently, the Board of Game adopted a wolf predation control implementation plan in Unit 20A to reduce wolf numbers to rebuild the caribou population. In addition, Valkenburg (1997) and Valkenburg et al. (2002) tested a diversionary feeding program that addressed predation by a wolf pack in the Wells Creek area. They concluded diversionary feeding of wolves near caribou calving areas could successfully reduce predation in some circumstances, but has significant limitations, primarily because wolves continue to hunt even when they are not hungry.

HABITAT

Assessment and Enhancement

In the past, research and management staff has collected fecal samples on the winter range to monitor the status and use of lichen. Analysis of fecal samples collected in late winter 1989 and 1993 indicated depletion of lichens on winter ranges used by caribou in Unit 20A. The proportion of lichens in the diet was relatively low, and the proportion of mosses was high compared to caribou in other Interior herds (Valkenburg et al. 2002), implying poor winter nutrition (Ihl 2010). We also weighed female calves to determine body condition and relate body condition to natality rates. Two studies, Valkenburg (1997) and Valkenburg et al. (2002), detailed trends of caribou calf weights. They found the heaviest mean April calf weights occurred during 1979–1983 as the Delta herd was recovering from its population low in the early 1970s. Mean calf weights declined dramatically from 1989 to 1991 coincident with deep snow winters and dry summers. Calf weights remained relatively low between 1992 and 2001, and have not recovered to the high levels seen during the late 1970s and early 1980s. Neonatal and fall calf weight and fecal data have not been collected in recent years, but the improved calf:cow ratios may be a sign that habitat quality is improving after a long period when the caribou population was at low density.

CONCLUSIONS AND RECOMMENDATIONS

We did not meet intensive management objectives to reverse the decline of the herd, increase the midsummer population to 5,000–7,000, and to sustain an annual harvest of 300–700 caribou. Research on the Delta herd, including analysis of fecal samples and condition of caribou, would help to determine whether the current population objective is too high. However, even with favorable weather, meeting the management objectives will be unlikely without more effective predation management. Now that the Unit 20A moose population has been reduced (ADF&G unpublished data, Fairbanks), predation control to increase the size of the DCH is a more viable option, if the range can support higher caribou densities.

We met the objective to maintain 30 bulls:100 cows and 6 large bulls:100 cows. In March 2004, the Board of Game authorized an increase to 200 drawing permits for hunt DC827 because harvest of bulls had been below the recommended allowable harvest of 2%–3% annually. Harvest rates averaged 2.8% during RY10–RY12, based on the average harvest of 56 bulls and an estimate of about 2,000 caribou in Unit 20A. At this rate, the proportion of large bulls in the population has remained high, which allowed us to meet our trophy management goal. We will continue to monitor sex ratios during fall surveys to ensure that management objectives concerning bull:cow ratios continue to be met. During the next reporting period, I recommend employing cluster sampling techniques (Cochran 1977) to estimate variance associated with ratios to improve interpretation of composition survey results.

The mixing of Delta and Nelchina herd caribou poses a significant management challenge. At this juncture, we have not been able to identify any specific pattern to their movements or mixing. As a result, we have begun to use hunt boundaries, rather than calving distribution, to define herd membership. We chose to draw the line at the subunit boundary, so that the population estimate area matches the areas designated during the hunting seasons. Due to this mixing, I recommend employing a Rivest et. al (1998) technique to estimate population size and trend during the next reporting period.

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Table 1. Delta caribou fall composition counts and estimated population size, 1989–2012.

Composition Survey date	Bulls: 100 Cows	Large bulls: 100 Cows	Calves: 100 Cows	Calves %	Cows %	Small bulls %	Medium bulls %	Large bulls %	% Total bulls	Composition sample size	Minimum herd size[a]	% Herd sampled
10/10/89	27	2	36	22	62	64	28	7	16	1,965	10,690	18
10/4/90	38	6	17	11	65	45	39	16	24	2,411	7,886[b]	31
10/1/91	29	5	8	6	73	55	29	16	21	1,705	5,755	30
9/28/92	25	3	11	8	74	46	43	11	19	1,240	5,870	21
9/25/93[d]	36	7	5	3	72	45	33	22	25	1,525	3,661	42
10/3–6/94[c]	25	10	23	16	68	33	29	39	17	2,131	4,341	49
10/3/95	24	10	20	14	69	41	19	40	17	1,567	4,646	34
10/3/96	30	9	21	14	66	51	20	29	20	1,537	4,100	37
9/27/97	27	9	18	12	69	48	20	32	19	1,598	3,699	43
10/1/98	44	9	16	10	62	31	49	20	27	1,519	3,829	40
10/2/99	44	10	19	11	62	37	40	23	27	674	3,625	19
10/3–4/00	46	10	11	7	64	41	37	22	30	1,010	3,227	31
9/30/01	39	9	13	8	66	46	30	24	26	1,378	2,965	46
9/28/02	50	17	25	14	57	43	23	34	29	924	2,803	33
10/6–7/03	37	10	20	13	64	32	39	29	23	1,023	2,581	40
9/29/04	49	14	35	19	54	29	42	29	27	1,267	2,211	58
9/26/05	50	11	33	18	55	28	49	23	27	1,182	–[d]	62
10/5&15/06	40	8	27	16	60	45	36	19	24	1,022	–[d]	64
10/8/07	35	11	24	15	63	21	48	30	22	719	2,985[e]	24
2008	–[d]	–[d]	–[d]	–[d]	–[d]	–[d]	–[d]	–[d]	–[d]	–[d]	2,078[e]	–[d]
10/12/09	52	13	16	10	60	41	34	25	31	642	1,764[e]	36
10/3/2010	61	16	28	15	53	43	31	26	33	1,244	–[d]	–[d]
10/3/2011	67	21	30	15	51	36	34	31	34	926	2,067[e]	31
10/3/2012	51	18	15	9	60	32	32	36	31	787	–[d]	–[d]

[a] Numbers of caribou counted during summer survey from the same calendar year.
[b] Excludes Yanert herd, which included approximately 600 caribou.
[c] Composition data was weighted according to the distribution of radiocollars (Eagan 1995).
[d] Survey was not conducted due to poor survey and/or weather conditions.
[e] Includes only caribou within Unit 20A.

Table 2. Mean weight of samples of 10-month-old female calves from the Delta caribou herd, 1979–2011.

	10-month-olds			
Year[a]	$\bar{x}$ (lb)	$\bar{x}$ (kg)	$s_{\bar{x}}$ (lb)	n
1979	132.3	60.1	2.4	11
1981	137.0	62.1	7.4	5
1982	135.1	61.3	3.9	11
1983	137.2	62.2	3.3	13
1984	126.9	57.5	1.3	14
1987	120.8	54.8	2.8	9
1988	131.3	59.6	2.9	12
1989	133.6	60.6	2.7	9
1990	119.9	54.4	3.3	9
1991	113.1	51.3	2.3	9
1992	119.1	54.0	2.6	17
1993	122.3	55.5	2.9	12
1994[b]				
1995	123.1	55.8	2.7	15
1996	120.8	54.8	3.3	15
1997	118.3	53.7	2.5	14
1998	123.7	56.1	3.0	12
1999	116.7	52.9	2.6	13
2000	114.9	52.1	2.6	12
2001	122.2	55.4	3.2	11
2002	130.0	59.1		15
2003	117.5	53.4		15
2004	129.4	58.8		14
2005	127.2	57.8		14
2007	121.9	55.4		11
2008				
2009				
2010	123.8	56.2	1.7	7
2011	123.0	55.9	2.5	15

[a] Years 1979–2001 come from Valkenburg et al. 2002.
[b] There were too few calves to obtain a sample of 10-mo-olds in April 1994.

Table 3. Delta caribou harvest data by permit hunt, regulatory years 2007 through 2012.

Hunt	Regulatory year	Permits issued	Did not hunt	%	Unsuccessful hunters	%	Successful hunters	%	Bulls	%	Cows	%	Unk	Harvest
DC827	2007	156	57	37	41	41	58	59	58	100	0	0	0	58
	2008	150	54	36	53	55	43	45	43	100	0	0	0	43
	2009	150	49	33	51	50	50	50	50	100	0	0	0	50
	2010	150	67	45	31	37	52	63	52	100	0	0	0	52
	2011[a]	151	45	30	36	34	70	66	70	100	0	0	0	70
	2012	150	72	48	32	41	46	59	45	100	0	0	1	46

[a] Includes one SC827 permit that did not hunt.

Table 4. Delta caribou annual hunter residency and success, permit hunt DC827, regulatory years 2007 through 2012.

	Successful					Unsuccessful					
Regulatory Year	Local[a] resident	Nonlocal resident	Nonresident	Total	%	Local[a] resident	Nonlocal resident	Nonresident	Total	%	Total hunters
2007	35	21	2	58	59	17	21	2	40	41	98
2008	21	17	5	43	45	20	30	3	53	55	96
2009	17	25	8	50	50	26	24	1	51	50	101
2010	18	28	6	52	63	11	16	4	31	37	83
2011	39	25	6	70	66	16	18	2	36	34	106
2012	24	17	5	46	59	22	10	0	32	41	78

[a] Residents of Unit 20.

Table 5. Delta caribou annual harvest chronology percent by harvest periods, permit hunt DC827, regulatory years 2007 through 2012.

Regulatory	Chronology percent by harvest periods					
Year	8/10–8/20	8/21–8/31	9/1–9/11	9/12–9/20	Unk	*n*
2007	33	17	22	26	2	58
2008	19	30	16	33	2	43
2009	28	10	34	28	0	50
2010	35	21	25	19	0	52
2011	30	20	31	19	0	70
2012	50	11	22	17	0	46

Table 6. Delta caribou harvest percent by transport method, permit hunt DC827, regulatory years 2007 through 2012.

Regulatory Year	Harvest percent by transport method							
	Airplane	Horse	Boat	3- or 4-Wheeler	ORV[a]	Highway vehicle	Unk	*n*
2007	37	2	3	51	2	3	2	58
2008	44	0	5	40	7	5	0	43
2009	32	4	4	48	2	10	0	50
2010	31	4	0	56	4	6	0	52
2011	34	10	1	39	4	10	1	70
2012	28	4	0	57	9	2	0	46

[a] Other off-road vehicles.

SPECIES

MANAGEMENT REPORT

Alaska Department of Fish and Game
Division of Wildlife Conservation
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CARIBOU MANAGEMENT REPORT

From: 1 July 2010
To: 30 June 2012[1]

LOCATION

GAME MANAGEMENT UNITS: 20B, 20C, 20D, 20E, and 25C (20,000 mi^2)

HERD: Fortymile

GEOGRAPHIC DESCRIPTION: Charley, Fortymile, Salcha, Goodpaster, and Ladue rivers, and Birch and Shaw Creek drainages between the Tanana River and the south bank of the Yukon River; the Fortymile caribou herd currently ranges up to 50 miles into Yukon, Canada

BACKGROUND

The Fortymile caribou herd (FCH) range includes portions of the upper Fortymile, Tanana, and Yukon river drainages in both Alaska and Yukon Canada. The FCH is important for consumptive and nonconsumptive uses in Interior Alaska and southern Yukon. Like other caribou herds in Alaska, the FCH has displayed major changes in abundance and distribution through time. During the 1920s it was the largest herd in Alaska and perhaps one of the largest in the world, estimated by Murie (1935) at over 500,000 caribou. For unknown reasons, the FCH declined during the 1930s to an estimated 10,000–20,000 caribou (Skoog 1956). Timing of the subsequent recovery is unclear, but by the 1950s the FCH had increased to an estimated 50,000 caribou (Valkenburg et al. 1994). Herd recovery was likely aided significantly by a federal predator control program that began in 1947. Through the early 1960s the herd fluctuated slightly, but most population estimates were around 50,000 animals (Valkenburg et al. 1994).

Between the mid-1960s and mid-1970s the herd declined, and was estimated to be at its lowest population level since the 1920s (5,740–8,610 animals) during 1973–1976 (Valkenburg et al. 1994). This decline was attributed to a combination of high harvests, severe winters, and wolf predation (Davis et al. 1978; Valkenburg and Davis 1989). During this decline, the FCH reduced its range size and changed its seasonal migration patterns. By the early 1960s, the herd stopped crossing the Steese Highway in significant numbers, and by the early 1970s few Fortymile caribou continued to make annual movements into Yukon, Canada. Since the early 1970s, the herd's range has remained about 19,300 mi^2 (50,000 km^2), less than 25% of the range thought to have been used by the FCH during the 1920s.

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[1] At the discretion of the reporting biologist, this unit report may contain data collected outside the report period.

The FCH began increasing after 1976, likely in response to favorable weather conditions, reduced harvests, and a natural decline in wolf numbers. By 1990 the herd was estimated at 22,766 caribou. During 1990–1995, the herd remained relatively stable at about 22,000 caribou when population growth stabilized due to high adult mortality, unusually low pregnancy rate in 1993, and low to moderate calf survival (Boertje and Gardner 2000*a*). In combination with public wolf trapping, the Alaska Department of Fish and Game (ADF&G) conducted nonlethal wolf control during November 1997–May 2001. Within the calving and summer range of the FCH, wolf numbers were reduced by 78% to 2 sterilized alpha wolves in each of 15 pack territories (Gardner 2003). During 1996–2002, the FCH doubled in size due to elevated pregnancy rates and increased adult and calf survival (Table 1). The current objectives of 50,000–100,000 caribou and harvest of 1,000–15,000 caribou were established by the Alaska Board of Game in 2000 and are defined in intensive management regulations (Title 5 of the Alaska Administrative Code, regulation 92.108 [5 AAC 92.108]).

The FCH historically provided much of the food needed by residents within its range. From the late 1800s to World War I, the herd was subject to market hunting in both Alaska and Yukon. Most hunting was concentrated along the Steese Highway and along the Yukon River upstream from Dawson before the Taylor Highway was constructed in the mid-1950s. During the 1960s, hunting was concentrated along the Steese and Taylor highways in Alaska and along the Top of the World Highway in Yukon. During the late 1970s and the 1980s, Alaska's hunting regulations for Fortymile herd caribou were designed to benefit subsistence hunters and to prevent harvest from limiting herd growth. Bag limits, harvest quotas, and season openings tailored to benefit local residents were the primary regulatory mechanisms used to meet these objectives. Hunting seasons were deliberately set to avoid the period when road crossings were likely. Consequently, hunter concentration and harvest distribution shifted from highways to trail systems accessed from the Taylor and Steese highways and areas accessed from small airstrips within the Fortymile and Charley river drainages.

Harvest was further restricted during the early 1990s to reduce impact on herd growth. Harvest regulations also became increasingly complex due to a legal ruling regarding Alaska's subsistence law that initiated federal management of the herd on federal lands. Competition among Alaska hunters increased because of the reduced quotas and complex regulations. During this period, many residents within the herd's range were unhappy with the ineffectiveness of dual federal and state management in administering the hunts and bringing about a herd increase. In response, the Upper Tanana–Fortymile Fish and Game Advisory Committee, the Tr'ondëk Hwëchîn First Nation in Yukon, and other public groups requested that ADF&G, the U.S. federal agencies, and Yukon Department of Renewable Resources work with the public to develop a management plan for the FCH.

In 1994 the Fortymile Caribou Herd Management Planning Team was established. The team comprised 13 members of the public representing subsistence users from Alaska and Yukon, sport hunters, Native villages and corporations, environmental groups, and agency representatives from ADF&G, Bureau of Land Management, U.S. Fish and Wildlife Service, National Park Service, and Yukon Department of Renewable Resources.

The team completed the *Fortymile Caribou Herd Management Plan* in October 1995 (Fortymile Caribou Herd Management Planning Team 1995). This plan included recommendations for herd size, harvest, and habitat management and recommended a combination of nonlethal wolf control by ADF&G and wolf trapping by the public to reduce wolf predation on caribou calves. Harvest management recommendations prompted the Alaska Board of Game and the Federal Subsistence Board to develop new harvest regulations. The Alaska Board of Game, the Federal Subsistence Board, and the Yukon Fish and Wildlife Management Board endorsed the plan and developed new harvest regulations that satisfied the plan and guided regulatory decisions during 1996–2000. The plan formally ended in 2001.

In 1999, the 5 Fish and Game advisory committees within the herd's range in Alaska (Central, Delta, Eagle, Fairbanks, and Upper Tanana–Fortymile) recognized the need to cooperatively develop harvest regulations that would benefit hunters and carry out the goals of the *Fortymile Caribou Herd Management Plan*. These advisory committees, with input from the federal Eastern Interior Regional Advisory Council to the Federal Subsistence Board, Yukon Department of Renewable Resources, Yukon First Nations, and many other interested parties, developed the *2001–2006 Fortymile Harvest Management Plan* (ADF&G, unpublished document, 2000, Tok). The 2001–2006 harvest plan was developed to guide harvest management of the Fortymile caribou herd in Alaska during 2001–2006 and retained the same primary goals of the 1995 *Fortymile Caribou Herd Management Plan* to provide conditions for continued growth of the Fortymile caribou herd to allow it to expand to its former range in Alaska and Yukon. However, the 2001–2006 harvest plan provided for resumption of traditional hunting opportunity that was severely reduced during 1995–2000. The 2001–2006 harvest plan was endorsed by the Alaska Board of Game in March 2000 and guided regulation development and implementation during regulatory years (RY) 2002 (RY = 1 July through 30 June; e.g., RY02 = 1 July 2002 through 30 June 2003) through RY05.

In 2005, these Fish and Game advisory committees again reconvened to develop an updated plan. In March 2006, with input from the federal Eastern Interior Regional Advisory Council, Yukon Department of Environment (formerly Yukon Department of Renewable Resources), Yukon First Nations, and many other interested parties, they developed the *Fortymile Caribou Herd Harvest Plan 2006–2012* (Alaska Department of Fish and Game 2006). The 2006–2012 harvest plan retained the same primary goals as the 1995 management plan and 2001–2006 harvest plan and was endorsed by the Alaska Board of Game in March 2006. The 2006–2012 harvest plan guided regulation development and implementation during regulatory years RY06–RY11.

Again in 2011, the original 5 Alaska Fish and Game advisory committees, as well as the Mat-Valley and Anchorage advisory committees developed the *Fortymile Caribou Herd Harvest Plan 2012–2018* (Harvest Management Coalition 2012). The 2012–2018 harvest plan retained the same primary goals as the 1995 management plan, the 2001–2006 harvest plan and the 2006–2012 harvest plan. The Alaska Board of Game endorsed the 2012–2018 harvest plan in March 2012. The 2012–2018 harvest plan will guide regulatory development and implementation during regulatory years RY12–RY18.

MANAGEMENT DIRECTION

Gardner (2003) summarized Fortymile caribou herd management direction during the 1970s through 2000. During RY02–RY05, FCH management was guided by recommendations in the 2001–2006 harvest plan. During RY06–RY12, management was guided by recommendations in the 2006–2012 and 2012–2018 harvest plans.

The Fortymile harvest plans have been a highly successful joint state–federal management program benefiting users and the FCH. Since 2001 these plans have had support of the public and regulatory boards and have withstood a number of proposals to state and federal boards that could have resulted in reduction in herd growth or potential population declines or to separation of state and federal hunt management systems.

The following management goals and objectives were developed to meet the goals of the 2006–2012 and 2012–2018 harvest plans and the intensive management regulations. In addition, management goals, objectives, and activities were revised for RY10–RY11 to address uncertainty about historic range size and sustainability of estimated historic population levels, and more clearly define the FCH management program.

MANAGEMENT GOAL

- Restore the FCH to as much of its traditional range in Alaska and Yukon as possible, within sustainable levels, and without significantly compromising herd health and habitat condition.

MANAGEMENT OBJECTIVES

Objective 1: Provide conditions for the Fortymile herd to grow at an annual rate of 5–10%, until population indices indicate the herd is becoming nutritionally stressed, to provide increased caribou hunting and viewing.

Objective 2: Manage for a herd size of 50,000–100,000, unless nutrition indices indicate a lower sustainable limit.

Objective 3: Manage the herd to sustain an annual harvest of 1,000–15,000 caribou.

Objective 4: Maintain an October bull:cow ratio of at least 35:100.

MANAGEMENT ACTIVITIES

- Work with land agencies, landowners, and developers to minimize the impact of human activities on caribou habitat (Objective 1).

- Work with land agencies, landowners, and developers to mitigate developments detrimental to Fortymile caribou (Objective 1).

- Maintain regulatory flexibility to stabilize the FCH population, if nutrition indices indicate herd health is becoming significantly compromised (Objectives 2 and 3).

- Work with land agencies and landowners to maintain a near-natural fire regime (Objective 1).

- Attempt annual photo censuses (Objectives 1 and 2).
- Conduct annual fall composition surveys (Objectives 1 and 4).
- Capture 35 female calves of the year annually to collect biological information and deploy radio collars to maintain the minimum sample size of 75 radiocollared females in the herd (Objectives 1–4).
- Maintain a minimum sample size of at least 75 radiocollared females, including a minimum of 15 satellite and 60 VHF collars (Objectives 1–4).
- Radiotrack throughout the year to determine seasonal distribution, mortality rates and proximity to highways during hunting seasons (Objectives 1–3).
- Monitor changes in seasonal range distribution (Objectives 1–3).
- Conduct annual parturition surveys in May to determine parturition rates of radiocollared females ≥3 years of age (Objectives 1 and 2)
- Regulate hunting to maintain an annual harvest of 2% (±0.3%) of the preseason population estimate, with no more than 25% of the harvest consisting of cows (Objectives 1–4).
- Monitor harvest through hunt reports (Objective 3).
- Regulate caribou hunting along the Steese Highway, Chena Hot Springs Road, Taylor Highway, and Boundary Cutoff to avoid heavy roadside harvest to the extent possible, without jeopardizing higher priority objectives (Objectives 1 and 3).
- Provide for increased caribou hunting, viewing, and other wildlife-related recreation (Objectives 1–4).

METHODS

POPULATION STATUS AND TREND

Population Census

During RY10–RY12 we attempted annual photocensus counts of the FCH between late June and mid-July. However, during these years caribou were not adequately aggregated or were not in areas that allowed for visual counting and photographing, and the census was not conducted. Population estimates will be developed for these years based on a population model (Boertje and Gardner 2000*b*).

When a photo census was successful, population size was estimated using the modified aerial photo-direct count technique (Davis et al. 1979). Photocensuses were conducted once the herd formed 5–15 tightly aggregated groups in areas that provided conditions adequate to visually count and photograph the caribou. Prior to the census we conducted several reconnaissance flights to determine if the caribou were adequately grouped near or above treeline. These postcalving aggregations were located by radiotracking radiocollared caribou. Once the herd was grouped, we attempted the census using 3–5 spotter planes (Piper PA-18 or Bellanca Scout) and one radiotracking aircraft (Cessna 185 or 206, Bellanca Scout, or PA-18). Groups of caribou were photographed with a Zeiss RMK-A aerial camera mounted in the belly of a DeHavilland Beaver aircraft. During the census, the radiotracking plane located all radiocollared animals in the herd and the spotter planes flew search patterns to locate groups of caribou that did not have radiocollared animals associated with them. We photographed all groups that were too large for observers to count accurately from aircraft (i.e., >50 caribou).

Caribou were counted directly from photographs and all photographs were counted twice, each time by a different person. If counts were within 3% of one another, the 2 counts were averaged; otherwise, photographs were counted a third time and the 3 counts were averaged. We derived minimum population estimates by adding individual caribou counted on photographs to caribou counted from spotter planes that were not photographed. No correction factors were used to account for caribou missed during the search.

Productivity

Parturition rates were determined by observing known-age radiocollared females from a Piper PA-18 during calving season. Caribou observed with calves, hard antlers, or distended udders were classified as parturient (Whitten 1995). During 2011 and 2012, radiocollared females ≥3 years old were radiotracked 3–4 times (at approximately 4–5 day intervals) during 12–27 May.

Population Composition, Captures, and Body Condition

We conducted aerial surveys and captures during late September through mid-October to estimate herd sex and age composition, deploy radio collars to maintain a sample of known-age females, and assess body condition of 5-month-old females.

During composition surveys we located all functioning radio collars in the herd using a fixed-wing aircraft (Piper PA-18 or Bellanca Scout) and used an observer in a Robinson R-44 helicopter to visually classify 10–15% of the herd. We tallied the composition of each group on a 5-position counter and recorded the tallies on a data sheet. We classified each caribou as a cow, calf, or bull. Bulls were further classified as small, medium, or large, based on antler size (Eagan 1993).

Composition data for each group of caribou were weighted by the proportion of radiocollared Fortymile caribou in that group. We attempted to spread survey effort evenly throughout the herd by classifying an equal number of caribou in the vicinity of each radio collar. To adjust for variable group size and number of radiocollared caribou per group, we multiplied the number of cows and bulls in each group by the proportion of radiocollared caribou that were in the group to derive weighted totals and ratios for each group. Weighted totals and ratios of all groups were added to derive herd composition.

Captures were conducted annually in the last week of September or first week of October. Sixteen to 18 female calves (4–5 months old) were fitted with VHF radio collars and 0–5 were also fitted with satellite radio collars to maintain a sample size of 60–80 radiocollared females in the herd. During captures we weighed each animal and recorded sex, age, and handling time. We also drew blood for serology, genetics, and trace mineral analysis.

Distribution and Movements

We obtained seasonal herd distribution, movements, and estimates of annual mortality by radiotracking 60–90 radiocollared cows throughout the year. On an annual basis, a portion of the radiocollared caribou were located approximately weekly during hunting seasons in August, September, and December, 3–4 times during calving in May, 8–10 times leading up to the annual photo census attempt during June and early July, and approximately once a month during the remainder of the year.

Harvest

Harvest was monitored using hunter checkstations, hunter contacts in the field, and registration permit hunt reports. To reduce the risk of overharvest, successful hunters were required to report their kill within 3–5 days. Harvest data were summarized by regulatory year. We analyzed data on harvest success, hunt area, hunter residence and effort, method of transportation, and harvest chronology. We established the annual harvest quota using the 2006–2012 and 2012–2018 harvest plans. During RY10 the annual harvest quota was 795 caribou and in RY11–RY12 the annual harvest quota was 1,000 caribou, with no more than 25% cows in any year.

To manage and distribute harvest, we followed the 2006–2012 and 2012–2018 harvest plan guidelines to divide the FCH hunt area into zones and allocated the annual quota between hunting seasons and among these zones. Seventy-five percent of the annual harvest quota was allocated to the fall hunting season (RC860 permit). The winter season (RC867 permit) harvest quota was 25% of the annual harvest quota plus any unharvested portion of the fall quota.

The fall harvest quota was further divided between hunt zones: the Steese Highway–Chena Hot Springs Road area (zone 1), the Taylor Highway area (zone 3), and the roadless area between these road-accessible zones (zone 2). The winter harvest quota was also allocated between zones. The road-accessible zone (zone 1 or 3) that had the greatest number of caribou immediately prior to the season opening was allocated 60% of the winter quota and the other road-accessible zone was allocated 40%. Zone 2 harvest was included with the harvest quota of either zone 1 or 3. In RY11 and RY12, zone 4 (the White Mountains north of the Steese Highway) was added to the hunt area for both the fall and winter hunts and had a combined quota with zone 1. No additional caribou were added to the combined zone 1 and 4 quota.

We issued emergency orders to close hunting seasons when harvest quotas were met or uncontrollable overharvest was expected. Emergency orders were also issued to reopen seasons if danger of uncontrollable overharvest had passed and unharvested quota was available. Further information regarding Fortymile caribou harvest management is in the 2001–2006 harvest plan (ADF&G, unpublished document, 2000, Tok), 2006–2012 harvest plan (ADF&G 2006) and 2012–2018 harvest plan (Harvest Management Coalition 2012).

RESULTS AND DISCUSSION

POPULATION STATUS AND TREND

Population Size

Modeled population estimates have not yet been developed for RY10–RY12. Analysis will be completed and included in the RY12–RY13 report.

During RY89–RY94, herd size remained relatively stable at around 22,000 caribou (Table 1). Between RY95 and RY02, the herd size doubled (annual growth rates of 4–14%) to 43,375 caribou counted during the RY02 photo census. Annual increases in herd size resulted from increased adult and calf survival rates and increased adult pregnancy rates (Table 1; Boertje and Gardner 1998*b*, 1999, 2000*a*).

During RY03–RY12, photo censuses were completed in RY06, RY08, and RY09. The herd size was likely underestimated in RY06 due to poor sightability and difficulty of identifying the large number of caribou in timbered habitat. Therefore, the RY06 results were not used to estimate population size. While herd size probably fluctuated during RY03–RY05, it likely remained at about 40,000–44,000 caribou based on low calf:cow ratios observed during fall herd composition surveys (Gross 2007; Boertje et al. 2012). The herd likely increased slowly during RY06 and RY07, and estimates during these years were derived from interpolations based on herd estimates from RY03–RY05 and RY08–RY09 (Gross, unpublished data, ADF&G Tok; Boertje, unpublished data, ADF&G Fairbanks). Successful photo censuses were completed in RY08 and RY09, with 46,510 and 51,675 caribou counted, respectively.

Productivity

May parturition rates (also referred to as natality rates or birth rates) of radiocollared females ≥3 years old were 86% (n =73) in 2011, 82% (n =71) in 2012, and 88% (n = 81) in 2013 (Table 2). Parturition rates of 3-year-old radiocollared females were 67% (n =3) in 2011, 62% (n = 13) in 2012, and 83% (n = 18) in 2013.

Natality rate can be a useful index to assess herd nutrition (Valkenburg et al. 2000). Parturition rates of 3-year-old cows during different phases of herd growth (increasing population phase, stable/high population phase, and decreasing population phase) were a more sensitive indicator of herd nutrition than parturition rate of other age classes in the George River herd in northeastern Quebec and northern Labrador (Bergerud et al. 2008), as well as the Delta and Nelchina herds in Alaska (Valkenburg et al. 2003).

Analysis of parturition rates of known-age cows in Alaska caribou herds indicates that a 5-year moving average of 3-year-old parturition rates of <55% could indicate nutritional stress (Boertje et al. 2012). In 2012, the 5-year moving average parturition rate of 3-year-old FCH cows (54%) fell below the threshold identified by Boertje et al. (2012) as a cautionary signal that nutritional status of the herd was notably reduced (Table 2). However, the 5-year moving average increased to 59% after inclusion of the 2013 3-year-old parturition rate of 83% (n = 18).

Although the 5-year moving average of 3-year-old parturition rate increased above the threshold in 2013, nutritional status of the herd is still in question and deserves ongoing scrutiny. Additional information about the nutritional status of the FCH can be found in Boertje et al. (2012).

Population Composition

<u>RY10</u>. We conducted the autumn 2010 composition survey in early October. A total of 7,169 caribou were classified in the vicinity of 65 radiocollared animals, resulting in an estimated 32 calves and 43 bulls:100 cows (Table 1).

RY11. We conducted the autumn 2011 composition survey in early October. A total of 3,949 caribou were classified in the vicinity of 97 radiocollared animals, resulting in an estimated 25 calves and 42 bulls:100 cows (Table 1).

RY12. We conducted the autumn 2012 composition survey in early October. A total of 4,832 caribou were classified in the vicinity of 55 radiocollared animals, resulting in an estimated 22 calves and 40 bulls:100 cows (Table 1).

The fluctuation of the bull:cow ratio between RY09 (59:100) and RY10 (43:100) was likely due to uneven distribution of bulls in the herd during the RY09 composition survey rather than a sudden change in the proportion of bulls in the herd. The bull:cow ratios observed in RY10 (43:100), RY11 (42:100) and RY12 (40:100) are closer to the previous 5-year average (RY05–RY09) of 45:100, indicating bull numbers are likely stable under the current harvest management strategy. Harvest quotas will remain conservative (~2% of the herd annually) through RY13 to allow for continued herd growth and a stable bull:cow ratio. This harvest strategy should also maintain the ratio of large bulls in the herd.

Captures and Body Condition

During the first week of October 2010, 2011, and 2012, we captured 18, 26, and 25 five-month-old female calves, and deployed 16, 20, and 21 VHF radio collars on these calves, respectively. In addition, 16 satellite radio collars were deployed on adult cows. Average calf weight was 120.7 lb in 2010, 111.6 in 2011 and 111.4 in 2012 (Table 3). Autumn calf weights have been collected on the FCH since 1990, with a long-term (1990–2009) average of 118.4 lb. Boertje et al. (2012) found a declining trend in the FCH fall calf weights (0.22 kg/yr, $P = 0.02$) during 1990–2010. Although a statistical analysis has not yet been conducted that includes the 2011 and 2012 fall calf weights, weights observed in these years were the third and fourth lowest since 1990 and likely indicate a continued declining trend. Additional analysis will be completed and included in the next FCH management report.

Distribution and Movements

Calving and post-calving. In May 2011, the FCH primarily calved in the upper Seventymile, Charley, South Fork Birch Creek and upper Salcha drainages. The majority of the herd spent June in the North Fork Fortymile, Middle Fork Fortymile, upper Charley, upper Goodpaster and upper Salcha drainages.

In May 2012, the FCH primarily calved in the Charley, Middle Fork Fortymile and upper Goodpaster drainages. The majority of the herd spent June in the Middle Fork Fortymile, upper Charley, upper Goodpaster and upper Salcha drainages.

In May 2013, the FCH primarily calved along the eastern and southern edges of the Yukon–Charley Rivers National Preserve in the lower Middle Fork Fortymile (downstream from and including Joseph Creek), North Fork Fortymile and upper Charley River drainages. The majority of the herd spent June in the North Fork Fortymile, upper Middle Fork Fortymile, upper Charley, upper Goodpaster, and upper Salcha drainages.

Pre-rut and rut. In late September–mid October 2010 and 2011, the FCH was concentrated in the Upper Seventymile, Charley, South Fork Birch Creek, upper Salcha, upper Goodpaster, and Joseph Creek drainages.

In late September–mid-October 2012, the FCH was concentrated in the Upper Seventymile, Charley, South Fork and mainstream Birch Creek, upper Salcha, and upper West Fork Chena drainages.

Winter. During November–March RY10–RY12, the majority of the herd was concentrated in the White Mountains and Birch Creek areas near the Steese Highway. During each of these years, a smaller portion of the herd was distributed in the eastern portion of its winter range, primarily near the Top of the World Highway between Boundary Alaska in the United States and Dawson Yukon in Canada.

MORTALITY

Harvest

Season and Bag Limit. Both fall and winter hunts were in place for the FCH during RY10–RY12, with various zone-specific bag limits and season dates for state and federal hunts (Table 4). Detailed descriptions and a map of the hunt zones are in Appendix A.

Alaska Board of Game Actions and Emergency Orders. We issued several emergency orders to delay, close, and reopen hunting seasons in various hunt zones in order to meet harvest quotas (Table 5).

The 2012–2018 harvest plan was adopted by the Board of Game in March 2012. Also at that 2012 meeting, based on recommendations in the 2012–2018 harvest plan, the FCH hunt area was expanded to include the White Mountains Herd range in portions of 20B, 20F, and 25C; the FCH winter season was extended to March 31; a to be announced limited registration hunt was established for the winter hunt period and proxy hunting for FCH caribou was prohibited within the entire FCH hunt area.

Harvest by Hunters. We issued 5,113 registration permits in RY10, 3,771 in RY11, and 4,701 in RY12 (Table 6). In RY10, 3,119 hunters reported taking 725 caribou, in RY11 2,200 hunters reported taking 1,066 caribou, and 2,822 hunters took 1,297 in RY12 (Table 6). Total human-caused mortality of Fortymile caribou, including harvest reported on registration permits and general harvest tickets, accidental death, and illegal and unreported harvest, was estimated to be 754 in RY10, 1,109 in RY11, and 1,331 in RY12 (Table 7). To assist herd growth during RY10–RY12, the Tr'ondëk Hwëchìn First Nation members in Yukon, Canada chose not to exercise their constitutional right to hunt the FCH; concomitantly all other federal and provincial hunting seasons for FCH were closed in Canada.

Hunter Residency and Success. Nonresidents made up 8% of hunters during RY10–RY12 and accounted for 12% of the total harvest (Table 8). The success rate for residents (local and nonlocal combined) was 36% during RY10–RY12, whereas success for nonresidents was 54% (Table 8).

Harvest Chronology. During the fall hunt (RC860) in RY10–RY12 most (65–90%) harvest occurred during the last week in August and first week in September, coinciding with the August 29 season openings in hunt zones 1 and 3 (Table 9).

During the winter hunting season (RC867) in RY10–RY12 harvest was more evenly spread throughout the season than during the fall hunt (Table 10). Closures and delayed openings portions of the hunt area where large numbers of caribou gathered along highways resulted in slower harvest and longer seasons during these years.

Transport Methods.

RC860 fall hunts — During the RC860 fall hunts in RY10–RY12, the types of transportation used by successful hunters varied by hunt zone and depended primarily on the number of ATV trails available and whether air taxi companies worked in the area. All successful hunters in the roadless portions of the FCH range (primarily zones 2 and 4) used boats and airplanes. This remote hunt area has few or difficult to access trails, resulting in very limited opportunities for ground transportation.

Successful hunters in the Steese Highway–Chena Hot Springs area in northeastern Unit 20B and southeastern Unit 25C (zone 1) primarily used ATVs, followed by highway vehicles. Hunters who used ATVs had high harvest success during the fall seasons.

Successful hunters in Unit 20E (zone 3 and part of zone 2) primarily used ATVs, followed by highway vehicles. The Chicken Ridge trail and its spur trails was the primary access used by hunters with ATVs to hunt the FCH in Unit 20E. Walk-in hunters accessed the herd from the Taylor Highway near American Summit in the Glacier Controlled Use Area where motorized vehicles were not allowed for hunting. American Summit provided an ideal location for hunters without ATVs or other off-road vehicles to access the FCH when caribou were in this area.

RC867 winter hunts — A variety of transportation types were used by successful hunters (Table 11). Successful hunters primarily accessed the FCH using snowmachines and highway vehicles along the Steese and Taylor highways (zones 1 and 3).

Other Mortality

Boertje and Gardner (1998*a*, 1998*b*, 1999, 2000*b*) and Gardner (2001) described in detail the factors that limited FCH growth during 1996–2000 and the management actions taken to mitigate those factors and encourage herd recovery. These factors, primarily wolf predation, continued to influence the FCH through RY12. We continued wolf predation control during RY10–RY12 to reduce wolf predation on the FCH (Alaska Department of Fish and Game 2013).

HABITAT

Assessment

In 1998, for the first time in 3 decades, the FCH exceeded 1.3 caribou/mi^2 (0.5 caribou/km^2). Beginning in 2001 the herd expanded its range use, possibly as a result of increased herd size. The herd moved farther west near the Steese Highway in fall 2001 and used winter range in Yukon, Canada during winters 2000–2001 through 2012–2013. Even so, more than 75% of the historic Fortymile range has not been used since the 1960s and the far eastern portion of the range has not been used since at least the 1940s.

Fecal samples from overgrazed winter ranges contain a relatively high proportion of mosses or vegetation other than lichens (Boertje 1984). During winters 1991–1992, 1992–1993, 1995–1996, 1996–1997, and 1999–2000, range conditions were excellent, as evidenced by high proportions of lichen fragments (72–81%) and a low proportion of mosses (8%) in fecal samples. Preliminary data collected during 2000–2004 indicate a high proportion of lichens in fecal samples (William Collins, ADF&G, personal communication, 2009), suggesting that Fortymile winter range continued to be in excellent condition.

Nelchina herd caribou have wintered in portions of the Fortymile winter range since 1999. Nelchina calves that wintered in the Fortymile range were significantly heavier than calves that wintered in Units 11 and 13 (Bruce Dale, ADF&G, personal communication, 2009). Also, Nelchina calves on Fortymile range gained weight over winter, except in years when snow depth was above average.

Wildfires in 2004 destroyed the habitat plots prior to the final assessment, but habitat quality in adjacent unburned areas of Unit 20E was likely unchanged. Wildfires in 2004 and 2005 burned about 15% of the winter range of the FCH and may have influenced habitat selection or predation risk of caribou starting in winter 2004–2005. Recent burns provide much lower biomass of terrestrial lichens than mature spruce forest with lichen understory, and caribou may avoid recent burns because of unfavorable snow conditions or deadfalls that impede movement (Joly et al. 2003). Caribou from the Nelchina herd occupied adjacent winter range in Unit 20E and used recent (<50-yr-old) burns less than expected (Joly et al. 2003).

Despite the area of winter range that burned in recent years, a large portion of the historic range of the FCH remains unoccupied by caribou. Thus, availability of winter range is likely not limiting growth of the FCH. However, if the fire return interval becomes shorter or additional large areas of historic winter range burns, availability of winter range and changes in habitat use (and fire management options) should be more closely evaluated relative to herd population dynamics (Rupp et al. 2006).

The Pogo gold mine began operating in 2003 in the Goodpaster River drainage. This mine has had limited impact on the Fortymile herd, but concern remains focused on future activity. If additional roads for the Pogo mine reach to the upper Goodpaster River and Mount Harper area, careful access management will be required to ensure that the herd is not negatively impacted during calving and postcalving. Future access decisions have not been adequately addressed in the mine planning process.

Enhancement

No habitat enhancement efforts in the FCH range were initiated during RY10–RY12. However, the *Alaska Interagency Fire Management Plan* (Alaska Wildland Fire Coordinating Group 1998) limits suppression of wildfire where human resources are not at risk. Limited suppression should ensure a near-natural fire regime necessary for the long-term maintenance of caribou range in Interior Alaska.

One of the goals of the *Fortymile Caribou Management Plan* was to ensure adequate protection for the herd's range during and after recovery. Current habitat and development issues are mostly related to mining and military activities in calving and postcalving areas. The FCH is most sensitive to disturbance during calving and postcalving. Working with the mining community and the U.S. Air Force, we minimized the effects of mining exploration and low-flying military aircraft during calving and postcalving by maintaining a website that displayed the areas the herd was using. The website was updated when the herd distribution changed. The mining industry and military used this website during 1999–2013 to plan their activities away from the herd and have minimized their impacts during calving and postcalving.

The *Upper Yukon Area Plan* (Alaska Department of Natural Resources 2003) guided management of state lands within the FCH range during RY04–RY12. The plan gives adequate protection to the Fortymile herd throughout its range and strong protection for the calving and postcalving ranges.

NONREGULATORY MANAGEMENT PROBLEMS AND NEEDS

The *Fortymile Caribou Herd Management Plan* formally ended in May 2001. Two of the plan's objectives are ongoing: habitat protection and a public awareness program. Protecting caribou habitat and informing the public about herd status and consumptive and nonconsumptive use opportunities were essential components of the plan's goal to restore the FCH to its traditional range. It was also the plan's goal to promote healthy wildlife populations for their intrinsic value. Since April 2003, habitat protection of the FCH range in Alaska has been addressed through land use plans and agreements made with the mining industry and the military.

We have several ongoing public awareness projects. Highway informational signs were placed along the Taylor and Steese highways in summer 2004. The Fortymile caribou newsletter *The Comeback Trail* was produced by ADF&G during RY02, RY03, RY06, RY08 and RY10 and distributed to about 4,500 Alaska and Yukon residents, advisory committees, regional councils, state and federal management boards, and area schools. Additional public awareness programs would help ensure continued public support for the FCH. A cooperative state–federal program enhancing the viewing, education, and hunting opportunities of the FCH would benefit the herd and people interested in the herd.

CONCLUSIONS AND RECOMMENDATIONS

Because we were unable to complete a photo census during RY10–RY11 we are unable to conclude whether objective 1 was met. However, conservative harvest quotas, emergency orders to limit harvest, continued wolf predation control, and following guidelines in the FCH harvest plans (ADF&G 2006, Harvest Management Coalition 2012) likely combined to provide conditions favorable for growth. With a declining trend in calf weights and the 5-year moving average parturition rate of 3-year-old cows remaining close to 55% during RY10–RY12, we will continue to closely monitor indicators of nutritional condition during RY12–RY13 as recommended by Boertje et al. (2012). This information will be used to evaluate the herd's nutritional status and determine if continued herd growth is warranted.

During RY10, with an estimated population of 51,675 caribou, the FCH reached the lower end of the intensive management objective of 50,000–100,000 caribou (management objective 2).

Additional analysis will be needed to determine if the population objective was met in RY11–RY12 and will be completed during the next report period.

Harvest was managed following the guidelines in the 2006–2012 and 2012–2018 harvest plans. During RY10 the annual harvest quota was 795 caribou and in RY11–RY12 the annual quota was 1,000 in both years (including up to 25% cows in all years). We did not meet the intensive management harvest objective of 1,000–15,000 caribou (management objective 3) in RY10 (729 caribou harvested), but did meet the lower end of this objective in RY11, with a harvest of 1,084. Harvest levels allowed fall bull:cow ratios to remain above 40 bulls:100 cows during RY10–RY11, so management objective 4, to maintain an October bull:cow ratio of at least 35 bulls:100 cows was met.

Increases in population size have made the FCH one of the most accessible herds in the state, benefiting hunters and nonconsumptive users. This provide for increased caribou hunting, viewing, and other wildlife-related recreation in Alaska and Yukon.

The Pogo mine is expected to have limited impact on the Fortymile herd, but concern remains regarding future access decisions. This project will continue to be monitored during RY12–RY13. The *Alaska Interagency Fire Management Plan* (Alaska Wildland Fire Coordinating Group 1998) allowed for a near-natural fire regime within the FCH range in Alaska during RY10–RY11.

For the next report period, the management goals, objectives, and activities will remain the same. In addition, we plan to continue with the following activities:

- Work with research staff to refine nutrition indices to determine when the herd is becoming nutritionally stressed.
- Consult with research staff to explore future research needs for the Fortymile herd, including:
    - Monitor early-calf survival in years when wolf control objectives of the Upper Yukon Tanana Predator Control Program are met.
    - Improve understanding of how habitat in areas historically used for calving and insect relief influences calf survival and weight gain.
    - Monitor baseline condition of the FCH calving–summer range to help assess herd health.
    - Explore use of antler data to assess summer nutrition. Hunter reports could be used to collect main beam length and/or number of antler points for use in this analysis.
    - Explore the possibility of collecting biological samples from hunters to assess nutrition and age-structure of the population.

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Table 1. Fortymile caribou fall composition counts and population size, regulatory years 1985–1986 through 2012–2013.

Regulatory year	Date of composition count	Bulls: 100 Cows	Calves: 100 Cows	% Calves	% Cows	% Small bulls	% Medium bulls	% Large bulls	% Bulls	Composition sample size	Photo-census estimate[a]	Estimate of herd size
1985–1986	10/16/85	50	36	19	54	39	23	38	27	1,067	15,307	15,307[b]
1986–1987	10/13/86	36	28	17	61	35	24	41	22	1,381		
1987–1988	9/28/87	40	37	21	57	13	43	44	22	2,253	19,975	19,975[b]
1988–1989	10/2–3/88	38	30	18	59	29	41	30	23	1,295		
1989–1990	10/13/89	27	24	16	66	34	41	25	18	1,781	22,766	22,766[b]
1990–1991	9/27–28/90	44	29	17	58	42	39	19	26	1,742		
1991–1992	10/10/91	39	16	10	64	41	34	25	25	1,445	21,884	21,884[b]
1992–1993	9/26/92	48	30	17	56	37	36	27	27	2,530		
1993–1994	10/3/93	46	29	17	57	48	36	17	26	3,659	22,104	22,104[b]
1994–1995	9/30/94	44	27	19	57	45	33	22	24	2,990	22,558	22,558[b]
1995–1996	10/3/95	43	32	18	57	43	31	27	25	3,303	23,458	23,458[b]
1996–1997	9/30/96	41	36	20	57	46	31	23	23	4,582	25,910	25,910[b]
1997–1998	9/30/97	46	41	22	53	48	28	24	25	6,196	31,029	31,029[b]
1998–1999	9/29/98	40	38	21	56	49	27	24	23	4,322	33,110	33,110[b]
1999–2000	9/29/99	48	37	20	54	55	29	16	26	4,336	34,640	34,640[b]
2000–2001	10/01/00	45	27	16	58	48	28	24	26	6,512		35,900[c]
2001–2002	9/29/01	49	38	20	53	44	32	24	27	6,878		40,800[c]
2002–2003	9/28/02	43	39	21	55	42	28	30	24	6,088	43,375	43,375[b]
2003–2004	9/27/03	50	17	10	60	51	29	21	30	6,296		40,000–44,000[d]
2004–2005	9/28/04	45	28	16	59	31	37	32	25	4,157		40,000–44,000[d]
2005–2006	10/5/05	51	18	10	59	25	23	52	30	2,350		40,000–44,000[d]
2006–2007	10/5/06	43	34	19	57	27	29	44	24	4,995		43,837[e]
2007–2008	10/4/07	36	37	22	58	34	34	33	21	5,228		44,673[e]
2008–2009	10/7–8/08	37	33	19	59	30	43	27	22	4,119	46,510	46,510[b]
2009–2010	10/7/09	59	34	17	52	26	33	42	30	4,503	51,675	51,675[b]
2010–2011	10/2/10	43	32	18	58	27	31	41	24	7,169		--[f]
2011–2012	10/5/11	42	25	15	60	21	42	37	25	3,949		--[f]
2012–2013	10/9/12	40	22	13	62	19	40	41	25	4,832		--[f]

[a] Number yearling, adults, and a portion of the calves counted during photocensus between mid June of the current regulatory year to early July of the following regulatory year. Census counts were not conducted in regulatory years 2000–2001, 2001–2002, 2003–2004 to 2005–2006, 2007–2008, and 2010–2011 to 2012–2013 because caribou were too scattered or visual conditions were inadequate.

[b] Herd estimates were the result of the summer censuses, and population models were used to derive total estimates. Population estimate for mid-June of the current regulatory year to early July of the following regulatory year.
[c] Herd estimates were derived from population models using data from summer census counts, fall composition counts, spring parturition surveys and monthly mortality surveys of collared caribou. Population estimate for 15 May of the current regulatory year.
[d] Based on summer 2009 and 2010 photo census results, the population estimates for regulatory years 2003–2004 through 2005–2006 were revised. While the herd likely experienced some level of fluctuation during this period, it likely remained relatively stable ranging 40,000–44,000 during regulatory years 2003–2004 to 2005–2006. This is based on below average fall calf:cow ratios (17:100 in 2003 and 18:100 in 2005), spring parturition rates (68% in 2003, 77% in 2005 and 80% in 2006) and over winter calf survival (56% [*n* = 16]) during winter 2004–2005.
[e] Average interpolations of herd size, because herd size was not estimated.
[f] modeled population estimates not yet developed.

Table 2. Fortymile caribou parturition rates of known-age radiocollared females, 1993–2013.

Year	Survey Date	3-year-olds[a]	(%)	4-year-olds[a]	(%)	≥5-years-old[a]	(%)	All cows ≥3-years-old[a]	(%)
1993	11 May–3 Jun[b]	4/9	(44)	1/1	(100)	27/37	(73)	32/47	(68)
1994	11 May–7 Jun[b]	5/6	(83)	4/6	(67)	28/33	(85)	37/45	(82)
1995	11–19 May[b]	5/7	(71)	2/3	(67)	28/31	(90)	35/41	(85)
1996	12–21 May[b]	9/9	(100)	5/5	(100)	24/25	(96)	38/39	(97)
1997	10–20 May[b]	6/6	(100)	7/8	(88)	26/32	(81)	39/46	(85)
1998	10–19 May[b]	9/9	(100)	6/6	(100)	32/33	(97)	47/48	(98)
1999	11–19 May[b]	10/12	(83)	9/9	(100)	40/47	(85)	59/68	(87)
2000	12–20 May[b]	8/9	(89)	11/13	(85)	37/40	(93)	55/61	(90)
2001	13–21 May[b]	7/10	(70)	6/7	(86)	37/40	(93)	50/57	(88)
2002	11–19 May[b]	6/7	(86)	10/10	(100)	34/36	(94)	50/53	(94)
2003	12–23 May[c]	9/11	(82)	1/7	(14)	26/35	(74)	36/53	(68)
2004	14–27 May[c]	4/7	(57)	9/9	(100)	28/31	(90)	41/47	(87)
2005	12–22 May[c]	2/6	(33)	7/7	(100)	21/26	(81)	30/39	(77)
2006	14–22 May[c]	9/11	(82)	6/6	(100)	34/44	(77)	49/61	(80)
2007	11–27 May[c]	5/6	(83)	10/10	(100)	40/45	(89)	55/61	(90)
2008	11–26 May[c]	7/8	(88)	3/5	(60)	43/46	(93)	53/59	(90)
2009	12–24 May[c]	3/10	(30)	5/7	(71)	31/40	(78)	39/57	(68)
2010	11–28 May[c]	2/7	(29)	8/10	(80)	33/43	(77)	43/60	(72)
2011	14–27 May[c]	2/3	(67)	5/7	(71)	42/48	(88)	63/73	(86)
2012	12–23 May[c]	8/13	(62)	1/2	(50)	41/45	(91)	58/71	(82)
2013	14–27 May[c]	15/18	(83)	12/13	(92)	38/44	(86)	71/81	(88)

[a]Number of radiocollared cows with calf + radiocollared cows with no calf, but with hard antler or udder divided by number of radiocollared cows observed.
[b]Near daily flights were flown during this period in conjunction with a calf mortality research project.
[c]Three to 4 flights were conducted during this period.

Table 3. Fortymile caribou fall 4-month-old female calf weights, 1990–2012.

Year	Capture Dates	Average weight in kg (lb)[a]	*n*
1990	25–27 Sep	52.8 (116.3)	14
1991	21–22 Oct	53.9 (118.9)	14
1992	29-30 Sep	55.1 (121.5)	14
1993	4 Oct	56.1 (123.8)	15
1994	1 Oct	54.5 (120.0)	14
1995	29 Sep	56.7 (125.0)	15
1996	29 Sep–1 Oct	54.7 (120.7)	14
1997	29-30 Sept	59.3 (130.7)	15
1998	26 Sept	53.0 (116.9)	17
1999	30 Sept	54.7 (120.5)	15
2000	2 Oct	56.7 (125.0)	15
2001	26 Sept	54.1 (119.3)	17
2002	29 Sept	52.0 (114.7)	15
2003	26-27 Sept	51.1 (112.6)	18
2004	28-29 Sept	53.7 (118.3)	16
2005	24-25 Sept	51.4 (113.4)	16
2006	1-3 Oct	54.4 (119.8)	14
2007	27 Sep	53.9 (118.8)	15
2008	6–7 Oct	47.4 (104.6)	15
2009	8–9 Oct	48.8 (107.5)	18
2010	8–9 Oct	54.7 (120.7)	18
2011	8–9 Oct	50.6 (111.6)	26
2012	8–9 Oct	50.5 (111.4)	25

[a] Weight without radio collar.

Table 4. Fortymile caribou seasons and bag limits managed as joint state–federal registration permit hunts, regulatory years 2010–2011 and 2012–2013.

	Zones 1[a]		Zone 2[a]		Zone 3[a]		Zone 4[a]	
Regulatory year	State Season/Bag limit	Federal[a] Season/Bag limit	State Season/Bag limit	Federal[a] Season/Bag limit	State Season/Bag limit	Federal[a] Season/Bag limit	State Season/Bag limit	Federal[a] Season/Bag limit
2010–2011 through 2011–2012								
RESIDENT:	29 Aug–30 Sep 1 bull.	10 Aug–30 Sep 1 bull.	10 Aug–30 Sep 1 bull.	10 Aug–30 Sep 1 bull.	29 Aug–30 Sep 1 bull.	10 Aug–30 Sep 1 bull.	10 Aug–30 Sep 1 bull.	10 Aug–30 Sep 1 bull.
	1 Dec–28 Feb 1 caribou.	1 Nov–28 Feb 1 caribou.	1 Dec–28 Feb 1 caribou	1 Nov–28 Feb 1 caribou.	1 Dec–28 Feb 1 caribou.	1 Nov–28 Feb 1 caribou.	1 Dec–28 Feb 1 caribou.	1 Nov–28 Feb 1 caribou.
NONRESIDENT:	29 Aug–20 Sep 1 bull.	No open season	10 Aug–20 Sep 1 bull.	No open season	29 Aug–20 Sep 1 bull.	No open season	10 Aug–20 Sep 1 bull.	No open season
2012–2013								
RESIDENT:	29 Aug–30 Sep 1 bull.	10 Aug–30 Sep 1 bull.	10 Aug–30 Sep 1 bull.	10 Aug–30 Sep 1 bull.	29 Aug–30 Sep 1 bull.	10 Aug–30 Sep 1 bull.	10 Aug–30 Sep 1 bull.	10 Aug–30 Sep 1 bull.
	1 Dec–31 Mar 1 caribou.	1 Nov–31 Mar 1 caribou.	1 Dec–31 Mar 1 caribou	1 Nov–31 Mar 1 caribou.	1 Dec–31 Mar 1 caribou.	1 Nov–31 Mar 1 caribou.	1 Dec–31 Mar 1 caribou.	1 Nov–31 Mar 1 caribou.
NONRESIDENT:	29 Aug–20 Sep 1 bull.	No open season	10 Aug–20 Sep 1 bull.	No open season	29 Aug–20 Sep 1 bull.	No open season	10 Aug–20 Sep 1 bull.	No open season

[a] Zone descriptions are in Appendix A.
[b] Federal subsistence hunters are residents who live in communities or units in rural areas defined by the Federal Subsistence Board. Definition of who qualifies as a Fortymile caribou federal subsistence user differs among units: In Unit 20E the definition includes rural residents of Unit 12 (north of Wrangell–St Elias National Park and Preserve), Unit 20D, and Unit 20E, whereas in Unit 25C eligible federal subsistence users are all rural residents in the state.

Table 5. Emergency orders issued during regulatory years 2010–2011 through 2012–2013.

Regulatory year	Effective date	Emergency order number	Permit hunt and area affected	Action taken/reason
2010–2011	29 Aug 2010	03-03-10	RC860 accessible from the Steese Highway and Chena Hot Springs Road in Units 20B and 25C.	Close area early to prevent over harvest.
2010–2011	4 Sep 2010	03-04-10	RC860 accessible from the Steese Highway and Chena Hot Springs Road in Units 20B and 25C.	Open area previously closed for 27 days.
2010–2011	30 Nov 2010	03-05-10	RC867 accessible from the Steese Highway and Chena Hot Springs Road in Units 20B and 25C and in part of the area accessible from the Taylor Highway in Unit 20E.	Close area early to prevent over harvest. Prevent Nelchina caribou harvest.
2010–2011	5 Jan 2011	03-01-11	RC867 accessible from the Steese Highway in Units 20B and 25C.	Delay opening to prevent over harvest.
2010–2011	10 Feb 2011	03-04-11	RC867 accessible from the Steese Highway in Units 20B and 25C.	Open area previously closed for 2 days.
2010–2011	19 Feb 2011	03-05-11	RC867 accessible from the Steese Highway in Units 20B and 25C.	Open area previously closed for 10 days.
2010–2011	5 Mar 2011	03-06-11	RC867 accessible from the Steese Highway in Units 20B and 25C and from the Taylor Highway in Unit 20E.	Open area previously closed for 27 days.
2011–2012	2 Sep 2011	03-09-11	RC860 accessible from the Steese Highway and Chena Hot Springs Road in Units 20B and 25C and from the Taylor Highway in Unit 20E.	Close area early. Quota met.

Regulatory year	Effective date	Emergency order number	Permit hunt and area affected	Action taken/reason
2011–2012	1 Dec 2011	03-12-11	RC867 accessible from the Steese Highway in Units 20B and 25C and from the Taylor Highway in Unit 20E.	Close area early to prevent over harvest. Prevent Nelchina caribou harvest.
2011–2012	1 Dec 2011	03-13-11	RC867 accessible from the Taylor Highway in Unit 20E.	Closed area early. Prevent Nelchina caribou harvest and quota met.
2012–2013	29 Aug 2012	03-06-12	RC860 accessible from the Steese Highway and Chena Hot Springs Road in Units 20B and 25C.	Closed area early. Quota met.
2012–2013	2 Sep 2012	03-07-12	RC860 accessible from the Taylor Highway and Chena Hot Springs Road in Unit 20E.	Closed area early. Quota met.
2012–2013	30 Nov 2012	03-08-12	RC867 and RC999 accessible from the Steese Highway in Units 20B and 25C.	Close area of RC867 early to prevent over harvest and open RC999 limited registration hunt.
2012–2013	12 Jan 2013	03-02-13	RC867 accessible from the Steese Highway and Chena Hot Springs Road in Units 20B and 25C.	Closed area early. Quota met.

Table 6. Reported Fortymile caribou harvest by joint state–federal registration permit, regulatory years 2002–2003 through 2012–2013[a].

Regulatory Year	Permits issued	Did not hunt (%)	Did not report (%)	Total hunted	Successful hunters (%)	Unsuccessful hunters (%)	Harvest			Total reported harvest	Harvest quota	
							Bulls	Cows	Unk		cows	total
2002–2003[b]	4,155	1,397 (34)	138 (3)	2,620 (63)	860[c] (33)	1,760 (67)	663	185	12	860	235	950
2003–2004[b]	5,718	2,135 (37)	143 (3)	3,440 (60)	799[d] (23)	2,641 (77)	612	181	6	799	210	850
2004–2005[e]	4,217	1,540 (37)	180 (4)	2,497 (59)	846[f] (34)	1,651 (66)	592	243	11	846	210	850
2005–2006[e]	4,438	1,786 (40)	169 (4)	2,483 (56)	741[g] (30)	1,742 (70)	557	182	2	741	210	850
2006–2007[e]	3,975	1,295 (33)	75 (2)	2,605 (66)	852[h] (33)	1,753 (67)	601	247	4	852	210	850
2007–2008[e]	4,576	1,361 (30)	33 (1)	3,182 (70)	1,012[i] (32)	2,170 (68)	746	262	4	1,012	210	850
2008–2009[e]	3,582[j]	1,078 (30)	9 (1)	2,471 (69)	913[k] (37)	1,558 (63)	681	217	15	913	210	850
2009–2010[e]	2,765[j]	736 (27)	7 (1)	2,018 (73)	1,083[l] (54)	935 (46)	881	192	10	1,083	210	850
2010–2011[e]	5,113	1,930 (38)	64 (1)	3,119 (61)	725[m] (23)	2,394 (77)	630	89	6	725	200	795
2011–2012[e]	3,771	1,495 (40)	56 (1)	2,220 (59)	1,066[n] (48)	1,154 (52)	935	125	6	1,066	250	1,000
2012–2013[e]	4,701	1,748 (37)	131 (3)	2,822 (60)	1,297[o] (46)	1,525 (54)	1,081	190	26	1,297	250	1,000

[a] Data from RC860, RC863, RC865, RC866 and RC867 harvest reports.
[b] Includes RC863, RC865, RC866 and RC867.
[c] An additional 16 hunters reported harvesting Fortymile caribou on general harvest reports.
[d] An additional 15 hunters reported harvesting Fortymile caribou on general harvest reports.
[e] Includes RC860 and RC867.
[f] An additional 12 hunters reported harvesting Fortymile caribou on general harvest reports.
[g] An additional 4 hunters reported harvesting Fortymile caribou on general harvest reports.
[h] An additional 12 hunters reported harvesting Fortymile caribou on general harvest reports.
[I] An additional 20 hunters reported harvesting Fortymile caribou on general harvest reports.
[j] Differences in permits issued and the sum of did not hunt + FTR + total hunted is due to individual hunters obtaining multiple permits during the same season.
[k] An additional 9 hunters reported harvesting Fortymile caribou on general harvest reports.
[l] An additional 11 hunters reported harvesting Fortymile caribou on general harvest reports.
[m] An additional 4 hunters reported harvesting Fortymile caribou on general harvest reports.
[n] An additional 18 hunters reported harvesting Fortymile caribou on general harvest reports.
[o] An additional 9 hunters reported harvesting Fortymile caribou on general harvest reports.

Table 7. Fortymile caribou harvest, regulatory years 2002–2003 through 2012–2013.

Regulatory year	Reported on registration permit[ab]				Reported on general harvest report	Estimated			Yukon harvest	Total
	M	F	Unk	Total		Unreported	Illegal	Total		
2002–2003	663	185	12	860	16	5	5	10	1	887
2003–2004	612	181	6	799	15	5	5	10	0	824
2004–2005	592	243	11	846	12	5	5	10	0	868
2005–2006	557	182	2	741	4	5	5	10	0	755
2006–2007	601	247	4	852	12	5	5	10	0	874
2007–2008	746	262	4	1,012	20	5	5	10	0	1,042
2008–2009	681	217	0	898	9	5	5	10	0	917
2009–2010	881	192	10	1,083	11	5	5	10	0	1,104
2010–2011	630	89	6	725	4	5	5	10	15	754
2011–2012	935	125	6	1066	18	5	5	10	15	1,109
2012–2013	1,081	190	26	1297	9	5	5	10	15	1,331

[a] Data from RC863, RC865, RC866 and RC867 harvest reports in RY02–RY03.
[b] Data from RC860 and RC867 harvest reports in RY04–RY09.

Table 8. Fortymile caribou hunter residency and success of hunters who reported residency, regulatory years 2002–2003 through 2012–2013[a].

Regulatory year	Successful: Local[b] resident	Successful: Non-local resident	Successful: Non-resident	Successful: Unknown residency	Successful: Total	Successful: (%)	Unsuccessful: Local[b] resident	Unsuccessful: Non-local resident	Unsuccessful: Non-resident	Unsuccessful: Unknown residency	Unsuccessful: Total	Unsuccessful: (%)	Unknown success	Total hunters
2002–2003	182	616	57	5	860	(33)	225	1,402	124	5	1,756	(67)	4	2,620
2003–2004	102	609	85	3	799	(23)	226	2,235	163	3	2,627	(77)	14	3,440
2004–2005	109	660	77	0	846	(34)	155	1,375	110	1	1,641	(66)	9	2,496
2005–2006	133	539	68	1	741	(30)	169	1,458	114	0	1,741	(70)	3	2,485
2006–2007	141	623	88	0	852	(33)	203	1,431	118	0	1,752	(67)	1	2,605
2007–2008	119	779	114	0	1,012	(32)	269	1,791	110	0	2,170	(68)	0	3,182
2008–2009	87	713	122	0	922	(36)	215	1,329	70	0	1,614	(64)	0	2,536
2009–2010	111	881	103	1	1,096	(53)	153	751	84	0	988	(47)	4	2,088
2010–2011	112	531	82	0	725	(23)	212	2,048	134	0	2,394	(77)	0	3,119
2011–2012	190	751	125	0	1,066	(48)	175	913	65	0	1,153	(52)	0	2,219
2012–2013	96	1,043	162	3	1,304	(45)	232	1,275	116	0	1,623	(55)	0	2,927

[a] Data from RC860, RC863, RC865, RC866 and RC867 harvest reports and general season harvest reports for the Fortymile caribou herd.
[b] Residents of Unit 12 north of Wrangell–St Elias, Unit 20E, Unit 20D, and residents of Circle and Central in Unit 25C.

Table 9. Fortymile caribou autumn harvest by month/day, regulatory years 2002–2003 through 2012–2013[a].

Regulatory year	8/10–8/16	(%)	8/17–8/23	(%)	8/24–8/30	(%)	8/31–9/6	(%)	9/7–9/13	(%)	9/14–9/20	(%)	9/21–9/27	(%)	9/28–9/30	(%)	*n*
2002–2003	146	(23)	75	(12)	133	(21)	251	(39)	11	(2)	15	(2)	9	(1)	6	(1)	646
2003–2004	110	(21)	77	(14)	92	(17)	84	(16)	42	(8)	126	(24)	3	(1)	0	(0)	534
2004–2005	129	(24)	80	(15)	126	(24)	87	(17)	47	(9)	51	(10)	4	(1)	3	(1)	527
2005–2006	272	(57)	85	(18)	41	(9)	46	(10)	26	(5)	4	(1)	1	(<1)	0	(0)	475
2006–2007	336	(70)	38	(8)	33	(7)	36	(8)	19	(4)	15	(3)	2	(<1)	1	(<1)	480
2007–2008	444	(74)	24	(4)	18	(3)	44	(7)	38	(6)	18	(3)	3	(1)	10	(2)	599
2008–2009	519	(72)	25	(4)	36	(5)	49	(8)	44	(6)	33	(5)	1	(1)	0	(0)	707
2009–2010	888	(84)	19	(2)	30	(3)	36	(3)	42	(4)	38	(4)	0	(0)	0	(0)	1,053
2010–2011	29	(6)	16	(4)	236	(51)	61	(13)	49	(11)	29	(6)	33	(7)	7	(2)	460
2011–2012	27	(3)	29	(3)	503	(59)	220	(26)	20	(2)	36	(4)	7	(1)	3	(1)	852
2012–2013	32	(3)	29	(3)	673	(67)	228	(23)	18	(2)	16	(2)	1	(1)	6	(1)	1,003

[a] Data from RC860, RC863, RC865 and RC866 harvest reports for the Fortymile caribou herd that indicated a harvest date.

Table 10. Fortymile caribou winter harvest by month/day, regulatory years 2002–2003 through 2012–2013[a].

Regulatory year	Harvest by month/day 11/1–11/16 (%)	11/17–11/30 (%)	12/1–12/15 (%)	12/16–12/31 (%)	1/1–1/15 (%)	1/16–1/31 (%)	2/1–2/15 (%)	2/16–2/28 (%)	Total
2002–2003[b]	4 (2)	7 (3)	183 (91)	1 (1)	1 (1)	5 (2)	0 (0)	0 (0)	201
2003–2004[b]	30 (12)	6 (2)	199 (82)	7 (3)	0 (0)	0 (0)	0 (0)	0 (0)	242
2004–2005[b]	23 (7)	21 (7)	224 (72)	24 (8)	4 (1)	1 (<1)	0 (0)	12 (4)	309
2005–2006[b]	68 (26)	5 (2)	42 (16)	42 (16)	33 (13)	19 (7)	17 (6)	38 (14)	264
2006–2007[b]	63 (17)	27 (7)	279 (75)	0 (0)	0 (0)	0 (0)	0 (0)	1 (<1)	370
2007–2008[b]	48 (12)	15 (4)	342 (84)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	405
2008–2009[b]	23 (12)	16 (8)	156 (79)	0 (0)	0 (0)	0 (0)	1 (1)	0 (0)	196
2009–2010[b]	10 (38)	14 (54)	1 (4)	0 (0)	0 (0)	0 (0)	1 (4)	0 (0)	26
2010–2011[b]	1 (1)	0 (0)	5 (2)	14 (5)	65 (25)	28 (11)	57 (22)	52 (20)	265[c]
2011–2012[b]	0 (0)	21 (10)	95 (44)	39 (18)	7 (3)	0 (0)	36 (17)	16 (7)	214
2012–2013[b]	10 (3)	6 (2)	47 (16)	52 (18)	125 (43)	12 (4)	13 (4)	2 (1)	294[d]

[a] Data from RC867 harvest reports for the Fortymile caribou herd that indicated a harvest date.
[b] Caribou harvested in November, were taken by federally qualified hunters, hunting on federal land only, under federal subsistence regulations.
[c] An additional 43 caribou (16% of total winter harvest) were harvested in March during a season extension opened by Emergency Order.
[d] An additional 27 caribou (9% of total winter harvest) were harvested in March. The march portion of the season was added by the BOG during their spring 2012 meeting.

Table 11. Fortymile caribou harvest by transport method, regulatory years 2002–2003 through 2012–2013[a].

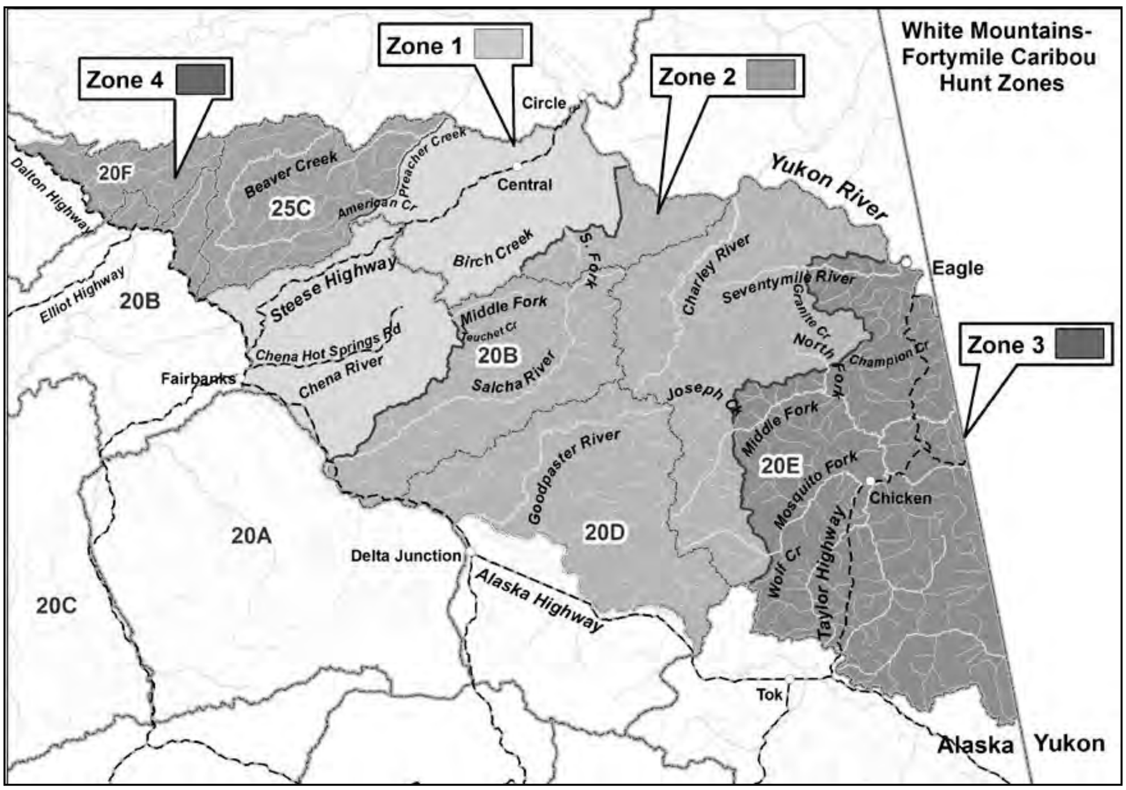
Regulatory year	Airplane (%)	Horse (%)	Boat/Airboat (%)	3- or 4-Wheeler (%)	Snowmachine (%)	ORV (%)	Highway vehicle (%)	Walking (%)	Unk (%)	Total
	Harvest by transport method									
2002–2003	64 (7)	0 (0)	26 (3)	341 (40)	132 (15)	36 (4)	229 (27)	2 (<1)	30 (3)	860
2003–2004	103 (13)	0 (0)	47 (6)	276 (35)	158 (20)	34 (4)	116 (15)	44 (6)	21 (3)	799
2004–2005	69 (8)	1 (<1)	43 (5)	319 (38)	199 (24)	34 (4)	135 (16)	12 (1)	34 (4)	846
2005–2006	75 (10)	1 (<1)	63 (9)	274 (37)	97 (13)	58 (8)	164 (22)	4 (1)	5 (1)	741
2006–2007	83 (10)	5 (1)	45 (5)	303 (36)	232 (27)	26 (3)	136 (16)	6 (1)	16 (2)	852
2007–2008	102 (10)	3 (<1)	39 (4)	376 (37)	288 (28)	37 (4)	148 (15)	7 (1)	12 (1)	1,012
2008–2009	135 (15)	0 (0)	55 (6)	409 (45)	137 (15)	29 (3)	114 (12)	18 (2)	16 (2)	913
2009–2010	106 (10)	8 (<1)	50 (5)	670 (62)	5 (<1)	69 (6)	145 (13)	17 (2)	13 (1)	1,083
2010–2011	116 (16)	0 (0)	18 (3)	246 (34)	156 (22)	21 (3)	141 (19)	12 (2)	15 (2)	725
2011–2012	107 (10)	0 (0)	29 (3)	480 (45)	166 (16)	30 (3)	224 (21)	12 (1)	18 (2)	1,066
2012–2013	130 (10)	0 (0)	29 (2)	635 (49)	211 (16)	47 (4)	191 (15)	14 (1)	40 (3)	1,297

[a] Data from RC860, RC863, RC865, RC866, and RC867 harvest reports for the Fortymile caribou herd.

APPENDIX A.

HUNT ZONE MAP AND DESCRIPTIONS.

Fortymile Caribou Herd (FCH) harvest is managed so that hunters in different parts of the herd's range all have hunting opportunity. To accomplish this, the Fortymile Caribou Herd Harvest Plan 2006–2012 (Alaska Department of Fish and Game 2006) and 2012–2018 (Harvest Management Coalition 2012) combine portions of Game Management Units (Units) 20B, 20D, 20E, 20F, and 25C into hunt zones for purposes of hunting the FCH. State of Alaska hunting seasons and bag limits are based on these zones, which are intended to help manage and distribute FCH harvest. Federal seasons are managed by units, not zones. Federal lands used for harvest of FCH are in Units 25C and 20E and 20F.



Zone 1

Unit 20B, that portion within the Chatanika River drainage north and east of the Steese Highway, and that portion south and east of the Steese Highway, except the middle fork of the Chena River drainage upstream from and including the Teuchet Creek drainage and except the Salcha River drainage.

Unit 25C, that portion east of the east bank of the mainstem of Preacher Creek to its confluence with American Creek, then east of the east bank of American Creek, excluding that portion within the drainage of the south fork of Birch Creek and excluding that portion within the Yukon–Charley Rivers National Preserve.

Zone 2

Unit 20B, that portion south and east of the Steese Highway within the middle fork of the Chena River drainage upstream from and including the Teuchet Creek drainage and the Salcha River drainage.

Unit 20D, that portion north of the south bank of the Tanana River.

Unit 20E, that portion within the Charley River drainage, the Seventymile River drainage upstream from and including the Granite Creek drainage, the North Fork Fortymile River drainage upstream from, but not including the Champion Creek drainage, the Middle Fork Fortymile River drainage upstream from and including the Joseph Creek drainage, the Mosquito Fork of the Fortymile River drainage upstream from and including the Wolf Creek drainage, and the drainages flowing into the Yukon River downstream from the confluence of the Seventymile and Yukon rivers.

Unit 25C, that portion within the drainage of South Fork Birch Creek and that portion within the Yukon–Charley Rivers National Preserve.

Zone 3

Unit 20E, remainder (the road and trail accessible portion of the herd's range in the vicinity of the Taylor Highway).

Zone 4

Unit 20B and Unit 20F those portions north and west of the Steese Highway, north and east of the Elliot Highway to its intersection with the Dalton Highway, then east of the Dalton Highway and south of the Yukon River, excluding the Chatanika River drainage.

Unit 25C, that portion west of the east bank of the mainstem of Preacher Creek to its confluence with American Creek, then west of the east bank of American Creek.

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CARIBOU MANAGEMENT REPORT

From: 1 July 2010
To: 30 June 2012[1]

LOCATION

GAME MANAGEMENT UNITS: Portions of: 20F, 21B, 21C, 21D, 24A, 24B, and 25D (9,980 mi^2)[2]

HERDS: Galena Mountain, Ray Mountains, Wolf Mountain, Hodzana Hills

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

BACKGROUND

Named for their distinct calving areas, the Galena Mountain, Wolf Mountain, Ray Mountains, and Hodzana Hills caribou herds occur north of the Yukon River in the Kokrines Hills, Ray Mountains, and Hodzana Hills. Galena Mountain is northeast of Galena and west of the Melozitna River. The Galena Mountain herd (less than 150 animals) typically calves east of Galena Mountain and winters west of the mountain. The Wolf Mountain herd (300–500 animals) calves and winters to the north and east of Wolf Mountain in the Melozitna and Little Melozitna River drainages. The Wolf Mountain herd and a portion of the Galena Mountain herd are occasionally sympatric on a portion of their ranges near Black Sand Creek in Unit 21C during calving season. The Ray Mountains herd (1,200–1,500 animals) calves in the Ray Mountains around Kilo Hot Springs and winters to the north in the Kanuti and Kilolitna River area, and to a lesser degree in the Tozitna drainage to the south.

Small groups of caribou in the Hodzana Hills, northeast of the Ray Mountains, were previously considered part of the Ray Mountains herd. Since 2003, efforts have been made by the Alaska Department of Fish and Game (ADF&G) and federal Bureau of Land Management (BLM) to gather better information about this group of caribou, now known as the Hodzana Hills caribou herd (Hollis 2007). The Hodzana Hills herd (700–1,000 animals) resides and calves mainly in the hills at the headwaters of the Dall, Kanuti, and Hodzana rivers.

The origin of these herds is unknown. Some residents speculated they were reindeer from a commercial operation in the Kokrines Hills that ended around 1935. However, evidence suggests

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[1] At the discretion of the reporting biologist, this unit report may contain data collected outside the report period.

[2] Area reflects estimates of annual herd ranges, not entire Game Management Units

these animals are caribou because 1) reindeer physical characteristics are not apparent, 2) reindeer alleles were not found when tested (Cronin et al. 1995), and 3) reindeer calve earlier than these 3 caribou herds (Saperstein 1997; Jandt 1998). Traditional ecological knowledge suggests that these herds are simply relict populations of once vast herds that migrated across western Alaska. Recent genetic analyses of these herds provides mixed support for this idea with some evidence that Galena Mountain and Wolf Mountain herds are distinct, although based on small sample sizes (Mager 2012).

These caribou herds are rarely hunted because they are relatively inaccessible during the hunting season, and few people outside the local area are aware of them. The combined average of reported and known unreported harvest from all 4 herds since 1991 was <10 caribou per year. All seasons were closed in the area of the Galena Mountain caribou herd beginning in regulatory year (RY) 2004 (RY = 1 July–30 June; e.g., RY04 = 1 July 2004–30 June 2005) due to declines observed in that herd (Table 1).

MANAGEMENT DIRECTION

MANAGEMENT GOALS

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

MANAGEMENT OBJECTIVES

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

METHODS

Caribou from these herds are monitored through cooperative radiotelemetry studies by ADF&G, U.S. Fish and Wildlife Service, and BLM. Radio collars placed on cows and short yearlings are used to locate the herds for composition counts, locate calving areas, and delineate seasonal ranges. The number of radiocollared caribou varies. During RY10–RY11 there were 10 active radio collars in the Galena Mountain herd, 10 in the Wolf Mountain herd, 8 in the Ray Mountains herd, and 9 in the Hodzana Hills herd.

Aerial surveys of the Galena and Wolf Mountain herds are difficult during fall and winter due to small group size and poor sightability in the dense black spruce forests where they occur. Similarly, fall aerial surveys of the Ray Mountains and Hodzana Hills herds are difficult due to frequent fog, clouds, and high winds.

Aerial surveys are typically conducted with helicopters (Robinson R-44) and fixed-wing aircraft (Piper PA-18 or Bellanca Scout) following techniques outlined by Eagan (1993). During RY10–RY11 fixed-wing aircraft were used in surveys for all 4 herds. In the Wolf Mountain herd we have had some success in estimating composition from fixed-wing aircraft by taking high-quality digital photographs of congregated groups and classifying each caribou from the photos. Herd size estimates during RY10–RY11 were obtained using methods similar to the direct count aerial photocensus technique (Valkenburg et al. 1985) using digital photographs taken from fixed-wing aircraft.

We monitored hunting mortality using hunter harvest reports, and adjusted those results to account for a small amount of unreported harvest. Harvest reports submitted by hunters were entered into the statewide harvest database. These data were summarized for each regulatory year, and included total harvest, harvest location, hunter residency and success, harvest chronology, and the types of transportation used. Harvest data were summarized by regulatory year.

RESULTS AND DISCUSSION

POPULATION STATUS AND TREND

Population Size

Galena Mountain Herd. The Galena Mountain herd has been difficult to census comprehensively, but the population probably declined from 250–500 prior to RY02 to less than 125 caribou by RY05. The highest number of caribou seen during RY10–RY11 was 147 animals in February 2012 (Table 1). The population probably declined because of predation and movement from the Galena Mountain herd to the Wolf Mountain herd (Stout 2001). Because these caribou reside in dense black spruce forests it can be expected that counts will be variable due to poor sightability. The Galena Mountain herd has had radiocollared animals since 1991. We found that radiocollaring more caribou did not increase the number of caribou found during fall surveys, but did demonstrate that during the rut caribou occupy dense black spruce habitat where sightability is low (Stout 2001). Conducting surveys in winter or during postcalving aggregations appears to provide the best estimates of population size for this herd. Regardless, it appears the Galena Mountain herd is declining to a point where recovery is unlikely without substantial management intervention or infusion of caribou from another herd.

Wolf Mountain Herd. The first comprehensive fall composition survey of the Wolf Mountain herd was in October 1995, when 346 caribou were counted. We counted 368 caribou in June 2010 and 462 caribou in June 2011 (Table 2). Since the Wolf Mountain herd is widely dispersed most of the year, surveys during summer or postcalving aggregations appear to provide the best estimates of population size for this herd.

Ray Mountains Herd. The Ray Mountains herd was first thoroughly surveyed by ADF&G and BLM in fall 1983 when 400 caribou were counted. Surveys were regularly conducted during the 1990s and 2000s (Table 3). We counted 1,060 caribou in February 2010 and 1,213 caribou in July 2011.

Hodzana Hills Herd. For many years, small groups of caribou northeast of the Ray Mountains were considered part of the Ray Mountains herd. Efforts since 2003 by ADF&G and BLM to gain better information on these animals included radiocollaring caribou east of the Dalton Highway in the Hodzana Hills. September composition counts yielded 880 caribou in 2008 and

775 in 2009 (Table 4). No thorough surveys were conducted on the Hodzana Hills herd during RY10–RY11.

Population Composition

During RY10–RY11, comprehensive composition data were not collected on Galena Mountain, Wolf Mountain, Ray Mountains or Hodzana Hills herds. However, opportunistic composition data were collected during radiotracking flights on the Galena Mountain herd (Table 1).

Distribution and Movements

<u>Galena Mountain Herd</u>. Seasonal movements of the Galena Mountain herd during RY10–RY11 were likely consistent with movement information from earlier investigations of those herds (Stout 2001). Galena Mountain caribou usually migrate toward alpine areas east of Galena Mountain in April and calve on the alpine slopes of the southern Kokrines Hills in Unit 21C. From June to September most caribou are in alpine areas west of the Melozitna River. A few bulls have been seen along the Yukon River and north of Galena in September. During October these caribou migrate from alpine areas across Galena Mountain toward the Holtnakatna Hills and Hozatka Lakes in Unit 21D, where they winter.

<u>Wolf Mountain Herd</u>. Based on composition surveys and radiotracking flights, the seasonal movements of the Wolf Mountain herd during RY10–RY11 appeared consistent with previous observations (Stout 2001). A general migration pattern for the Wolf Mountain herd was surmised based on tracks observed during surveys in the early 1980s (Stout 2003). This pattern was confirmed and detailed through radiotracking studies (Stout 2003). The herd calved on the south-facing slopes of the Kokrines Hills south of Wolf Mountain in Unit 21C, spent most of the summer in the surrounding alpine habitat near Wolf Mountain, then moved northward toward Lost Lake on the Melozitna River in October. Generally, the Wolf Mountain herd can be found on or around Wolf Mountain, in the Kokrines Hills, in the Hot Springs Creek drainage, or in the Melozitna River drainage downstream from Lost Lake (Stout 2003).

<u>Ray Mountains Herd</u>. The limited radiotracking data collected during RY10–RY11 showed no deviation in locations of Ray Mountains caribou from that observed in previous investigations. Prior to October 1994 there were no radiocollared caribou in the Ray Mountains, and movements of the herd were not well known. Robinson (1988) found caribou north of the Ray Mountains and in the upper Tozitna River drainage in Unit 20F. Based on the trails found, he suspected this herd made seasonal migrations between the 2 areas. During late October 1991, several hundred caribou were seen along the Dalton Highway near Old Man. In March 1992 groups of 10–20 bulls were regularly seen near Sithylemenkat Lake and 200 caribou were seen in the Kanuti Lake area in Unit 24B.

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

Hodzana Hills Herd. Since 2003, caribou that reside in the Hodzana Hills typically have been found in the headwaters of the Hodzana, Dall, and Kanuti rivers on the border of Units 24A and 25D. In October 2006 these caribou were found in the upper Hodzana River, with a few groups south of Caribou Mountain on the west side of the Dalton Highway. Radiotracking data obtained during 2007–2012 confirm that these areas are within the range of the Hodzana Hills herd (ADF&G, BLM unpublished data, Fairbanks). In the past, caribou seen along the Dalton Highway near Finger Mountain were thought to be Ray Mountains caribou. Today, we consider these animals to be Hodzana Hills caribou.

MORTALITY

Harvest

Some areas covered by this report, particularly Units 24 and 21D north of the Yukon River and west of the trans-Alaska pipeline, are seasonally occupied by caribou from the Western Arctic, Teshekpuk and Central Arctic herds. Seasons and bag limits in those areas reflect harvest recommendations for those herds.

Season and Bag Limit during RY10–RY11

Units and Bag Limits	Resident/Subsistence Open Seasons	Nonresident Open Seasons
Ray Mountains Herd:		
Unit 20F, North of the Yukon River		
1 caribou	10 Aug–31 Mar (General hunt only)	10 Aug–30 Sep
Galena Mountain Herd:		
Unit 21B, that portion north of the Yukon River and downstream from Ukawutni Creek	No open season	No open season
Wolf Mountain Herd:		
Remainder of Unit 21B.		
1 caribou	10 Aug–30 Sep	10 Aug–30 Sep
Galena Mountain Herd:		
Unit 21C, that portion within the Dulbi River drainage and that portion within the Melozitna River drainage downstream from Big Creek	No open season	No open season
Wolf Mountain Herd:		
Remainder of Unit 21C		
1 caribou	10 Aug–30 Sep	10 Aug–30 Sep

Units and Bag Limits	Resident/Subsistence Open Seasons	Nonresident Open Seasons
Galena Mountain Herd:		
Unit 21D, that portion north of the Yukon River and east of the Koyukuk River		
2 caribou	Winter season to be announced	No open season
Western Arctic Herd:		
Remainder of Unit 21D		
RESIDENT HUNTERS:	1 Jul–30 Jun	
5 caribou per day; however, cow caribou may not be taken 16 May–30 Jun		
NONRESIDENT HUNTERS:		1 Jul–30 Jun
5 caribou total; however, cow caribou may not be taken 16 May–30 Jun		
Ray Mountains Herd:		
Unit 24A, that portion south of the south bank of the Kanuti River.		
1 caribou	10 Aug—Mar 31	10 Aug—Sept 30
Unit 24B, that portion south of the south bank of the Kanuti River, upstream from and including that portion of the Kanuti Kilolitna River drainage, bounded by the southeast bank of the Kodosin Nolitna Creek, then downstream along the east bank of the Kanuti Kilolitna River to its confluence with the Kanuti River		
1 caribou	10 Aug–31 Mar	10 Aug–30 Sep
Ray Mountains and Hodzana Hills Herds:		
Unit 25D, that portion drained by the west fork of the Dall River, west of the 150°W long		
1 bull	10 Aug–31 Mar	10 Aug–30 Sep

Alaska Board of Game Actions and Emergency Orders. No Board of Game actions were taken during RY10–RY11 and no emergency orders were issued.

Harvest by Hunters. During RY10–RY11, 12 caribou (10 bulls, 2 unknown) were reported taken from the 4 herds. All were harvested from the Ray Mountains (*n* = 6) and Hodzana Hills (*n* = 6) herds (Table 5).

Hunter access to the Ray Mountains herd is limited to lengthy snowmachine trips during the winter or to a few ridgetop landing areas. The Hodzana Hills caribou are accessible primarily by aircraft, with occasional access from the Dalton Highway. The Galena Mountain herd is most accessible for hunting when it crosses the Galena–Huslia winter trail during winter. However, that area is closed to prevent overharvest. The Wolf Mountain herd is rarely accessible for hunting because of the scarcity of aircraft landing areas. Moose hunters on the Melozitna River have rarely taken Wolf Mountain caribou incidentally in September. During RY10–RY11, the 12 caribou harvested in the Ray Mountains and Hodzana Hills herds were taken by 8 local residents, 3 nonlocal residents, and one nonresident (Table 6).

The total combined harvest reported for these herds continues to be less than 10 caribou per year (Table 5). In addition, 1–2 caribou are thought to be taken (but not reported) each year along the Yukon River near Ruby, and an additional 3–5 unreported caribou are likely taken along the Yukon River between Rampart and Tanana each year (Osborne 1995). These caribou, usually bulls, are occasionally found on remaining snowfields near the river in August or wander to the river during September. An additional 5–7 caribou are probably taken each year by hunters from Tanana who use snowmachines (Osborne 1995).

Other Mortality

Predation is likely the main limiting factor in these herds, but no studies to determine cause-specific mortality have been completed for these herds. Black bears were probably the primary predators on the calving ground of the Wolf and Galena mountain herds (Paragi and Simon 1993). Grizzly bears are found throughout the calving ranges of all 4 herds, and calf mortality studies in other areas indicate that grizzlies are important predators of caribou calves (Boertje et al. 1995). It is possible that high moose populations since the 1980s have supported high numbers of wolves and bears that incidentally prey on the Galena Mountain caribou, potentially contributing to a decline in that herd.

CONCLUSIONS AND RECOMMENDATIONS

The mountains between Galena and the upper Hodzana River on the north side of the Yukon River contain 4 recognized caribou herds. These herds are relatively small compared to most other herds in Alaska and inhabit distinct geographical areas with minimal overlap. However, the calving areas of the Galena and Wolf mountain herds occasionally overlap. Because the herds overlap only occasionally during calving season and only a small portion of the Galena mountain herd mixes with the Wolf mountain herd during this time, we classify these as two distinct herds. Although open hunting seasons for caribou existed for most of these herds, few animals were harvested due to limited access. Poor survival due to predation is likely the primary factor restricting herd growth. Large body size and weight of calves and adults in the Ray Mountains and Galena Mountain herds previously indicated good nutrition (Osborne 1995), although in 2005 fall calf weights in the Ray Mountains were not consistent with this observation (M. Keech, ADF&G, personal communication 2005).

The decline in the Galena Mountain herd was not due to harvest; therefore, the first management goal, to ensure harvest does not result in a population decline, was met. However, the second goal, to provide opportunity for people to participate in caribou hunting, was not achieved for the Galena Mountain herd because there was no open season. In addition, the management objective for this herd was not achieved because no harvest opportunity was available. All other management objectives were met, as harvest opportunity was available but did not exceed the objectives. Harvest of bulls and cows did not exceed desired levels for any of the herds.

To allow harvest of Western Arctic herd caribou in Unit 21D east of the Koyukuk River and to protect the Galena Mountain and Wolf Mountain caribou herds, we need to maintain a restricted season for the smaller herds when the Western Arctic herd is not present. Maintaining radio collars in the Galena and Wolf Mountain herds will help us to distinguish these caribou from the Western Arctic herd. In addition, radio collars will help us to obtain better population estimates if adequate numbers are maintained in each of the 4 herds. Other management work on these herds will remain a low priority because of low harvest and relatively few animals in these herds.

Management objectives for the next reporting period will remain unchanged. Management goals will be modified to the following:

- Provide opportunity for people to participate in caribou hunting.

- Ensure that harvest does not result in long-term population decline.

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Table 1. Galena Mountain caribou composition counts, 1991–2012.

Month/ Year	Cows	Calves	(%)	Bulls	Unclassified	Total caribou observed
12/91[a]						260
10/92[c]	123	9	(5)	49		181
10/93[c]	165	41	(16)	53		259
10/94[c]	115	46	(25)	25		186
10/95[c]	211	40	(13)	59		310
10/96[c]	151	19	(8)	62		232
12/98[a]						313
12/99[a]						89
01/01[a]						65
06/01[a]						105
07/02[a]						102
09/04[b]	64	7	(8)	13		84
12/04[a]						95
04/05[a]						78
11/05[b]	58	9	(12)	6		73
01/06[a]						95
06/07[a]						61
05/08[b]	22	12	(34)	1		35
03/09[a]		12	(13)			89
06/09[b]		9	(18)	5		49
03/10[b]	11					46
05/10[b]	22	6	(20)	2		30
06/10[b]	50	13	(19)	6		69
06/11[b]	68	19	(20)	3	3	93
07/11[b]	14	10	(42)			24
08/11[b]	23	5	(15)	6		34
02/12[b]	50	11	(7)	4	82	147
03/12[b]	62	17	(12)		61	140
06/12[b]	40	9	(17)	2	1	52

[a] Fixed-wing survey, no composition classifications.
[b] Fixed-wing survey, composition classification without photographs.
[c] Helicopter survey, composition classifications.

Table 2. Wolf Mountain caribou composition counts, 1991–2011.

Month/ Year	Cows	Calves (%)	Bulls	Unclassified	Total caribou observed
06/91[b]	117	18 (12)	11		146
06/92[a]					595
05/94[b]	337	121 (26)	16		474
01/95[a]					194
10/95[b]	192	51 (15)	103		346
03/96[a]					561
10/96[b]	167	37 (14)	62		266
05/97[a]					423
01/98[a]					163
06/01[a]					489
04/02[a]					455
07/02[a]					319
07/02[d]		27 (5)			516
06/03[a]					271
05/04[a]					146
05/06[a]					95
06/07[a]					268
06/08[a]		45 (18)			244
07/09[c]	312	95 (22)	27		434
03/10[c]	129		18	18	165
06/10[d]		61 (17)			368
10/10[c]	9	10 (17)	1	39	59
06/11[d]					462

[a] Fixed-wing survey, no composition classifications.
[b] Helicopter survey, composition classifications.
[c] Fixed-wing survey, composition classifications with photographs.
[d] Photocensus (fixed-wing).

Table 3. Ray Mountains caribou composition counts and estimated population size, 1991–2011.

Survey date (month/year)	Bulls: 100 cows	Calves: 100 cows	Calves %	Cows %	Small bulls %	Medium bulls %	Large bulls %	Total bulls %	Composition sample size	Count or estimate of herd size
06/91		31						13[a]		446
06/91			19							303[b]
10/91[c]										140[d]
10/94[c]										652
10/94[f]	37	19	12	64	4	8	11	24	629	629
01/95[c]										684
06/95[e]										1,731
10/95[f]	34	12	8	69	3	9	11	23	994	994
10/96[f]	28	15	10	70	3	8	9	20	1,387	1,387
07/97[c]										1,575
10/97[f]	33	13	9	68	5	6	12	23	1,114	1,114
10/98[f]	26	32	20	63	6	3	7	16	1,756	1,756
10/00[e]	38	19	12	64	10	6	9	24	1,736	1,800
09/01[f]	30	15	11	68	10	5	5	21	1,685	1,800
09/02[f]	51	31	17	55	11	15	2	28	140	
10/03[f]	33	18	12	66	10	6	7	22	921	
06/04[e]									1,705	1,858
10/04[c]									1,403	
10/05[f]	35	20	7	69	10	6	8	24	795	
04/06[c]									1,022	
10/06[f]	27	10	7	73	8	6	6	20	815	
10/07[f]	26	25	17	66	2	5	10	17	785	
09/08[f]	47	28	16	57	12	8	7	27	780	
09/09[f]	36	29	18	61				22	953	
02/10[d]										1,060
07/11[e]										1,213

[a] Includes 50 unclassified adult; [b] Includes 245 unclassified adults; [c] Fixed-wing survey, no composition classifications; [d] Caribou Mountain portion only; [e] Photocensus; [e] Helicopter survey, composition classifications.

Table 4. Hodzana Hills caribou composition counts, 2003–2009.

Month/Year	Cows	Calves (%)	Bulls	Total caribou observed
10/03[b]	173	43 (14)	90	306
06/04[a]				242
10/04[a]				136
06/05[a]				318
10/05[b]	661	111 (10)	343	1,115
04/06[a]				320
10/06[b]	247	20 (5)	122	389
09/07[b]	201	38 (11)	122	361
09/08[b]	232	64 (16)	99	395
09/08[a]				880
09/09[b]	527	93 (12)	155	775

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

Table 5. Ray Mountains, Galena Mountain, Wolf Mountain, and Hodzana Hills caribou reported harvest, regulatory years 2000–2011.

Regulatory	Ray Mountains			Galena Mountain		Wolf Mountain		Hodzana Hills[a]	
year	Bulls	Cows	Unk	Bulls	Cows	Bulls	Cows	Bulls	Cows
2000	2	0	0	2	0	0	0		
2001	1	2	0	0	0	0	0		
2002	2	0	0	0	0	0	0		
2003	2	0	0	0	0	0	0		
2004	2	1	0	0	0	0	0		
2005	0	0	0	0	0	0	0	0	0
2006	0	0	0	0	0	0	0	0	0
2007	3	0	0	0	0	0	0	1	0
2008	2	0	0	0	0	0	0	0	0
2009	1	0	0	0	0	0	0	0	0
2010	2	0	1	0	0	0	0	2	0
2011	2	0	1	0	0	0	0	4	0

[a] Hodzana Hills caribou were considered part of the Ray mountain harvest prior to regulatory year 2005–2006.

Table 6. Galena Mountain, Wolf Mountain, Ray Mountains, and Hodzana Hills caribou hunter residency and success, regulatory years 2000—2011.

	Successful				Unsuccessful				
Regulatory year	Local resident[a]	Nonlocal resident	Nonresident	Total	Local resident[a]	Nonlocal resident	Nonresident	Total	Total hunters
2000	3	1	0	4	3	13	2	18	22
2001	1	2	0	3	0	20	8	28	31
2002	1	0	1	2	4	4	3	11	13
2003	0	2	0	2	1	13	1	15	17
2004	3	0	0	3	9	8	2	19	22
2005	0	0	0	0	10	1	1	12	12
2006	0	0	0	0	19	13	0	32	32
2007	0	3	1	4	8	11	2	21	25
2008	1	0	1	2	8	9	1	18	20
2009	0	1	0	1	12	6	0	18	19
2010	4	1	0	5	10	4	2	16	21
2011	4	2	1	7	6	3	2	11	18

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

SPECIES

MANAGEMENT REPORT

Alaska Department of Fish and Game
Division of Wildlife Conservation
(907) 465-4190 PO BOX 115526
JUNEAU, AK 99811-5526

CARIBOU MANAGEMENT REPORT

From: 1 July 2010
To: 30 June 2012

LOCATION

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

HERD: Western Arctic

GEOGRAPHIC DESCRIPTION: Northwest Alaska

BACKGROUND

The Western Arctic caribou herd (WAH) ranges over approximately 157,000 mi^2 (363,000 km^2) of northwestern Alaska (Figs. 1 and 2). During spring, most parturient cows travel north toward the calving grounds in the Utukok Hills (Fig. 3). Bulls and nonmaternal cows lag behind pregnant cows and move toward the Wulik Peaks and Lisburne Hills (Fig. 4). During the post-calving period, maternal cows and neonates travel southwest toward the Lisburne Hills where they mix with bulls and nonmaternal cows (Fig. 5). During summer WAH caribou move eastward through the Brooks Range (Fig. 6); this is the most rapid, concentrated (in terms of both space and time), and predictable seasonal movement of the year. In late summer, most bulls become relatively sedentary in the upper Noatak–Nigu river area while most cows disperse back onto the coastal plain (Fig. 7). Caribou from this herd are more dispersed during fall than at any other time of year as they move southwest toward winter range (Fig. 8). Rut occurs in late October during the fall migration. In most years during the mid-1980s through 1995 much of the WAH wintered in the Nulato Hills as far south as the Unalakleet River drainage. Since 1996 few WAH caribou have wintered in the southern portion of the Nulato Hills, shifting instead to either the Seward Peninsula or upper Kobuk and Koyukuk drainages (Fig. 9). In some years, a relatively small proportion of this herd has wintered on the North Slope near Point Lay.

In 1970 the WAH numbered approximately 242,000 caribou and was thought to be declining (P. Valkenburg, ADF&G, personal communication). By 1976 it had declined to about 75,000 animals (Table 1, Fig. 10). From 1976 to 1990 the WAH grew 13% annually, and from 1990 to 2003 it grew 1–3% annually. In 2003 the WAH numbered ≥490,000 caribou but by 2013 it had declined to 235,000 caribou.

At its peak in 2003, density of the WAH over its total range was 3.1 caribou/mi^2 (1.2 caribou/km^2). Density estimates for caribou can be misleading, though, because they exhibit a "clumped" distribution in both space and time. Seasonal densities provide a more useful measure for evaluating the effects of caribou on their range and on each other but only reduce rather than correct for the effects of clumping. For example, although almost all of the WAH was on its summer range during the first 2 weeks of July 2007, for a density of 11.2 caribou/mi^2; caribou actually occupied less than 25% of this total area. Additionally, the ranges of the WAH and Teshekpuk Herd (TCH) overlap, and caribou from these herds co-mingle on some seasonal WAH–TCH ranges annually. Occasionally, caribou from the Central Arctic Herd (CAH) also move onto WAH range. Caribou from the WAH mix with Seward Peninsula reindeer as well. For example, during the winter of 2013–2014, caribou from the WAH, TCH, and CAH all wintered in or near the Goodhope River drainage, an area that probably contained remnants of several reindeer herds. Density estimates on WAH ranges should include these other *Rangifer* populations as well.

The Western Arctic Caribou Herd Working Group became established as an interim group in 1997 and adopted its current structure in 2000. The purpose of the group is to facilitate communication and cooperation among people who use, value and manage this herd, and to promote its conservation for the future. A working group technical committee consisting of agency staff was subsequently established in 2004. These groups now meet once each year to discuss the status of the herd, share information, and discuss issues that affect caribou and the people who rely on or value them.

MANAGEMENT DIRECTION

MANAGEMENT GOALS

- Protect and maintain the WAH and its habitat.
- Provide for subsistence and general season hunting on a sustained yield basis.
- Provide for viewing and other uses of caribou.
- Perpetuate associated wildlife populations, including carnivores.

MANAGEMENT OBJECTIVES

The following management objectives compose the seven basic elements of the Western Arctic Caribou Herd Cooperative Management Plan (Western Arctic Caribou Herd Working Group 2011):

- Encourage cooperative management of the herd and its habitats among state, federal, and local entities and all users of the herd.
- Manage for a healthy population using strategies adapted to population levels and trends while recognizing that caribou numbers naturally fluctuate.
- Assess and protect important habitats of the WAH.
- Promote consistent, understandable, and effective state and federal regulations for the conservation of the WAH.
- Seek to minimize conflict between reindeer herders and the WAH.

- Integrate scientific information, traditional ecological knowledge of Alaska Native users, and knowledge of all users into management of the herd.

- Increase understanding and appreciation of the WAH through use of scientific information, traditional ecological knowledge of Alaska Native users, and knowledge of all other users.

METHODS

These terms used in this report are defined as follows:

"ADF&G" is the Alaska Department of Fish and Game.

"ARGOS" is a world-wide satellite-based system that collects, processes, and transmits environmental data (in this report, from caribou satellite radio collars) to the individuals, organizations and agencies that own them.

"Adult caribou" is any caribou >12 months old.

"BLM" is the Bureau of Land Management.

"BOG" refers to the Alaska Board of Game.

"Calf" is any caribou <12 months old.

"Caribou" in the generic sense refers to individuals belonging to the WAH. Acronyms used for other caribou herds are as follows: TCH for Teshekpuk caribou herd, CAH for Central Arctic caribou herd, MCH for Mulchatna caribou herd, NAP for Northern Alaska Peninsula caribou herd, and PCH for Porcupine caribou herd.

"CARMA" is the CircumArctic Rangifer Monitoring and Assessment, a network organization with the mission to monitor and assess the impacts of global change on the Human-Rangifer System across the CircumArctic, through cooperation, both geographically and across disciplines.

"c.i." is the abbreviation for "confidence interval."

"Collar year" or "CY" is the 12-month period from 1 October through the following 30 September, abbreviated as CY (e g., 1 October 2010 through 30 September 2011 is abbreviated as CY10). It is defined based on the time when radio collars are deployed on WAH caribou.

"Conventional telemetry" refers to techniques using radio collars with very high frequency (VHF) transmitters and antennas mounted on airplanes to locate caribou. When referring to radio collars, the terms "VHF" and "conventional" are used interchangeably.

"Department" or "department" refers to the Alaska Department of Fish and Game.

"FSB" refers to the Federal Subsistence Board.

“USFWS” is the U.S. Fish and Wildlife Service.

“GPS” is Global Positioning System, a satellite-based system that provides latitude and longitude of location information.

“Guide” is a licensed commercial operator who accompanies a hunter in the field and provides professional services to assist in the taking of trophy wildlife.

“High quality” telemetry data refers to: 1) VHF location data with the latitude and longitude recorded directly over the group of caribou that contained the collared individual; 2) PTT location data with a location quality index (LQI) of 1, 2, or 3 (or 10, 20 or 30, depending on when the collar was deployed); or 3) all GPS collar data.

“Light weight satellite collar” refers to models ST-10, ST-18, ST-20, and TAW-4610 PTT collars and TGW-4680 GPS collars manufactured by Telonics, Inc. (Mesa, AZ). Model ST-3 or ST-14 PTT collars are not considered to be light weight collars.

“Local hunter” is a hunter that resides within the range of the WAH.

“LQI” refers to location quality index, an ARGOS ranking level applied to satellite collar locations.

“Maternal cow” refers to a female caribou accompanied by a calf or having $\geq$1 hard antler during June.

“NPS” is the National Park Service.

“Nonlocal hunters” are hunters that live outside the range of the WAH, including Alaska residents, nonresidents, and aliens.

“Photo census” is the aerial direct count photo extrapolation technique (Davis et al. 1979).

“Potentially active” radio collars refer to VHF transmitters and are those that have been located within the previous 2 years.

“Recruitment survey” is used interchangeably with “short yearling survey.” These surveys are conducted during late March through May to estimate the ratio of short yearlings:100 adult caribou.

“Regulatory year” or “RY” is the 12-month period from 1 July through 30 June, abbreviated as RY (e. g., RY10 = 1 July 2010–30 June 2011)

“Rivest population estimate,” “Rivest technique” or simply “Rivest” refers to an estimate of population size based on the homogeneity model reported by Rivest et al. (1998).

“Satellite collar” is a radio collar that contains both a VHF transmitter and either a PTT or a GPS transmitter.

"Short yearling" or "SY" is any caribou 10–11 months old.

"SNWR" is the Selawik National Wildlife Refuge.

"Successful hunter" is applied only to nonlocal hunters and is defined as anyone who reported taking at least 1 caribou of either sex during the regulatory year. With regard to hunter success, the distinction between 'local' and 'nonlocal' hunter stems from how WAH harvest data is collected from each group. Harvest data for local hunters is collected through community harvest surveys where 'household' is the sample unit. For nonlocal hunters, harvest data is collected through reports that individual hunters must submit; thus, 'hunter' is the sample unit.

"Teck Alaska, Incorporated" is the company that operates the Red Dog Mine, road, and port site in partnership with NANA Regional Native Corporation. In past reports, it has been referred to by its previous names, including TecCominco and NANA-TecCominco.

"Transporter" is a commercial operator who provides only transportation services to hunters.

"WG" refers to the Western Arctic Caribou Herd Working Group.

<u>Population Status and Trend</u>. Our understanding of WAH population status and trend is based on conventional, PTT, and GPS telemetry information; opportunistic observations of caribou by department staff located in Nome, Barrow, Kotzebue, and Fairbanks; and reports from the public. Implementation and early objectives of the conventional radio telemetry program in the WAH were previously reported (Dau 2005).

The department began deploying PTTs in the WAH in 1987 primarily to assist in locating conventionally collared caribou. As the PTT database expanded through time and the number of satellite-collared WAH caribou increased, we increasingly used this information to evaluate seasonal movements and distribution of this herd. Now, we also use satellite telemetry to more accurately determine time of death. Although we rely heavily on telemetry information to monitor the WAH, we have never collared more than 0.03% of the herd. We have typically conducted at least 15–20 VHF relocation flights annually since the late 1980s in part to monitor characteristics of caribou (e.g., body condition and sex-age distribution), and in part to assess environmental conditions (e.g., snow conditions and the prevalence of predators). In 1995, 2000, and 2012, VHF telemetry flights enabled us to identify localized mortality events that were not apparent from satellite telemetry data.

During this reporting period, VHF and satellite telemetry techniques were used to estimate population size, adult mortality, calf production and recruitment, sex and age composition, movement patterns, and distribution. Telonics Inc. (Mesa, AZ) manufactured all radio collars deployed in the WAH during this (and previous) reporting periods. Configuration of conventional and satellite collars, PTT duty cycles, VHF relocation techniques, types of data collected, allocation of collars between bulls and cows, and sources of error in telemetry data have been previously described (Dau 1997).

We have not attempted to radiocollar a representative cross-section of ages and sexes in the WAH. This is partly because the age structure of the WAH is unknown, very few yearlings are collared due to small size, and the specific age of adult caribou cannot be determined when they are collared. Every year we have attempted to maintain about 15 collared bulls in the total marked sample primarily to aid in conducting censuses. Mortality rates for mature bulls have exceeded 60% in some years, and bulls are sometimes scarce during the collaring project. Although we've usually managed to begin each CY with ≥15 collared bulls in the WAH, we've usually been below our objective by the end of each CY. We do not deploy collars on bulls less than 3 years old to avoid choking them from skeletal growth and seasonal enlargement of their neck during rut. Collars are randomly deployed on cows ≥1 year old annually irrespective of age or maternal status. Only cows in very poor physical condition are not collared.

We began CY10 with 129 potentially active collars on living caribou (114 cows and 15 bulls). Of the collared caribou, 29 cows and 14 bulls were equipped with a functional PTT collar, and 48 cows and 1 bull had an active GPS collar. We began CY11 with 125 potentially active collars on living caribou (108 cows and 17 bulls). Of these caribou, 25 cows and 14 bulls had an active PTT collar; 58 cows and 3 bulls had an active GPS collar. The number of radiocollared caribou reported for each year is inconsistent between consecutive management reports because individuals are retroactively removed from initial sample sizes as we determine that their batteries were likely exhausted or that a caribou died prior to the start of a collar year.

During the reporting period all new radio collars were deployed during September in Unit 23 at Onion Portage on the Kobuk River. The rationale and methods for this technique have been previously described (Dau 1997). Many residents of northwest Alaska object to chemical immobilization and helicopter capture techniques. Therefore, to avoid using these techniques, we have not removed or replaced previously deployed radio collars on WAH caribou since at least the mid-1980s. The Onion Portage project is broadly supported by people who reside within the range of this herd. Even so, we limit the duration of the collaring project and the number of agency staff present at Onion Portage to minimize our impact on local hunters.

In 2010 we deployed 5 VHF collars (all department collars), 20 PTTs (1 for BLM and 19 for the department) and 15 GPS collars (all NPS collars) on WAH caribou. In 2011 we deployed no VHF collars, 10 PTT collars (all department collars) and 19 GPS collars (5 for the department and 14 for NPS). To maintain a minimum 36-month VHF transmitter life expectancy in PTT and GPS collars, we specified a 12-hr ON/12-hr OFF duty cycle in conventional transmitters contained in department and NPS satellite collars (ON 8:00 a.m.–8:00 p.m. daily). Increasing involvement by federal agencies in the department's telemetry program has resulted in a variety of duty cycles for PTTs deployed on WAH caribou. For location density analyses (kernel analyses) we standardized all PTT location data to a 1-day-on/5-days-off duty cycle for the entire year (this is the most conservative of the PTT duty cycles and has long been used in the WAH). We identified movement (or migration) areas using line density depictions that were based on all GPS locations as well as all high quality PTT locations. During this reporting period all collars purchased by the NPS were fitted with a Cr-2a breakaway device programmed to release in 5 years (most of the 2009 collars released in early June 2013). Each of the federal agencies stipulated that their collars be deployed on female caribou. All PTT or GPS collars deployed on bulls have been purchased by the department.

Population Size and Composition. Since 1986 we have determined population size using the aerial photo-direct count extrapolation (photo census) technique (Davis et al. 1979). This herd was photographed on 7 and 9 July 2011, overlap lines were placed on the photos by 2 department staff (J. Dau and C. Westing) by December 2011, and all photographs were counted by 15 March 2012. The department hired Don Williams (Ambler) to count all of the 2011 census photos. The estimate was finalized in May 2012.

After this reporting period, we also photographed the herd twice in 2013: once on 7 July and a second time on 8 July (i.e., the entire herd was completely photographed each day). We treated each day as a separate census for comparison. All overlap lines were completed by 2 department staff (J. Dau and B. Saito) during December 2013, and Don Williams completed counting all of the photos by 12 March 2014.

This report presents both minimum population counts of census photographs as well as population estimates based on radiocollared caribou following Rivest et al. (1998). In this report I use the higher of the Rivest point estimate or the minimum count. The rationale and effects of this change in reporting population size on other aspects of this report were previously described (Dau 2011). Differences between minimum counts and Rivest estimates are small relative to the size of the WAH.

Population composition for the WAH was estimated from annual calving surveys during June, fall composition counts during October 2010 and 2012, and annual short yearling surveys during April–May. We conduct calving surveys to delineate calving areas, monitor initial calf production, and contribute to our annual estimate of adult caribou mortality. Additionally, the neonate:cow ratio provides an indirect way to assess body condition of mature cows during the previous fall (Cameron and Ver Hoef 1994), a parameter that is difficult to measure directly.

Calving survey techniques for this herd have been previously described (Dau 1997, Dau 2011). During 2010, calving surveys were conducted using a PA-18 airplane during 5–10 June; in 2011, they were conducted during 7–10 June; and in 2012 (after this reporting period) during 5–12 June. In this report I arbitrarily used the 95% kernel isopleth to show the extent of the calving area, and a Bayesian model (Wilson et al. 2010) to identify core areas.

During this reporting period we continued to relocate collared cows multiple times during calving surveys to better determine maternal status and improve the accuracy of parturition sites. We tried to locate cows until they were observed with a calf at heel or began to sprout velvet antlers. However, some cows having at least 1 hard antler were never observed with a neonate at the end of the survey. I used only the first location a cow was observed with a neonate or, for cows with at least 1 hard antler never observed with a neonate, I used its last location for kernel analyses. During this reporting period no collared cows were observed >4 times.

Caribou collared at Onion Portage tend to move *en masse* through their first fall and winter so are not randomly mixed throughout the herd until the following June. Therefore, we exclude location data for these individuals from the time of collar deployment through May 31 of the subsequent calendar year from analyses that describe the distribution of this herd.

Fall composition surveys were conducted on 18–19 October 2010 and 24, 26, and 27 October 2012 using techniques previously described (Dau 1997). Survey dates were determined by the availability of an R-44 helicopter and weather.

In 2011 spring composition (short yearling or recruitment) surveys were conducted on 21, 24, and 25 April as well as 5 May. In 2012 recruitment surveys were conducted on 29 and 30 March, 7 and 13 April, and 5 May. Recruitment survey techniques as well as their strengths and limitations have been previously described (Dau 1997, Dau 2005).

The period over which we monitor recruitment (June through the following May) does not directly correspond with the period over which we estimate adult mortality (October through the following September). As a result, recruitment is graphed differently in Figures 11 and 15. In Figure 11 recruitment is plotted on the year it was estimated (i.e., the year following the birth year) to best correspond with estimates of adult mortality. The purpose of Figure 17 is to show the ratio of calves to cows through their first year of life; therefore, the spring recruitment estimate for any specific year is shifted 1 year earlier to track its year of birth. For example, we observed 86 neonate calves:100 cows during June 1992, 52 calves:100 cows during October 1992, and 28 calves:100 cows during April 1993. The 28 calves:100 cows would be attributed to 1993 (time of collection) in Figure 11, and 1992 (birth year) in Figure 17.

I estimated size of total annual range using an arbitrary 95% fixed kernel (using ArcGIS Spatial Analyst). All PTT and GPS location data was standardized using the first best location every 6 days throughout each year. Only high quality (LQI values of 1-3) PTT records were used.

I used the mean annual growth rate ($N=e^r$) to estimate population size for years between censuses where:

$$N = \text{caribou population estimate}$$

$$e = 2.7183$$

$$r = [\ln(N_{t2})-\ln(N_{t1})]/t_2-t_1$$

$$t = \text{year of census}$$

Distribution and Movements. Distribution and movements of the herd were monitored through rangewide conventional telemetry surveys, and through PTT and GPS locations. Rangewide VHF surveys were conducted throughout the year, often in conjunction with composition surveys. Flights were based out of Barrow, Kotzebue, Nome, and Fairbanks using survey techniques previously described (Dau 1997).

During this reporting period we examined the seasonality of WAH movements and distribution at the population level. We included only high quality PTT and GPS collar data collected during 1 June 1988 through 20 November 2012 to calculate median speed and circular direction of travel for each day of the year, using only the first best location per day. Records for caribou that were affected by the Red Dog road were removed for the period between 15 August and 30 November (for those individuals, records for the rest of the year were included in all analyses). We applied the Kalman filter to all PTT data collected after 1 January 2008. We examined bulls and cows separately. Data were organized chronologically and we arbitrarily selected a starting date for the first season and an ending date for the second season. We then varied the cut point date that separated the 2 seasons. For each range of dates that tentatively delimited one season, we calculated the conventional mean, SD, and coefficient of variation (CV) for rate of travel. We used circular statistics to calculate these parameters for direction of travel. We summed CV values for both rate and direction of travel for each season. We defined the 2 seasons using the range of dates that produced the lowest cumulative CV over the 2 seasons combined. We then repeated this process for the next 2 consecutive seasons until we had worked through the entire year. Rut is an important 'season' for caribou; however, it occurs during the fall migration and is not characterized by any change in either rate or direction of travel. I estimated dates for rut by subtracting a gestation period of 230 days (Russell et al. 1998, Valkenburg et al. 1996, Bergerud 1975, Skoog 1968) from the start and end dates of the calving period. For kernel analyses, I used one location per collared individual that was closest to 1 January to determine winter distribution, the location that was closest in time to the midpoint date of late summer for bulls (Julian day 232) and cows (Julian day 236), and the first location a cow was observed with a neonate or its last location if we never observed it with a neonate and she had at least 1 hard antler.

Mortality. Mortality rates for adult WAH caribou were estimated from cows with conventional, PTT or GPS collars on a collar-year basis. Estimated mortality includes all causes of death including hunting. Portions of 3 collar years (CY09, CY10, CY11) span this reporting period. Mortality rates are estimated separately for cows and bulls because we do not collar bulls less than 3 years old, and sample sizes of collared bulls historically have been small. We began using expandable collar sections on bulls in 2001 which seems to have reduced the number of collars that are lost by slipping over their head during winter.

Mortality rates reported in consecutive management reports are inconsistent because sample sizes are continually adjusted as we determine the fate of collared individuals. For example, radiocollared caribou not located for 2 years are retroactively dropped from the sample of active collars going back to the year they were last located. Also, when a hunter returns a collar to ADF&G that was harvested years earlier we adjust our annual sample sizes accordingly. Inconsistencies in mortality estimates are most pronounced for the last 1–3 years of these reports.

I examined seasonal patterns of mortality for bulls and cows separately. Annual sample sizes for bulls were consistently much smaller than for cows, and I was able to use only CY94 through CY13 data for bulls. For cows, I used CY83 through CY13. To compare differences between sexes I standardized initial sample sizes to 100 individuals separately for each sex. For cows, this was of little consequence because initial sample sizes usually approximated 100 individuals for all years after and including CY89 (for CY83 through CY88, the multiplier to normalize the sample to 100 individuals was 2.3). For bulls the multiplier used for individual years ranged 5–11. Therefore, conclusions regarding seasonal patterns of mortality for bulls should be viewed with caution. Because the duration of individual seasons varied, I standardized all estimates of mortality to number of deaths per week.

I reviewed archived telemetry data to evaluate causes of WAH mortality. There is little information regarding cause of death for collared individuals before CY88. This is partly attributable to small sample sizes of collared caribou and our complete dependence on VHF collars during the early years of the telemetry program. We often were unable to visit mortality sites to determine cause of death during the early years of the program and, when we did, staff often did not record cause of death even when that could be determined. We increased our efforts to determine cause of death for collared caribou after this herd began declining around 2003. Given this change in effort, temporal trends in causes of mortality should be viewed with caution.

I used a latent bloodstain reagent (Bluestar Forensic Reagent, Monte Carlo, Monaco) to detect dried blood on retrieved collars to help determine whether caribou had been killed by predators or merely scavenged by them. When using the bloodstain reagent, I focused on the inside of the brass hardware that holds the 2 ends of the collar together, and on the inside of the 2 overlapping ends of the collar. Bloodstains in this area would get there only if the collar had been drenched in blood as during a predation event. If there was only a small amount of blood on other portions of the collar, I assumed that the caribou had not been killed by a predator (but may have been scavenged). Each collar was individually placed in a plastic bag at the time of retrieval from the field to prevent transfer of blood residue from collar to collar.

Most collars were retrieved during the snow-free period so that we could examine mortality sites to determine cause of death and collect a mandible for aging. Caribou that died from an unknown cause far from a community were classified as 'unknown natural mortality.' Caribou that died from an unknown cause in proximity to a village or a transportation corridor (i.e., winter staked trails or major rivers) were classified as 'unknown mortality.' Mortalities attributed to human harvest were based on the collar being returned to the department, or on characteristics of the mortality site (e.g., an obvious butchering site, collar material having been cut with a knife, or removal of collar hardware). I used characteristics observed at the mortality site to determine causes of natural mortality, for example, presence of hair and hide, presence of various bones, whether the collar was buried under a rock or land slide, amount of disarticulation of bones, degree to which bones had been consumed, pattern of bone consumption (e.g., complete shattering of large bones versus only the articulating surfaces of large bones chewed off), presence of predator scat in the immediate area, presence of bear hair on bones or antlers (bears often lay on top of carcasses), time of death (bears rarely kill caribou during the denning period), and whether the carcass had been buried in vegetation. I was conservative when assigning cause of death when the evidence was inconclusive.

Harvest. Harvest data were summarized by regulatory year (RY), which begins 1 July and ends 30 June (e.g., RY10 = 1 July 2010–30 June 2011). We collected harvest information using statewide harvest tickets for nonlocal hunters; these data are available from RY98 through the present time. We also collected harvest information from local hunters using community-based harvest assessments for communities within the range of the WAH, including Nome. This is differs from earlier analyses in previous reports where I estimated Nome harvest levels using RC900 registration permits.

Community-based harvest assessments have been conducted in selected villages within the range of the WAH since 1985. I used an analysis of covariance based on per capita community harvest levels to estimate harvests by hunters who live within the range of the WAH (Sutherland 2005). This approach considered the human population size of individual communities and their accessibility to caribou. Harvests of WAH caribou in Units 21 and 24 were not incorporated into

Sutherland's harvest model because they were so low they were insignificant relative to the other units. Human populations of communities were based on estimates for the year 2007 (Alaska Department of Fish and Game 2000).

Techniques for calculating WAH harvests for communities within Unit 26A, where most caribou harvested are typically from the TCH, were previously described (Dau 2011).

Body Condition and Disease. We collected blood samples from caribou while deploying radio collars at Onion Portage. Blood was collected from all caribou that were radiocollared as well as from additional individuals. Caribou were captured, restrained, and released as previously reported (Dau 1997). We collected blood from 16 bulls and 46 cows in 2010, 33 bulls and 30 cows in 2011, and 21 bulls and 25 cows in 2012. Body condition (very skinny, skinny, average, fat, very fat), abnormalities, and presence of a calf were recorded for caribou from which a blood sample was collected. Since 2001, serum samples have been analyzed mainly to assess haptoglobin levels, which indicate inflammation (Dau 2001), and exposure to *Brucella suis* bacteria. However, in 2010 and 2011 tests used to indicate exposure to brucellosis produced too many questionable results to indicate the prevalence of this disease in the WAH.

In September 2010 we collected 10 WAH caribou during the Onion Portage collaring project to comprehensively assess their health. Dr. Kimberlee Beckmen, ADF&G Division of Wildlife Conservation veterinarian, conducted the necropsies and collected tissues that were later analyzed for metal levels and cultured for selected viruses and bacteria. Cell structure was examined through histology (Dr. K. Burek, Alaska Veterinary Pathology Services, Wasilla, AK). We extracted an incisor to determine age. This was the second comprehensive health assessment conducted on WAH caribou since the late 1980s (the first assessment was conducted in 2007).

Calf weights. We record live weight of calves each year calves during the Onion Portage collaring project; this began in 2008. Most calves weighed accompany cows that we radio collar or sample for blood. Occasionally, we weigh an orphan calf that is not with an adult.

It takes 3 individuals to weigh a calf from a small boat. Cow-calf pairs are separated from the rest of the group while swimming the Kobuk River. Once by themselves, the cow and calf are separated and the cow is captured by the "collar boat." Calves are grabbed around the neck by staff in a second boat. As soon as the calf is caught, the anchor is set. One person, the 'grabber,' holds the calf around the neck and a second person holds the tail. The third person, usually the boat driver, slips 2 nylon belt slings around the calf's torso, one just behind the front legs and one in front of the hind legs. A carabiner is used to close each loop around the calf. The top eye of each sling is fitted over a hook on the bottom of the scale (we used a 250 lb mechanical spring scale until 2010 when we transitioned to a 440 lb digital scale: Pesola PHS200, China). An 8-foot-long, 2-inch diameter straight aluminum pole is balanced on the shoulders of the 2 individuals holding the calf. The scale is attached to the center of this pole. The 2 individuals holding the calf release it while simultaneously standing up to lift it out of the water and over the side of the boat. The third person, who attached the slings, helps guide the calf over the side of the boat as it is being lifted and then reads its weight on the scale. After reading the scale the process is reversed and the calf is immediately returned to the water. The weighing equipment is removed, the anchor is pulled, and the calf is held while the boat slowly maneuvers close to the boat that is holding its mother. The mother and calf are simultaneously released and, if necessary, gently herded to the south side of the river. The process of weighing a calf is often completed within several minutes by an experienced crew.

Calf weights are corrected for water weight that is held in their fur. We determined water weight by weighing calves held at the University of Alaska Large Animal Research Center when they were dry and again after soaking them with a hose. The correction factor is 2 lb (1 kg).

Mandible collections. Mandibles of harvested WAH caribou have been collected in the past for various purposes; in 2009, we resumed collecting mandibles from WAH caribou carcasses to annually monitor the body size and age composition of this herd. Mandibles collected from WAH caribou fall into 4 general periods: 1959–1961; 1975; 1985–1991; and 1997 through the present time. Mandibles collected during 1959-1961 are archived at the University of Alaska (UAF) museum. We hired a technician during 2009 to measure jaws in the UAF collection and estimate the age of the caribou based on tooth wear and eruption. No teeth were extracted from jaws in the UAF collection to section for determining age. The samples from 1975 were part of a University of Alaska M.S. project (Doerr 1979). Data from the Doerr project was added to the ADF&G jaw project during this reporting period. Mandibles collected during 1985–1991 were housed at the department office in Fairbanks but, unfortunately, were destroyed. Measurement data exists for this collection but all records lack an estimate of age. Age estimates have been done for most jaws collected since 1997, the estimates based on tooth eruption and wear patterns as well as on cementum annuli (Matson's Laboratory, LLC, Milltown, MT). Some caribou aged as 1 year old by Matson's were estimated to be much older based on tooth wear and eruption. I excluded these individuals from all analyses that required age as a parameter. Sex, approximate time of death, cause of death and general location of mortality site were recorded for each mandible. All mandibles have been measured following the CARMA protocol (Gunn and Nixon 2008).

RESULTS AND DISCUSSION

POPULATION STATUS AND TREND

Population Size

The 2011 census estimate (using the Rivest [1998] analysis) was 325,000 caribou (Table 1, Fig. 10). Radiocollared caribou were not randomly distributed among groups during the census photography ($P<0.001$). This constitutes a 4% average annual rate of decline from 2009 and continues the 4–6% annual decline that began around 2003 (Table 1, Fig. 10). As of 2011, the WAH was still in the 'liberal' management zone described in the cooperative management plan (Western Arctic Caribou Herd Working Group 2011).

Ninety six of 97 living collared caribou were found during the 2011 census photography. Most caribou were not moving rapidly while being photographed and caribou were optimally aggregated for photography and counting. There were no gaps in photo coverage among adjoining photographs. Light conditions were excellent for photography and the quality of the 2011 prints was high.

I recounted 54 of the 2011 census photos counted by Don Williams. There was no statistical difference in the variance of our respective counts ($F = 1.02$, $P = 0.47$). Williams counted 46,419 caribou compared to my 44,800 caribou. Williams' mean number of caribou/photo was statistically greater than mine (860 vs. 830, SD = 1,531 vs. 1,517, respectively; F = 4.02, P = 0.003). I did not correct for this difference partly because Williams probably just did a better job counting photos than I did because he had fewer distractions and more time to count photos and he counted early in the day while I tended to count after a full day of office work. Also, I felt the difference of 30 caribou per photo, although statistically significant, was biologically insignificant given other potential sources of error associated with this technique.

We completely photographed the WAH on 7 July 2013 and again on 8 July 2013 (after this reporting period). There were rain showers over some groups photographed on 7 July which had the potential to affect the quality of the photos. Conditions were optimal on 8 July and we had adequate film to photograph the herd a second time for comparison to the 7 July census.

The Rivest estimate for 7 July was 234,757 caribou (SE = 3,871) and for 8 July was 220,549 caribou (SE = 3,997). The ranges of the upper and lower 95% confidence intervals for the 2 estimates overlapped. The official estimate of herd size in 2013 released to the public was 235,000 caribou (7 July estimate rounded up). The difference between these estimates may have been attributable to difficulty establishing overlap lines on one of the largest groups photographed on 8 July. Other factors that most often affect the quality of aerial photo-direct count-extrapolation (APDCE, Davis et al. 1979) estimates of caribou herd size were favorable: 1) we found 77 of 78 collared caribou on each day of the photography; 2) the herd was highly aggregated into few groups (7 groups on 7 July of which 6 groups contained a collared caribou, and 5 groups on 8 July all of which contained at least one collared individual); 3) there was little movement of caribou during the photography; and 4) light was good. I recounted 8 photographs from the 7 July census, ~10% of the total number, originally counted by Don Williams. There was no statistical difference between our mean counts (paired T test, t = 1.47, P = 0.19).

We found 8 collared TCH caribou in the WAH aggregations during both the 7 and 8 July photography. The 8 collared individuals could mean that ~8,000 TCH caribou were present during the 2013 WAH censuses. This is of little importance to the WAH estimate but could comprise almost 20% of the 2013 TCH estimate. I did not use collared TCH caribou for the Rivest WAH population estimate, and I did not adjust the WAH estimate down to account for a possible influx from the TCH.

In addition to completely censusing the WAH twice in 2013, we also photographed 3 groups twice on 7 July, and 1 group twice on 8 July. The collars were randomly distributed among groups on both days (P = 0.80 and 0.78, respectively). Differences between counts of these groups were 10%, 5%, and 5% on 7 July, and 23% on 8 July (this was the group for which we had difficulty establishing overlap lines). The Rivest technique assumes that groups containing collared caribou are counted accurately. This source of variability is not included in Rivest estimates of standard error.

The decline from 325,000 caribou in 2011 to 235,000 caribou in 2013 represents a 15% average annual rate of decline (Table 1). This is substantially higher than the 4–6% rate of decline experienced from 2003 to 2011, and it approaches the 18% average annual decline experienced during the 1970s population crash (Table 1, Fig. 10). However, the adult WAH cow mortality rate (Table 2) suggests that the rate of decline from 2011 to 2013 was likely not a constant 15% over those 2 years. Instead, mortality was very high during the CY11 (33%) and lower (20%)

during CY12 (Table 2, Fig. 11). The CY11 cow mortality estimate is among the highest recorded for the WAH. Adult cow mortality was 36% during CY83 but that was based on a sample of only 21 VHF-collared caribou during an era when radiotracking flights were conducted infrequently. In addition to high mortality during CY11, recruitment was relatively low during 2012 and 2013 (Table 3). The 2013 census estimate is consistent with these estimates of adult cow mortality and recruitment.

As of 2013, the WAH had slipped from the 'liberal' to the 'conservative' management level identified in the WAH cooperative management plan (Western Arctic Caribou Herd Working Group 2011). Appendix II of this plan recommends several regulatory restrictions at the current management level: 1) no harvest of calves; 2) no cow harvest by nonresidents; and 3) restriction of bull harvests by nonresidents. If imposed by the BOG, they would be the first regulatory restrictions on WAH hunting regulations in over 30 years. If the WAH continues to decline even just 4–6% annually, as it did during 2003–2011, this herd will enter the preservative management level within 2–3 years. Appendix II recommends increasingly restrictive regulations as the population level and trend decline.

My observations of snow conditions, caribou carcasses, and the body condition of live caribou during spring suggest that fall and winter icing events were probably a primary factor that initiated this population decline around 2003. Additionally, although we have little quantitative information regarding densities of brown bears or wolves throughout the range of this herd, opportunistic observations by department staff and many reports from residents of this area, long-term guides, and transporters all indicate that predator numbers are high compared to previous years. I have seen substantially more wolf-killed caribou during the last 3–5 winters than prior to that time. Although BLM (Joly et al. 2007) has documented a decline in lichen cover with a concomitant increase in shrub and grass cover on portions of WAH winter range, the body condition of WAH caribou suggests that density dependent habitat degradation is probably not driving this population decline (although it could be contributing to it).

The department has supplemented bi- and triennial census counts of the herd with annual estimates of adult cow mortality (Table 2, Fig. 11) and recruitment (Fig. 12) to fill data gaps between years when censuses were conducted, and to help understand factors that could be driving population size and trend. Converging trends of increased adult female caribou mortality and decreased recruitment are consistent with the decline in population size shown by census data (Fig. 13).

At its peak in 2003 WAH density over its total range was 3.5 caribou/mi^2 (1.3 caribou/km^2). However, this is a conservative measure of density because it does not include reindeer or caribou from the TCH or CAH, all of which overlap on seasonal ranges, particularly from late summer through winter. Additionally, WAH caribou are never distributed evenly over their entire range. Thus, the functional density of caribou on seasonal ranges, especially summer range, was much higher than calculated density.

Although census data for this herd date back to 1970, satellite location data adequate to calculate total range extends back only to CY99. The size of total WAH annual range has not changed with decreasing population size (Fig. 14). There has been no correlation between total annual range size and estimated population size (using average annual growth rates to estimate herd size for years between censuses) for this herd since about 2000 (Pearson correlation coefficient = -0.34, $P = 0.25$). Similarly, the 95% calving kernel was not correlated to population size (Pearson correlation = 0.34, $P = 0.12$, $n = 22$; Fig. 15) or to total range size (Pearson correlation = 0.09, P = 0.78, $n = 13$).

Population Composition

Calf production and survival. Our estimates of parturition are probably conservative because we do not record udder status for collared cows (Whitten 1995) and undoubtedly misclassify some cows as nonmaternal if they have lost their antlers and their neonate. Since 2010 we have looked at collared WAH cows with either no antlers or at least 1 hard antler that were not accompanied by a neonate multiple times to reduce this source of error, and to improve parturition site location data. Rate and direction of travel of satellite-collared cows indicates that calving occurs during 9–13 June (Dau and Sutherland, unpublished data). Calving probably peaked early, at least in relation to the timing of calving surveys, during 1987 and 1990 based on the westerly distribution of collared cows, their uniformly rapid and westerly direction of travel, and their lack of hard antlers. The earliest reported peak calving date for the WAH is 26 May 1960 (Lent 1966). During 1987–2013 there was no correlation between median annual date of calving surveys and the June calf:cow ratio (Pearson rank correlation = -0.18, $P = 0.39$, $n = 26$).

During June calving surveys, we observed 77 calves:100 cows in 2011, 62 calves:100 cows in 2012 and 63 calves:100 cows in 2013 (Table 4, Fig. 16). Historical estimates of calf production suggest parturition rates were more variable 1960–1970 than in recent years (Fig. 16). However, sampling approaches varied prior to 1987 when conventional telemetry techniques were adopted to locate calving caribou. Therefore, measurement error may have contributed to this early variability.

In 2010, we observed 29 collared cows multiple times. Of these, 23 had ≥1 hard antler so their maternal status did not change with additional locations (i.e., no 'maternal' designations are reversed by multiple sightings). Six cows had no antlers and no calf the first time they were observed, of which 2 were subsequently observed with a neonate. This increased our estimate of parturition from 70 to 73 calves:100 cows. In 2011, we observed 12 cows on 2 occasions; of these, none changed their parturition status as a result of multiple sightings. In 2012 we observed 15 cows multiple times; of these, the parturition status of 1 cow changed from nonmaternal to maternal. In 2013 we observed 21 cows multiple times, and 1 changed its status from nonmaternal to maternal. Although multiple observations of collared cows have had little effect on the estimated parturition rate since we began locating cows multiple times during calving surveys, this approach has improved the accuracy of recorded parturition sites. We've looked at 34 cows from 2 to 6 times during 2010–2013 to identify calving sites. For cows with at least 1 hard antler and no calf that were first observed north of 68.65° N Latitude (i.e., cows that would have had their first observation used to denote parturition site prior to 2010), the median distance between the first observation to where we first saw them with a calf was 9 mi (range 0.8–39.0 mi; 14 km, range 1–63 km). In 2013, 3 cows first observed with a hard antler and no calf south of 68.65° N Latitude were later found with a calf. These individuals traveled 23.5, 119.0 and 40.9 mi (37.8, 191.5 and 65.8 km), respectively, from their initial location to where we first saw them with a neonate. This supports our long-held policy of not using the location of hard antlered-no calf cows to denote parturition site when first observed south of the De Long

Mountains crest. Pregnant cows can rapidly move long distances to reach the calving grounds before giving birth.

The negative linear relationship (F = 21.54, P = 0.0001, R^2=0.47) between the calf:cow ratio and the proportion of cows with velvet antlers during calving previously reported (Dau 2009) continued through this reporting period (Spearman rank correlation = –0.70, P = 0.0001, n = 26 years). The median proportion of cows with velvet antlers during years when the calf:cow ratio was ≥70:100 (7.6%, n = 12) was significantly lower than the median for years when this ratio was <70:100 (15.2%, n = 14; Kruskal-Wallis test statistic 8.15, P = 0.004). This suggests low WAH parturition rates are real and not artifacts of sampling error.

The fall calf:cow ratio generally increased during 1976–1982, a period of rapid population growth. In contrast, this ratio declined 1992–2012, a period of slow growth or decline (Table 5, Fig. 18).

We observed 9 short-yearlings:100 adults in spring 2011, 13:100 in spring 2012 and 17:100 in spring 2013 (Table 3, Fig. 18). Recruitment, as reflected in April–May surveys, has slowly declined since the early 1980s (Table 3, Figs. 12 and 18). Although we have estimated WAH recruitment annually since 1982, we didn't begin collecting this information using 'group' as the sample unit until 1987. Recruitment during 1987–2013 is shown in relation to 80% c.i. in Figure 12. The persistent, declining trend in recruitment would not be evident without this long-term data set.

Least squares linear regression indicates that there has been no trend in the June calf:cow ratio during 1982–2013 (F = 0.23, P = 0.64, n = 26, Fig. 18). The fall calf:cow ratio declined linearly during 1982–2012 (correlation coefficient = -0.77, R^2 = -0.69, F = 24.64, P=0.0004, n=13) as did the spring calf:cow ratio (correlation coefficient=-0.69, R^2=0.53, F=32.24, P<0.001, n=31; Figure 18).

Calf:cow ratios were estimated during June, the following fall, and the following spring in 12 years between 1992 and 2010 (Figure 18). During 1982–2013 there has been no correlation between the June calf:cow ratio and subsequent fall ratio (Spearman rank correlation = -0.10, P = 0.77), or with the following spring ratio (Spearman rank correlation = -0.20, P = 0.53). In contrast, the fall and subsequent spring ratios were correlated (Spearman rank correlation = 0.61, P = 0.04). Calf production has likely had little influence on the population trajectory of the WAH; however, declining calf survival through the summer of their birth may have contributed to its current decline.

Bull:cow ratios. During 1992–2012 the fall bull:cow ratio declined linearly (correlation coefficient = -0.81, F = 10.66, P= 0.008, n = 12, Fig. 19). During this time the median was 44 bulls:100 cows (Table 5, Fig. 19). In contrast, the fall bull:cow ratio generally increased during 1976–1980, a period of rapid population growth (Fig. 19).

Sexual segregation and our inability to sample the entire population during fall probably account for more annual variability in this parameter than actual changes in population composition. The low value of 38 bulls:100 cows in 2001 was almost certainly caused by spatial segregation and incomplete sampling of the entire herd rather than an actual short-term drop in the proportion of bulls in the population. Because of this measurement error, the bull:cow ratio data reported here should be viewed with caution. We think these data probably reflect trends in bull:cow ratios reasonably accurately; however, this function could be shifted up or down. This will make it difficult to determine when to restrict bull harvests in order to prevent this ratio from dropping below the minimum level of 40 bulls:100 cows specified in the 2011 *Western Arctic Caribou Herd Cooperative Management Plan*.

Distribution and Movements

Historical Summary. Our historical understanding of WAH distribution has been previously described (Dau 2001). We have conducted spring and fall rangewide telemetry surveys since spring 1995 and consistently found ~75% of the collared caribou through VHF telemetry flights. Often, collars missed during one seasonal survey are located during the subsequent survey mixed with caribou that had been previously found. Also, we have repeatedly flown very near satellite- and GPS-collared caribou without hearing their VHF transmitter. This suggests that long telemetry receiver scan times, shifts in VHF duty cycles, weak transmitter batteries, topography, receiver programming errors, and infrequent relocation flights are responsible for "missed" collars rather than incomplete survey coverage of the herds' range. Deployment of GPS collars with VHF transmitters in the federal frequency band has almost certainly increased the number of caribou missed in the state frequency band during VHF relocation flights. Similarly, we typically miss more collars in the federal band on VHF tracking flights than we typically do for state collars. In addition to missing collared caribou in both frequency bands, monitoring collars in 2 frequency bands has greatly reduced our efficiency during radiotracking flights.

General Movement Pattern: The general movement pattern of this herd was previously reported using our best understanding (essentially guesses) of season dates (Dau 2009). In this report we determined season dates using rate and direction of travel. Therefore, delineations of seasonal ranges reported here are somewhat different from previous reports. Most of the data used to determine season dates was produced by PTT collars with conservative duty cycles. Therefore, median daily rates of travel reported here are certainly lower than actual caribou speeds because straight line distances were used to calculate time and distance traveled, and long-time intervals between consecutive locations excluded departures from linear travel that caribou certainly made. Even so, this should not affect our determinations of season dates because our analyses focused on relative speeds between consecutive seasons rather than cardinal estimates of speed *per se*. These speeds should not be used to model energetics or even distances traveled, though, because they are conservative.

Season dates: Determining dates that WAH caribou use their seasonal ranges is essential for delineating those ranges. For many years, caribou biologists (me included) have used sophisticated kernel analyses to identify seasonal ranges (e.g., calving grounds) without understanding when calving actually occurs. As large scale resource development is contemplated within the range of this herd (e.g., the proposed roads to Umiat and the Ambler Mining district; gas development in the northern foothills of the Brooks Range; hard rock mines in the De Long Mountains; and an east-west oil pipeline across the coastal plain), the department increasingly is being asked by state and federal agencies, as well as by industry, to delineate critical habitat and the seasonal ranges of this herd.

At the population level, seasonal movements and distribution of WAH caribou differ between bulls and cows (Table 6, Figs. 20 and 21). Some differences in season dates between bulls and cows reported here are probably at least partly attributable to the substantially smaller sample sizes for bulls compared to cows. Even so, some of these temporal differences are real and not merely artifacts of sampling error, especially during the period between the end of winter and beginning of summer. Bulls begin the spring migration about 10 days later than cows. The spring migration for bulls spans 3 seasons for cows: spring migration, calving, and post-calving. Many bulls don't even enter the calving grounds during their spring migration and, of those that do, they only travel through its southernmost extent. Sexual segregation is more pronounced during this time of year than at any other time.

The calving period (9 June–13 June) is defined solely by movements of cows. Calving for this herd is highly synchronous as evidenced by an abrupt decline in rate of travel that lasts only about 5 days. The movements that do occur during calving are oriented west-northwest. As with calving, the post-calving period (14 June–5 July) is defined solely by movements by cows and is characterized by a rapid increase in rate of travel following the calving period. Rates of travel for cows during post-calving are second only to those exhibited during summer. Post-calving movements are oriented southwest.

The onset of summer is essentially the same for bulls (5 July) and cows (6 July, Table 6). Both sexes reverse their course of travel to rapidly move east-northeast until 30 July (cows) or 2 August (bulls). Differences between bulls and cows for starting and ending dates of summer may be attributable to small sample sizes for bulls compared to cows. Caribou achieve their highest rates of travel (and degree of aggregation) during summer. In terms of movements, summer is the most predictable season of the year.

There is a distinct season between summer and fall for both bulls (3 August–6 September) and cows (31 July–17 September) which I termed 'late summer.' During this time bulls exhibit little movement (Fig. 21). For cows, there is no obvious difference in rates of travel between late summer and fall (Fig. 20). Even so, summed CVs show a distinct minimum separating late summer and fall for cows.

The fall season for cows is 18 September–November 7 (Fig. 20), and for bulls is 7 September–4 November (Fig. 21). The earlier start date for bulls is counter to local knowledge noting that the vanguard of the fall migration tends to have relatively more cows than mature bulls compared to the rear echelon. As noted elsewhere, differences between the sexes in start and end dates for fall may be caused by small sample sizes for bulls. Rut (22–26 October) for both sexes occurs entirely within the fall season (Figs. 20 and 21). There is no signature in terms of rate or direction of travel that distinguishes rut from fall. I back-calculated rut from calving dates using a gestation period of 230 days (Russell et al. 1998).

Winter comprises almost half of the year for both sexes (Table 6, Figs. 20 and 21). The onset of winter is 5 November for bulls and 8 November for cows, an almost negligible difference probably attributable to disparities in sample sizes between the sexes. Cows end their winter season and begin the spring migration on 5-6 May, roughly 10 days before bulls (15–16 May). Based on my observations during spring recruitment surveys, bulls do lag behind cows in initiating the spring migration.

Calving grounds. The WAH has exhibited strong fidelity to its calving grounds in the Utukok hills for decades. For example, the areas identified by Lent (1966) as calving areas in 1960 and 1961 are within the 95% calving kernel for 1988–2012. In previous reports (e.g., Dau 2011) we combined all years of data to delineate the calving grounds using kernel analyses. With over 20 years of calving data, the addition of individual years now has little effect on our depiction of the general calving area. In this report I show annual calving distributions for 2009–2012 to illustrate annual variability in calving distribution (Fig. 4).

The distribution of maternal cows extended unusually far south in 2013 (after this reporting period). This was the first time a 'core' calving area extended south of the crest of the De Long Mountains. As in 2000 and 2001 when cows were late getting to the calving grounds, breakup was late in spring 2013 as well. It appears that the onset of spring migratory movement is temperature dependent. When average daily ambient air temperature rises to 0^{o} C (32^{o} F), cows begin migrating north (Sutherland and Dau, unpublished data). From my opportunistic observations, difficult traveling conditions (e.g., extensive overflow on river ice, open water, deep or rotten snow, etc.) do not seem to strongly affect the northward migration of either cows or bulls. However, ice pans flowing down rivers during both freeze-up and breakup will halt migrating caribou for up to several days until ice bridges form from bank to bank, or ice pans disappear during breakup.

In 2009 we located a collared cow with a neonate along with 2 other caribou cow–calf pairs about 5 miles south of Cape Espenberg. This was the first time we documented a collared WAH cow with a neonate on the Seward Peninsula. We found 1 radiocollared cow near Kiwalik during the 2013 calving surveys. This cow had soft antlers so almost certainly was not pregnant. This individual was harvested by a hunter near Selawik while migrating toward the calving grounds roughly 1 week after we observed her during the calving survey. Although we've not found any collared, maternal cows on the Seward Peninsula during calving surveys since 2009, we have observed a small number of caribou cows with calves in the vicinity of Cape Espenberg and Serpentine Hot Springs in recent years. These individuals were mixed with reindeer females and fawns. No collared cows have calved on the Seward Peninsula during multiple, consecutive years, which would suggest the re-establishment of a 'Seward Peninsula caribou herd' as postulated by Burch (2012).

Summer. The WAH uses the western North Slope and Brooks Range during summer (Fig. 6). The importance of summer range to the WAH has been previously discussed (Dau 2003). Small numbers of WAH caribou, mostly bulls and nonmaternal cows, were observed on the Seward and Baldwin peninsulas by department staff during both summers of this reporting period. Summer movements by WAH caribou are more predictable than any other season, and movement rates during summer greatly exceed those of the fall or spring migration periods.

Late summer. Following the summer period of large, dense aggregations and rapid easterly movement, cows slow down and either remain in the De Long or Schwatka mountains or disperse north and west back onto the coastal plain (Fig. 7). Most bulls remain in the De Long or Schwatka mountains during late summer; however, since at least the early 1990s, a small percentage of WAH bulls have remained on the Seward Peninsula near Serpentine Hot Springs, Cape Espenberg, and Mount Bendeleben.

Fall. As with the calving period, in this report I show annual fall migration areas for 2009–2012 (Fig. 8). Caribou from this herd are generally more widely distributed during fall than at any other time of year. During autumn of 2009 and 2010, WAH movements through Unit 23 mainly occurred through a relatively narrow east-west corridor down the Anisak River, through Ivishak Pass, and into the Purcell Mountains or Nulato Hills. As a result, most communities within Unit 23 had difficulty getting caribou during autumn of 2009 and, especially, during 2010. Noatak, Kivalina, and Kotzebue hunters were strongly affected by this easterly distribution.

During this reporting period, residents of Unit 23 continued to express concerns about guides and transporters placing large numbers of nonlocal hunters in fall movement corridors and deflecting caribou from traditional subsistence hunting areas. This has been a major, recurrent issue dating to the early 1980s. Incomplete camp location information seriously compromises our ability to evaluate whether airplane activity and nonlocal hunters deflect caribou from migration corridors and traditional subsistence hunting areas.

Winter Range. In previous reports (e.g., Dau, 2009, 2011) I delineated winter range showing where most of the WAH wintered in most years since the mid-1980s. In this report I show annual winter range for 2008–2009 through 2011–2012 (Fig. 9). Annual distributions of caribou during winter show that in some years some caribou winter in areas typically used during summer.

An unusually high number of WAH caribou wintered in the southern foothills of the central Brooks Range during the winter of 2010–2011 (Fig. 9 and subarea 6 in Tables 7 and 8 and Fig. 22). The estimates of caribou density on winter ranges reported in Table 8 represent minimum values because they do not include reindeer or caribou from the TCH or CAH that also use WAH winter range. This would primarily affect densities reported for the central Brooks Range, the foothills of the Brooks Range east of the Utukok River, and the Seward Peninsula. Before the winter of 1996–1997, few WAH caribou wintered on the Seward Peninsula west of the Kugruk River drainage. Since that time a large proportion of the herd has wintered there during some years (Tables 7 and 8).

Satellite and GPS Collars. The objectives and limitations of the WAH satellite collar program were previously described (Dau 2007). Federal agencies have shared all PTT and GPS data with the department since they began purchasing satellite collars to deploy in the WAH in 2000. Since December 2010 the department has shared with NPS, FWS and BLM all PTT and GPS data from state-purchased collars that were collected during or after 2000. With increasing interest in resource development within the range of the WAH, our objectives for deploying PTT and GPS collars have shifted from merely facilitating VHF telemetry surveys to collecting detailed and highly accurate location information on larger numbers of caribou. Data from GPS collars is clearly superior to that from PTT or VHF collars for evaluating the effects of existing or proposed development on caribou. The department should increase its level of investment in GPS collars to deploy on WAH caribou in the future.

MORTALITY AND RECRUITMENT

Survival rates in relation to collar type and sex have been previously reported (Dau 2009). I estimated adult caribou mortality separately for bulls and cows based on radiocollared individuals. There are a number of limitations for this data. Mortality estimates for cows are conservative because collaring efforts exclude emaciated, injured, or clinically diseased individuals even though they compose part of the population. Additionally, we collar few yearling cows. Mortality estimates for bulls are biased high because we do not collar bulls younger than 3 years old, and some are substantially older than that when we first collar them. Our selection of old bulls was more pronounced during the late 1980s through early 2000s; since 2006, we have selected bulls 3–4 years old to collar. Age related bias in our sample of collared caribou has been previously reported (Dau 2011; Prichard et al. 2012). The WAH telemetry program was based almost solely on VHF observations during the 1970s through 1990s. During this period we sometimes could not determine time of death to year much less season. This introduces uncertainty into early estimates of adult caribou mortality.

There is also error associated with our estimates of recruitment. We probably misclassify some 10- and 22-month-old caribou during spring composition surveys because we conduct them from a Piper PA-18 airplane. This provides a briefer view of the animals compared to observations made from a helicopter.

The 33% mortality rate for 2011–2012 was second only to 1983–1984 (Table 2, Fig. 11). The 1983–1984 estimate (36%) is suspect because no satellite collars were deployed then to facilitate VHF telemetry, few VHF flights were made, and mortalities could 'accumulate' over 1–2 years to be discovered during a year of relatively high search effort. Given that the WAH was in a phase of rapid growth that spanned the 1983–1984 mortality period, it's highly unlikely that the actual mortality rate was as high as estimated. In contrast, the 2011–2012 mortality estimate is probably reasonably accurate. Snow depth was relatively high in many portions of WAH winter range during the winter of 2011–2012, and both wolves and brown bears were abundant. I observed many wolf-killed caribou while flying aerial surveys and while traveling via snow machine. My observations were consistent with many reports I received from the public, and with similar comments almost universally made during recent WG round table discussions. I suspect that caribou weakened by deep snow were easy prey for wolves during the winter of 2011–2012. Many wolf-killed caribou carcasses I observed that winter were only partially eaten. Wolves may have found it easier to kill fresh caribou than to gnaw what remained of a frozen caribou carcass they had killed earlier. I saw less snow on WAH range during the winter of 2012–2013 than in any winter during my tenure here (which began in 1988). The lower mortality estimate for that year (18%) is commensurate with an 'easier' winter, and I found few wolf-killed caribou. Furthermore, the carcasses I saw were almost completely consumed during 2012–2013. This was particularly noticeable while retrieving radio collars from mortality sites during July 2013. The effects of deep snow or otherwise harsh winter conditions on caribou mortality may have been magnified by wolf predation.

Adult cow mortality has equaled or exceeded 20 deaths per 100 collared individuals during 7 of the last 9 collar years (Table 2, Figs. 11 and 13). From CY90 through CY04 this value was equaled or exceeded only twice (in CY92 and CY99). In CY07 and CY11 adult cow mortality exceeded 30 deaths:100 cows. Median cow mortality during CY84 through CY03 (15 deaths:100 collared cows, $n_i = 20$) was significantly lower than during CY04 through CY12 (23 deaths:100 collared cows, $n_i = 9$; Kruskal-Wallis statistic = 12.17, $P = 0.0001$). There was a significant linear increase in adult cow mortality during CY85 through CY11 ($n_i = 27$, slope = 0.56, $F = 27.92$, $P = 0.0001$, $R^2 = 0.54$; Fig. 11).

Adult mortality has slowly increased while recruitment has slowly decreased since the mid-1980s (Fig. 13). These trends are consistent with census results (Fig. 9). As noted above, age related bias in our sample of collared cows causes us to overestimate mortality and recruitment (Prichard et al. 2012). *However*, the opposing trends in these relationships are more important than their annual values. There has been a significant negative correlation between recruitment and adult cow mortality during 1985–2013 (Spearman rank correlation = -0.60, $P = 0.0005$, $n_i = 29$).

Survival data collected since the last reporting period did not change the shape of survival curves for bulls or cows (Fig. 23). Collared bulls exhibited higher seasonal mortality rates than cows throughout the year, and seasonal differences in mortality rates were less pronounced for cows than bulls (Fig. 24). Cows died from natural causes at similar rates throughout the year. Little harvest of cows or bulls occurred during summer, and few bulls were harvested during spring. In contrast, natural and harvest mortality of bulls both spiked during fall.

Possible effects of winter thaws and rain-on-snow events on caribou mortality have been previously reported (Dau 2009). Additionally, our opportunistic observations and many reports from the public indicate that wolf numbers have been high and increasing during recent years. During the 2012 WG meeting, every representative of communities within WAH range reported very high numbers of wolves in their respective areas. Most representatives reported high numbers of brown bears as well. My opportunistic observations during winter suggest that wolf predation on caribou has been higher since about 2008 than in previous years. Not surprisingly, given the large size of this herd since the mid-1980s, BLM has documented substantial declines in percent lichen cover with concomitant increases in grasses and shrubs on some WAH winter range (Joly et al. 2007). Despite these changes in winter range, body condition of caribou has remained good based on the 2007 and 2010 health assessments, and on our subjective index of caribou body condition during the September collaring project. This suggests that range limitation is not yet a primary driver of high mortality or the current population decline.

Despite the limitations of WAH mortality data, it is clear that far more WAH caribou have died of natural causes than were killed by hunters since the mid-1980s (Table 9, Fig. 25). Of those caribou that perished of natural causes, the majority were killed by predators (Table 9, Figure 26). Wolves, brown bears, wolverines, lynx and even coyotes kill WAH caribou but I was unable to identify the latter 3 species as sources of mortality. For collared caribou likely killed by predators, I could not identify the type of predator 81 of 152 times (53%). For caribou killed by a predator that I could distinguish between wolves or a bear, wolves killed at least 3–4 times as many collared caribou as bears. Undoubtedly, some kills I attributed to wolves or bears were actually kills by other predators; however, I think this error was small. Additionally, I probably erroneously attributed some deaths to predators that were caused by other factors (e.g., disease or starvation), and where the carcasses were subsequently scavenged by predators. Although this was almost certainly the largest source of error in these data, I was conservative when assigning cause of death and for many individuals could only record ‘unknown cause of death,’ ‘unknown natural mortality,’ or ‘unknown predator.’

Harvest

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

RY10 and RY11 Unit and Bag Limits	Resident Open Season (Subsistence and General Hunts)	Nonresident Open Season
Units 21D, 22A, and 22B remainder		
Resident Hunters:		
5 caribou per day		
Bulls	No closed season	
Cows	1 Jul–15 May	
Nonresident Hunters:		
5 caribou total per year		
Bulls		No closed season
Cows		1 Jul–15 May
Unit 22B west of Golovnin Bay and west of Fish and Niukluk Rivers excluding Libby River		
Resident Hunters:		
5 caribou per day	1 Oct–30 Apr	
Nonresident Hunters:		
5 caribou per year		1 Oct–30 Apr
Unit 22C		
Resident Hunters:		
5 caribou per day	May be announced	
Nonresident Hunters:		
5 caribou per year		May be announced
Unit 22D that portion in the Pilgrim River		
Resident Hunters:		
5 caribou per day	1 Oct–30 Apr	
Nonresident Hunters:		
5 caribou per year		1 Oct–30 Apr

RY10 and RY11 Unit and Bag Limits	Resident Open Season (Subsistence and General Hunts)	Nonresident Open Season
Unit 22D that portion in the Kougarok, Kuzitrin, American, Agiapuk River drainages		
Resident Hunters:		
5 caribou per day		
Bulls	No closed season	
Cows	1 July–15 May	
Nonresident Hunters:		
5 caribou per year		
Bulls		No closed season
Cows		1 July–15 May
Unit 22D Remainder		
Resident Hunters:		
5 caribou per day	May be announced	
Nonresident Hunters:		
5 caribou per year		May be announced
Unit 22E that portion east of and including the Sanaguich River		
Resident Hunters:		
5 caribou per day		
Bulls	No closed season	
Cows	1 July–15 May	
Nonresident Hunters:		
5 caribou per year		
Bulls		No closed season
Cows		1 July–15 May
Unit 22E remainder		
Resident Hunters:		
5 caribou per day	May be announced	
Nonresident Hunters:		
5 caribou per year		May be announced

RY10 and RY11 Unit and Bag Limits	Resident Open Season (Subsistence and General Hunts)	Nonresident Open Season
Unit 23		
Resident Hunters: 5 caribou per day		
Bulls	No closed season	
Cows	1 July–15 May	
Nonresident Hunters: 1 caribou total per year[a]		
Bulls		No closed season
Cows		1 July–15 May
Units 24A excluding that portion south of the south bank of the Kanuti River (24 remainder), 24B excluding that portion south of the south bank of the Kanuti River upstream from and including the Kanuti-Kilolitna River drainage (24B remainder), 24C, 24D, and 26A		
Resident Hunters: 5 caribou per day		
Bulls	No closed season	
Cows	1 Jul–15 May	
Nonresident Hunters: 5 caribou total per year		
Bulls		No closed season
Cows		1 Jul–15 May

[a] The nonresident caribou bag limit in Unit 23 was increased to 2 per year beginning 1 July 2011. This was the only difference in WAH hunting regulations between RY10 and RY11.

Federal hunting seasons were identical to state seasons during this reporting period. However, the bag limits under federal subsistence regulations were 15 caribou per day in Unit 23, 10 caribou per day in Unit 26A, and 5 caribou per day in other units used by the WAH.

Board of Game (BOG) Actions and Emergency Orders. During this reporting period no emergency orders (EOs) were issued for caribou hunting within the range of the WAH. The nonresident caribou bag limit was increased from 1 caribou per year to 2 caribou per year beginning 1 July 2010.

Human-Induced Harvest. The total harvest of WAH caribou was approximately 11,600 caribou in RY10 and 15,800 caribou in RY11 (Table 10). We assumed that 95% of all caribou harvested by visiting hunters in Unit 26A were from the WAH and the remainder from the TCH. These levels are within the range of harvest levels estimated for previous years (Dau 2009, 2011). Total annual harvest during each regulatory year was roughly 4% of the population using the 2011 population estimate (Table 1). Our harvest data do not include wounding losses or caribou killed but not salvaged.

Permit Hunts. All caribou hunting by residents that live north of the Yukon River and within the range of the WAH is administered through a registration requirement (RC900) instead of statewide harvest tickets. Registration overlays are free, not limited, and available at license vendors throughout the range of this herd. Comparisons of registration harvest data and community harvest assessments indicated only about 10% of the actual harvest was reported through this system (Georgette 1994) even though vendors were paid twice the normal amount to issue caribou registrations, and Department of Public Safety (DPS) staff invested substantial time educating hunters in some communities about the need for data produced through this system. The exception to this is the community of Nome, where compliance with reporting requirements is believed to be much better (K. Person and T. Gorn, ADF&G, personal communication). The department has not collected registration harvest information outside of Unit 22 since the year 2000 because it is so incomplete.

Nonresidents and residents that live outside the range of the WAH must carry a statewide caribou harvest ticket when hunting. DPS Wildlife Enforcement officers indicate that compliance with this requirement is almost 100% (C. Bedingfield, J. Rodgers, and D. Hildebrand, DPS Alaska Wildlife Troopers, personal communication). We think this system is reasonably accurate for monitoring caribou harvested by nonlocal hunters.

Hunter Residency and Success. Hunters living within the range of this herd took roughly 11,200 WAH caribou in RY10 (Table 11) and 15,000 caribou in RY11 (Table 13). Most of the subsistence harvest of WAH caribou came from Unit 23 (86% in RY10 and 69% in RY11; Tables 11 and 12). There has been no clear trend in subsistence harvests since RY01 (Fig. 27). Demand for caribou by subsistence users is mainly a function of human population size within northwest Alaska. Subsistence harvest levels vary annually by community and game management unit, primarily in response to the availability of caribou, which in turn is affected by the timing of movements and spatial distribution of the herd. Traveling conditions (e.g., characteristics of snow cover and the duration of freeze-up and breakup, affect subsistence harvest levels to some degree but much less than caribou distribution per se. Availability of caribou to individual communities, human population sizes, and estimated harvests are reported in Tables 11 and 12.

There has been no clear trend in numbers of nonlocal WAH caribou hunters during the fall hunting season since RY98 (Table 13). This is surprising because many nonlocal hunters who have come to Unit 23 in recent years have indicated that declines in the MCH and accompanying regulatory restrictions had caused them to shift their effort to the WAH. Other factors, such as the stagnant national economy, may have offset this effect by discouraging nonlocal hunters from coming to northwest Alaska. In most years numbers of nonlocal Alaska residents slightly exceed numbers of nonresident WAH caribou hunters; however, in some years, numbers of each group are virtually the same.

As in the past, most WAH caribou taken by nonlocal hunters were harvested in Unit 23 (66% in RY10 and 73% in RY11). The fall migration during 2010 was geographically restricted to a narrow east-west corridor centered on the Anisak drainage. The success rate for nonlocal hunters during RY10 was the lowest on record for Unit 23 (42%), and for all game management units combined (44%, Table 13). Despite this variation in success there has been no trend in nonlocal hunter success across units 22, 23, and 26A since RY98, and the median annual success rate for nonlocal hunters has been 64% (range 47–72%).

Cow caribou have always been an important component of the subsistence harvest. Beginning around 7–12 October, bulls enter rut and their meat takes on a strong odor and flavor that renders it unpalatable to most people. Communities within the range of the WAH harvest caribou whenever they are available year-round, including during and after rut, by shifting harvests from bulls to cows after the former become inedible. Subsistence hunters avoid taking bulls through the following spring. Some communities, especially those in the southern portion of WAH range, have had little opportunity to harvest bulls before the onset of rut given the late timing of fall migrations in recent years. These communities have taken proportionately more cows during recent years compared to the 1980s and 1990s.

Nonlocal hunters take few caribou after the first week of October, and take very few cows (roughly 40–80 cows annually) relative to the subsistence harvest of female caribou. Even so, the proportion of cows in the total harvest by nonlocal hunters has increased since RY08. This has two implications relevant to the management of this herd. First, if the WAH declines to the point that harvests need to be restricted, eliminating cow harvests by nonlocal hunters, resident and nonresident alike, will have little effect on slowing or reversing that trend. Second, as this herd declines and hunters experience increasing difficulty harvesting caribou (even without regulatory restrictions), hunters (even nonlocal hunters who strongly prefer to take bulls) may become more prone to harvest cows. Thus, as the need to protect cows to ensure the conservation of this herd increases, demand for cows by hunters will likely increase.

If the proportion of bulls in this herd continues to decline (Fig. 19), this will further complicate reducing harvests in response to declining abundance. Shifting harvests from cows to bulls may only briefly delay harvest restrictions necessary for cows and bulls. Rather than maintaining liberal harvests of bulls through a persistent population decline and possibly driving bull:cow ratios to a low level (as has happened with many moose and some caribou populations throughout Alaska), it may be better to maintain a healthy proportion of bulls in this herd while restricting harvests of both sexes throughout the period of decline.

The nonresident caribou bag limit in Unit 23 was increased from 1 caribou per year to 2 caribou per year beginning 1 July 2010. Despite this liberalization, the number of nonresident hunters in Unit 23 did not increase during RY10, nor did the nonresident caribou harvest. As noted above, caribou distribution was limited during fall 2010 and the main thrust of the migration did not move through the Noatak and Kobuk drainages until mid to late October 2010, at least a month later than typical years. In 2011–2012 the number of nonresident caribou hunters in Unit 23 remained stable; however, the nonresident harvest in this unit almost doubled (116 to 224 caribou). Caribou were distributed more widely during the fall of 2011 than 2010 which improved access to caribou for nonlocal and local hunters.

Harvest Chronology. Seasonal subsistence harvest patterns have been previously described (Dau 2009). Subsistence hunters throughout WAH range take caribou whenever they are available. Seasonal movements of caribou drive seasonal harvest patterns among communities within the range of this herd.

Despite no closed season on bulls, 85–90% of all caribou taken by nonlocal hunters are harvested between 25 August and 7 October. This temporal concentration of nonlocal hunters in Unit 23 combined with intense subsistence hunting during the same period is why conflicts among users have occurred in this unit for many years. The median date of harvest for nonlocal hunters was 12 September in RY10 and 13 September in September RY11.

Transport Methods. Most subsistence hunters harvest WAH caribou using snowmachines during late October–early May, and boats or 4-wheelers during the rest of the year. Few local hunters use aircraft to hunt caribou. Transport methods used by nonlocal caribou hunters have been surprisingly consistent through time (Table 14). During this reporting period, most nonlocal hunters accessed hunting areas by airplane (75% in RY10 and 69% in RY11). Since RY98, most nonlocal hunters accessed hunting areas using an airplane (median = 73%) followed by boats (median = 15%). Guides now rely heavily on 4-wheelers for hunting. This practice dramatically increased during the mid-1990s in Unit 23, and most guides now cache 4-wheelers at remote camps.

Other Mortality

Disease. We have collected blood annually from caribou during the Onion Portage project since 1992 to screen for exposure to selected pathogens and measure haptoglobin levels. Haptoglobin levels during this reporting period were within the range seen in previous years, and there has been no temporal trend in the percentage of caribou with an elevated haptoglobin level (Table 15).

Exposure to brucellosis has trended downward in the WAH since the early 1960s (Table 15). The primary impact of this disease on caribou populations is reduced reproductive success (Dieterich 1981). Final brucellosis results for 2010 and 2011 were not available when this was written. Low and declining levels of exposure to this disease suggest that brucellosis is probably not currently affecting the population dynamics of this herd.

The department collected 10 caribou, including males and females of various ages, during the Onion Portage project in September 2010 to assess their health. Gross characteristics during necropsies indicated the collected individuals were healthy. Histopathology results have revealed no disease problems at the cellular level that likely go beyond the individual caribou sampled.

Results of 2007 and 2010 health assessments, serological surveys conducted since 1992, opportunistic observations by staff, and hundreds of conversations with hunters suggest that neither disease nor a chronic decline in body condition are likely causing the current population decline.

A localized die-off of WAH caribou occurred on the eastern side of the Lisburne Hills during the winter and spring of 2011–2012. Although I wasn't able to search this entire area, I did make several flights via PA-18 Cub and R-44 helicopter to search for carcasses. In 7 hours of search time during July 2012 I observed 112 caribou carcasses in a 150 mi^2 (400 km^2) area east of Maktak and Angmakrok mountains. The number and spatial distribution of caribou that I observed suggested that perhaps several hundred caribou died during this event. Ted Frankson, a resident of Point Hope and representative of that community to the WG, told me that this area had experienced 3–4 days of light rain during November 2011, and that it had formed a hard crust of ice.

On 23 July, TeckAlaska provided an R-44 helicopter to retrieve radio collars from mortality sights and to visit carcasses from this die-off to collect jaws and determine cause of death. Although all of the carcasses had been lightly scavenged, the presence of small bones and degree of articulation suggested most or all of them had died of starvation. This is consistent with the emaciated body condition of caribou I observed in this area during recruitment surveys in April 2012.

I collected at least 1 tooth for aging from 55 caribou that perished in this Lisburne Hills die-off: 43 cows, 10 bulls and 2 of unknown sex (both calves). Twenty nine percent of the carcasses were calves (11 females, 3 males and 2 of unknown sex). For caribou >12 months old, ages were evenly distributed among cohorts. Three cows were 12 years old and one was 14 years old at the time of death. The oldest bull was 10 years old.

Mandible Collections

I resumed collecting mandibles from WAH caribou in 2009 to evaluate whether the body size of individual caribou or the age structure of the population were correlated to population size or density. Most WAH jaws have come from harvested caribou. Unless caribou are so scarce that it precludes selective harvesting, hunters choose individuals based on sex, body condition or antler size. Thus, hunter-killed samples rarely reflect the overall population in terms of age, size or sex. This is especially true for bulls because antler size indicates at least age categories that hunters select for. There was no difference in the median age of bulls killed by hunters (5 yrs, range 0.5–12 years, n_i = 433) versus those that died of natural causes (5 yrs, range 0.5–16 yrs, n_i = 45; Kruskal-Wallis F = 0.00, P = 0.95). Therefore, I combined harvested bulls with natural mortalities for analyses involving age. In contrast, the median age of cows that died of natural causes (7 yrs, range = 0.5–20 yrs, n_i = 146) was significantly older than those harvested by hunters (5 yrs, range = 0.5–19 yrs, n_i = 131, Kruskal-Wallis F = 7.48, P = 0.007). For analyses involving age, I included only harvested cows.

Analyses regarding body size could be affected by the age structure of harvested caribou. Based on the size of antlers of hundreds of discarded bull heads at Onion Portage, it has appeared that in some years bulls have not been randomly distributed throughout the herd with regard to age. Instead, relatively few mature bulls have comprised the vanguard of the fall migration in some years while in others just most bulls in the early portion of the migration were mature. To see if body size changed in relation to population size, I needed to restrict the sample to adult caribou only.

Using cementum ages for mandibles collected since 2009 and ramus length as an index of skeletal size, WAH cows approach their full physical size by age 3 (Fig. 28). Median ramus length for 2-yr-old cows (252 mm, n_i = 9) was smaller than for cows >2 yrs old (259 mm, n_i = 381; Kruskal-Wallis F = 3.07, P = 0.08). There was no difference in median ramus length for 3-yr-old cows (256 mm, n_i = 23) compared to cows >3 yrs old (259 mm, n_i = 358; Kruskal-Wallis F = 0.17, P = 0.68). In contrast, WAH bulls do not reach their full physical size until 5-6 yrs of age (Fig. 29). Median ramus length for 4-yr-old bulls (284 mm, n_i = 59) was significantly smaller than for bulls >4 yrs old (291 mm, n_i = 842; Kruskal-Wallis F = 17.52, P = 0.00). Similarly, median ramus length for 5-yr-old bulls (287 mm, n_i = 75) was significantly smaller than for bulls >5 yrs old (291 mm, n_i = 767; Kruskal-Wallis F = 4.97, P = 0.03). There was no significant difference in ramus length for bulls 6 yrs old (290 mm, n_i = 77) versus bulls >6 yrs old (292 mm, n_i = 690; Kruskal-Wallis F = 0.96, P = 0.33). For analyses regarding size, I defined 'adult cows' as individuals ≥3 yrs old, and 'adult bulls' as individuals ≥6 yrs old.

<u>Age.</u> There are no tooth cementum age data for this herd prior to 1997. All age estimates for caribou collected before that time are based on tooth eruption and wear patterns by department staff. For caribou with age estimates from tooth eruption/wear as well as cementum annuli, these parameters were significantly correlated (Pearson correlation coefficient = 0.69, P = 0.00).

Difference in ages of caribou between 1959–1961 and 1997–2013 are equivocal. Based on tooth wear as well as cementum ages, the median age of adult bulls (harvested and natural mortalities) during 1959–1961 (10 yrs, n_i = 107) was significantly older than during 1997–2013 (7 yrs, n_i = 251; Kruskal-Wallis F = 104.93, P = 0.00). The median age of harvested adult cows during 1959–1961 (6 yrs, n_i = 172) was not significantly different from 1997–2013 (6 yrs, n_i = 121; Kruskal-Wallis F = 0.24, P = 0.63).

<u>Size.</u> Median mandible length for adult bulls (harvested and natural mortalities) was least during 1959–1961 (276 mm, n_i = 107) and greatest during 1985–1991 (295 mm, n_i = 369). Since 1997, median adult bull jaw length has been 291 mm (n = 228). These differences are all statistically significant (Kruskal-Wallis tests, all P<0.05). Median mandible length for harvested adult cows during 1959–1961 (260 mm, n_i = 173), 1985–1991 (258 mm, n_i = 15) and 1997–2013 (263 mm, n_i = 99) were not significantly different (Kruskal-Wallis F = 2.18, P = 0.12). The inconsistency between bulls and cows regarding the significance of differences in age and mandible length among these 3 time periods may be attributable to the much larger sample sizes for bulls compared to cows.

Calf Weights

During 2008–2013 (all years combined), median live weight of male calves (92 lb, $n_i = 68$) was significantly heavier than for female calves (88 lb, $n_i = 69$; Kruskal-Wallis $F = 4.68$, $P = 0.03$; Table 16). There was no difference in calf weight among years for male calves (Kruskal-Wallis $F = 4.62$, $P = 0.48$) or for female calves (Kruskal-Wallis $F = 4.24$, $P = 0.53$). There was no difference in calf weight among 3 body condition categories of the calves' mothers (very skinny or skinny; average; fat or very fat) for female calves (Kruskal-Wallis $F = 1.00$, $P = 0.61$; $n_i = 6$, 34, and 27, respectively) or for male calves (Kruskal-Wallis $F = 0.36$, $P = 0.84$; $n_i = 8$, 40, and 17, respectively).

Other Management Issues

User conflicts. Residents of Unit 23 have long held that the state is generally unwilling to take action to try to minimize or even reduce user conflicts because they think the department and BOG have refused to try to reduce numbers of nonlocal hunters in this unit. Even so, this criticism is not wholly deserved. For example, the original Noatak Controlled Use Area was established by the BOG over 20 years ago and was later substantially expanded in both space and time. The department has led two Unit 23 user conflict planning processes, the last of which functioned throughout this reporting period. The BOG passed a mandatory Unit 23 pilot orientation requirement which was developed by department staff. Additionally, the department has developed and distributed extensive public outreach products that are available online and as hard copy posters and brochures that focus on reducing user conflicts. Despite these efforts by the state, subsistence users in Unit 23 have increasingly looked to federal agencies to address their concerns regarding guides, transporters, and nonlocal hunters. In response to pressure from local residents, during this reporting period the NPS created 2 new federal controlled use areas that prohibit transporters from dropping off caribou hunters in the western portion of the Noatak National Preserve before September 15 (guides and hunters pursuing other big game species were not affected by this action). If DOI agencies continue to act individually to reduce user conflicts, it will likely create a further divergence of state and federal regulations and a mosaic of regulatory requirements with little regard for issues that might be better addressed at a regional or game management unit basis. Numerous independent regulatory responses to user conflicts may just push problems to other areas without solving them. If the Unit 23 user conflict working group continues to be funded, all participating agencies should attempt to cooperatively reduce user conflicts on a unitwide basis.

Failure to salvage meat. The issue of 'waste' should be addressed soon by the department, fish and game advisory committees, the Department of Public Safety, and Department of Law. Everyone agrees that waste is wrong. But while salvage regulations provide guidance regarding what must be salvaged from harvested wildlife damaged by trauma or disease, it is by no means definitive and of little value to hunters who cannot understand technical jargon. Additionally, there are strongly held differences among subsistence users, agency staff, and recreational hunters regarding what is fit for human consumption and, hence, what constitutes 'waste.' Allegation of waste was a major issue during the last decline of this herd during the 1970s. If the WAH again declines to a level where it becomes necessary to restrict hunting, it will be critical for agencies and users to agree on a mutually acceptable definition of waste. Managers, enforcement staff, and users should try to address this issue now, while the WAH population is still high, and before the controversy and allocation battles that will likely accompany a significant population decline. The WG could be a good venue for this discussion. Unfortunately, given the contentious nature of this topic, agency staff as well as the public are reluctant to discuss it. This may prove to be a disservice to managers and users of the WAH in the future.

HABITAT

Assessment

The department did not monitor WAH range condition during this reporting period. Staff from the SNWR monitored snow conditions on WAH winter range during both winters of this reporting period. Landscape ecologists for USGS and NPS initiated a vegetation project to investigate productivity of summer WAH range.

Enhancement

There were no WAH habitat enhancement activities during the reporting period.

NONREGULATORY MANAGEMENT PROBLEMS/NEEDS

WAH Cooperative Management

The history, organization and accomplishments of the WG through 2010 was previously reported (Dau 2011). The WG finalized a review of the WAH Cooperative Management Plan at its December 2011 meeting (Western Arctic Caribou Herd Working Group 2011).

Resource Development

The WAH has one of the most intact ranges of any large caribou herd in North America. Currently, the Red Dog mine, road, and port site comprise the only large development complex within the range of this herd. These facilities are located wholly within the northwestern portion of WAH range.

Most of the potential development projects reported in the last WAH management report (Dau 2011) are still under consideration. The Rock Creek Mine near Nome has been discontinued and the existing facilities have been closed. During this reporting period the state continued to push to establish a road from the Dalton Highway to the Ambler Mining District. In 2012 the Alaska Industrial Development and Export Authority (AIDEA) assumed leadership of this project from the Alaska Department of Transportation.

During this reporting period I mapped fall movements of WAH caribou near the Red Dog road in response to questions I received from the public during a March 2012 scoping meeting in Ambler regarding potential effects of the proposed road to Ambler on caribou.

During fall 2011, 21 of 74 satellite-collared WAH caribou (28%), all cows, came within 30 mi (50 km) of the Red Dog road. The 30-mi area was arbitrarily defined only to identify a sample of collared caribou; it had no biological significance. The direction of movement changed >90 degrees for 18 of the 21 cows (86%). Examples of caribou movements near the road are shown in Figure 30. Two of the 3 other caribou approached the road from the east and reversed direction as they approached the Aggy/Eli or Noatak rivers. These individuals may have responded to hunters rather than the Red Dog road. One of the other caribou barely contacted the

30-mi zone from the northeast. There is little chance that this caribou responded to the road. This cow wintered northwest of the road and died there that winter. Given the dilution factor of satellite collared caribou to total herd size, each satellite collar conservatively represented roughly 4,000 caribou in the herd. Thus, these 18 satellite-collared caribou could represent roughly 70,000–80,000 WAH caribou.

Of the 18 collared individuals that changed their direction of travel as they approached the road, 16 eventually crossed it. The 2 that did not cross the road wintered northwest of it and died there that winter. One VHF-collared caribou also wintered northwest of the road: it died in this area that winter as well.

Most of the caribou that changed their direction of travel as they approached the road traveled northwest as far as the Tigara Peninsula near Point Hope, a straight-line distance of >100 miles (160 km). Although their rate of travel was similar as they initially approached the road and after they changed their direction of travel, once they had crossed the road their speed roughly doubled until they caught up with the rest of the herd on their winter range. This is significant for hunters 'downstream' of the road. Their window of opportunity to hunt caribou was substantially shortened as caribou attempted to make up for lost time after crossing the road. The average time between when a caribou first changed its direction of travel to when it crossed the road was approximately 44 days (range 16–84 days).

I mapped the movements of 17 satellite collared caribou as they crossed a portion of the middle Noatak drainage 50–75 mi east of Red Dog (2 examples of these 17 caribou are shown in Figure 31). The physical and biological characteristics of this area are similar to those near Red Dog. Also, it is situated about the same distance from the summer and winter ranges of this herd and the river could be considered a natural proxy for the road in that it is a relatively linear feature. Not surprisingly, no caribou moved through this 'control' area in a straight line. Caribou typically move in a fairly sinuous pattern; direct, linear movements occur only when caribou are strongly motivated to get to some destination. None of the 17 caribou migrating through the middle Noatak drainage reversed course and traveled 100 mi north or northwest as did the caribou that approached the Red Dog road.

After examining 2011 data, I looked at satellite data for all previous years to determine if caribou had been affected by the Red Dog road to this degree in the past. We did not maintain at least 10 satellite collars in this herd until 1999; therefore, it isn't possible to characterize annual movements at the herd level prior to that time. In some years (2000, 2002, 2006, 2007, 2009 and 2010), $\leq$10% of the herd passed within 30 mi of the Red Dog road. In years when >10% of the herd migrated near the road, they approached it from every direction except from the west (which is ocean). Caribou appeared to have little difficulty crossing the Red Dog road in some years while other years were similar to 2011. This variability in caribou response to the road may depend on whether caribou in the vanguard of the migration are disturbed as they approach it. If the leaders pass without consequence, caribou behind them may cross easily as well. However, if the 'leaders' are deflected by the road, local wisdom suggests that all caribou following them will be deflected, too. These are preliminary analyses and the numbers I report here will almost certainly change with more refined analyses. However, regardless of details or specific statistics, it is clear that in some years substantial numbers of WAH caribou have been delayed and deflected by the Red Dog road during the fall migration. We are currently modeling movements of WAH and TCH caribou near the Red Dog road to better understand its impacts on caribou from these herds. Hopefully, this will also enable us to predict how proposed roads, for example the road to Umiat and the road to the Ambler Mining District, could affect these herds.

Department staff has been working with Dr. Ryan Wilson (USFWS) and NPS staff to model movements of WAH and TCH caribou near the Red Dog road. These analyses are not yet complete.

I mapped movements of satellite-collared caribou on the Seward Peninsula during winter to assess whether they reacted to the Nome road system as they had to the Red Dog road. During winter, spatial movements of caribou are minimal. Also, there is essentially no traffic and little human activity along the Nome road system during winter. Despite these differences from the fall situation near Red Dog, WAH caribou tended to not cross the Nome road system (Fig. 32). Even so, this may not necessarily be evidence that caribou avoided these roads. Instead, they may have been selecting for elevated hills or ridges where wind reduced snow depths, for areas where food was abundant, or habitats where they could detect and avoid predators and hunters. It is noteworthy that caribou did not move west of the longitude of Shishmaref even though no man-made structures or activities were present to prevent them from doing so; in fact, you would think the reindeer herds still present in Wales and Teller would attract caribou to expand their range westward.

School Programs

In 2010, students from Shishmaref and Golovin participated in the Onion Portage caribou project. In 2011, students from Shungnak and Ambler participated in this project, and in 2012 (after this reporting period) the Kobuk and Kivalina schools participated. In each year all students were high school level. In addition to working with agency staff, the students learned subsistence skills from their chaperones. This project has been a positive experience for students, school district staff, and agency staff since its inception in 1991.

Conflicts Between WAH and Reindeer Industry

The Seward Peninsula reindeer industry continued to lose deer to the WAH during this reporting period. Fewer reindeer have been seen accompanying WAH caribou in recent years compared to the 1990s. However, this apparent reduction is likely only because all but the westernmost reindeer herds on the Seward Peninsula essentially had been previously lost to the WAH.

During this reporting period the department removed the web page that showed real-time locations of satellite-collared WAH caribou on the Seward Peninsula. This online map had been intended to help herders avoid conflicts with caribou (caribou with satellite or GPS collars purchased by federal agencies had been excluded from these maps). With the demise of so many reindeer herds in this region since the mid-1990s, it had become evident that the primary use of this map was by hunters who used them to locate caribou. This was clearly in violation of state statute (AS 16.05.815) and the map was removed from the department website.

User Conflicts

Conflicts among nonlocal hunters, guides, transporters and local hunters continued in portions of WAH range during this reporting period. These conflicts were most pronounced in Unit 23 but also occurred near Anaktuvuk Pass. This complex issue involves all hunters, not just caribou hunters, and is affected by a variety of factors (Dau 2005). Factors that contribute to these conflicts in Unit 23 include limited access points for guides and transporters, and the perception among residents of Unit 23 that commercial hunting activities and drop off hunters 'upstream' in the migration deflect caribou from traditional hunting areas. The Unit 23 User Conflict Working Group held meetings during January 2009 and May 2010 to address these concerns.

Interagency Cooperation

Beginning in 2009, ADF&G and NPS began deploying GPS collars in the WAH. Initially, VHF transmitters in all NPS GPS collars were in the state frequency band (148.000–153.999 kHz). Since 2010 the NPS has transitioned to using only VHF frequencies in the federal frequency band (164.000–168.999 kHz) in their GPS collars. It is difficult to monitor VHF transmitters in 2 separate bands during telemetry flights because of antenna-frequency band mismatches and our inability to simultaneously monitor multiple receivers while radiotracking. Therefore, relatively little VHF (or observational) data has been collected for NPS collars with VHF frequencies in the federal band. As the number and proportion of collars with VHF frequencies in the federal band has increased, it has compromised our ability to find collared individuals in each frequency band and greatly reduced our efficiency during radiotracking flights. This has affected to varying degrees most of the results of VHF-based telemetry analyses reported herein.

Although NPS has provided all data from its GPS collars to the department since they began purchasing collars, it is currently not clear whether or how we can use that data. During this reporting period this management region (Region V) and headquarters staff spent substantial time drafting Memorandums of Understanding and data sharing agreements to clarify and document the mutual sharing of WAH telemetry data. None of these documents had been finalized or adopted at the time this report was prepared.

CONCLUSIONS AND RECOMMENDATIONS

The WAH is still very large despite its decline since 2003. There is no evidence that any single factor (e.g., human harvests, predation, environmental contaminants, range degradation, or disease) is currently limiting the size of this herd. Icing events likely caused high mortality in some years and may have initiated this population decline. Long-term declines in recruitment and the proportion of bulls in the population suggest that density dependent factors may be subtly affecting the population dynamics of this herd as well. Opportunistic observations by department staff and numerous reports from local residents and long-term commercial operators suggest that predators (brown bears and, especially, wolves) have been abundant and taking many caribou in recent years. Predators are almost certainly affecting the population dynamics of this herd to a greater extent now than in the previous 30 years.

Despite the continued large size of this herd, local and visiting hunters have experienced difficulty harvesting caribou during recent fall hunting seasons due to delays in the onset of the fall migration, and to caribou moving through relatively narrow migration corridors. Limited availability of caribou appears to intensify conflicts among user groups even when local and nonlocal hunters are spatially separated. User conflicts will likely intensify if this herd continues to decline and hunting becomes more difficult.

The need for accurate and complete WAH harvest data is becoming increasingly important to the management of this herd for several reasons.

1. Cows compose a significant component of the total harvest in terms of their importance to subsistence users, and their importance to the population dynamics of this herd.
2. During the last population decline of the WAH during the 1970s, one of the most controversial aspects of restricting harvests centered on how to allocate the limited harvestable surplus of caribou among communities within the range of this herd.
3. Caribou from the WAH and TCH have long mingled during fall, winter and spring, and some radiocollared TCH caribou were found in WAH aggregations even during July 2013 (after this reporting period). The need to restrict harvests for one or both of these herds will increase if both of them continue to decline. It will be impossible to regulate harvests for either herd without reasonably accurate harvest data for both.

Without substantial increases in funding and staffing levels or a substantial change in methodology, it is unlikely that ADF&G's Division of Subsistence will ever be able to contact all communities within the range of the WAH annually to conduct community harvest assessments. Although most communities within the range of this herd have now had at least one assessment completed by the department's Division of Subsistence, we lack a structured design to determine when and how often to sample individual communities. The need to develop a statistically-based, comprehensive sampling approach for the community harvest assessment program is probably the greatest current need with regard to harvest monitoring for the WAH and TCH. Any harvest assessment program for these herds must include the communities of Kotzebue, Barrow, and Nome on a regular basis. The department should continue to monitor harvests of WAH caribou by nonlocal hunters through the statewide caribou harvest ticket system.

Seward Peninsula reindeer continue to be lost to the WAH, albeit more slowly now than in past years when reindeer were present on the eastern half of the Seward Peninsula. The westward expansion of WAH caribou onto the Seward Peninsula has essentially stopped during recent years. This may provide refugia for the remaining reindeer on the western half of the Seward Peninsula.

The department should continue to monitor the health of caribou in this herd through annual serological surveys and health assessment collections at least once every 2 to 3 years. We should consider conducting intensive health assessments during spring as well as fall. Greater consideration of analyzing caribou health assessment data to determine trends and biological significance is needed in this component of the departments' WAH survey and inventory (S&I) program.

A number of large-scale developments are being considered for northwest Alaska. Potential impacts of individual projects on caribou and users should not be evaluated individually. Instead, the cumulative effects of all existing and proposed development should be collectively considered over the short and long term to predict impacts on caribou. Additionally, social impacts from extending roads into historically remote, traditional subsistence areas must be considered in addition to their direct impacts on wildlife. Preliminary analyses strongly suggest that roads significantly affect WAH movements at least during some years. The mechanisms for this and their biological impacts on caribou are still not understood. Even so, the implications of delayed or diverted caribou migrations on subsistence users and other hunters could be serious. The social impacts of establishing new roads into previously remote areas used by few people outside of local subsistence users should be a primary consideration when deciding whether to build these roads.

Conflicts among local subsistence hunters, nonlocal hunters, and commercial operators have continued in portions of WAH range. Data on camp locations is needed to assess whether airplane activity and itinerant camps affect caribou movements. The department should press the Big Game Commercial Services Board to require all commercial operators to provide latitude and longitude of all drop-off, pick-up, and camp locations. The department should also try to merge commercial operator contract data from the Department of Commerce, Community and Economic Development with department hunter harvest data, and make this data available to department staff.

The department should continue to support the WACH WG. The 2011 Western Arctic Herd Cooperative Management Plan describes a step-down approach for monitoring activities and recommendations for regulatory restrictions in relation to population size and trend. There are many things agencies and users might voluntarily do to try to minimize human impacts on this herd that would not necessarily require regulatory action by the BOG or FSB. The WG would be a good forum for discussing these types of responses to the population decline.

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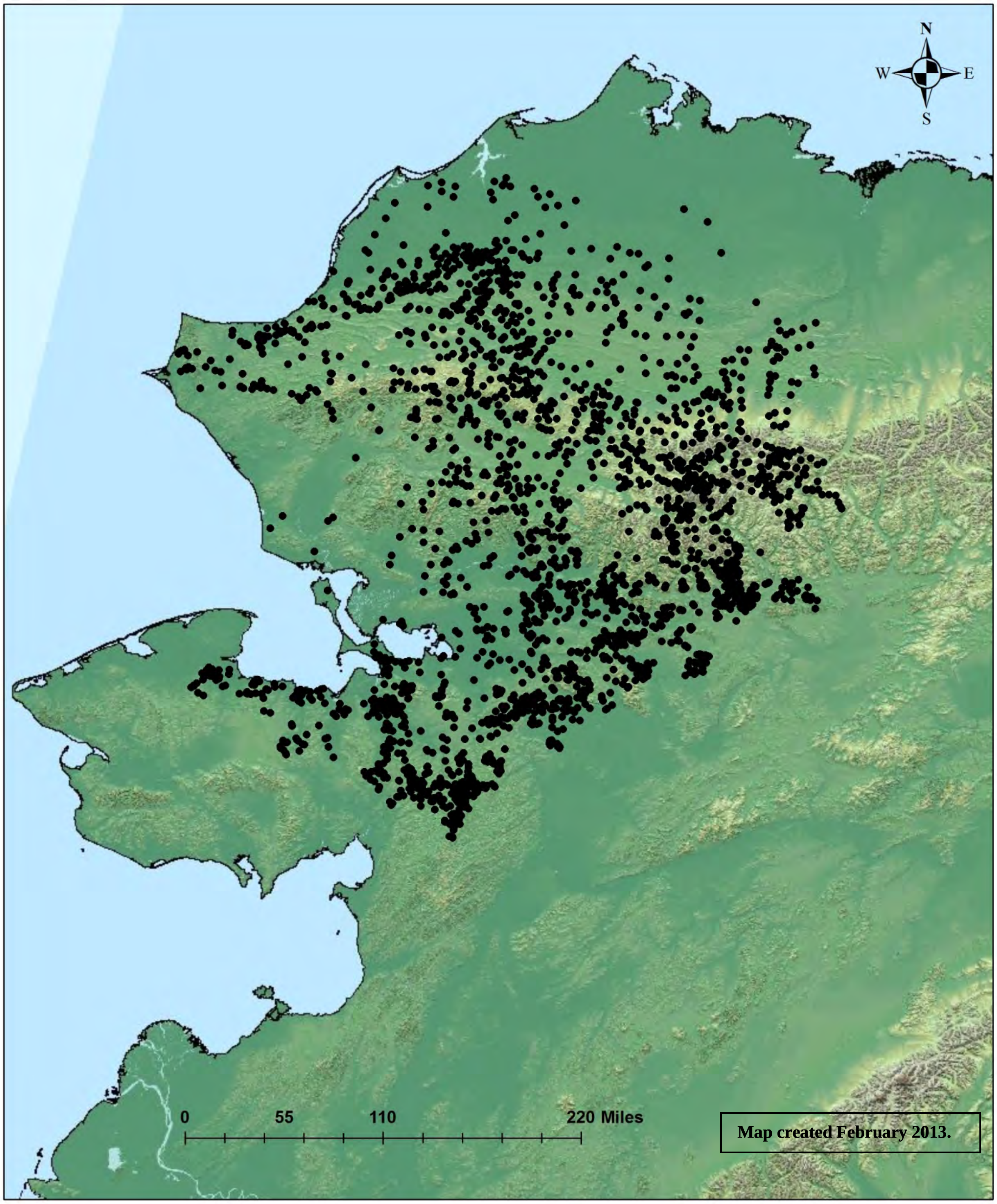


Figure 1. Locations of 94 satellite-collared caribou, Western Arctic caribou herd, regulatory year 2010. Data excludes first 8 months after collaring. All collar duty cycles standardized to 1 location every 6 days (n_i=2,978 locations).

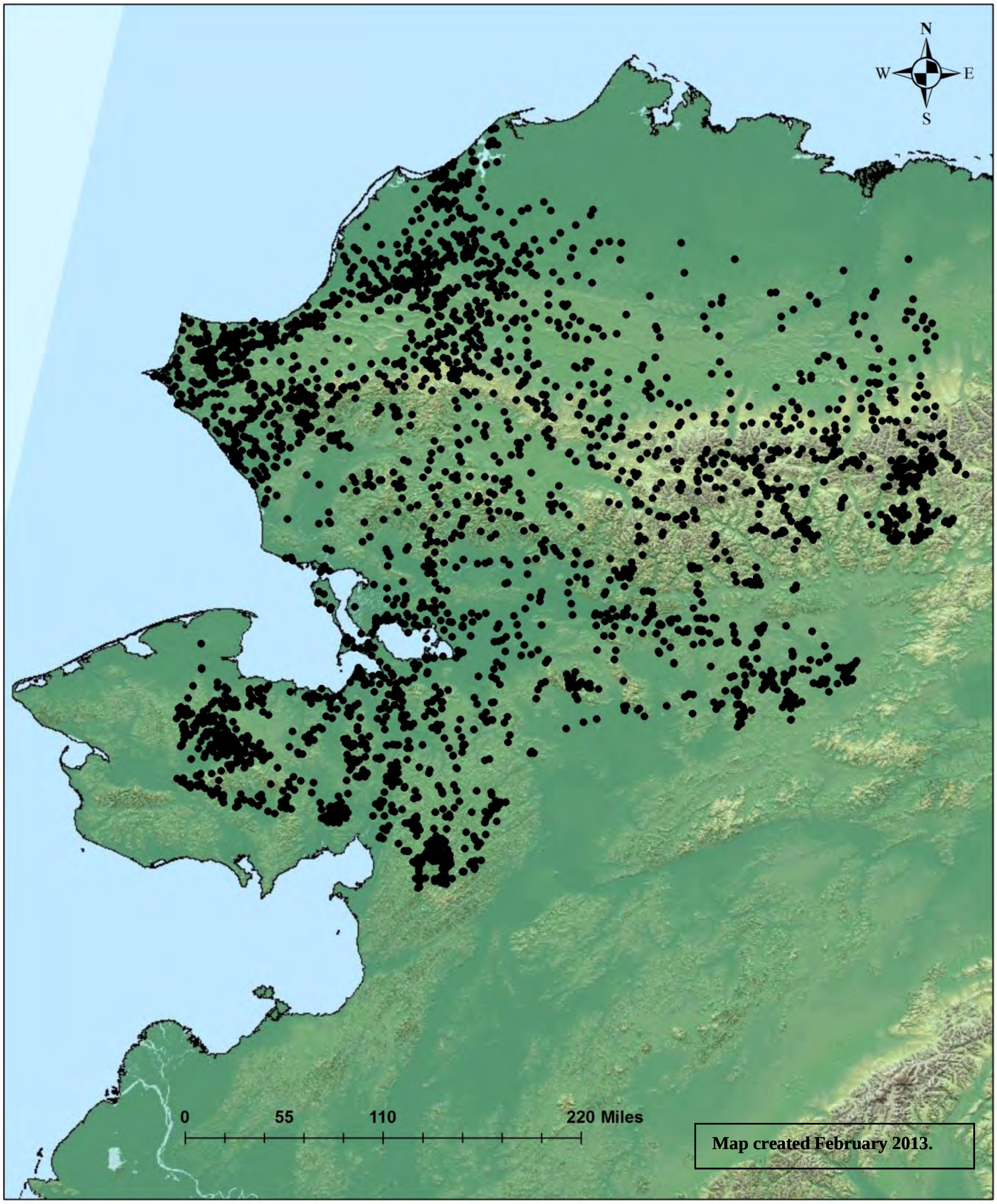


Figure 2. Locations of 93 satellite-collared caribou, Western Arctic caribou herd, regulatory year 2011. Data excludes first 8 months after collaring. All collar duty cycles standardized to 1 location every 6 days (n_i=3,314 locations).

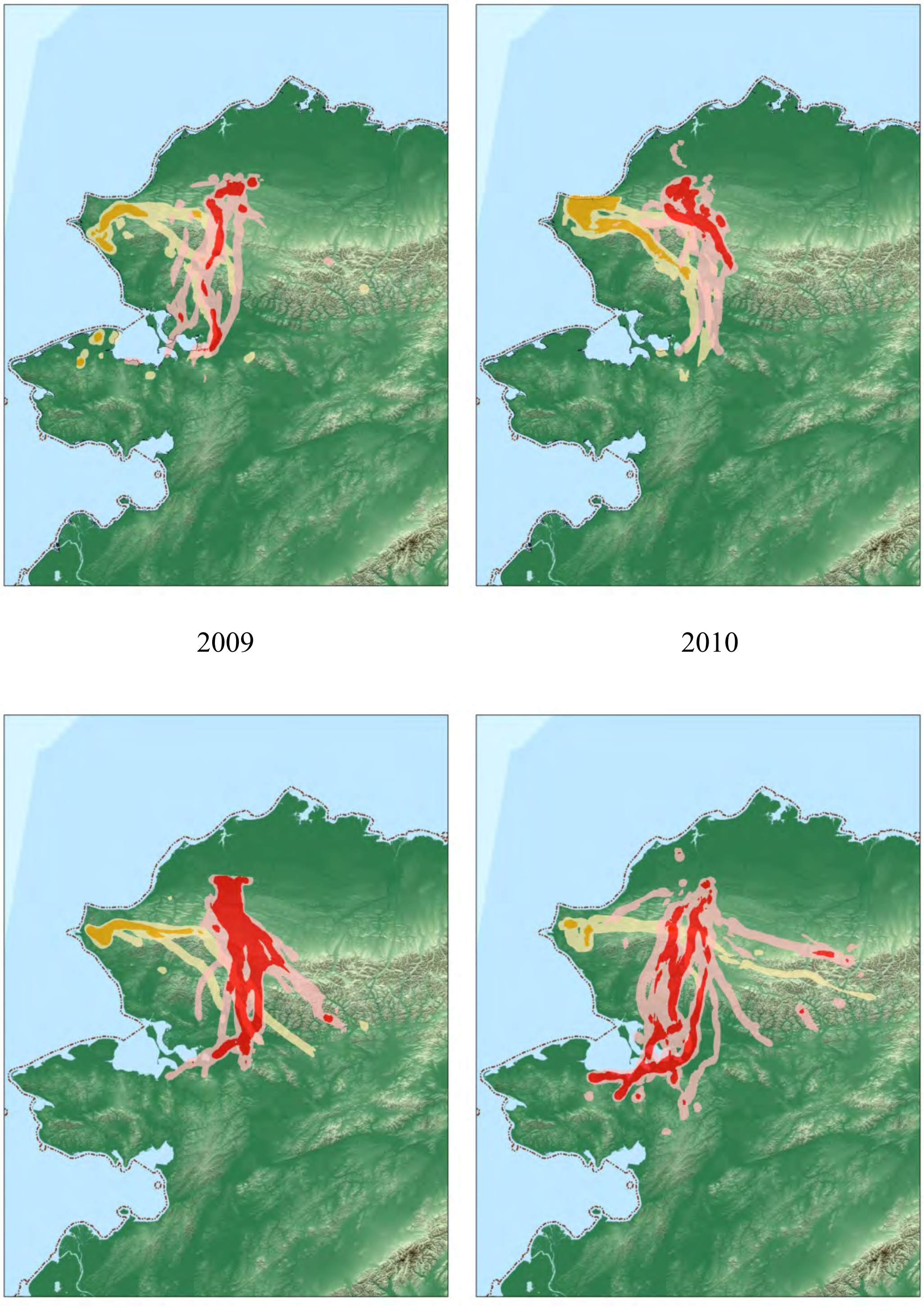


Figure 3. Spring movements of satellite-collared, Western Arctic herd caribou, 2009–2012. Cows (6 May–8 June) in pink/red; bulls (16 May–4 July) in tan/brown. Shaded area is based on density of individual caribou track lines; darker color indicates heavier use.

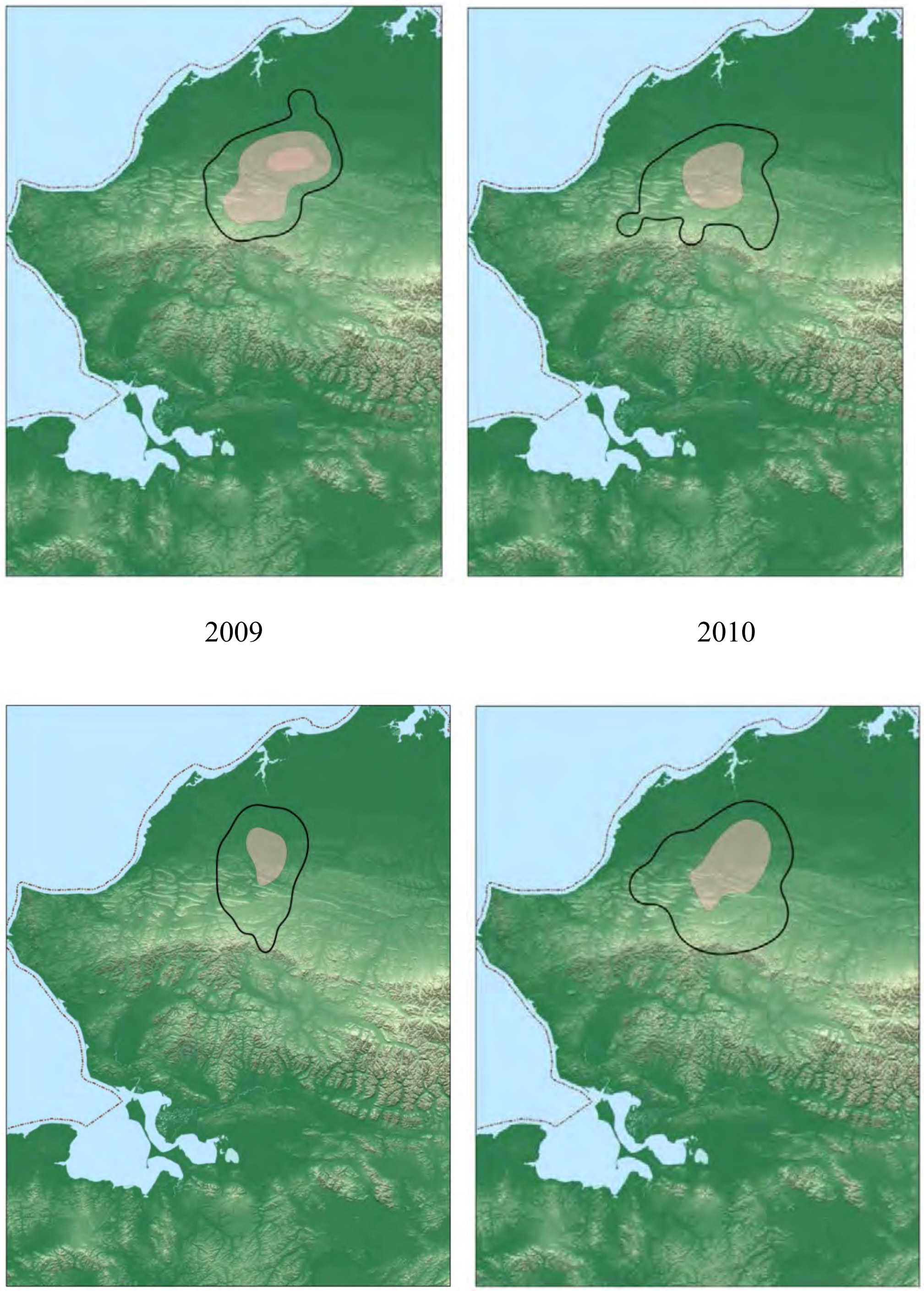


Figure 4. Kernel depictions of calving grounds based on locations of maternal cows, Western Arctic caribou herd, 2009–2012. Calving period is 9–13 June. Outer black boundaries represent the 95% isopleth to show the extent of calving. Shaded areas were selected by a Bayesian model to reflect statistical intensity of use rather than biological importance (these isopleths vary by year; in 2009, there were 2 levels of clustering).

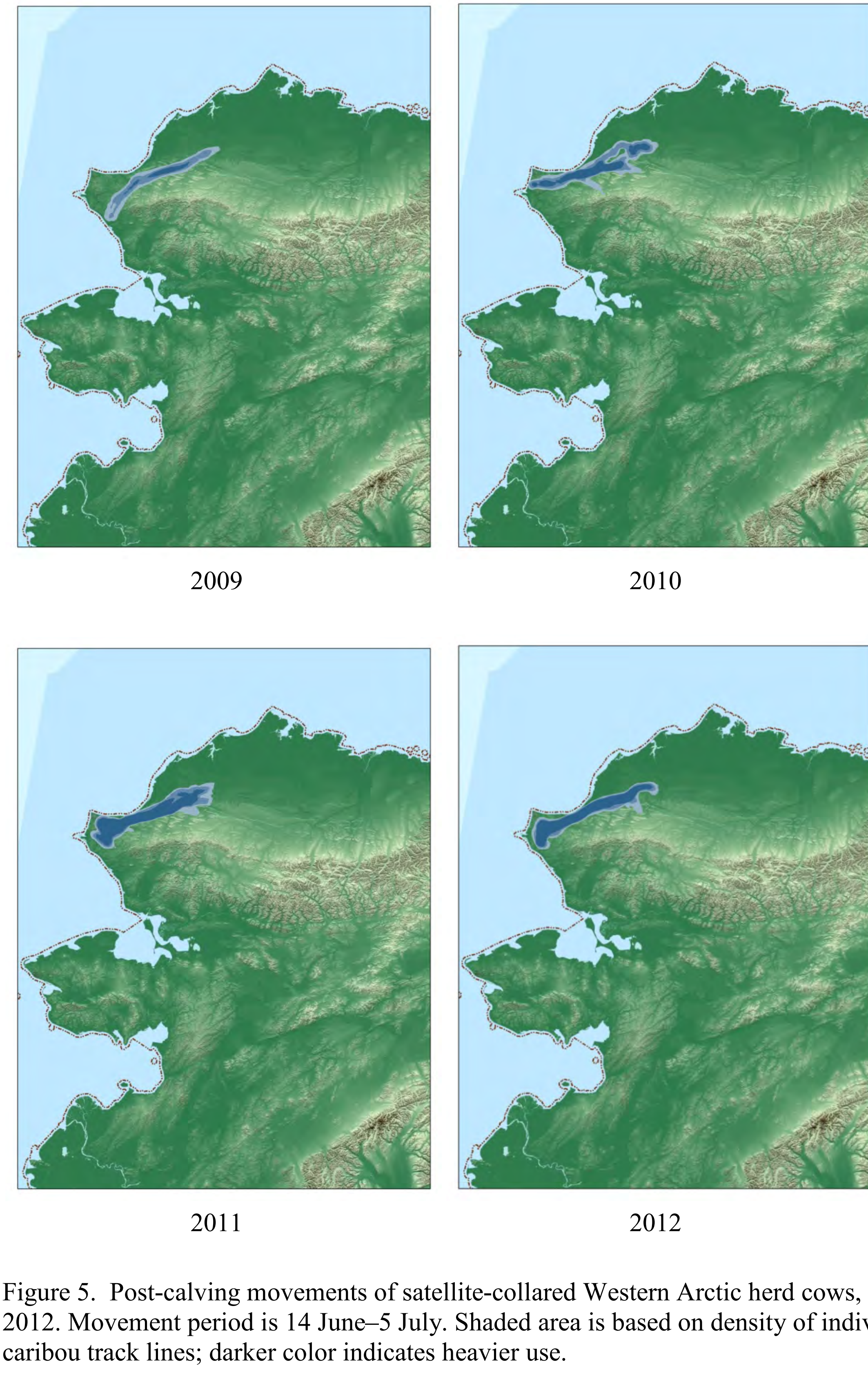


Figure 5. Post-calving movements of satellite-collared Western Arctic herd cows, 2009–2012. Movement period is 14 June–5 July. Shaded area is based on density of individual caribou track lines; darker color indicates heavier use.

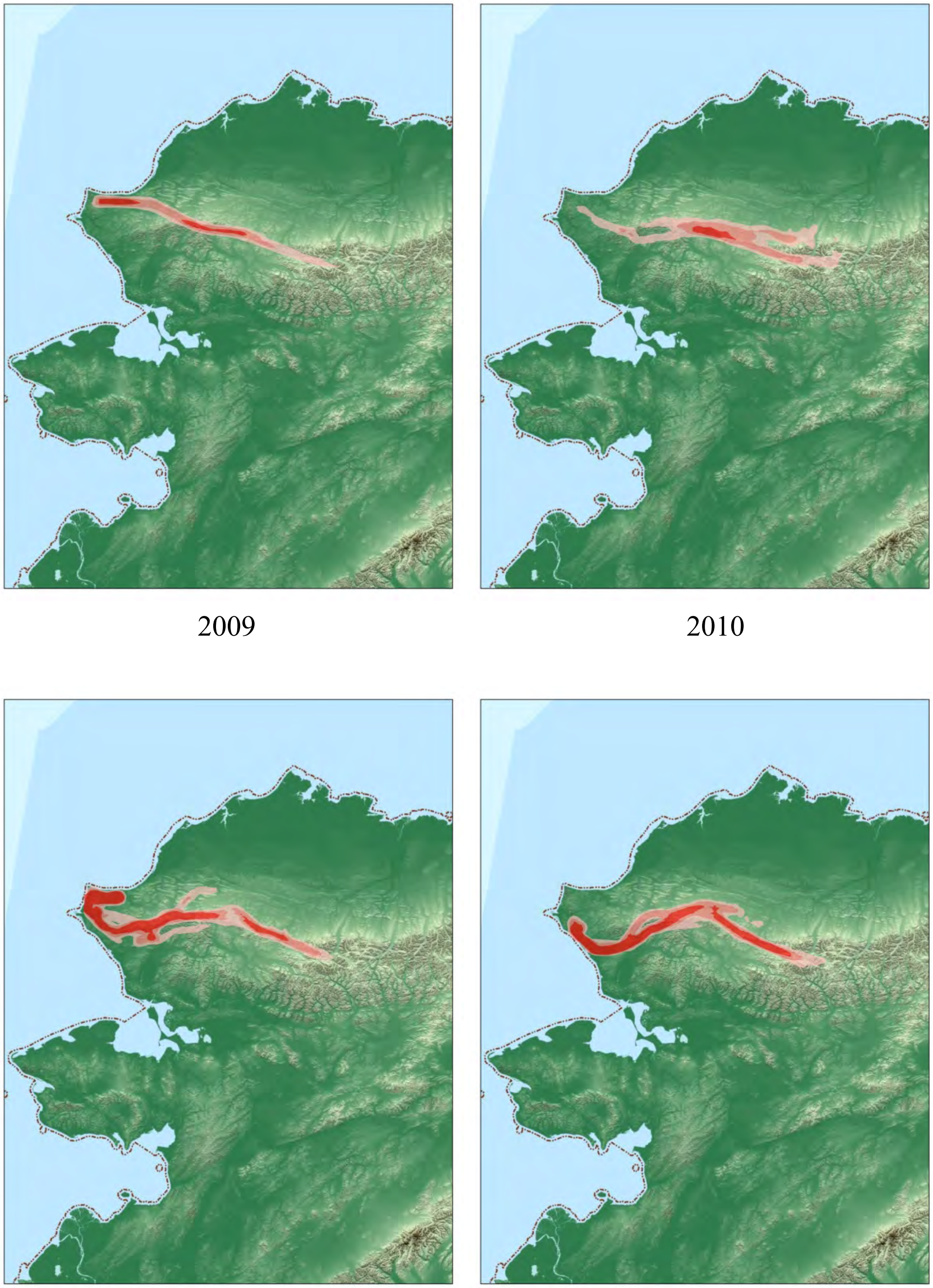
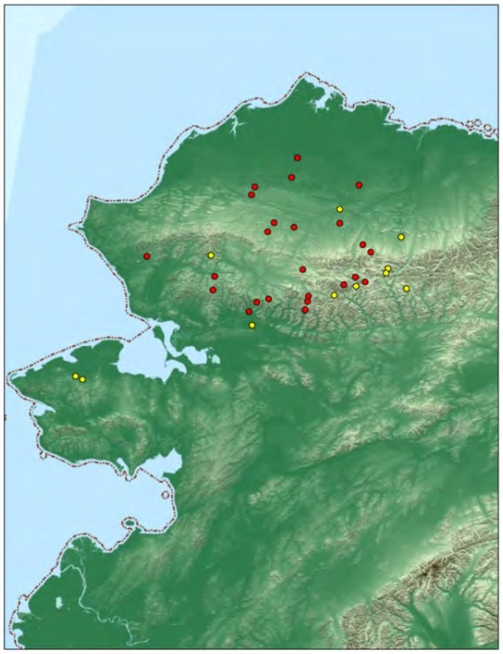
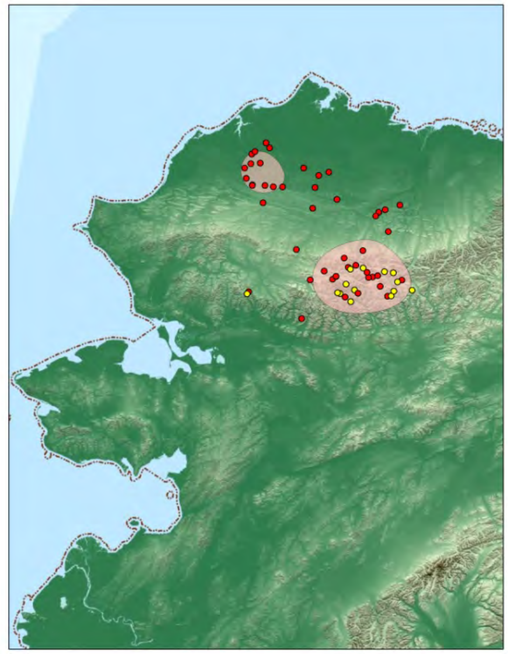


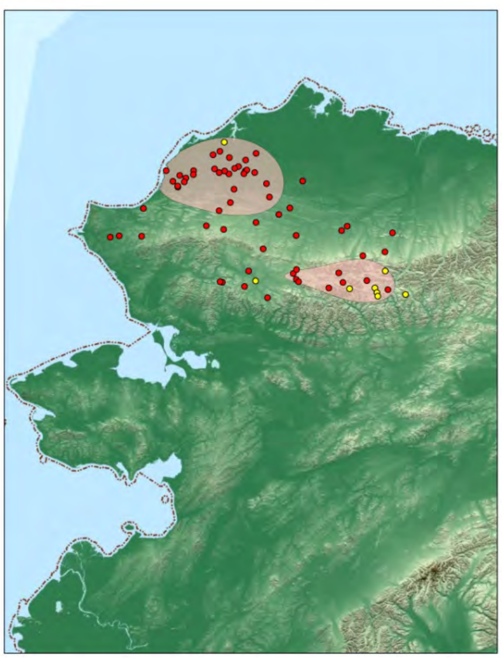
Figure 6. Summer (6 July–30 July) movements of satellite-collared Western Arctic herd caribou, 2009–2012. Shaded area is based on density of individual caribou track lines; darker color indicates heavier use.



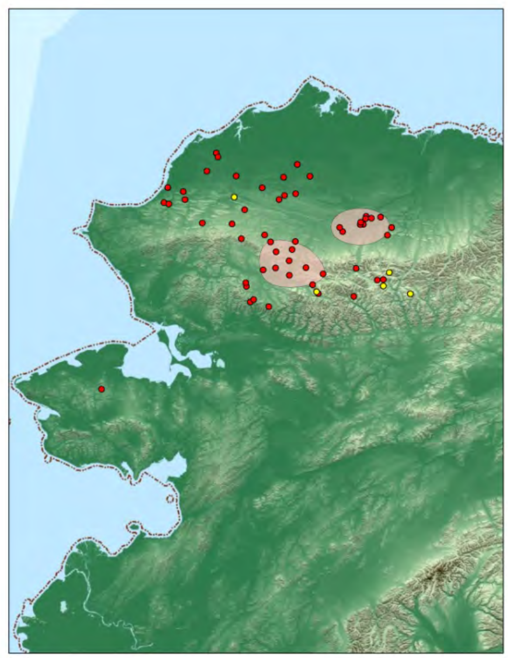
2009 (NO CLUSTERING)



2010 (39% KERNEL)



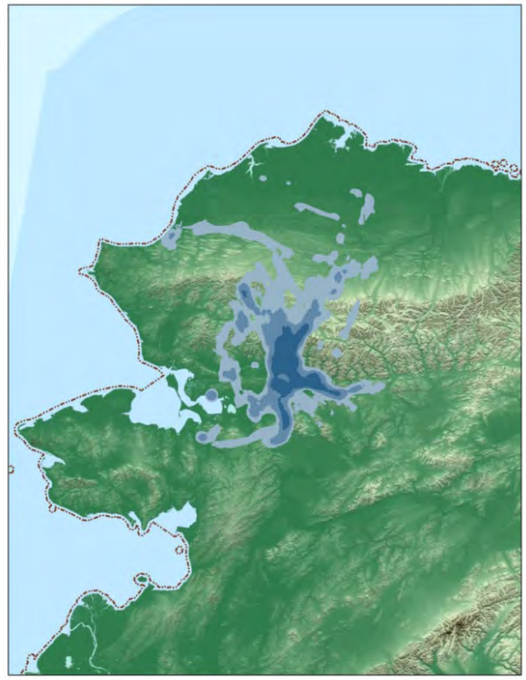
2011 (41% KERNEL)



2012 (15% KERNEL)

Figure 7. Point locations and kernel areas of late summer distribution for bulls and cows (yellow and red symbols, respectively), Western Arctic caribou herd, 2009–2012. Isopleths were selected by a Bayesian model and reflect statistical intensity of use rather than biological importance. The location closest in time to the midpoint date of late summer season was selected for each collared caribou.

2009

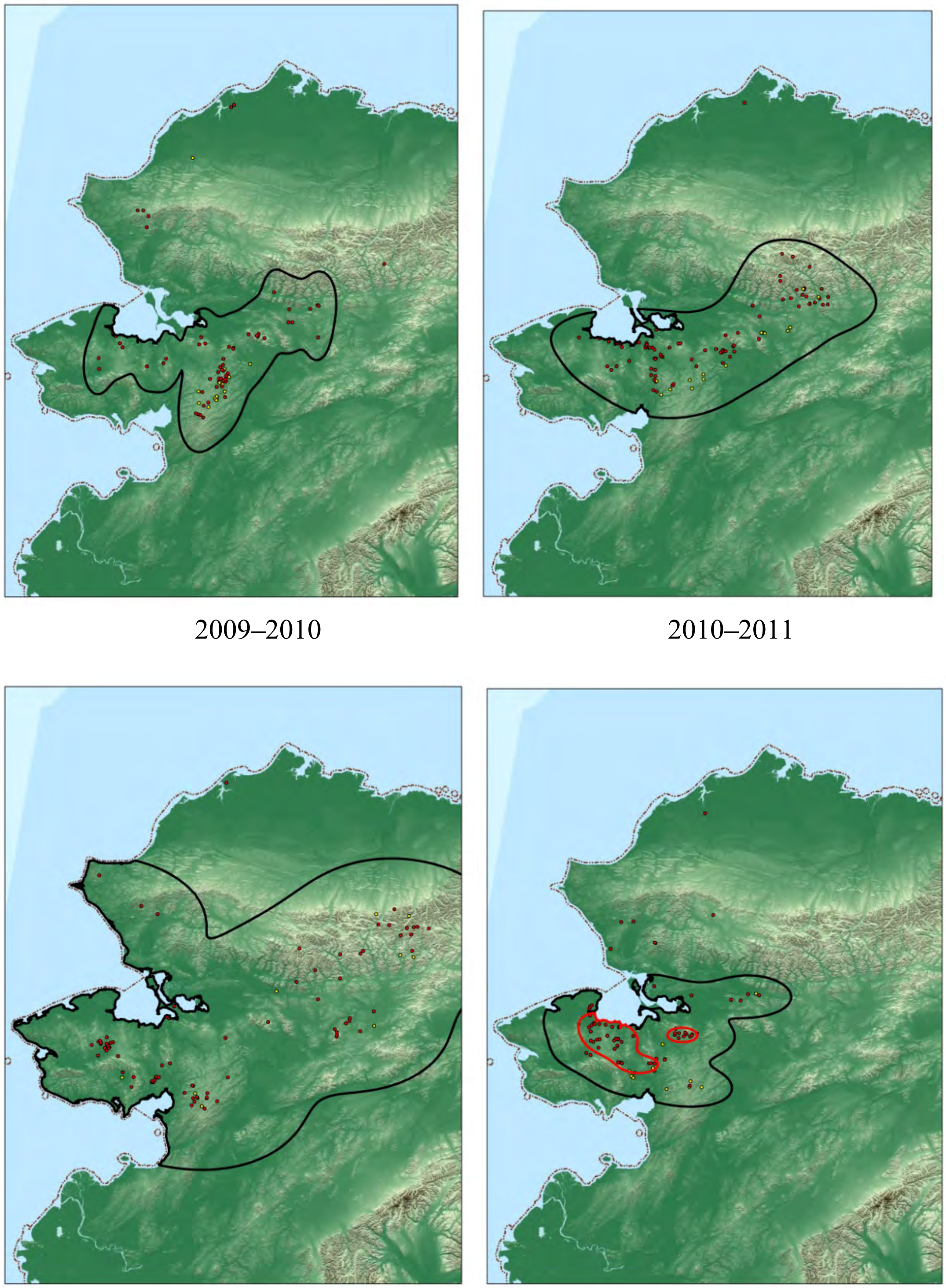


2010

2011

2012

Figure 8. Fall (18 Sept.–7 November) movements of satellite-collared Western Arctic herd caribou, 2009–2012. Data excludes 8 months after collaring. Shaded area is based on density of individual caribou track lines; darker color indicates heavier use.



2009–2010 2010–2011

2011–2012 2012–2013

Figure 9. Kernel densities showing winter (8 November-5 May) distribution of Western Arctic Herd caribou. Points shown are the locations closest to 1 January. Black line=95% kernel; red line=high use area (high-use areas were identified only during 2012–2013).

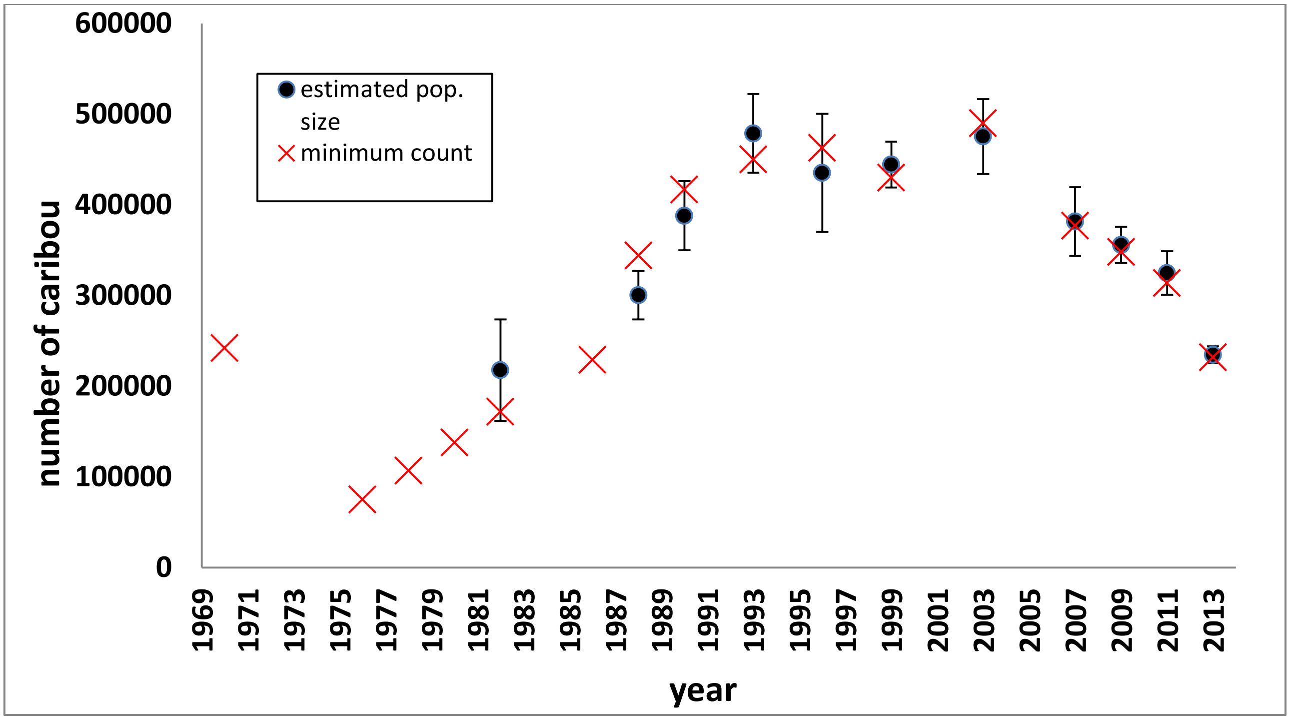


Figure 10. Western Arctic caribou herd photo census results, 1970–2013. Brackets around the open circles represent 95% confidence intervals for Rivest population estimates.

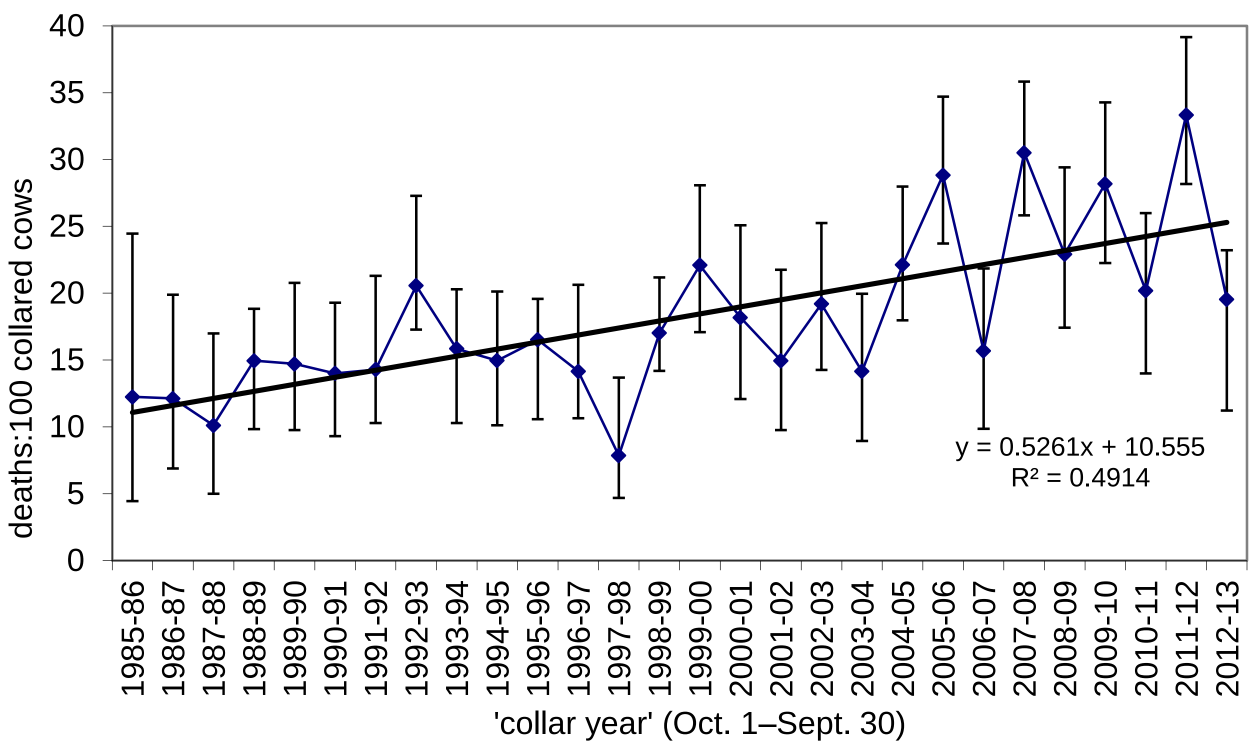


Figure 11. Adult cow mortality, Western Arctic caribou herd, collar year 1985 through 2012 (brackets indicate 80% binomial c. i.; estimates based on radiocollared cows excluding ST-3 and ST-14 satellite collars; estimates not corrected for age bias in sample of collared cows).

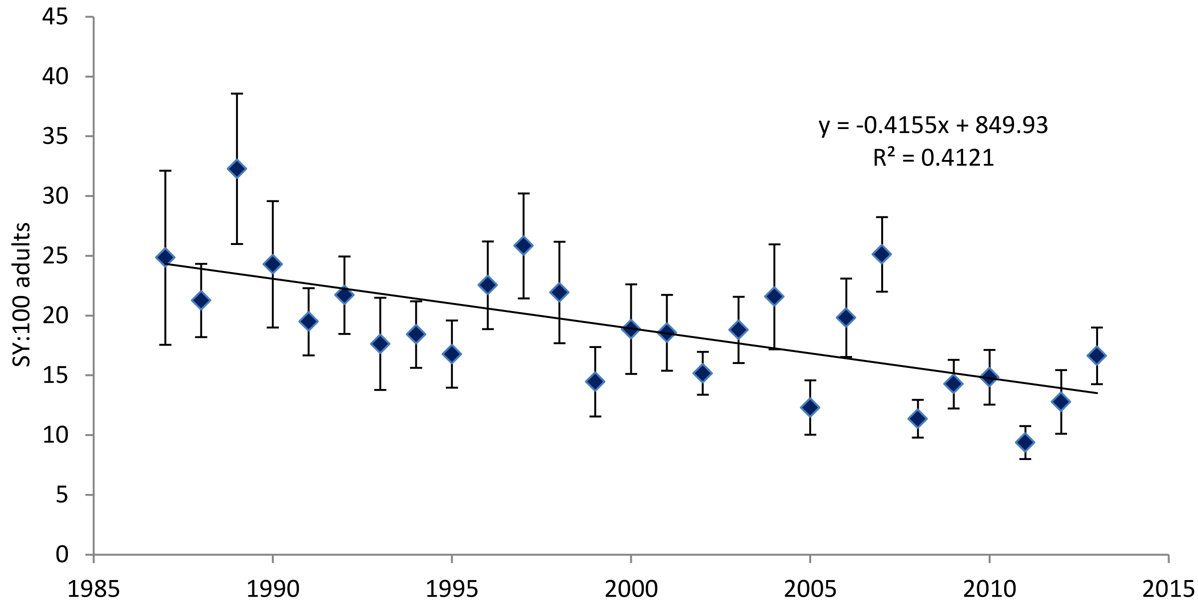


Figure 12. Recruitment for the Western Arctic caribou herd (brackets indicate 80% binomial confidence intervals), 1987–2013.

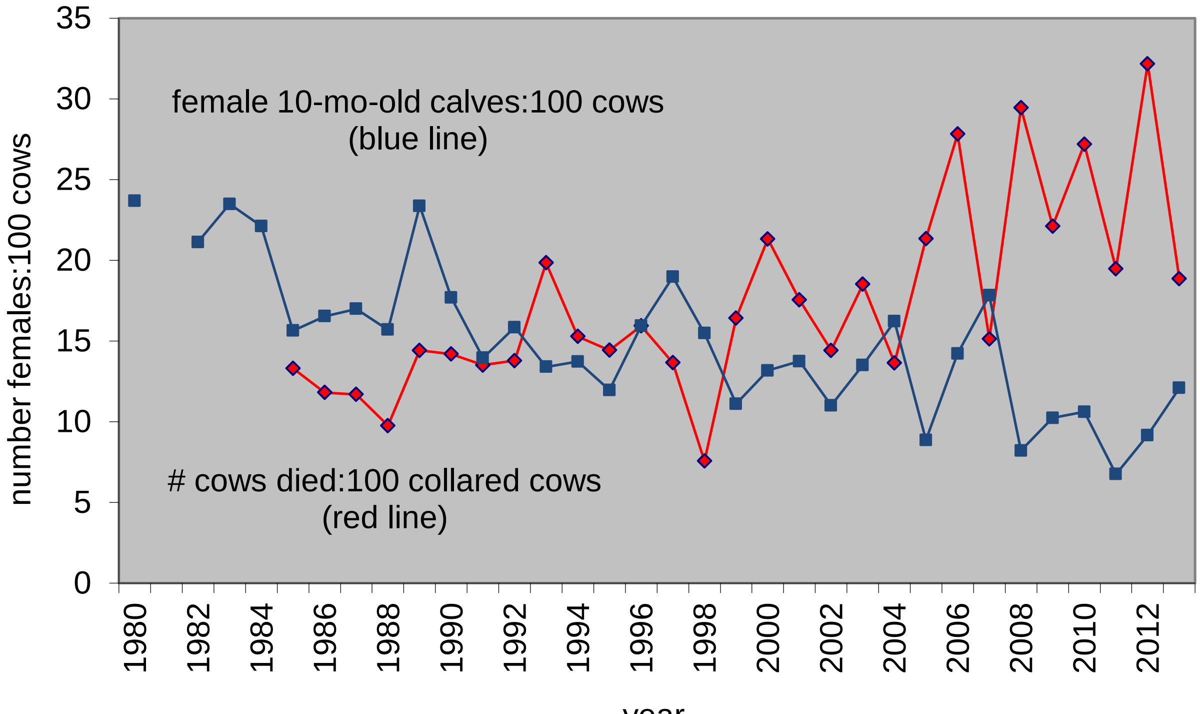


Figure 13. Indices of adult cow mortality and female calf recruitment for the Western Arctic caribou herd, 1980–2012. The spring calf:adult ratio is transformed to female calf:cow ratio based on fall composition data assuming equal male–female sex ratio at birth. Female calf recruitment is adjusted 3.3% down and adult cow mortality is adjusted 3.4% down to correct for age bias in the sample of collared adult cows.

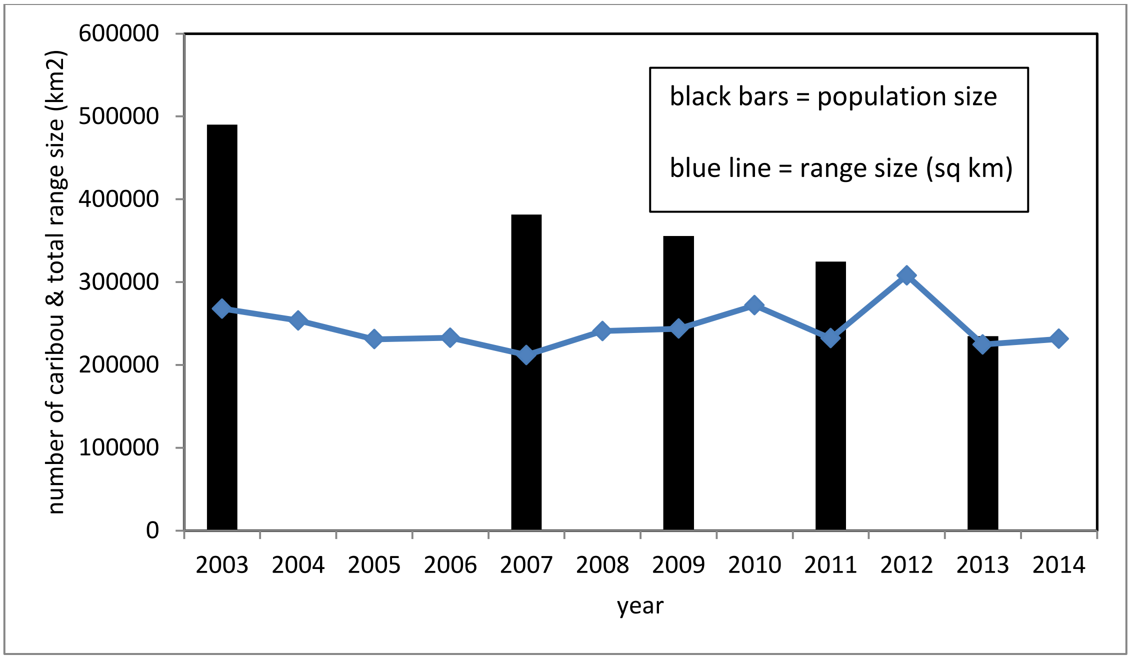


Figure 14. Annual range size (km^2) in relation to estimated population size of the Western Arctic caribou herd, 1999–2011.

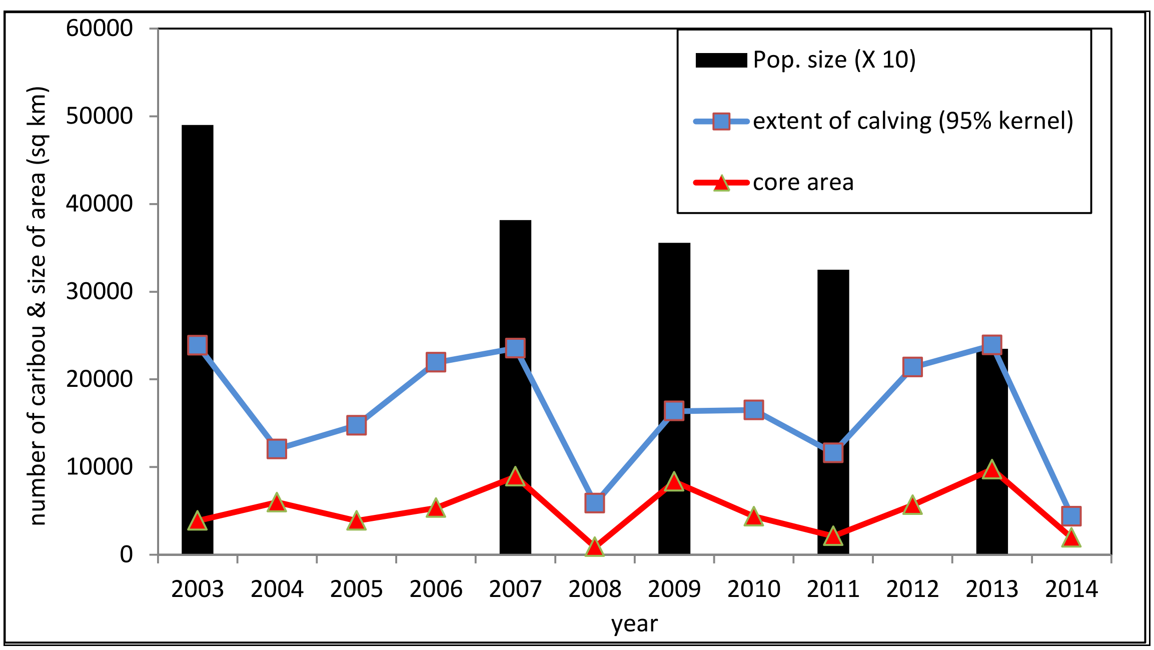


Figure 15. Size of calving area extent (km^2) based on 95% kernel in relation to estimated population size of the Western Arctic caribou herd, 1988–2011.

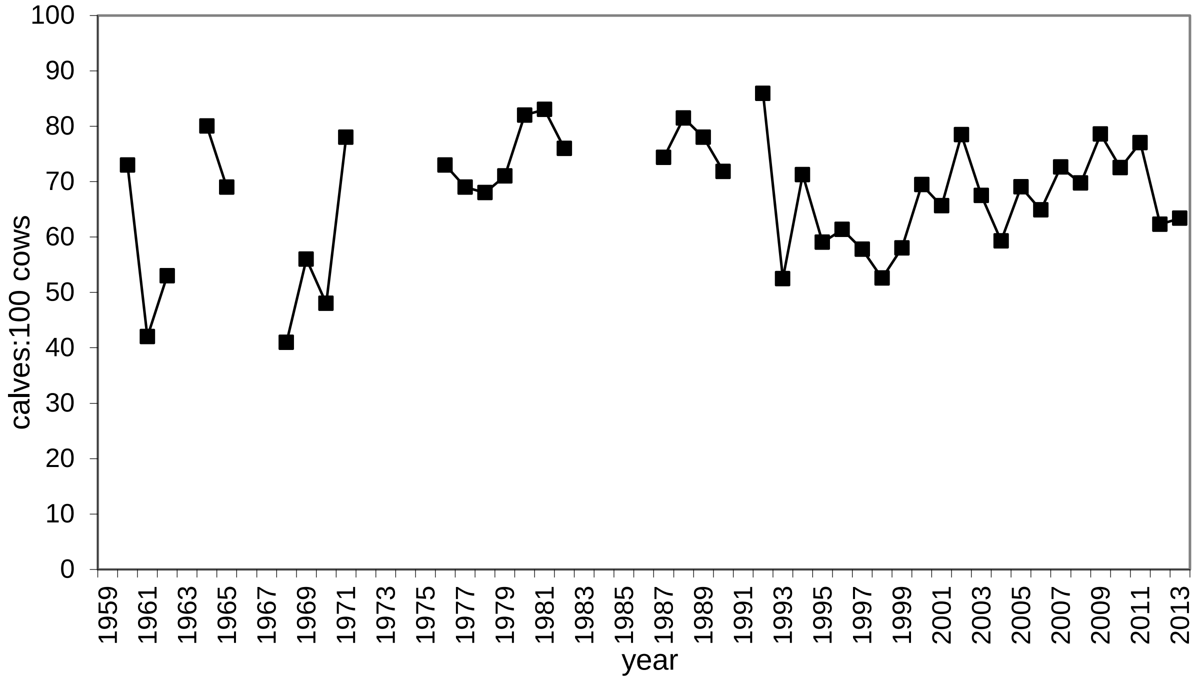


Figure 16. Western Arctic caribou herd calving survey results, 1960–2013. Telemetry-based surveys were initiated in 1987.

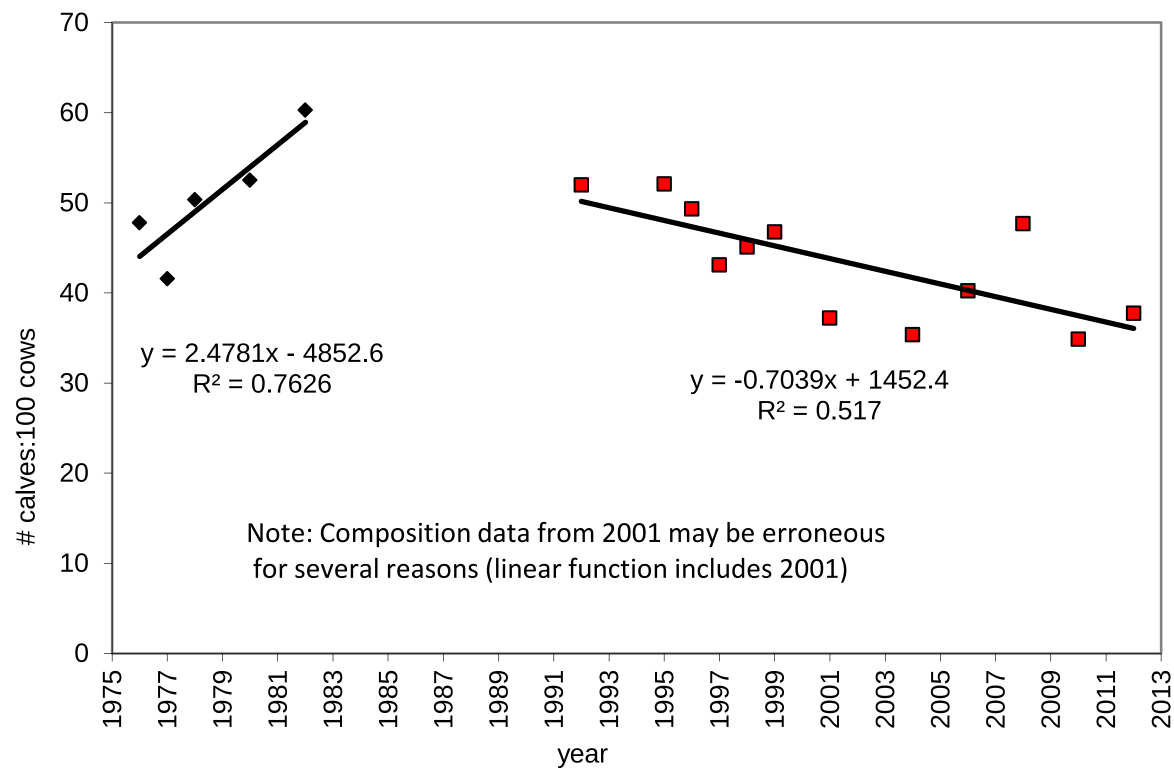


Figure 17. Fall calf:cow ratios with trend lines for the Western Arctic caribou herd, 1976–1982 and 1992–2012. Composition data from 2001 may be biased low for several reasons.

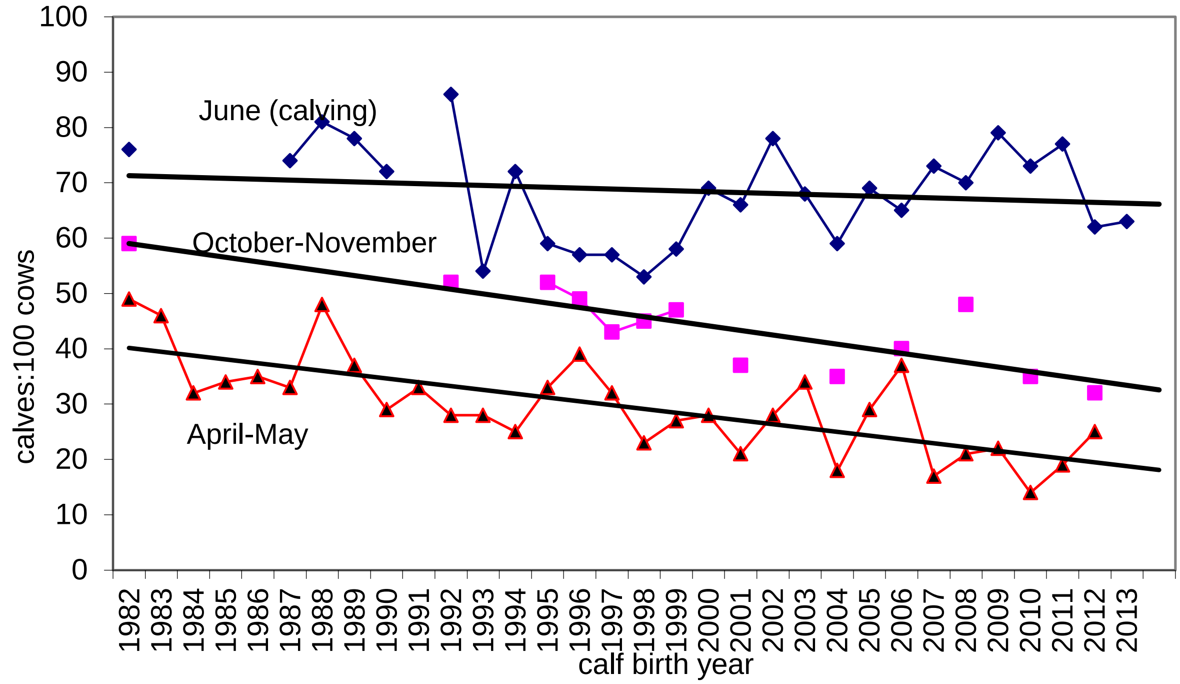


Figure 18. Unweighted least squares linear regression of calf:cow ratios during June, the subsequent fall (Oct–Nov) and following spring (Apr–May), Western Arctic caribou herd, 1982–2013. In this graph the April–May ratio for any specific year is shifted 1 year earlier to reflect year of birth. In contrast, in Figures 12 and 13, recruitment is plotted in the year the estimate was made to correspond with the period over which adult mortality is monitored. The April–May calf:cow ratio in this figure was calculated from the recorded calf:adult ratio using fall composition data from the closest point in time.

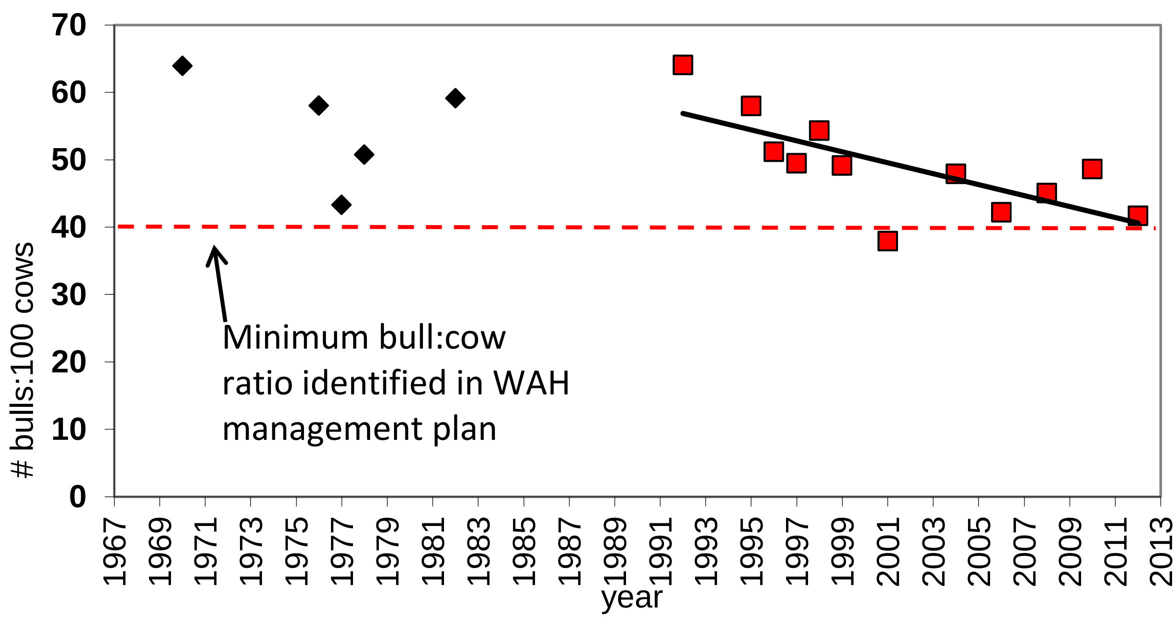


Figure 19. Fall bull:cow ratios, Western Arctic caribou herd, 1976–2012. No trend line shown for 1970–1982 because yearly survey methods varied: view these data with caution.

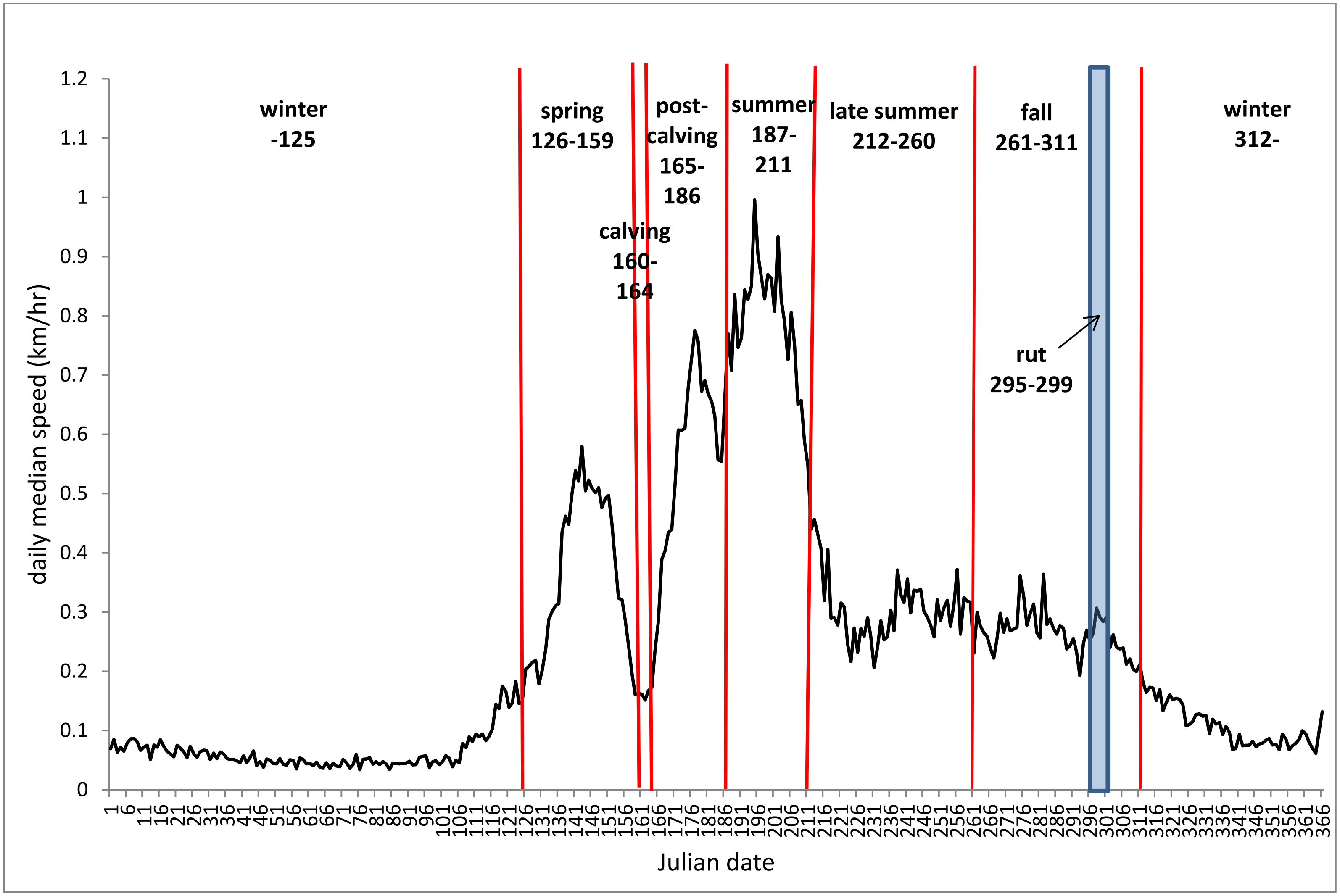


Figure 20. Median daily rate of travel and seasonal period determined from rate and direction of travel of female satellite-collared caribou, Western Arctic caribou herd, 1 June 1988 through 20 November 2012 (all years combined).

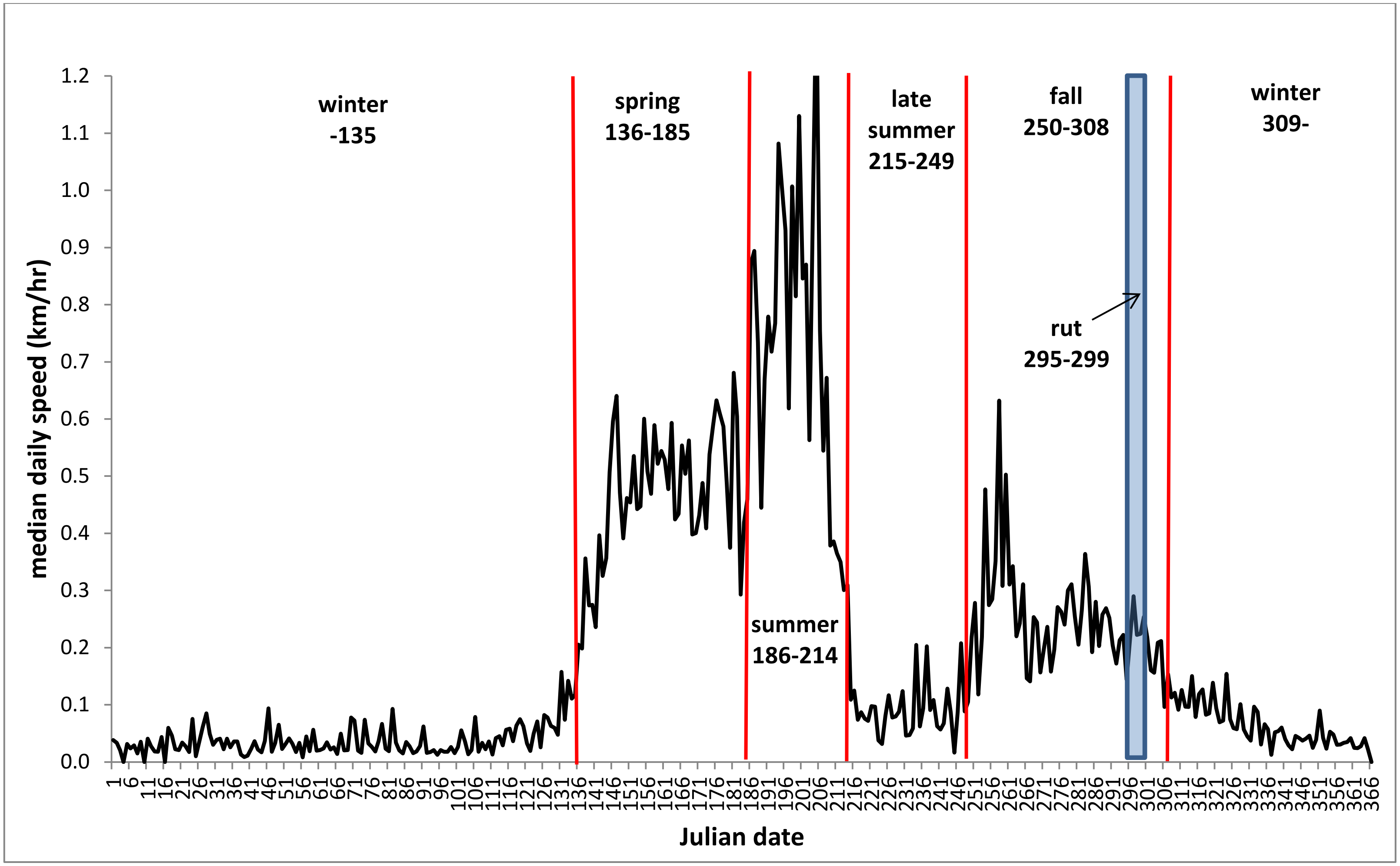


Figure 21. Median daily rate of travel and seasonal period determined from rate and direction of travel of male satellite-collared caribou, Western Arctic caribou herd, 1 June 1988 through 20 November 2012 (all years combined).

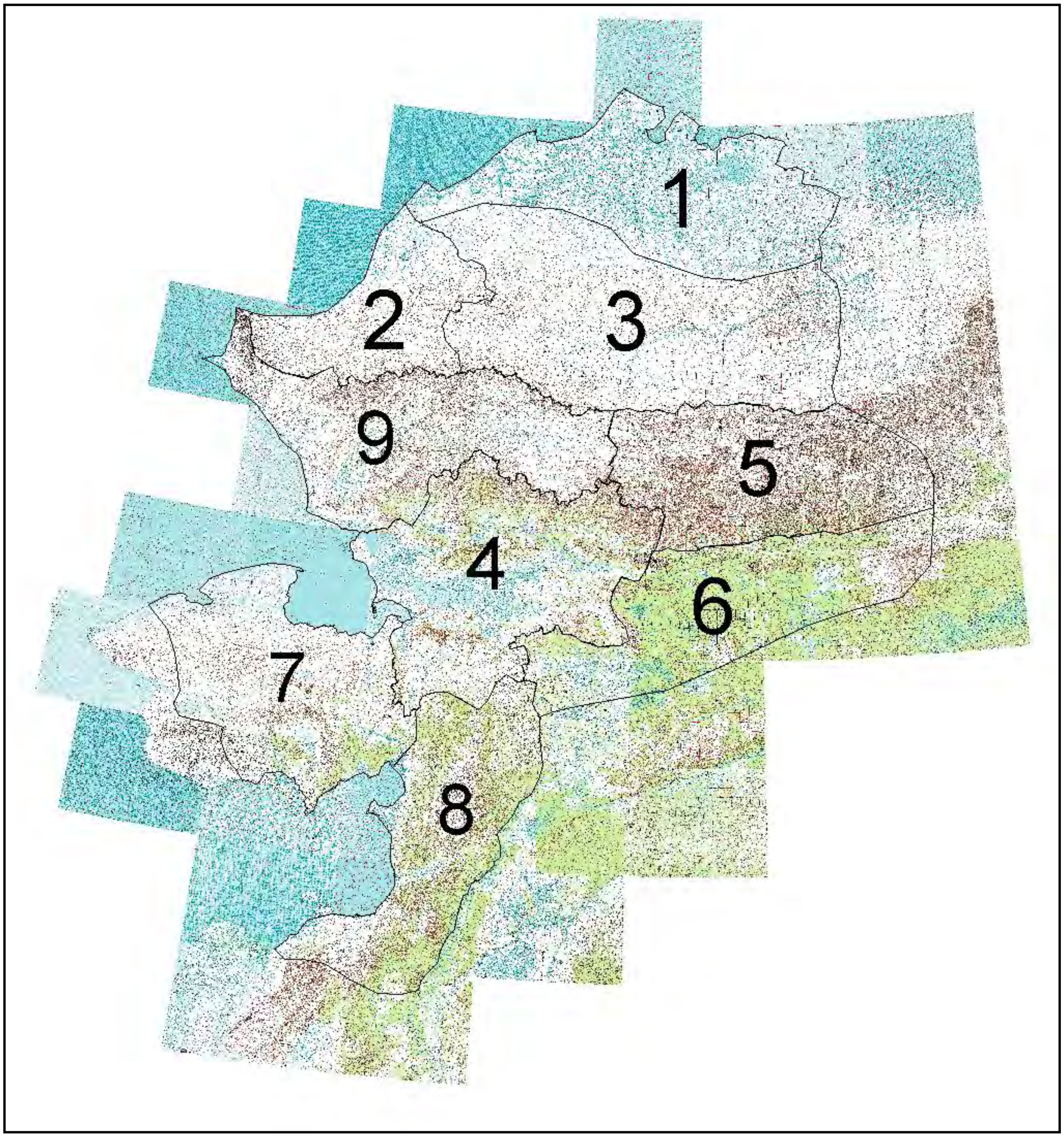


Figure 22. Subareas of Western Arctic herd range used to assess winter distribution (see Table 7 for geographic descriptions).

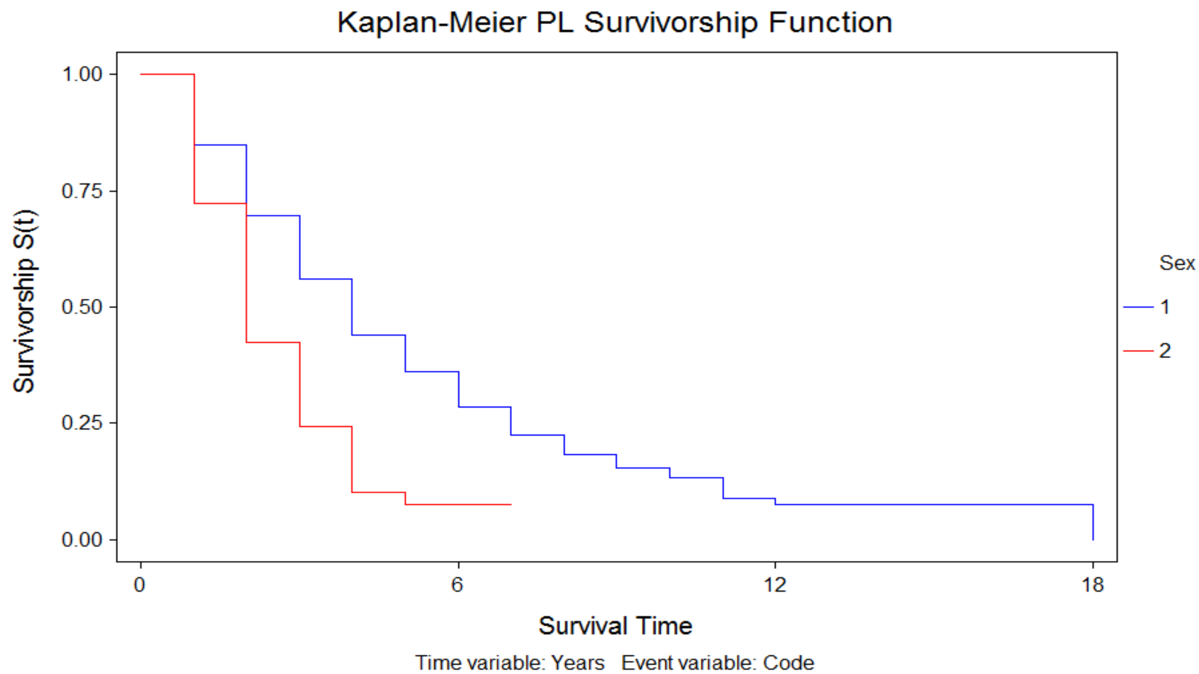


Figure 23. Kaplan-Meier Product-Limit survival estimates for collared bulls (sex=2, red line) vs. cows (sex=1, blue line), 1985–2012. Survival time is calculated from the time of collaring rather than time of birth.

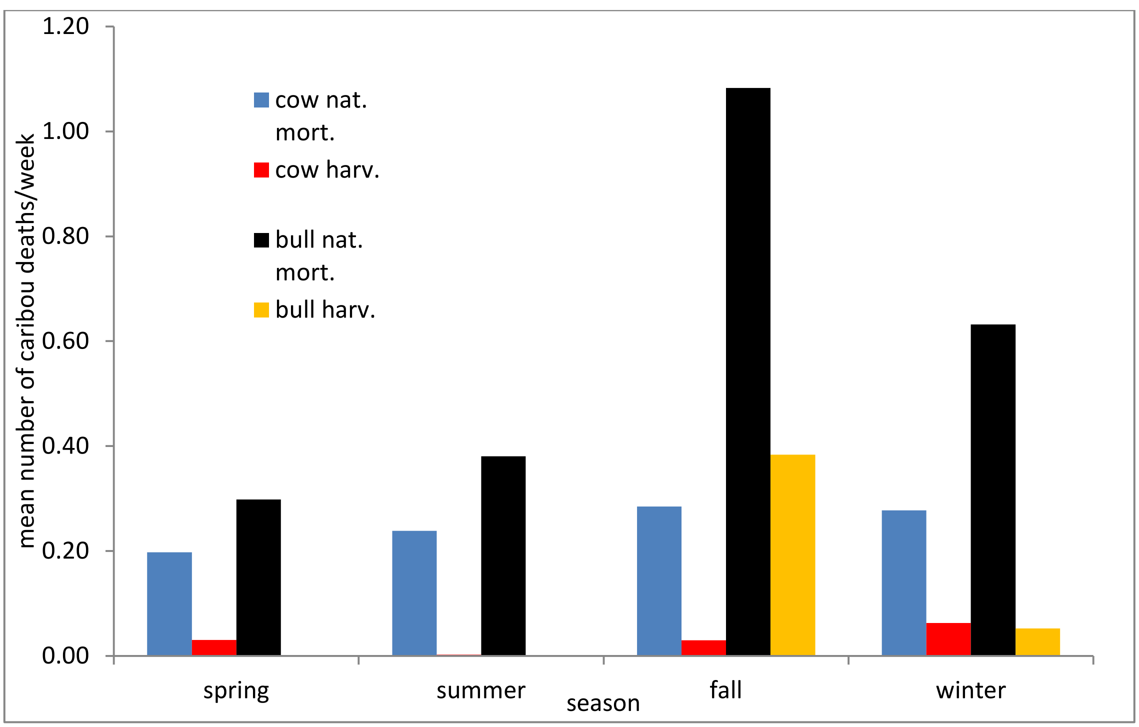


Figure 24. Seasonal mortality of radiocollared caribou by sex, collar year 1992 through 2012 (all years combined); sample sizes normalized to 100 individuals/yr to compensate for yearly differences in numbers of collared individuals and to enable bull-cow comparisons.

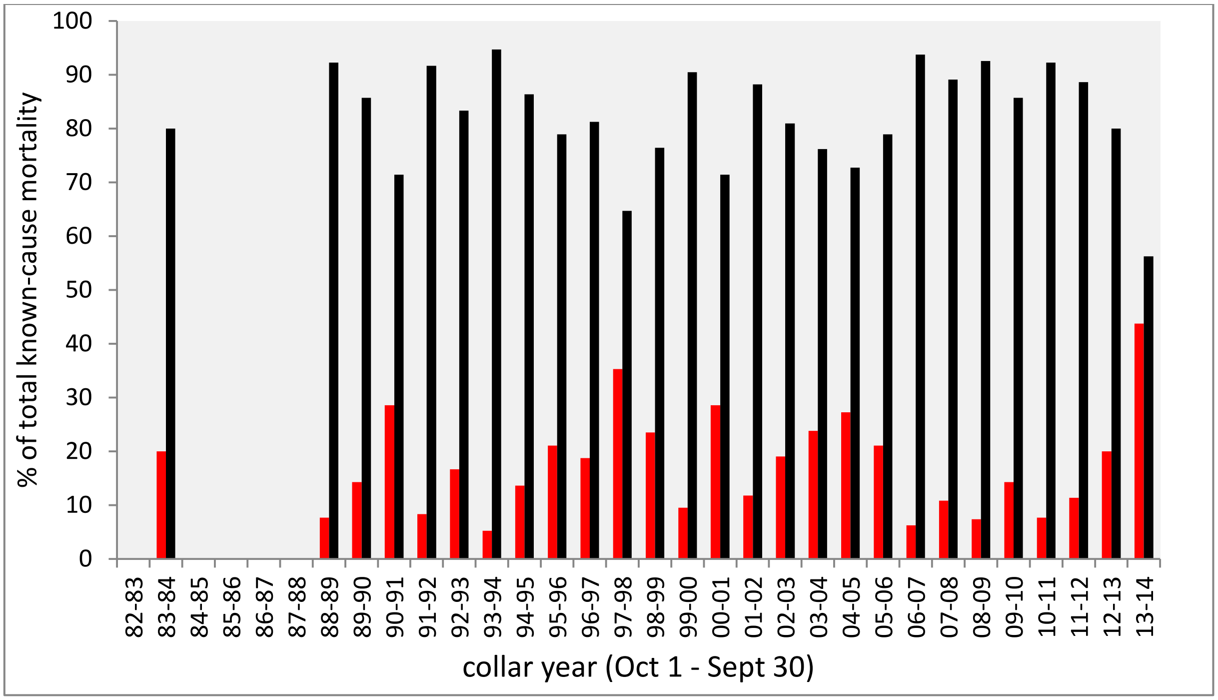


Figure 25. Percentage of total known-cause caribou mortality attributed to hunters (red bars) vs. natural factors (black bars), Western Arctic caribou herd, collar year 1983–2012; (data based on radiocollared bulls and cows; excludes all unknown-cause mortalities).

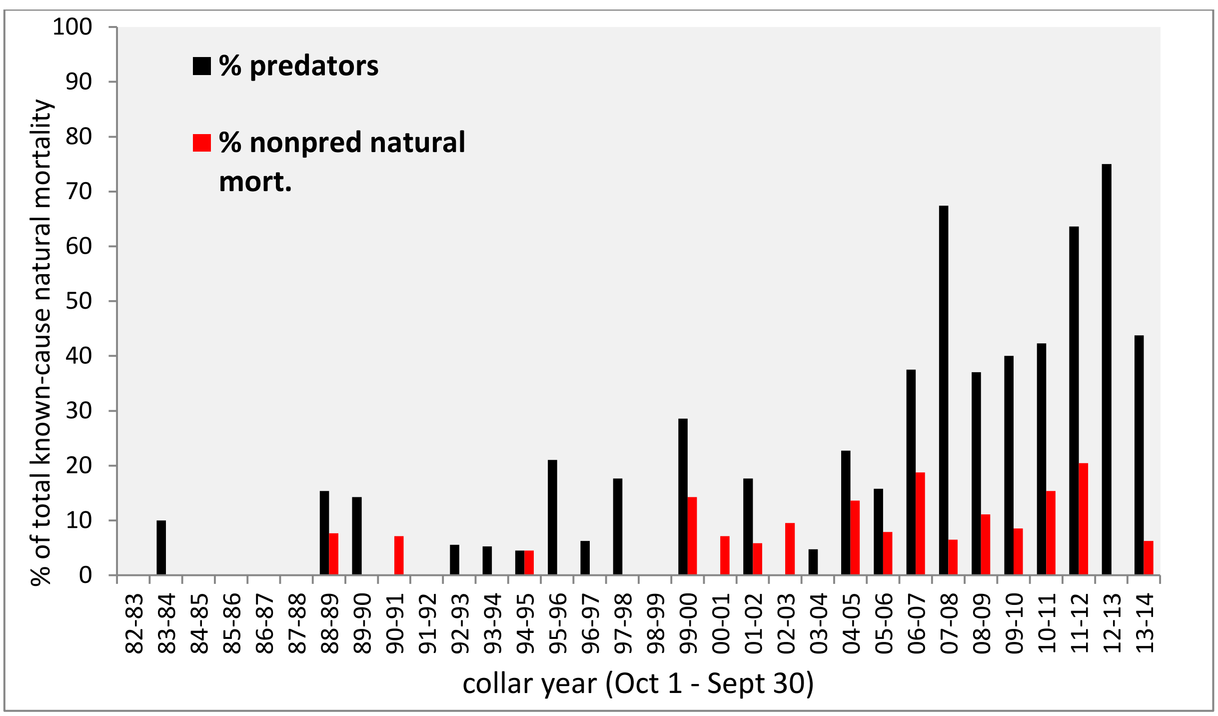


Figure 26. Percentage of total known-cause natural mortality attributed to predators (black bars) vs. other natural causes (red bars), Western Arctic caribou herd, collar year 1983–2012; (data based on radiocollared bulls and cows; excludes all unknown-cause mortalities as well as natural mortalities for which cause could not be determined).

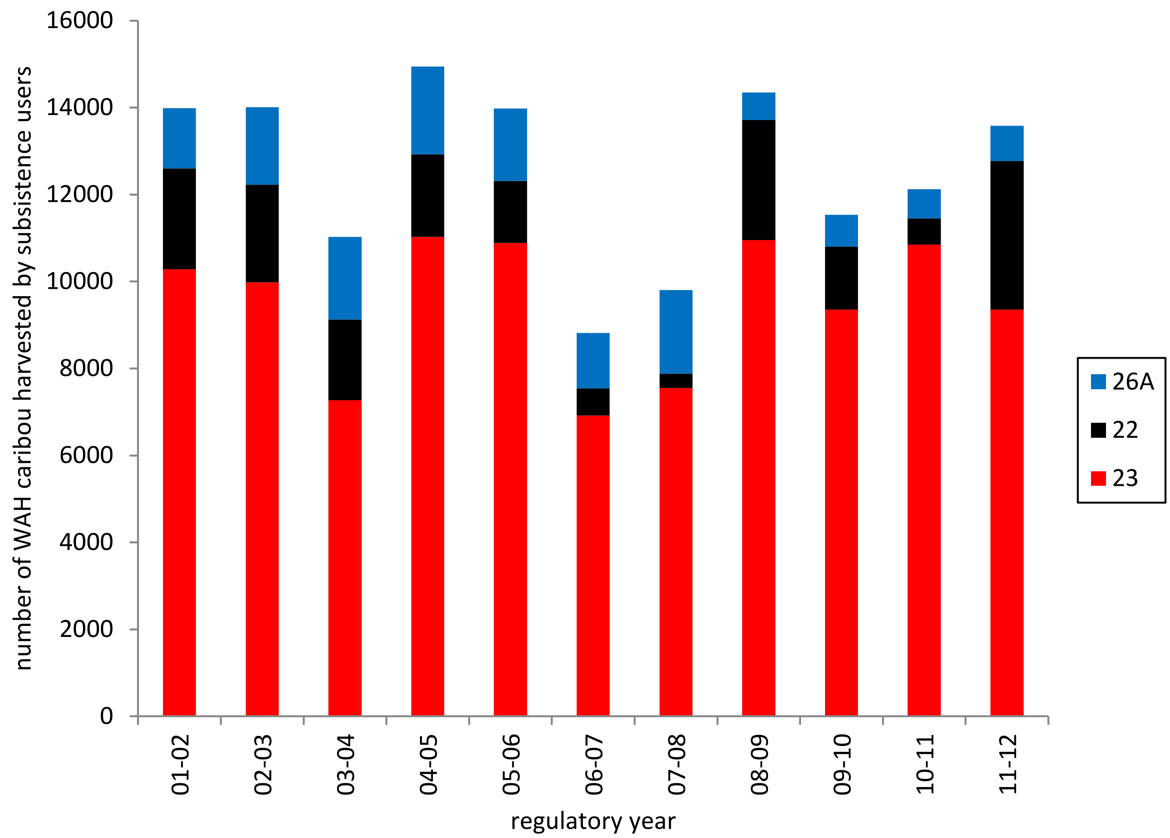


Figure 27. Estimated annual caribou harvest by local hunters and Game Management Unit, Western Arctic caribou herd, regulatory year 2001–2011 (estimates made using the levels model, Sutherland 2005).

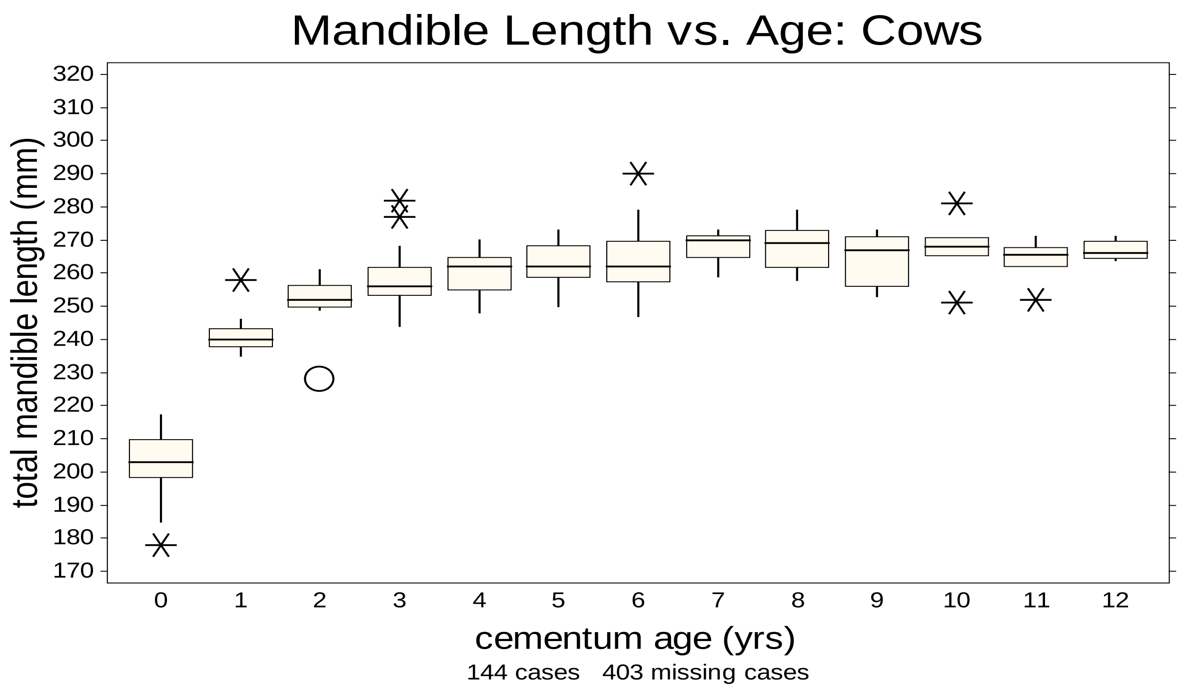


Figure 28. Box and whisker plot of cow mandible length as a function of tooth cementum age, Western Arctic caribou herd, 1997–2013 (all years combined; open circles=probable outliers; asterisks=possible outliers).

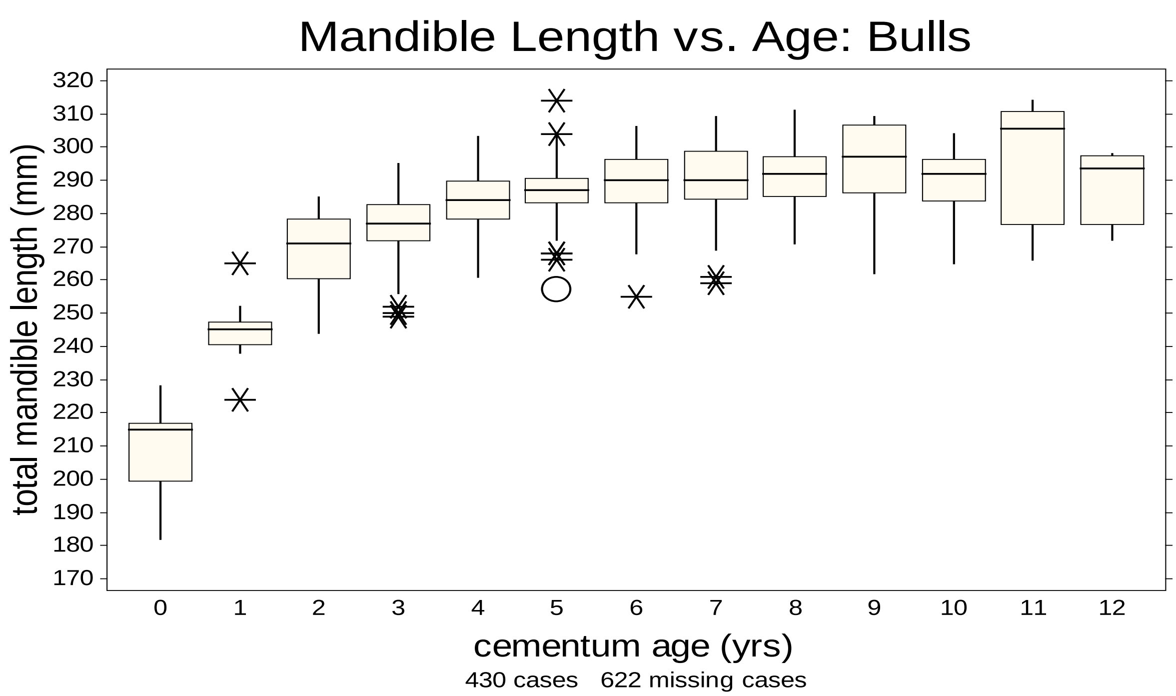


Figure 29. Box and whisker plot of bull mandible length as a function of tooth cementum age, Western Arctic caribou herd, 1997–2013 (all years combined; open circles=probable outliers; asterisks=possible outliers).

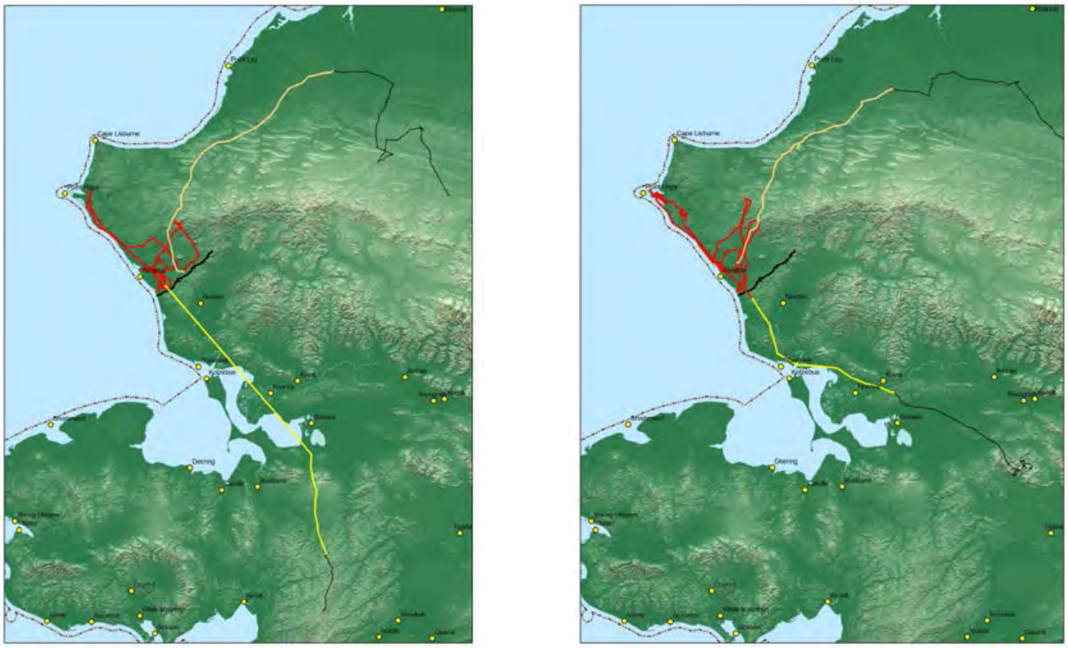


Figure 30. Fall movements of 2 satellite-collared caribou that changed direction of travel near the Red Dog road (denoted by the heavy black line that extends to the coastline), Western Arctic caribou herd, 2011 (fine black line=nonmigratory movement; tan line=migratory movement; red line=substantially modified direction and/or rate of travel; yellow=resumption of fall migration after crossing road).

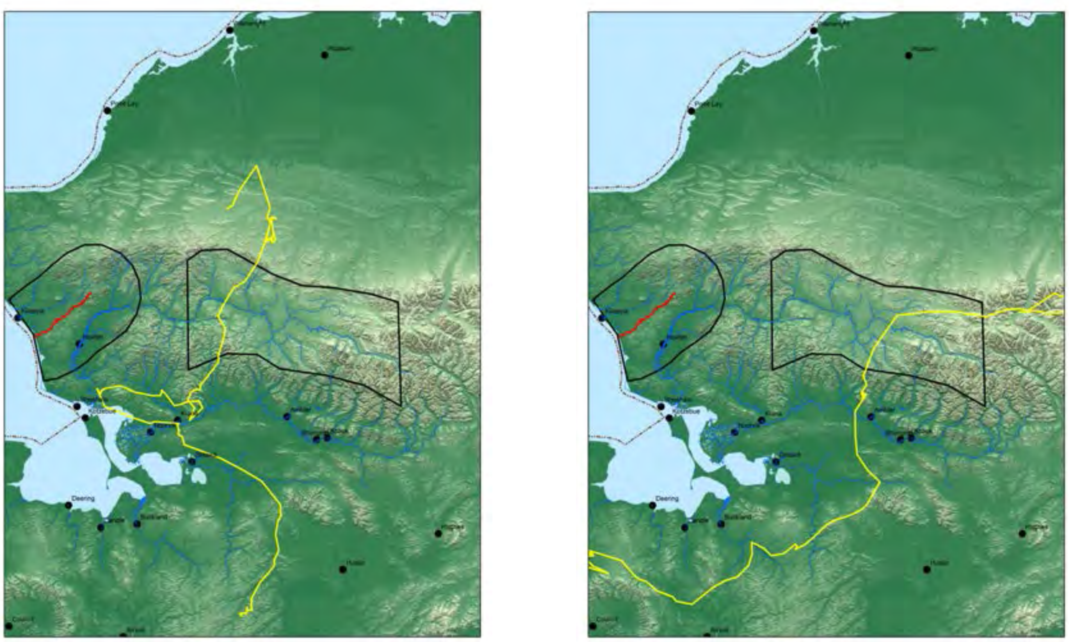
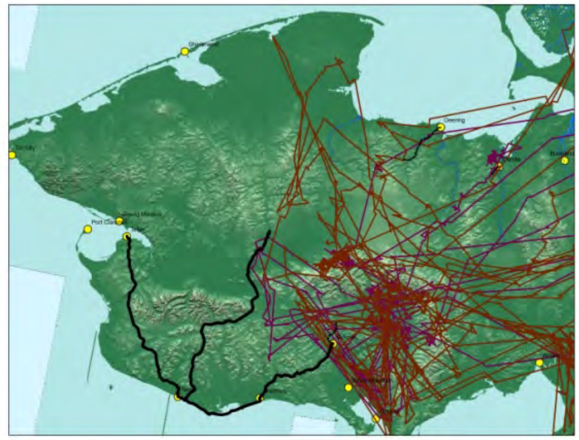
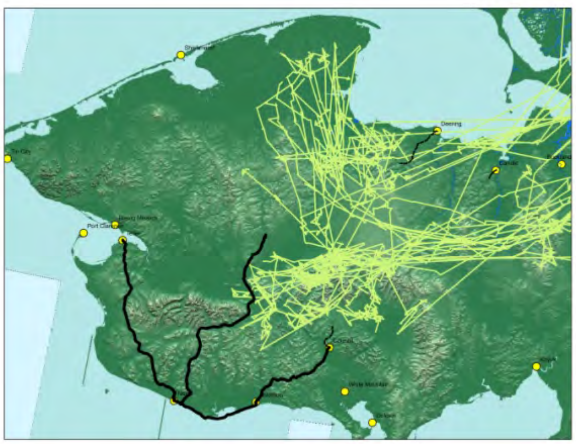


Figure 31. Fall movements of 2 satellite-collared caribou through a hypothetical control area in the middle Noatak River drainage, Western Arctic caribou herd, 2011.

1999–2000 (8 caribou)

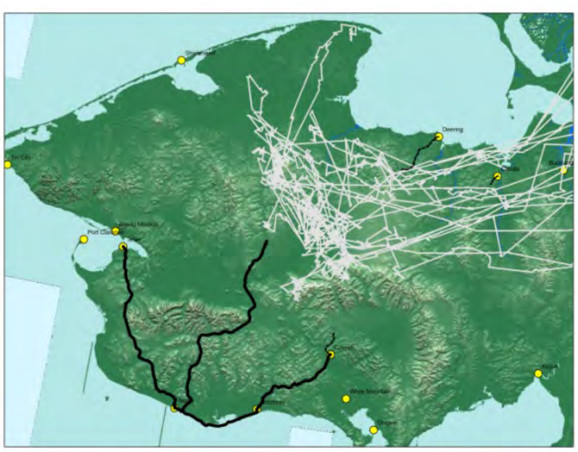


2000–2001 (13 caribou)

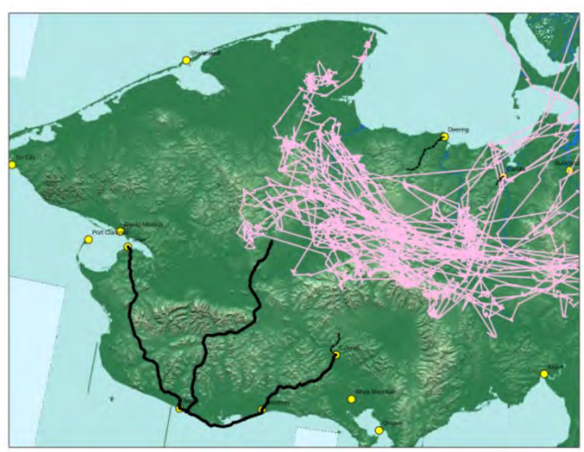


2001–2002 (16 caribou)

2002–2003 (19 caribou)



2007–2008 (10 caribou)



2011–2012 (23 caribou)

Figure 32. Examples of satellite-collared caribou movements during fall through spring in relation to the Nome road system, Western Arctic caribou herd (only years when substantial numbers of WAH caribou wintered on the Seward Peninsula are shown).

Table 1. Photo census population estimates of the Western Arctic caribou herd, 1970–2013.

Census year	Min. count pop. est.	Rivest estimated population size	Population size[a]	Mean annual rate of change[b]	Estimated population size between censuses
1970	242,000		242,000		
1971				-18	199,000
1972				-18	164,000
1973				-18	135,000
1974				-18	111,000
1975				-18	91,000
1976	75,000		75,000		
1977				19	90,000
1978	107,000		107,000		
1979				14	122,000
1980	138,000		138,000		
1981				26	173,000
1982	172,000	217,863	217,863		
1983				1	221,000
1984				1	223,000
1985				1	226,000
1986	229,000		229,000		
1987				22	280,000
1988	343,000	300,299	343,000		
1989				10	378,000
1990	417,000	388,105	417,000		
1991				5	437,000
1992				5	457,000
1993	450,000	478,822	478,822		
1994				-1	473,000
1995				-1	468,000
1996	463,000	435,363	463,000		
1997				-1	458,000
1998				-1	453,000
1999	430,000	444,597	444,597		
2000				2	455,000
2001				2	466,000
2002				2	478,000
2003	490,000	475,391	490,000		
2004				-6	460,000
2005				-6	432,000
2006				-6	406,000
2007	377,000	381,501	381,501		
2008				-3	368,000
2009	348,000	355,828	355,828		
2010				-4	340,000
2011	314,000	324,963	324,963		
2012				-15	276,000
2013	232,000	234,757	234,757		

[a] Maximum value of minimum count or Rivest estimate.

[b] Mean annual rate of change = e^r where e = 2.7183; $r = [\ln(N_{t2}) - \ln(N_{t1})]/t$; t = number of years between censuses; N_{t1} = population estimate at $time_1$; N_{t2} = pop. estimate at $time_2$.

Table 2. Annual mortality rate (uncorrected for age bias in collared sample) and binomial confidence intervals for cows collared with conventional or lightweight satellite radio collars[a], Western Arctic caribou herd, collar years[b] 1987 through 2012.

Collar year	Sample size[a]	Nr died	Mortality rate[c] (%)	Binomial Confidence Intervals 80%	90%	95%
CY87	88	8	9	5–14	5–16	4–17
CY88	87	13	15	10–21	9–23	8–24
CY89	102	15	15	10–20	9–22	8–23
CY90	100	15	15	10–21	9–22	9–24
CY91	104	16	15	11–21	10–22	9–24
CY92	107	21	20	15–25	14–27	13–28
CY93	102	16	16	11–21	10–23	9–24
CY94	108	14	13	9–18	8–20	7–21
CY95	112	20	18	13–23	12–25	11–26
CY96	107	16	15	11–20	10–22	9–23
CY97	102	8	8	5–12	4–14	3–15
CY98	94	16	17	12–23	11–25	10–26
CY99	86	19	22	16–29	15–31	14–32
CY00	77	14	18	13–25	11–27	10–29
CY01	87	13	15	10–21	9–23	8–24
CY02	99	19	19	14–25	13–27	12–28
CY03	99	14	14	10–20	9–21	8–23
CY04	104	23	22	17–28	16–30	15–31
CY05	111	32	29	23–35	22–37	21–38
CY06	102	16	16	11–21	10–23	9–24
CY07	118	36	31	25–37	24–38	22–40
CY08	96	22	23	17–29	16–31	15–33
CY09	110	31	28	22–34	21–36	20–37
CY10	114	23	20	15–26	14–27	13–29
CY11	108	36	33	27–40	26–42	25–43
CY12	87	17	20	14–26	13–28	12–29

[a] Sample size = number of potentially active conventional or lightweight satellite radio collars active on adult cows at the beginning of the collar year.

[b] Collar year = 12 month period beginning 1 October (e. g. CY1987=1 October 1987–30 September 1988).

[c] Mortality rate = (Number caribou died/Sample size)100.

Table 3. Short yearling[a] survey results of the Western Arctic caribou herd, 1984–2013.

Year	Number of caribou: Adults	SY[a]	Total	Number: Groups	Radio-collared cows	SY[a]:100 adults	4r moving average SY[a]:100 adults
1984	1646	503	2149			31	28
1985	2776	600	3376			22	25
1986	5372	1227	6599			23	23
1987	4272	1003	5275			23	23
1988	6047	1312	7359	31	45	22	26
1989	5321	1718	7039	29	37	32	26
1990	5231	1278	6509	25	36	24	25
1991	7111	1371	8482	47	48	19	22
1992	7660	1678	9338	49	52	22	20
1993	4396	814	5210	19	33	19	20
1994	8369	1587	9956	44	53	19	18
1995	13283	2196	15479	53	86	17	19
1996	4876	1073	5949	32	36	22	22
1997	9298	2438	11736	40	56	26	23
1998	7409	1585	8994	34	46	21	21
1999	6354	975	7329	34	36	15	18
2000	8398	1513	9911	41	47	18	17
2001	6814	1294	8108	32	33	19	17
2002	8268	1258	9526	38	42	15	18
2003	8518	1602	10120	42	49	19	19
2004	7078	1599	8677	33	42	23	18
2005	8376	1026	9402	35	40	12	18
2006	7528	1479	9007	36	41	20	19
2007	10570	2603	13173	44	57	25	19
2008	9550	1084	10634	43	54	11	17
2009	13873	1963	15836	59	71	14	13
2010	9890	1479	11369	47	53	15	13
2011	11316	1058	12374	52	58	9	12
2012	8015	1012	9027	40	41	13	13
2013	9584	1601	11185	36	53	17	

[a] Short yearlings (SY) are defined as 10 to 11-month-old caribou.

Table 4. Aerial calving survey results from observations of radiocollared cows in the Western Arctic caribou herd, 1990–2013.

Year	Median June survey date	With Calf	No Calf $\geq$1 hard antler	No Calf soft antlers	No Calf no antlers	Total	Maternal	Non-Maternal	Calves: 100 Cows
1990	11	51	0	5	15	71	51	20	72
1991	Fogged out								
1992	12	55	6	0	10	71	61	10	86
1993	14	39	3	17	21	80	42	39	53
1994	11	42	15	2	21	80	57	23	71
1995	11	47	2	13	21	83	49	34	59
1996	6	38	16	13	21	88	54	34	61
1997	5	39	13	16	22	90	52	38	58
1998	13	36	5	16	21	78	41	37	53
1999	12	47	0	11	23	81	47	34	58
2000	13	39	11	5	17	72	50	22	69
2001	16	8	34	9	13	64	42	22	66
2002	2	13	38	8	6	65	51	14	78
2003	6	16	38	7	19	80	54	26	68
2004	6	38	13	17	18	86	51	35	59
2005	10	45	13	8	18	84	58	26	69
2006	10	37	11	8	18	74	48	26	65
2007	6	36	25	7	16	84	61	23	73
2008	12	48	5	7	16	76	53	23	70
2009	6	35	20	6	9	70	55	15	79
2010	7	49	9	17	5	80	58	22	73
2011	9	47	10	13	4	74	57	17	77
2012	7	41	3	21	6	71	44	27	62
2013	12	37	8	13	13	71	45	26	63

Table 5. Fall population composition of the Western Arctic caribou herd, 1961–2012.

Year	Bulls	Cows	Calves	Total	Calves: 100 Cows	Calves: 100 Adults	Bulls: 100 Cows
1961	276	501	187	964	37	24	55
1970	1748	2732	1198	5678	44	27	64
1975	720	2330	1116	4166	48	37	31
1976	273	431	222	926	52	32	63
1980	715	1354	711	2780	53	34	53
1982	1896	3285	1923	7104	59	37	58
1992	1600	2498	1299	5397	52	32	64
1995	1176	2029	1057	4262	52	33	58
1996	2621	5119	2525	10265	49	33	51
1997	2588	5229	2255	10072	43	29	49
1998	2298	4231	1909	8438	45	29	54
1999	2059	4191	1960	8210	47	31	49
2001[a]	1117	2943	1095	5155	37	27	38
2004	2916	6087	2154	11157	35	24	48
2006	1900	4501	1811	8212	40	28	42
2008	2981	6618	3156	12755	48	33	45
2010	2419	4973	1735	9127	35	23	49
2012	2119	5082	1919	9120	38	27	42

[a]Sample from Mulgrave Hills only and based on 25 radio collared caribou in the area. Survey was conducted on Nov. 14 and segregation between bulls and cows was apparent. The bull:cow ratio is probably biased low.

Table 6. Season dates for Western Arctic Herd bulls and cows, 1 June 1988–20 November 2012, determined from rate and direction of travel (excludes records for caribou movements that were affected by the Red Dog during 15 August through 20 November).

Sex	Season	Julian dates	Calendar dates
Cows			
	Spring	126–159	6 May–8 June
	Calving	160–164	9 June–13 June
	Post-calving	165–186	14 June–5 July
	Summer	187–211	6 July–30 July
	Late summer	212–260	31 July–17 Sept.
	Fall	261–311	18 Sept.–7 Nov.
	(Rut)	(295–299)	(22 Oct.–26 Oct.)
	Winter	312–125	8 Nov.–5 May
Bulls			
	Spring	136–185	16 May–4 July
	Summer	186–214	5 July–2 Aug.
	Late summer	215–249	3 Aug.–6 Sept.
	Fall	250–308	7 Sept.–4 Nov.
	(Rut)	(295–299)	(22 Oct.–26 Oct.)
	Winter	309–135	5 Nov.–15 May

Table 7. Percent[a] winter distribution of radiocollared caribou in 9 geographic subareas[b] of total range, Western Arctic caribou herd, 1988–1989 through 2012–2013 (winter = 1 Nov–31 Mar; bottom row (n_i) is number of radiocollared caribou found during each winter; subareas are shown in Figure 22).

	88	89	90	91	92	93	94	95	96	97	98	99	00	01	02	03	04	05	06	07	08	09	10	11	12
Area	89	90	91	92	93	94	95	96	97	98	99	00	01	02	03	04	05	06	07	08	09	10	11	12	13
1	0	0	5	5	9	0	1	10	4	6	9	0	5	5	4	2	0	1	0	0	0	5	1	1	1
2	0	0	0	1	0	0	1	0	0	0	0	9	0	0	0	0	0	0	0	1	0	0	0	0	0
3	0	11	0	1	2	4	0	5	0	5	1	1	5	0	4	0	0	2	1	8	0	1	0	0	1
4	28	20	2	52	6	1	26	33	12	5	11	42	12	22	23	12	16	48	33	38	31	26	17	8	37
5	1	9	0	9	6	8	3	26	4	25	31	5	6	9	16	31	5	10	8	28	6	3	20	24	0
6	1	1	0	6	19	4	1	2	2	0	2	12	0	3	8	20	0	13	0	10	2	19	33	16	0
7	5	2	3	4	4	7	6	9	59	29	24	17	42	31	38	14	19	5	16	13	43	13	6	25	41
8	65	56	89	20	54	75	54	16	20	29	20	5	29	5	0	20	53	18	42	2	15	25	23	20	7
9	1	2	0	2	0	0	9	1	0	1	1	9	2	25	7	1	6	2	0	1	3	9	0	6	13
n_i[c]	77	57	75	61	70	90	78	63	81	88	67	72	63	58	69	86	78	70	69	90	78	68	81	83	82

[a] Percent of total radiocollared caribou observed each winter, by subarea during each winter period; column totals include rounding error of ±2%.

[b] Areas: 1 North Slope coastal plain west of Colville drainage; 16,378 mi^2
2 Foothills of Brooks Range west of Utukok River; 8,817 mi^2
3 Foothills of Brooks Range east of Utukok River and west of Dalton Highway; 24,082 mi^2
4 Kobuk drainage below Selby River; Squirrel drainage below North Fork; Selawik drainage; Buckland drainage; 18,928 mi^2
5 Kobuk drainage above Selby R; central Brooks Range north of Koyukuk R & west of Dalton Hwy; Noatak drainage above Douglas Creek; 12,436 mi^2
6 Koyukuk drainage south of Brook Range mountains, including Kanuti Flats, Galena Flats; 13,089 mi^2
7 Seward Peninsula west of Buckland and Koyukuk villages; 15,436 mi^2
8 Nulato Hills; 14,418 mi^2
9 Noatak drainage below Douglas Creek; Squirrel drainage above North Fork; Wulik and Kivalina drainages; Lisburne Hills; 16,541 mi^2

[c] n_i = number of radiocollared caribou found during each winter; excludes the year of collar deployment; when collared caribou wintered in >1 subarea, we proportioned equal time among subareas and included fractions of use.

Table 8. Winter density (number/mi^2) of caribou in 9 geographic subareas of total range, Western Arctic caribou herd, 1989–1990 through 2011–2012 (winter = 1 Nov–31 Mar; subareas are shown in Figure 22).

Area[a]	89 90	90 91	91 92	92 93	93 94	94 95	95 96	96 97	97 98	98 99	99 00	00 01	01 02	02 03	03 04	04 05	05 06	06 07	07 08	08 09	09 10	10 11	11 12	12 13
1	0.0	1.3	1.2	2.4	0.0	0.2	2.6	1.0	1.5	2.3	0.0	1.3	1.4	1.2	0.7	0.0	0.1	0.0	0.0	0.0	1.1	0.2	0.2	0.1
2	0.0	0.0	0.4	0.0	0.0	0.3	0.0	0.0	0.0	0.0	4.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0
3	1.6	0.0	0.1	0.3	0.6	0.0	0.8	0.0	0.7	0.2	0.2	0.8	0.0	0.6	0.0	0.0	0.1	0.0	1.0	0.0	0.1	0.0	0.0	0.1
4	4.0	0.5	12.1	1.5	0.3	6.4	8.1	2.8	1.3	2.7	9.8	2.9	5.3	5.7	3.0	3.7	4.3	2.8	7.7	6.1	4.9	3.0	1.3	6.1
5	2.0	0.0	2.4	2.0	2.5	0.7	7.5	1.0	7.0	8.5	1.3	1.6	2.5	4.6	9.5	1.5	1.1	0.8	6.6	1.3	0.6	4.3	4.8	0.0
6	0.2	0.0	1.2	4.0	1.0	0.3	0.4	0.5	0.0	0.5	2.5	0.0	0.8	1.8	4.6	0.0	1.0	0.0	1.8	0.3	3.2	5.4	2.4	0.0
7	0.4	0.8	1.2	1.3	2.2	2.0	2.7	17.2	8.5	7.0	5.0	12.4	9.4	11.8	4.5	5.7	0.5	1.6	3.2	10.3	2.9	1.2	5.2	8.3
8	14.8	26.3	6.3	17.1	25.4	18.0	5.3	6.8	9.5	6.4	1.5	9.2	1.7	0.2	6.9	17.5	2.1	4.7	0.6	4.0	6.2	5.5	4.7	1.6
9	4.0	0.0	0.4	0.0	0.00	2.6	0.2	0.0	0.3	0.4	2.4	0.7	7.0	2.1	0.3	1.8	0.2	0.0	0.3	0.6	1.9	0.0	1.2	2.5
N[b]	*378*	**417**	*437*	*457*	**479**	*473*	*468*	**463**	*457*	*450*	*444*	*455*	*466*	*478*	**490**	*460*	*432*	*406*	**382**	*368*	**355**	*340*	**325**	*311*

[a] Areas: 1 North Slope coastal plain west of Colville drainage; 17,322 mi^2

2 Foothills of Brooks Range west of Utukok River; 8,817 m

3 Foothills of Brooks Range east of Utukok River and west of Dalton Highway; 28,875 mi^2

4 Kobuk drainage below Selby River; Squirrel drainage below North Fork; Selawik drainage; Buckland drainage; 18,928 mi^2

5 Kobuk drainage above Selby R; central Brooks Range north of Koyukuk R & west of Dalton Hwy; Noatak drainage above Douglas Creek; 16,281 mi^2

6 Koyukuk drainage south of Brook Range mountains, including Kanuti Flats, Galena Flats; 20,945 mi^2

7 Seward Peninsula west of Buckland and Koyukuk villages; 15,436 mi^2

8 Nulato Hills; 14,126 mi^2

9 Noatak drainage below Douglas Creek; Squirrel drainage above North Fork; Wulik and Kivalina drainages; Lisburne Hills; 16,541 mi^2

[b] Western Arctic caribou herd population size in thousands using Rivest et al. (1998) estimates from Table 1. Numbers in italics are estimated using average

Table 9. Number of radiocollared caribou mortalities by source and year, Western Arctic caribou herd, collar years 1979–2012. (All categories are mutually exclusive; collar year = 1 Oct–30 Sep).

Collar year	Initial n_i collared caribou	Total # morts	# Known-cause morts	Harvested by hunter	Wolf	Bear	Unknown predator	Starved	Non-predator natural mortality	Unknown natural mort.
CY79	18	5	3	0	1	1	0	0	1	0
CY80	33	3	0							
CY81	50	9	3	2	1	0	0	0	0	0
CY82	43	2	1	0	0	0	0	0	0	1
CY83	46	17	10	2	1	0	0	0	0	7
CY84	29	5	1	1	0	0	0	0	0	0
CY85	49	6	3	3	0	0	0	0	0	0
CY86	66	8	6	3	0	0	0	0	0	3
CY87	95	7	7	3	0	0	0	0	1	3
CY88	93	16	13	1	2	0	0	0	1	9
CY89	107	17	14	2	2	0	0	0	0	10
CY90	104	16	14	4	0	0	0	0	1	9
CY91	112	16	12	1	0	0	0	0	1	11
CY92	128	26	18	3	1	0	0	0	0	14
CY93	116	24	19	1	0	0	1	0	0	17
CY94	116	23	22	3	0	0	1	1	0	17
CY95	121	25	19	4	2	1	1	0	0	11
CY96	118	18	16	3	1	0	0	0	0	12
CY97	114	20	17	6	1	1	1	0	0	8
CY98	107	19	17	4	0	0	0	0	0	13
CY99	100	27	21	2	2	0	4	0	3	10
CY00	86	20	14	4	0	0	0	0	1	9
CY01	98	21	17	2	0	0	3	0	1	11
CY02	115	26	21	4	0	0	0	0	2	15
CY03	113	27	21	5	0	0	1	0	0	15
CY04	115	25	22	6	3	1	1	0	3	8
CY05	129	47	38	8	0	0	6	0	3	21
CY06	115	17	16	1	0	0	6	0	3	6
CY07	139	46	46	4	7	2	22	0	3	8
CY08	114	28	27	2	1	0	9	0	3	12
CY09	130	38	36	5	5	1	7	0	4	14
CY10	128	29	26	2	9	2	0	0	4	9
CY11	122	45	42	5	12	5	11	3	4	2
CY12	105	18	18	4	4	2	7	0	0	1

Table 10. Annual harvest of Western Arctic herd caribou by hunter residency, regulatory year and unit, RY01 through RY11. Estimates of harvest by 'Residents within WAH range' were made using 'levels' model from Sutherland (2005); number of caribou taken by 'All other hunters' based on harvest ticket reports; 95% of total Unit 26A caribou harvest by visiting hunters was from the WAH.

		Residents within WAH range		All other hunters		Total harvest	
Reg. year	GMU	# Caribou	%	# Caribou	%	# Caribou	%
2001	21	0	0	0	0	0	0
	22	2326	16	43	0	2,369	16
	23	10,279	69	402	3	10,681	72
	24	418	3	8	0	426	3
	26A	1381	9	52	0	1,433	9
	Total	14,404	97	505	3	14,909	
2002	21			0	0		0
	22	2247	15	69	0	2,316	15
	23	9979	68	525	4	10,504	72
	24			19	0	19	0
	26A	1783	12	72	1	1,855	13
	Total	14,009	95	685	5	14,694	
2003	21			0	0		0
	22	1860	16	32	0	1,892	16
	23	7268	63	406	4	7,674	67
	24			17	0	17	0
	26A	1899	16	89	1	1,988	17
	Total	11,027	95	544	5	11,571	
2004	21			0	0	0	0
	22	2021	13	46	0	2,067	13
	23	11,787	75	603	4	12,390	79
	24			34	0	34	0
	26A	1201	8	110	1	1,311	9
	Total	15,009	95	793	5	15,802	
2005	21			0	0	0	0
	22	1433	10	18	0	1,451	10
	23	10,883	74	626	4	11,509	78
	24			4	0	4	0
	26A	1666	11	80	1	1,746	12
	Total	13,982	95	728	5	14,710	

Table 10. continued

Reg. year	GMU	Residents within WAH range # Caribou	%	All other hunters # Caribou	%	Total harvest # Caribou	%
2006	21			0			0
	22	628	7	40	0	668	7
	23	6,916	73	544	6	7,460	79
	24			9	0	9	0
	26A	1,276	13	83	1	1,359	14
	Total	8,820	93	676	7	9,496	
2007	21			1		1	0
	22	331	3	39	0	370	4
	23	7,548	72	465	5	8,013	77
	24			9	0	9	0
	26A	1,923	18	108	1	2,031	19
	Total	9,802	94	622	6	10,424	
2008	21			0	0		0
	22	2,763	18	34	0	2,797	19
	23	10,951	73	543	4	11,494	77
	24			6	0	6	
	26A	632	4	87	1	719	5
	Total	14,346	96	670	5	15,016	
2009	21			0	0		0
	22	1,454	12	26	0	1,480	12
	23	9,354	78	393	3	9,747	81
	24			19	0	19	0
	26A	728	6	70	1	798	7
	Total	11,536	96	508	4	12,044	
2010	21			2	0	2	0
	22	603	5	38	0	641	6
	23	9,953	86	248	2	10,201	88
	24			20	0	20	0
	26A	670	6	66	1	736	6
	Total	11,226	97	374	3	11,600	
2011	21			0	0	0	0
	22	3,416	22	48	0	3,464	22
	23	10,852	69	521	3	11,373	72
	24			46	0	46	0
	26A	810	5	98	1	908	6
	Total	15,078	95	713	5	15,791	

Table 11. Availability of caribou, community population size, and estimated harvests of Western Arctic Herd caribou using the Sutherland estimator (ADF&G, unpublished data), 2010–2011 (community population size based on 2007 estimates).

	%WAH caribou in total harvest	Human Pop.	Relative Distance to Caribou	Total harvest estimate	80% confidence limits	WAH harvest
Unit 22						
Brevig Mission	100	328	Far	16	0–211	16
Elim	100	309	Far	16	0–212	16
Golovin	100	167	Far	16	0–232	16
Koyuk	100	347	Avg	152	0–343	152
Nome	100	3495	Far	14	0–872	14
Shaktoolik	100	214	Far	16	0–224	16
Shishmaref	100	608	Avg	293	90–498	293
Saint Michael	100	444	Far	16	0–210	16
Stebbins	100	598	Far	16	0–228	16
Teller	100	256	Far	16	0–218	16
Unalakleet	100	724	Far	15	0–252	15
Wales	100	136	Far	16	0–238	16
White Mountain	100	215	Far	16	0–224	16
TOTAL						618
Unit 23						
Ambler	100	277	Close	478	365–591	478
Buckland	100	461	Close	729	619–840	729
Deering	100	133	Close	282	158–405	282
Kiana	100	391	Avg	467	387	546
Kivalina[a]	100	398	Far	0	0	0
Kobuk	100	119	Close	262	137–387	262
Kotzebue	100	3133	Avg	4208	3,617–4,798	4,208
Noatak[a]	100	489	Far	0	0	0
Noorvik	100	636	Avg	801	690–912	801
Point Hope	100	704	Avg	894	772–1,016	894
Selawik	100	869	Close	1286	1,140–1,432	1,286
Shungnak	100	269	Close	467	354–581	467
TOTAL						9,953
Unit 26A						
Anaktuvuk Pass	80	277	Close	539	467–612	431
Atqasuk	2	223	Avg	285	231–339	6
Barrow	3	4052	Far	2053	1,795–2,312	62
Nuiqsut	1	403	Far	255	205–305	3
Point Lay	40	250	Avg	298	244–352	120
Wainwright	15	540	Far	322	272–373	48
TOTAL						670
Total Harvest						11,241

[a]Actual harvest levels for Noatak and Kivalina, although very low, were >0.

Table 12. Availability of caribou, community population size, and estimated harvests of Western Arctic Herd caribou using the Sutherland estimator (ADF&G, unpublished data), 2011–2012 (community population size based on 2007 estimates) .

	%WAH caribou in total harvest	Human pop.	Relative distance to caribou	Total harvest estimate	80% confidence limits	WAH harvest
Unit 22						
Brevig Mission	100	328	Far	16	0–210	16
Elim	100	309	Close	330	130–530	330
Golovin	100	167	Close	159	0–378	159
Koyuk	100	347	Close	375	176–574	375
Nome	100	3495	Avg	1,867	1,108–2,626	1,867
Shaktoolik	100	214	Avg	79	0–290	79
Shishmaref	100	608	Avg	294	90–498	294
Saint Michael	100	444	Far	16	0–210	16
Stebbins	100	598	Far	16	0–228	16
Teller	100	256	Far	16	0–218	16
Unalakleet	100	724	Far	15	0–252	15
Wales	100	136	Far	16	0–238	16
White Mountain	100	215	Close	217	6–427	217
TOTAL						3,416
Unit 23						
Ambler	100	277	Avg	311	238–384	311
Buckland	100	461	Close	729	619–840	729
Deering	100	133	Close	282	158–405	282
Kiana	100	391	Close	634	524–743	634
Kivalina	100	398	Close	643	533–753	643
Kobuk	100	119	Avg	96	19–172	96
Kotzebue	100	3133	Close	4375	3,812–4,937	4,375
Noatak[a]	100	489	Far	0	0–98	0
Noorvik	100	636	Close	968	848–1,088	968
Point Hope	100	704	Close	1061	934–1187	1,061
Selawik	100	869	Close	1286	1,140–1,432	1,286
Shungnak	100	269	Close	467	354–581	467
TOTAL						10,852
Unit 26A						
Anaktuvuk Pass	80	277	Close	539	467–612	431
Atqasuk	2	223	Far	166	115–217	4
Barrow	3	4052	Far	2053	1,795–2,312	62
Nuiqsut	1	403	Far	255	205–305	3
Point Lay	40	250	Close	526	453–599	210
Wainwright	15	540	Close	669	596–742	100
TOTAL						810
Total Harvest						15,078

[a]Actual harvest level for Noatak, although very low, was >0.

Table 13. Number of hunters, success rates and caribou harvest by sex for hunters residing outside the range of the Western Arctic caribou herd per regulatory year and unit, RY07 through RY11 (Note: this table erroneously assumes all caribou taken in Unit 26A were from the WAH; some are undoubtedly from the Teshekpuk Caribou Herd)

Reg.		Number of hunters			Success	Caribou harvest			
Year	Unit	Successful	Unsuccessful	Total	Rate	Bulls	Cows	Unk.	Total
2007	21	1	0	1		1	0	0	1
	22	24	21	45	53	37	2	0	39
	23	357	195	552	65	418	45	2	465
	24	7	28	35	20	5	4	0	9
	26A	73	24	97	75	109	5	0	114
	Total	462	268	730	63	570	56	2	628
2008	21	0	2	2		0	0	0	0
	22	21	23	44	48	33	1	0	34
	23	395	155	550	72	492	50	1	543
	24	5	19	24	21	5	1	0	6
	26A	62	24	86	72	84	8	0	92
	Total	483	223	706	68	614	60	1	675
2009	21	0	1	1		0	0	0	0
	22	15	29	44	34	23	3	0	26
	23	276	163	439	63	324	60	9	393
	24	18	63	81	22	13	6	0	19
	26A	58	22	80	72	60	12	2	74
	Total	367	278	645	57	420	81	11	512
2010	21	1	1	2		1	0	1	2
	22	29	29	58	50	37	1	0	38
	23	178	243	421	42	222	25	1	248
	24	10	38	48	21	16	4	0	20
	26A	46	31	77	60	51	12	3	66
	Total	264	342	606	44	327	42	5	374
2011	21	0	1	1		0	0	0	0
	22	31	23	54	57	43	5	0	48
	23	315	142	457	69	452	55	14	521
	24	32	14	46	70	39	7	0	46
	26A	70	21	91	77	80	10	8	98
	Total	448	201	649	69	614	77	22	713

Table 14. Numbers and percent of nonlocal hunters by transport methods and year for the Western Arctic caribou herd, RY99–RY11 (all Units combined; annual % in parentheses).

Reg. year	Plane	Horse-Dog Team	Boat	4-wheeler	Snow machine	Off road vehicle	Highway vehicle	Airboat	Total
1999	414 (72)	3 (1)	83 (14)	20 (3)	14 (2)	4 (1)	32 (6)	3 (1)	573
2000	426 (65)	0 (0)	139 (21)	23 (3)	19 (3)	1 (0)	51 (8)	0 (0)	659
2001	410 (69)	3 (1)	88 (15)	19 (3)	12 (2)	3 (1)	59 (10)	2 (0)	596
2002	460 (67)	1 (0)	122 (18)	31 (5)	14 (2)	2 (0)	50 (7)	3 (0)	683
2003	377 (67)	0 (0)	99 (17)	28 (5)	9 (2)	5 (1)	48 (8)	0 (0)	566
2004	470 (73)	3 (0)	90 (14)	17 (3)	18 (3)	2 (0)	47 (7)	0 (0)	647
2005	510 (74)	1 (0)	112 (16)	11 (2)	12 (2)	6 (1)	33 (5)	1 (0)	686
2006	523 (76)	4 (1)	102 (15)	20 (3)	4 (1)	7 (1)	26 (4)	0 (0)	686
2007	557 (76)	4 (1)	90 (12)	29 (4)	9 (1)	4 (1)	35 (5)	0 (0)	731
2008	526 (75)	2 (0)	90 (13)	35 (5)	11 (2)	5 (1)	28 (4)	0 (0)	697
2009	411 (65)	5 (1)	92 (14)	32 (5)	12 (2)	9 (1)	70 (11)	4 (1)	635
2010	372 (75)	5 (1)	49 (10)	28 (6)	6 (1)	12 (2)	26 (5)	0 (0)	498
2011	442 (69)	4 (1)	72 (11)	32 (5)	32 (5)	11 (2)	49 (8)	3 (0)	645

Table 15. Percent positive results for brucellosis, haptoglobin levels, and sample sizes (in parentheses) from serology analyses of the Western Arctic caribou herd, 1962–2012.

	Brucellosis[a]		Elevated Haptoglobin Level[b]	
Year	%	(*n*)	%	(*n*)
1962	30	(56)		
1963	19	(74)		
1964	14	(37)		
1965	12	(149)		
1975	14	(14)		
1981	39	(23)		
1986	19	(37)		
1992	4	(52)	0	(14)
1993	12	(51)	4	(25)
1994	11	(47)	19	(27)
1995	12	(34)	5	(19)
1996	3	(76)	1	(73)
1997	0	(76)	11	(62)
1998	7	(113)	16	(112)
1999	5	(77)	10	(77)
2000	6	(115)	10	(116)
2001	2	(85)	0	(83)
2002	1	(92)	3	(92)
2003	6	(107)	5	(108)
2004	6	(80)	5	(80)
2005	2	(66)	17	(58)
2006	0	(45)	9	(45)
2007	0	(44)	25	(44)
2008	1	(72)	15	(73)
2009	5	(83)	7	(83)
2010			13	(60)
2011			8	(63)
2012	2	(44)	17	(46)

[a]Brucellosis is a bacterial disease caused by *Brucella suis* type 4; a positive result indicates presence of serum antibodies from exposure to the bacteria and not necessarily an active infection.
[b]Haptoglobins are proteins that indicate inflammation regardless of cause; an elevated haptoglobin level indicates the caribou had some type of infection.

Table 16. Median live body weight (lb) of calves during mid-September, Western Arctic caribou herd, 2008–2013. All body weights corrected for water weight. Sample sizes in parentheses.

	Calf weight, lb (n)		Body condition of mother (n)		
Year	Female	Male	Skinny or Very Skinny	Average	Fat or Very fat
2008	82 (13)	83 (9)	82 (3)	81 (14)	90 (5)
2009	89 (16)	90 (20)	92 (2)	89 (22)	93 (12)
2010	90 (7)	94 (22)	88 (4)	91 (17)	92 (7)
2011	90 (14)	86 (9)	91 (2)	98 (11)	90 (9)
2012	85 (10)	97 (4)	89 (1)	93 (9)	85 (4)
2013	93 (9)	94 (4)	97 (2)	78 (1)	94 (6)

SPECIES

MANAGEMENT REPORT

Alaska Department of Fish and Game
Division of Wildlife Conservation
(907) 465-4190 PO Box 115526
Juneau, AK 99811-5526

CARIBOU MANAGEMENT REPORT

From: 1 July 2010
To: 30 June 2012[1]

LOCATION

GAME MANAGEMENT UNITS: 25A, 25B, 25D, and 26C (59,400 mi^2)

HERD: Porcupine

GEOGRAPHIC DESCRIPTION: Eastern portions of the Arctic Slope, Brooks Range, and northeastern Interior Alaska

BACKGROUND

The Porcupine caribou herd (PCH) migrates between Alaska, and Yukon and Northwest Territories in Canada. Most of the herd's 130,000 mi^2 range is remote, roadless wilderness. The PCH is an important subsistence resource for Native people of Alaska and Canada. In addition, the PCH provides valued hunting and wildlife viewing opportunities for nonlocal Alaska residents and nonresidents. Because the PCH often calves in promising onshore petroleum prospects in Alaska (Clough et al. 1987), various state and federal agencies and their Canadian counterparts cooperated to carry out baseline ecological studies of the PCH in the 1980s and 1990s (Fancy and Whitten 1991, Whitten and Fancy 1991, Whitten et al. 1992, Fancy et al. 1994, Griffith et al. 2002). These studies are expected to provide baseline information for development of additional studies, planning, and mitigation should petroleum development occur in the future. Since these studies, research of the PCH has been substantially reduced and efforts have been focused on monitoring population parameters to evaluate management objectives.

In 1987 the United States and Canada established the International Porcupine Caribou Board (IPCB) to coordinate management and research among government and user groups. The IPCB includes a representative from the Alaska Department of Fish and Game (ADF&G), representatives of the governments of the United States, Canada, Yukon and Northwest Territories, and members of communities and Native organizations in Alaska and Canada. Additionally, ADF&G is a member of the Porcupine Caribou Technical Committee (PCTC), an ad hoc committee operating under the IPCB with representatives of the various management and research agencies with responsibilities for the PCH. These include the U.S. Fish and Wildlife Service; Yukon Department of Environment (YDE; formerly Yukon Department of Renewable Resources); Northwest Territories Department of Environment and Natural Resources (NWT);

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[1] At the discretion of the reporting biologist, this unit report may contain data collected outside the report period.

Canadian Wildlife Service (CWS); Parks Canada; and U.S. Geological Survey, Biological Resources Division. The PCTC meets regularly to coordinate research and management activities and set priorities for future work.

A variety of factors affect PCH management, including IPCB and PCTC recommendations, biological studies, subsistence harvest, and congressional actions regarding the potential opening of the Arctic National Wildlife Refuge (ANWR) to petroleum exploration and development.

The PCH remained more stable than other Alaska 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 (Arthur et al. 2003). The herd continued to decline to an estimated 129,000 animals in 1998 and 123,000 in 2001, probably due to increased adult mortality (Arthur et al. 2003). Estimates of population size could not be obtained during 2002–2009 due to inadequate survey conditions. In 2010, a successful photocensus survey was conducted which resulted in a population estimate of 169,000 caribou; however, the current population trajectory is unknown.

MANAGEMENT DIRECTION

The following goals, proposed by the IPCB in 1998 (International Porcupine Caribou Board 1998), have been used to guide management activities since the decline in research efforts of the early 1990s.

MANAGEMENT GOALS

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

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

- Enable users of the PCH to participate in international efforts to conserve the PCH and its habitat.

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

MANAGEMENT OBJECTIVE AND MANAGEMENT ACTIVITIES

- Maintain a minimum population of 135,000 caribou.

  - Conduct photo censuses every 2–3 years to estimate population size.

  - Estimate parturition rates and late June calf:cow ratios from radiocollared females.

  - Monitor herd movements by periodically locating radiocollared and GPS (satellite) collared caribou.

- Monitor the harvest through field observations, hunter reports, and contact with residents.

METHODS

RADIO COLLAR DEPLOYMENT AND MAINTENANCE

We maintained 75–90 radio collars (VHF [very high frequency] transmitters, GPS [global positioning system] transmitters, and PTT [Platform Terminal Transmitters]) on cow caribou and 10–20 VHF radio collars on bull caribou, annually. Caribou were captured using a handheld netgun from an R-44 helicopter and manually restrained with hobbles and hood and fitted with a VHF, GPS, or PTT collar. Annually in March, 10–20 ten-month-old calves (short yearlings) were captured and radiocollared, adult female caribou were recaptured and fitted with new collars approximately 4 to 6 years after radio collars were originally deployed, and 10–15 bulls (ages unknown) were radiocollared.

POPULATION STATUS AND TREND

Population Size

ADF&G, with assistance from ANWR and YDE, estimated population size of the herd using the modified aerial photo–direct count extrapolation (APDCE) technique (Davis et al. 1979; Valkenburg et al. 1985) conducted at 2–4 year intervals during 1979–2001. The technique required monitoring postcalving aggregations by radiotracking radiocollared caribou from mid-June through mid-July. Aggregations of sufficient quality to conduct a photo census typically occurred, presumably in response to insect harassment, when temperatures were >55°F and wind speed was <8 mph (Davis et al. 1979; Valkenburg et al. 1985). Groups of caribou were then photographed with a Zeiss RMK-A aerial camera mounted in the belly of a de Havilland DHC-2 Beaver aircraft. Small groups of caribou were often photographed with handheld cameras or visually estimated. Estimated population size in a given year was the summation of the total number of caribou enumerated from photographs and caribou that were visually estimated.

Prior to 2010, photocensus results were considered a minimum estimate of herd size. The method lacked an estimate of variance and underestimated herd size because groups of caribou having no radio collars can be difficult to detect and occasionally groups with radio collars are not detected. Furthermore, the magnitude of the bias likely varied between years and was largely affected by how well the herd aggregated and to a lesser extent the number of radio collars deployed within the herd.

Beginning in 2010, herd size was estimated by conducting a photocensus survey as described above and applying a model developed by Rivest et al. (1998) to estimate herd size and provide a measure of uncertainty. The estimator is based on a 2-phase sampling design. Phase 1 uses the distribution of radiocollared caribou among groups of known size to estimate the number of caribou in groups without radiocollared caribou. Phase 2 uses a Horvitz–Thompson estimator and the proportion of active radio collars detected to expand the herd size from phase 1 to account for caribou represented by radio collars not located during the survey. Rivest et al. (1998) describe 3 detection models for use in phase 2. Of these models, the "homogeneity" model has been most frequently applied (Couturier 1996; Patterson et al. 2004) and is best suited for our data. This model assumes that 1) all active radio collars are identified in observed groups and 2) unobserved groups with radiocollared caribou are missed because they are outside of the surveyed area. Phase 2 calculations are not necessary if all radio collars are located and associated groups are counted. Also, the consequences of not meeting the assumptions of phase 2, particularly by choosing an inappropriate detection function, are greatly mitigated when a high proportion of the active radio collars are detected and associated groups are counted. Finally, this estimator assumes random distribution of radio collars among caribou in the herd and a statistical test is provided to evaluate the appropriateness of this assumption for a given survey.

Parturition, Calf:Cow Ratios, and Early Calf Survival

Parturition rate was estimated by observing radiocollared females ≥4 years old from a fixed-wing aircraft during the first half of June. In addition, we opportunistically observed 2- and 3-year olds to estimate age-specific parturition rates. Caribou observed with calves, hard antlers, or distended udders were classified as parturient (Whitten 1995*a*). Parturient caribou may have been misclassified because the cow did not have hard antlers, the udder was not distended, calves were born early and died, or calves were born late and not observed.

The proportion of calves:100 cows was estimated by observing radiocollared females ≥4 years old from a fixed-wing aircraft in late June after most calves were born. June calf survival was estimated with 2 methods: 1) the proportion of radiocollared cows observed with a calf in late June compared to those observed with a calf in early June (excludes most perinatal mortality), and 2) late June calf:cow ratio/parturition rate (survival from birth to late June).

Population Composition

Fall sex and age composition was estimated by classifying caribou from a helicopter near peak of rut to take advantage of presumed mixing of bulls, cows, and calf caribou. Peak rut was estimated as the date 228 days (gestation period) prior to the median calving date of the PCH estimated from parturition surveys conducted annually in early June. Caribou groups were located by radiotracking radiocollared caribou (bulls and cows) from fixed-wing aircraft. Using a cluster sampling scheme (Cochran 1977), we classified approximately 200 caribou per radio collar per group. If <200 caribou were present in a group, all or most of the caribou in that groups were classified. The presence or absence of a vulva was used to differentiate the sexes for adult caribou, and size was used to differentiate calves from adults. Bulls were further classified as small, medium, or large based on antler characteristics (Eagan 1993). Bull:cow and calf:cow ratios were generated using pooled data, and variance was estimated using variance in those ratios between independent clusters, weighted by cluster size.

Using sampling techniques recommended by Urquhart (1983), personnel from YDE conducted composition counts from a helicopter during March on the PCH winter range in most years since 1991. Because group composition is unlikely to be homogeneous, Urquhart (1983) recommended a sample size of 10% of herd size composed from several well dispersed sample areas. Caribou were classified as adult cow, calf, and immature and mature bulls.

Historical composition data for the herd can be found in Whitten (1993a) and Stephenson (2005) for the postcalving period during 1971–1992 and in Whitten (1981, 1992) for the fall period during 1972–1980.

Distribution and Movements

Personnel from ADF&G, ANWR, and YDE cooperated to monitor distribution of the PCH during calving, postcalving, summer, rut, and winter by relocating radiocollared caribou from fixed wing aircraft and using location data collected remotely from GPS or PTT collars.

HARVEST

Harvest and hunting pressure by Alaska residents who lived south of the Yukon River (nonlocals) and by nonresidents were monitored using harvest reports submitted by hunters. Alaska residents who lived north of the Yukon River (locals) were not required to obtain caribou harvest tickets and report cards. However, they were required to register with ADF&G or an authorized vendor. Reporting has typically been poor; therefore, harvest by local residents prior to regulatory year 2006 (RY06; RY06 = 1 July 2006–30 June 2007) was estimated based on knowledge of local hunting patterns and the availability of caribou near communities. Local harvest depends largely on the relative availability of caribou and can be quite variable between years.

Prior to RY06, ADF&G likely underestimated local harvest in Alaska in years when the PCH wintered near Arctic Village and Kaktovik. Underestimates of harvest for those communities was due to poor harvest reporting by local residents and a lack of subsistence household surveys by ADF&G. We adjusted total annual local harvest from 200–500 annually during RY93–RY05 to 400–700 annually beginning in RY06. To arrive at this estimate, we used, in part, a model developed by Sutherland (2005) to estimate harvest of Western Arctic caribou for villages within that herd's range. The model uses household surveys, community size, proximity to the herd, and the ability of villagers to access caribou to estimate harvest for a given year. Although we did not have the data necessary to run the model for Arctic Village, Sutherland (2005) provided estimates of harvest for various villages on a per capita basis. Among similarly-sized communities, Anaktuvuk Pass consistently had the highest per capita harvest, 2 caribou/person. Because both communities show a high reliance on caribou, we used estimated per capita harvest for Anaktuvuk residents to estimate harvest of PCH caribou by Arctic Village residents (200–350 caribou/year). We estimated harvest by Kaktovik residents (200–250 caribou/year) from household surveys conducted in 1987–1988 (Pedersen 1990), and adjusted per capita harvest rates for current Kaktovik population size. In some years, caribou are opportunistically harvested by residents of Venetie, Beaver, Fort Yukon, and Chalkyitsik (0–100 caribou/year combined) which are on the periphery of the PCH's range.

Canadian harvest was obtained from YDE during 1984–1998. During 1999–2009, YDE did not collect harvest data, but Canadian managers assumed average harvest was 4,000 annually. Beginning in 2010, hunters in Canada were required to report harvest as the result of a Harvest Management Plan implemented in that year. For years when harvest data were available (reported or estimated) data were summarized by regulatory year.

RESULTS AND DISCUSSION

POPULATION STATUS AND TREND

Population Size

On 2–3 July 2010, we completed a photo census of the PCH, resulting in a population estimate of 169,000 caribou (95% CI 153,493–184,403 caribou). During the photo census we located all radio collars known to be active during spring 2010 on PCH bulls and cows (n = 100). This included one cow that was originally radiocollared as a Central Arctic Herd (CAH) caribou, but calved and was generally relocated with PCH caribou in 2010. The distribution of radiocollared caribou resulted in 21 groups containing only PCH radio collars and 3 groups containing both PCH and CAH radio collars. We also located 4 groups that did not contain radio collars. In total, 28 groups were identified, 25 groups were photographed with a large format camera mounted on a de Havilland DHC-2 Beaver, 2 groups were photographed with a handheld digital camera from a Cessna 185 Skywagon, and 1 group was visually estimated from a Cessna 182 Skylane. Enumeration of all caribou on photographs and visual estimation of 1 group not photographed resulted in 175,843 caribou.

Although all radio collars were located during the 2010 photo census, the homogeneity model in phase 2 was used to estimate the number of caribou in the group that was not photographed due to fog (visually estimated) and the number of PCH caribou in 3 groups that also contained CAH radio collars. In this ad hoc use of the estimator, we treated all PCH radio collars that were mixed in groups with CAH radio collars (n = 3; 1 in each of 3 groups) or were located but not photographed (n = 3 PCH radio collars; all in a single group) as "missing." Because the estimator relies only on counts for groups with radiocollared caribou (i.e., the size of groups without radio collars are estimated), we excluded from the input data all groups that were photographed but contained no radio collars (n = 4). The resulting data set consisted of 20 groups that contained a total of 147,268 caribou, accounted for 94 of 100 PCH radio collars, and produced an abundance estimate of 168,948 caribou (SE = 7,384, 95% CI = 153,493–184,403; Table 2). The statistical test of randomness supported our reliance on the assumption of random distribution of radio collars (P = 0.65; Table 2).

Parturition and Early Calf Survival

Parturition rate of radiocollared females ≥4 years old was 86% (n = 59) in 2011 and did not differ significantly (95% binomial CI) from the long-term mean (1987–2010; $\bar{x}$ = 81%; Table 2). Parturition rate was not estimated in 2012 due to poor weather that prevented adequate radiotracking flights.

Parturition rate for 3-year-olds was not estimated in 2011 because no caribou from the 2008 cohort were radiocollared. No 2-year-old caribou were observed parturient (n = 7) in 2011. Parturition rates of 2- and 3-year-olds were not estimated in 2012 due to poor weather that prevented adequate radiotracking flights. Prior to 2011, mean parturition for all 3-year-olds during 2005–2010 was 69% (n = 35). Parturition rates of 3-year olds have been positively correlated with herd growth rates and reproductive rates have been used as an index to evaluate nutritional status (Boertje et al. 2012). Herd growth rates were negative when 3-year old parturition fell below 40% and were stable or positive when this parturition rate was ≥70% (Boertje et al. 2012).

Postcalving survival of calves estimated from cows observed with calves in early June that were subsequently observed in late June (excludes most perinatal mortality) was 59% in 2011; the lowest recorded since 1993 (Table 2). Postcalving survival was not estimated in 2012. In addition to few parturient radiocollared cows being observed during parturition surveys, dense aggregations and shrubby vegetation would have made identification of individual radiocollared caribou and their unmarked calves difficult or impossible.

Late June calf:cow ratio of radiocollared females ≥4 years old was 41:100 in 2011 and was the lowest observed since 1987 (Table 2). The calf:cow ratio was not estimated in 2012 due to previously mentioned issues with sightability.

Population Composition

In October 2010, we located 53 radiocollared caribou in Alaska and Yukon and sampled 29 caribou groups containing 1–12 radio collars per group. Most caribou groups (n = 17) contained 1 radiocollared caribou, 7 groups contained 2 radiocollared caribou, and 5 groups contained 3 or more radiocollared caribou. Twenty-three groups contained radiocollared cows, 4 groups contained radiocollared bulls, and 2 groups included both radiocollared bulls and cows. The number of individuals classified per group ranged 8–2,000 caribou and varied based on the number of radiocollared caribou present per group and the total number of caribou available for classification in each group. The number of individuals classified per radio collar ranged 8–370 caribou and averaged 193 caribou. Of 11,207 caribou classified, 9,221 were adults. We estimated ratios of 57 bulls:100 cows and 34 calves:100 cows.

In addition to the 53 radiocollared caribou used for sampling, we located 25 radiocollared caribou that were not sampled. Combined, we located 82% of all radiocollared caribou known to be alive since the photo census in July, 2010. During the October survey, 92% of satellite radiocollared caribou (n = 13) and 95% of located VHF radiocollared caribou (n = 65) were in the upper East Fork Chandalar River drainage, in Alaska. The remaining satellite and located VHF radiocollared caribou were in the Old Crow Flats or foothills of the Richardson Mountains, in Canada. In Alaska, the PCH was slightly mixed with the Central Arctic Herd (CAH) at the southern and western extent of their distribution. Therefore, we avoided areas of significant mixing to the south and west to minimize samples of mixed PCH and CAH caribou. The survey did, however, include 5 cow caribou originally radiocollared as CAH caribou.

Previous caribou composition surveys (PCH 2009, CAH 2009, Teshekpuk 2009) identified sources of bias associated with estimating compositions of large caribou herds (Caikoski 2011; ADF&G files, Fairbanks). Although minimized compared to many other times of the year, sexual segregation is still apparent during rut-timed composition counts. In particular, substantial heterogeneity in calf:cow and bull:cow ratios were observed both within and between groups of caribou found by locating radiocollared bulls and those identified by locating radiocollared cows. In addition, large scale spatial heterogeneity in composition was observed for the PCH in 2009 when the herd was split between Alaska and Yukon.

In 2010, bias was likely minimized compared to the 2009 survey due to more concentrated spatial distribution and apparent mixing of sex and age classes. Over 90% of the PCH was congregated in one geographic region in Alaska and we sampled proportionally to the distribution. In addition, we sampled more groups identified by locating radiocollared bulls and several groups that contained radiocollared bulls and cows.

The March 2010 composition survey indicated a ratio of 20 calves:100 cows. This is the lowest March calf:cow ratio recorded for the PCH (Table 2; D. Cooley, YDE, personal communication, 2011). The long-term mean calf:cow ratio in March is 34 calves:100 cows (range = 20–56 calves:100 cows; Table 2).

Distribution and Movements

Calving Distribution. In early May 2011, the PCH migrated from wintering areas to the calving grounds. By the end of May, 12 of 13 satellite radiocollared caribou were on the coastal plain or adjacent foothills between the Babbage and Kongakut rivers. The remaining satellite radiocollared caribou migrated from the upper East Fork Chandalar River to the lower Canning River near the Sadlerochit Mountains. Sixty-seven radiocollared cows were observed during calving flights during 1–2 June. Of those, 14 radiocollared cows were located in ANWR and 53 radiocollared cows were located in Ivvavik National Park, Canada. Extent of calving occurred discontinuously from the Canning River in Alaska to the Babbage River in Yukon and was concentrated in the foothills between the Firth and Babbage Rivers.

In April 2012, satellite and GPS radiocollared PCH caribou migrated northeast to the upper East Fork Chandalar, Sheenjek, Coleen, Firth, and Kongakut river drainages. By the end of May, satellite and GPS radiocollared caribou arrived on the calving grounds. Fifteen of 16 satellite and GPS radiocollared caribou were along the coastal plain in Yukon between the Blow and Firth rivers. The remaining radio collar was in the Jago River drainage in Alaska. Calving distribution was not estimated in 2012 due to extensive fog that prevented adequate radiotracking flights. However, based on limited radiotracking flights and satellite radio collar locations, calving distribution likely occurred from the Blow River to the Kongakut River and may have been concentrated near the Babbage River, if the distribution of satellite radiocollared cows was representative of the overall distribution.

In the 1980s and 1990s, most of the PCH calved in ANWR, often in the 1002 area (The Alaska National Interest Lands Conservation Act of 1980 established ANWR. Section 1002 of that act identifies 1.5 million acres on the coastal plain in the western portion of ANWR in which management direction for land use(s) has been deferred due to the area's potential for oil and gas resources. This area is referred to as the "1002 area" in this report). Since 2004 the PCH has primarily calved in Ivvavik National Park, Canada. In 5 of 8 years during 2004–2011, calving occurred on the coastal plain, primarily in Yukon between the Alaska–Canada border and the Babbage River. In the remaining 3 years, calving occurred in both Alaska and Canada but occurred in the 1002 area during only 2 of those years.

Summer Distribution. Following calving in summer 2010, most of the PCH was distributed across the northern foothills of the Brooks Range between the Jago and Hulahula rivers. By late June and early July, a portion of the PCH moved from the north to the south side of the Brooks Range between the Sheenjek and East Fork Sheenjek rivers. Caribou that remained on the north side of the Brooks Range moved west, between the Canning and Hulahula river drainages.

Following calving in summer 2011, most of the PCH was distributed across the northern foothills of the Brooks Range and the coastal plain between the Jago and Kongakut rivers with additional caribou extending as far east as the Babbage River and as far west as the Canning River.

Following calving in summer 2012, caribou were dispersed north of the Continental Divide from the Babbage River to the Canning River using both the northern foothills of the Brooks Range and coastal plain. Additional caribou were present in the upper Firth, Coleen, and Sheenjek river drainages in July.

Fall Distribution. In August 2010 about 75% of the PCH satellite radiocollared caribou were in the Richardson Mountains in northern Yukon and the remaining caribou were in Alaska, mostly in the Sheenjek and East Fork Chandalar river drainages. During September, most of the PCH that were in Yukon moved west into Alaska and by late September over 90% of the PCH was in Alaska distributed between the North Fork Chandalar River and the Sheenjek River.

In August 2011, the PCH was distributed over a large geographic area extending from the Canning River to the Babbage River north of the Continental Divide and from the East Fork Chandalar River to the Richardson Mountains south of the Continental Divide. Throughout September, the herd converged on the Sheenjek and Coleen River drainages and by early October over 90% of the herd was located in this region.

Winter Distribution. During 2010–2011, 12 of 13 satellite radiocollared caribou wintered on the south side of the Brooks Range in Alaska and 1 satellite radiocollared caribou wintered in the Ogilvie Mountains in Yukon. Caribou that wintered in Alaska were distributed between the Wind and Sheenjek rivers during October–January. From February through April, caribou in Alaska were dispersed more widely and their distribution extended from the Wind River to the Upper Firth and Kongakut river drainages. The western extent of the PCH distribution overlapped with wintering Central Arctic herd caribou.

During 2011–2012, 10 of 11 satellite radiocollared caribou wintered on the south side of the Brooks Range in Alaska and 1 satellite collared caribou wintered in the Ogilvie Mountains in Yukon. Caribou that wintered in Alaska were mostly distributed between the Coleen and North Fork Chandalar rivers from October 2011 to March 2012. The western extent of the PCH distribution overlapped with Central Arctic and Teshekpuk caribou in late winter.

Historical information on movements and distribution of the PCH are summarized by Garner and Reynolds (1986), Whitten (1987, 1993*b*, 1995*b*), Whitten and Regelin (1988), Fancy et al. (1989), Golden (1989, 1990), Whitten and Fancy (1991), and Griffith et al. (2002).

MORTALITY

Harvest

Season and Bag Limit. The State of Alaska hunting season for resident hunters during RY10–RY11 was 1 July to 30 April; in addition, hunters could take only bull caribou during 23–30 June in Unit 26C. The bag limit for all Alaska residents was 10 caribou. The season for nonresident hunters during RY10–RY11 was 1 August to 30 September and the bag limit was 1 bull.

Alaska Board of Game Actions and Emergency Orders. In March 2010, the Alaska Board of Game (board) changed the nonresident seasons and bag limits starting in RY10. The nonresident bag limit was changed from 5 caribou to 1 bull and the season was changed from 1 July–30 April to 1 August–30 September. These bag limit and season date changes were implemented for Units 26C, 25D, 25B, and that portion of Unit 25A east of the East Fork Chandalar River. These regulations were adopted by the board in cooperative management with Yukon, Canada to match nonresident regulations for the PCH in that country. In March 2012, the board changed the nonresident bag limit from 1 bull to 2 bulls beginning in RY12. Similar to the previous regulatory change, this regulation was adopted by the board in cooperative management with Yukon, Canada to match nonresident regulations for the PCH in Canada. There were no emergency orders issues during RY10–RY11.

Alaska Harvest. Nonlocal Alaska resident and nonresident hunters harvested 107 PCH in Alaska during RY10 and 155 in RY11 (Table 3). Most harvest by nonlocals and nonresidents occurred in Unit 25A in the Coleen, Sheenjek, and East Fork Chandalar river drainages. Overall, harvest and hunting pressure by nonlocal Alaska residents and nonresidents remained low. The combined reported harvest by nonlocal Alaska residents and nonresidents represents a small proportion (<20%) of the estimated harvest in Alaska and is less than 10% of the total combined harvest in Alaska and Canada. Due to difficult logistics, high expense, and uncertainty in herd location from year to year, the PCH has never been subjected to substantial harvest by nonlocal and nonresident hunters in Alaska.

Total annual harvest of the PCH in RY10 and RY11 in Alaska is unknown because reporting by local Alaska residents is low. Most local Alaska harvest is by residents of Kaktovik and Arctic Village. Harvest occurs seasonally and is affected by caribou distribution. Harvest by Kaktovik residents occurs primarily during summer, following the calving period, and likely does not exceed 200 animals. Residents of Arctic Village harvest caribou primarily during winter in years when the PCH winters in or near the upper Chandalar River. This harvest likely ranges 200–350 caribou in years when caribou are accessible. In RY10 and RY11, harvest was likely near the upper range for Arctic Village because caribou were concentrated near the community for several months during winter. A small number of additional caribou were harvested by residents of Venetie in both years.

Canada Harvest. PCH harvest in Canada during RY10 was estimated at 1,720 caribou (Table 3) (Cooley and Branigan 2012). Sex composition of the RY10 harvest is largely unknown because sex was not reported for a large proportion of the harvest. However, for users that did report sex, 90.5% of harvest was reported as bulls. Harvest in Canada during RY11 was estimated at 1,850 caribou consisting of 1,750 bulls and 100 cows (Table 3; Cooley and Branigan 2013). Most harvest occurred in October, followed by September and August.

Harvest Rate. In RY10 the total harvest was estimated at 2,227–2,527 caribou (Table 3), which is up to 1.5% of the 2010 population estimate. Total harvest in RY11 was estimated at 2,405–2,705 caribou (Table 3). Harvest rate in 2011 is unknown because population size was not estimated in 2011 and population trend since the 2010 population estimate is unknown. However, it is unlikely harvest exceeded 2% of the population in 2011 even if herd size had declined.

Hunter Success. Success rates for nonlocal Alaska residents and nonresidents combined were 47% in RY10 and 62% in RY11, similar to previous years (Table 4). Most PCH caribou harvested by nonlocal Alaska residents and nonresidents were harvested in Units 25A and 26C. Hunting pressure was low in Units 25D and 25B. This is expected, as these units are on the periphery of the PCH range.

Local hunter success depended on spatial and temporal distribution of the PCH relative to village locations. Success rates by Kaktovik residents were likely low or moderate in RY10 and RY11 because the PCH migrated south of the coastal plain into the Brooks Range during mid to late June. However, success rates for residents of Arctic Village were likely high in RY10 and RY11 due to an abundance of PCH caribou that wintered in the upper Chandalar River drainage.

Harvest Chronology. Nearly all nonlocal Alaska resident and nonresident harvest of the PCH in Alaska occurs during August and early September. Local harvest near Kaktovik primarily occurs in July, August, and April if traveling conditions are good and caribou are present (Pedersen 1990). Harvest by local residents south of the Brooks Range primarily occurs during winter. However, harvest chronology depends on availability of caribou near villages, and harvest occurs whenever caribou are present.

Transport Methods. Traditionally, nonlocal Alaska resident and nonresident hunters fly into the PCH range, and a few travel by boat up the Porcupine River. Local residents in Alaska use boats or ATVs in summer and snowmachines in winter when the predominant harvest of the PCH in Alaska occurs.

Natural Mortality

A study on the causes of natural mortality on the PCH has not been conducted since the late 1980s. However, wolves, grizzly bears, and golden eagles were determined to be the 3 most common predators, with golden eagles being a significant source of mortality on PCH calves on the calving grounds (Whitten et al. 1992).

Although recent data on the cause of mortalities have not been collected, Wertz et al. (2007) reported annual adult female survival rates of 75–88% ($\bar{x}$ = 82%) during 2003–2006. This appears to be lower than during 1997–2001 when average annual survival was 90% (Arthur et al. 2003), and during 1982–1991 when average annual survival was 84% (Fancy et al. 1994). Population models (Walsh et al. 1995; Griffith et al. 2002; Arthur et al. 2003) suggest that annual adult survival rates less than 84% would result in a population decline such as that observed in the PCH during 1989–2001. U.S. Fish and Wildlife Service (USFWS) data for survival of adults and yearlings after 2006 are currently being analyzed and will be available for the next report period (Tara Wertz, Fairbanks USFWS, personal communication, 2010).

HABITAT

Studies indicate that calving caribou select areas with rapid plant growth, rather than specific sites or habitats (Griffith et al. 2002). Areas with the most rapid plant growth vary each year, but tend to be in the region identified by Fancy and Whitten (1991) as the primary calving area of the PCH. Over time, the entire extent of the calving grounds may be important for caribou.

In recent years, the PCH has wintered partially or entirely on the south side of the Brooks Range between the North Fork Chandalar and Coleen rivers in Alaska. The herd is often partially mixed with the Central Arctic herd. It is unknown whether the shift in winter range from the Ogilvie Mountains, Old Crow Flats, and Richardson Mountains in Yukon to Alaska is habitat related.

CONCLUSIONS AND RECOMMENDATIONS

The Porcupine caribou herd likely peaked near 178,000 caribou in 1989 and declined to 123,000 by 2001. Modeling indicated that the PCH may have numbered 110,000–115,000 by 2006 (Lenart 2007). However, based on the 2010 photo census, we estimate the PCH at 169,000 caribou, indicating the herd likely grew at an average annual rate of 2–3% since 2001, although rates may have varied substantially during that period.

Current and historic harvest rates of the PCH in Alaska are low; thus, consumptive use in Alaska has probably played a small or insignificant role in the periods of increasing or decreasing abundance observed in the PCH since the 1970s. Therefore, ADF&G and the Board of Game have maintained liberal hunting seasons and bag limits for residents and nonresidents compared to most herds in Alaska.

For the first time since the late 1990s, an estimate of PCH harvest in Canada was obtained for the 2010–2011 and 2011–2012 hunting seasons. In those years, consumptive users in Canada harvested an estimated 1,720 and 1,850 caribou, respectively, composed mostly of bulls (Cooley and Branigan 2012, 2013). Prior to these years, harvest levels or composition was mostly unknown but was thought to average 4,000 caribou annually and may have been as high as 6,000 in some years (Porcupine Caribou Management Board 2010). Harvest in Canada is likely strongly influenced by spatial and temporal distribution of the PCH relative to communities and more importantly, the Dempster Highway. Future harvest estimates in Canada will provide additional insight into the range of PCH harvest in Canada.

We met our goal to conserve the PCH and its habitat through international cooperation and coordination with ANWR and Canadian government agencies (YDE, NWT, CWS and Parks Canada) to assess demographic indices (parturition rates, early calf survival, adult and yearling survival, population size, and seasonal distribution). We met regularly with these agencies as part of the Porcupine Caribou Technical Committee (PCTC).

We met our goal to ensure opportunities for customary and traditional uses of the PCH by providing liberal seasons and bag limits. The goals to enable users of the PCH to participate in international efforts to conserve the PCH, and to encourage cooperation and communication among users and governments were met because the IPCB, which includes members from Alaska and Canada, met during RY10–RY11. In addition, local and nonlocal residents of Alaska participated in the State of Alaska's regulatory process through Advisory Committee and Board of Game meetings and residents of Canada participated in the development and adoption of the Harvest Management Plan.

Based on the population estimate of 169,000 caribou obtained in July 2010, we met our management objective of 135,000 caribou in RY10 and presumably met it in RY11. No regulatory changes are recommended at this time.

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Table 1. Porcupine caribou herd population estimates, 1961–2010.

Year	Population estimate[a]	Technique[b]
1961	110,000	Calving ground census
1972	99,959	APDCE
1977	105,000	APDCE
1979	105,683	APDCE
1982	125,174	APDCE
1983	135,284	APDCE
1987	165,000	APDCE
1989	178,000	APDCE
1992	160,000	APDCE
1994	152,000	APDCE
1998	129,000	APDCE
2001	123,000	APDCE
2002–2009[c]		
2010	169,000	APDCE[d]

[a] All estimates include calves except for the 1961 estimate.
[b] Calving ground census data presented by R. O. Skoog at the 1962 Alaska Science Conference; APDCE is aerial photo-direct count extrapolation (Davis et al. 1979; Valkenburg et al. 1985).
[c] No estimates due to poor aggregation or weather conditions for photography.
[d] Modeling developed by Rivest et al. (1998) applied to data collected from APDCE method to estimate herd size and apply confidence intervals.

Table 2. Porcupine caribou demographic data, 1987–2012[a].

Year	Cows observed[b]	Parturition rate	June calf survival[c]	Postcalving survival[d]	Late June calf:cow[e]	March calf:cow[f]	Population estimate
1987	51	0.78	0.71		0.55		165,000
1988	91	0.84	0.65		0.55		
1989	74	0.78	0.74		0.58	0.43	178,000
1990	74	0.82	0.90		0.74		
1991	77	0.74	0.82		0.61	0.22	
1992	78	0.86	0.57		0.49	0.30	160,000
1993	63	0.81	0.56	0.83	0.45	0.32	
1994	98	0.91	0.77	0.93	0.70	0.40	152,000
1995	95	0.69	0.85	0.92	0.59	0.46	
1996	74	0.89	0.81	0.91	0.72	0.38	
1997	48	0.75	0.77	0.90	0.58	0.39	
1998	58	0.83	0.82	0.94	0.68	0.28	129,000
1999	39	0.84	0.83	0.86	0.70	0.56	
2000	44	0.73	0.61	0.82	0.44	0.27	
2001	70	0.84	0.61	0.79	0.51	0.31	123,000
2002	68	0.87	0.65	0.85	0.56	0.38	
2003	70	0.87	0.79	0.85	0.69	0.33	
2004	74	0.82	–[g]	–[g]	–[g]	0.24	
2005	55	0.64	0.77	0.88	0.49	–[h]	
2006	66	0.79	0.73	0.86	0.58	0.39	
2007	67	0.88	0.83	0.90	0.73	–[h]	
2008	63	0.79	0.73	0.92	0.59	–[h]	
2009	65	0.77	0.57	0.75	0.44		
2010	41	0.85	0.76	0.87	0.65	0.20	169,000
2011	59	0.86	0.48	0.59	0.41		
2012		[g]	[g]	[g]	[g]		
	mean[i]	0.81	0.72	0.85	0.58	0.34	

[a] Data from Fancy et al. (1994), Alaska Dept. Fish and Game, and Yukon Dept. of Environment.
[b] Number of radiocollared cows for which parturition status was determined in early June, excluding those known to be <4 years old. Includes cows of unknown age, likely ≥4 years old. Prior to 2003, all caribou were of unknown age, however most were thought to be ≥4 years old
[c] Estimated as (July calf:cow ratio)/(parturition rate).
[d] Includes only calves observed during early June whose dams were observed in late June (i.e., does not include most perinatal mortality).
[e] Excludes radiocollared cows known to be <4 years old.
[f] As of March of the year following birth of each cohort; includes all cows >1 year old.
[g] No data due to adverse weather conditions.
[h] No data due to mixing of caribou herds on winter range.
[i] Mean is for years 1987–2011.

Table 3. Porcupine caribou herd harvest[a], regulatory years 1985–1986 through 2011–2012.

Regulatory	Reported				Estimated		
year	M	F	Unk	Total	Alaska	Canada[b]	Total
1985–1986	52	12	1	65	500–700	4,000	4,500–4,700
1986–1987	70	14	0	84	1,000–2000	500–1,000	1,500–3,000
1987–1988	106	22	1	129	<500	2,000–4,000	2,500–4,500
1988–1989	82	7	0	89	<500	2,000–4,000	2,500–4,500
1989–1990	104	8	0	112	500–700	2,000	2,500–2,700
1990–1991	19	1	0	20	100–150	1,680	1,780–1,830
1991–1992	101	3	0	104	100–150	2,774	2,874–2,904
1992–1993	78	1	0	79	658	1,657	2,315
1993–1994	77	5	0	82	250	2,934	3,184
1994–1995	72	3	0	75	200	2,040	2,240
1995–1996	61	7	0	68	200	2,069	2,269
1996–1997	76	2	0	78	200	2,159	2,359
1997–1998	58	4	1	63	300	1,308	1,608
1998–1999	83	11	1	95	300	–[c]	
1999–2000	84	4	0	88	400	–[c]	
2000–2001	62	10	0	72	300	–[c]	
2001–2002	105	9	0	114	400	–[c]	
2002–2003	72	3	1	76	300	–[c]	
2003–2004	120	8	0	128	500	–[c]	
2004–2005	60	7	0	67	200	–[c]	
2005–2006	32	10	0	42	500	–[c]	
2006–2007	57	1	1	59	400–700	–[c]	
2007–2008	113	13	0	126	400–700	–[c]	
2008–2009	78	15	0	93	400–700	–[c]	
2009–2010	108	18	2	128	400–700	–[c]	
2010–2011	89	15	3	107	400–700	1,720	2,227–2,527
2011–2012	127	27	1	155	400–700	1,850	2,405–2,705

[a] A small proportion (<10%) of the reported harvest may be Central Arctic Herd caribou from Unit 25A.
[b] Includes reported and estimated harvest
[c] Canadian data not collected.

Table 4. Porcupine caribou herd[a] local, nonlocal[b] and nonresident hunter success, regulatory years 1995–1996 through 2011–2012.

Regulatory year/ Hunters	Unit				Total for Units 25 and 26C
	25A	25B	25D	26C	
1995–1996					
Total hunters	57	9	1	21	88
Successful	32	2	0	10	44
% Successful	56	22	0	48	50
1996–1997					
Total hunters	47	20	0	9	76
Successful	29	16	0	2	47
% Successful	62	80	0	22	62
1997–1998					
Total hunters	56	10	3	17	86
Successful	34	5	0	6	45
% Successful	61	50	0	35	52
1998–1999					
Total hunters	85	12	3	17	117
Successful	63	3	2	9	77
% Successful	74	25	67	53	66
1999–2000					
Total hunters	80	23	16	6	125
Successful	55	14	5	3	77
% Successful	69	61	31	50	62
2000–2001					
Total hunters	91	13	12	6	122
Successful	56	0	2	2	60
% Successful	62	0	17	33	49
2001–2002					
Total hunters	121	27	14	14	176
Successful	85	5	2	9	101
% Successful	70	19	14	64	57
2002–2003					
Total hunters	98	21	23	12	154
Successful	65	5	2	4	76
% Successful	66	24	9	33	49
2003–2004					
Total hunters	127	29	12	13	181
Successful	95	19	0	9	123
% Successful	75	66	0	69	68

Regulatory year/ Hunters	Unit				Total for Units 25 and 26C
	25A	25B	25D	26C	
2004–2005					
Total hunters	85	11	16	20	132
Successful	54	0	3	8	65
% Successful	64	0	19	40	49
2005–2006					
Total hunters	80	11	12	30	133
Successful	24	0	0	18	42
% Successful	30	0	0	60	32
2006–2007					
Total hunters	88	12	33	23	156
Successful	45	1	1	12	59
% Successful	51	8	3	52	38
2007–2008					
Total hunters	142	10	16	55	223
Successful	82	1	3	40	126
% Successful	58	10	19	73	57
2008–2009					
Total hunters	140	10	18	52	220
Successful	74	1	1	32	108
% Successful	53	10	6	62	49
2009–2010					
Total hunters	195	14	16	39	264
Successful	108	2	4	18	132
% Successful	55	14	25	46	50
2010–2011					
Total hunters	152	16	16	42	226
Successful	79	1	5	22	107
% Successful	52	6	31	52	47
2011–2012					
Total hunters	169	10	15	56	250
Successful	116	0	9	30	155
% Successful	69	0	60	54	62

[a] A small proportion (<10%) of reported harvest in Unit 25A may be Central Arctic Herd caribou.

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

SPECIES

MANAGEMENT REPORT

Alaska Department of Fish and Game
Division of Wildlife Conservation
(907) 465-4190 PO Box 115526
Juneau, AK 99811-5526

CARIBOU MANAGEMENT REPORT

From: 1 July 2010
To: 30 June 2012[1]

LOCATION

GAME MANAGEMENT UNIT: Western half of Unit 25C and small portions of northern Unit 20B and eastern Unit 20F (3,090 mi^2)

HERD: White Mountains

GEOGRAPHIC DESCRIPTION: White Mountains area north of Fairbanks

BACKGROUND

As recently as 1960, 30,000 caribou from the Fortymile caribou herd (FCH) regularly crossed the Steese Highway to calve and summer in the White Mountains (Jones 1961). As the FCH declined throughout the 1960s, these caribou 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).

When the White Mountains caribou herd (WMCH) was first documented as a distinct herd in the late 1970s, it was thought to number 100–200 caribou (P. Valkenburg, ADF&G, personal communication, 2009). The federal Bureau of Land Management (BLM) estimated the herd's size at around 1,000 caribou in the mid-1980s (Valkenburg 1988), although the basis for this estimate is unknown. In a photo census on 6 July 1992, J. Herriges (BLM) counted 832 caribou but extrapolated the estimate to 1,200, based on missing radiocollared animals and a rough estimate of herd composition. Based on surveys since the late 1970s, it seems most likely that the herd grew from about 150 in 1978 to around 1,000 in 1992, was stable until about 1999, then slowly declined to about 500–700 animals by the mid to late 2000s (Table 1).

The White Mountains National Recreation Area is managed by BLM and encompasses most of the WMCH range. The recreation area was created by the 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 herd movements and distribution. The WMCH also

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[1] At the discretion of the reporting biologist, this unit report may contain data collected outside the report period.

provided a low-density comparison population for the long-term Delta caribou herd research project.

Public use of the White Mountains is increasing, especially during late winter. BLM continues to improve access and increase recreational opportunities through development of roads, trails, and cabins. Despite this increased access, annual reported harvests have been low. In 1990, 2 drawing permit hunts (DC877 and DC878) were established to provide opportunity to hunt caribou in winter. DC877 allowed motorized access hunting, while DC878 was nonmotorized access only. Although 100 permits were issued for the first 3 seasons (50 per hunt), participation and success were low (6 caribou harvested). The number of permits available was increased to 250 (125 per hunt) during regulatory years (RY) 1993 and 1994 (RY = 1 July through 30 June; e.g., RY93 = 1 July 1993 through 30 June 1994). However, the increase in available permits did not produce an increase in harvest, and participation dropped until there were more permits available than applicants. During the March 1998 Board of Game meeting, drawing permit hunts DC877 and DC878 were changed to registration hunts RC877 and RC878 with an unlimited number of permits available. Regulations were further liberalized at the March 2000 Board of Game meeting. The fall general season bag limit was changed from 1 bull to 1 caribou, and RC877 and RC878 were combined to create RC879, with season dates of 1 November through 31 March and no motorized restrictions. However, the area open to hunting the White Mountains caribou herd was reduced because the FCH hunt boundary was moved northwest from the Steese Highway to Preacher and American Creeks, removing a portion of the eastern area for hunting White Mountains caribou. In March 2002 the Board of Game changed the fall caribou bag limit back to one bull because cow harvests in 2000 and 2001 approached sustainable limits.

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 OBJECTIVE

- Maintain a stable or increasing population with a fall bull:cow ratio of at least 30 bulls:100 cows.

METHODS

POPULATION STATUS AND TREND

Population Size

In 2010, a photo census of the WMCH was not attempted due to unfavorable weather.

In 2011, a photo census was completed on 7 July using the radio-search technique (Valkenburg et al. 1985). We located 18 of 22 (82%) functioning radio collars during the survey, and photographed groups of caribou with an externally mounted digital camera from a radiotelemetry-equipped de Havilland Beaver fixed-wing aircraft.

We strive to maintain at least 20 radiocollared caribou in the WMCH to aid in estimating herd dynamics. During June 2012, 15 caribou had functioning radio collars and we plan to deploy up to 18 additional radio collars during spring 2013.

Population Composition

We conducted composition surveys on 1 October 2010 and 4 October 2011 using an R-44 helicopter and a Bellanca Scout fixed-wing aircraft. The biologist in the fixed-wing aircraft located the radiocollared caribou. A biologist in the R-44 helicopter classified caribou that were in groups with radiocollared animals and also classified any caribou found in a search of the surrounding area. We searched areas containing numerous radiocollared caribou for additional groups. We also classified any caribou encountered while in transit between search areas. Classification categories consisted of cows; calves; and large, medium, and small bulls. Observers identified bulls by the absence of vulva and classified bulls by antler characteristics (Eagan 1993). In 2010, we tallied the composition of each group on a 5-position counter and recorded the tallies on a data sheet. In 2011, we recorded composition information on a handheld digital recorder and then downloaded the digital data onto a personal computer for transcription and tabulation.

MORTALITY

Harvest

We estimated harvest by using data from returned harvest ticket and registration permit report cards. For RY10 and RY11, caribou harvested west of Preacher and American Creeks and north of the Steese Highway were considered WMCH animals; caribou harvested east of these drainages or south of the Steese Highway were considered FCH animals. To separate harvest of the White Mountains herd from the Ray Mountains herd in Unit 20F, we considered caribou killed south of the Yukon River to be White Mountains herd animals. Harvest data were summarized by regulatory year.

RESULTS AND DISCUSSION

POPULATION STATUS AND TREND

Population Size and Composition

During the 2011 photo census, we counted 423 caribou and estimated the population at 517 animals (423/.818; Table 1).

The June 2008 population estimate of 677–762 caribou was higher than the 2007 estimate of 590–650. In both 2007 and 2008, the minimum count grew by 15% from the previous year. It is likely that the herd was increasing at a high rate during this period, since 2 of the highest 5 calf:cow ratios ever recorded for the WMCH were observed in 2007 and 2008 (Table 1). This increase is further supported by high survival of radiocollared adults during RY08 and RY09, when only 1 of 17 radiocollared cows died. However, population estimates in 2009 and 2011 suggest the herd may be declining; poor calf recruitment during 2009–2011 ($\bar{x}$ = 21%) supports this assertion.

During fall composition surveys in 2010 and 2011, we classified 443 and 435 caribou, respectively (Table 1). Bull:cow ratios during 2010 and 2011 remained relatively high (40–50 bulls:100 cows) and continued to meet objectives.

Fall bull:cow ratios in the WMCH have been variable (23–62 bulls:100 cows during 1983–2012). This probably reflects biased sampling because bulls are often segregated after the rut (e.g., surveys conducted in 1991 and 1995). Surveys conducted early in the fall (i.e., 29 September–6 October) tend to yield higher bull:cow ratios than surveys conducted later. Differences in composition among years may also be attributed to behavior of the White Mountains caribou herd. Because these caribou are usually in small, scattered groups and can be in timbered areas, it is easy to miss groups and this could affect overall composition estimates.

Distribution and Movements

Calving in the WMCH is often widespread and dispersed, which appears to have changed little since Durtsche and Hobgood (1990) observed calving behavior in the White Mountains. This dispersed calving behavior is not unlike other small mountain herds (e.g., Barten et al. 2001, Bergerud et al. 2008). Calving occurs primarily in the higher elevations east of Beaver Creek, including the Nome, Fossil, Cache, and Preacher creek drainages. Some scattered calving also occurs west of Beaver Creek. Postcalving aggregations occur from mid-June to late July east of Beaver Creek to Mount Prindle. Prior to RY02, WMCH caribou often moved north of Beaver Creek and wintered in upper Hess and Victoria creeks and the upper Tolovana River drainages, although some wintered in the Preacher Creek drainage west of Circle. The western wintering area burned in 1988, followed by a perceived shift of caribou away from the western wintering area. Most of the herd wintered in the Preacher Creek drainage during RY04–RY09 and the Beaver and Preacher creek drainages in RY10–RY11.

Fortymile herd caribou crossed to the north side of the Steese Highway in autumn 2008. On 9 October 2008, some mixing with the WMCH was documented during a composition survey. When the FCH traveled back toward the core of their traditional range in February and March 2009, some WMCH animals went with them. On 29 March and 22 April 2009, 5 radiocollared yearling and 2-year-old female WMCH caribou were found in the upper Salcha and Goodpaster rivers, 80–120 miles from their typical winter range. These far-ranging White Mountains herd animals remained with the FCH at least through April, and had returned to the WMCH by 16 June 2009 when we radiotracked the herd. If we assume that the percentage of radiocollared White Mountains herd caribou that dispersed with the FCH was representative of the White Mountains herd animals that dispersed with the FCH (5 of 16 radiocollared caribou, or 31%), then more than 200 animals may have participated in the journey away from their home range and back. Perhaps some of those White Mountains herd caribou did not return to their natal herd. Therefore, concurrent with the observed decline in WMCH, fall calf recruitment dropped and range overlap with the FCH increased. These 2 factors, independently or in combination, could account for the population decline observed from RY08 through RY11.

MORTALITY

Harvest

Season and Bag Limit.

<table>
<tr><th>Season/Hunt conditions</th><th>RY90–RY97</th><th>RY98–RY99</th><th>RY00–RY01</th><th>RY02–RY11</th></tr>
<tr><td>Fall general season[a]</td><td colspan="4">10 Aug–20 Sep</td></tr>
<tr><td>Hunt area</td><td colspan="2">Units 20B, 20F, and 25C, north and east of the Elliott and Dalton Highways, and north and west of the Steese Highway.</td><td colspan="2">Units 20B and 20F north and east of the Elliott and Dalton Highways, and north and west of the Steese Highway, and Unit 25C west of Preacher and American Creeks.</td></tr>
<tr><td>Bag limit</td><td colspan="2">1 bull</td><td>1 caribou</td><td>1 bull</td></tr>
<tr><td>Motor vehicle restrictions</td><td colspan="4">None</td></tr>
<tr><td>Winter season[a]</td><td>Drawing;
1 Feb–31 Mar</td><td colspan="2">Registration; 1 Nov–31 Mar</td><td>Registration;
1 Dec–31 Mar</td></tr>
<tr><td>Hunt area</td><td colspan="2">Units 20B, 20F, and 25C, north and east of the Elliott and Dalton Highways, and north and west of the Steese Highway.</td><td colspan="2">Units 20B and 20F north and east of the Elliott and Dalton Highways, and north and west of the Steese Highway, and Unit 25C west of Preacher and American Creeks.</td></tr>
<tr><td>Bag limit</td><td colspan="4">1 caribou</td></tr>
<tr><td>Motor vehicle restrictions</td><td colspan="2">Yes</td><td colspan="2">No</td></tr>
</table>

[a] Residents and nonresidents.

Alaska Board of Game Actions and Emergency Orders. There were no board actions for the WMCH during RY10–RY11. However, due to herd mixing, the board passed new regulations for RY12 that combined the FCH and WMCH seasons under 1 registration permit (RC860 during fall and RC867 during winter). An additional hunt zone (Zone 4: portions of Units 20B, 20F and 25C) was created to better manage WMCH harvest under these permits. Previous board actions are addressed in the background section of this report.

Harvest by Hunters. Harvest during fall general season hunts was low from RY87 to RY99 (range 6–26). Fall harvest peaked in RY00 at 51 (Table 2) when Fortymile caribou herd animals came north of the Steese Highway and may have been the source of many of the 51 caribou taken. Additionally, RY00 was the first year that cow caribou were legal in the fall hunt, and harvest of cows contributed 20 of the 51 caribou in the reported harvest. The bag limit was changed to bull only in RY02, and the FCH has not returned to the area in large numbers during the fall general season since RY00. Due to these factors, the fall harvest declined to previous levels through RY11.

Permit Hunts. Historically, harvest has been low for winter registration hunt RC879 probably because the vast majority of the permits issued go unused (Table 3). This trend continued with 275 permits issued, 198 unused and 3 caribou reported taken in RY10 and 200 permits issued, 153 unused and 4 caribou reported taken in RY11.

Based on sustainable harvest rates for the adjacent Delta caribou herd, also a small mountain herd, we manage the White Mountains herd at a harvest level of ≤3% (Seaton 2009). The total annual WMCH reported harvest (fall and winter hunts) was 25 in RY10 and 12 in RY11. Based on these harvest numbers and an estimated population of 500–600 animals, harvest rates likely exceeded 3% in RY10, but not RY11. Longer-term harvest rates have averaged 3% during the last 5-year period (RY07–RY11).

Tracking the ratio of large bulls:100 cows can provide an indication of bull harvest with respect to sustainable limits. The proportion of large bulls per hundred cows averaged 11 during RY89–RY09 (Table 1). The White Mountains herd could likely sustain a harvest higher than 3% because the large bull ratio remained high during RY10–RY11 ($\bar{x}$ = 12 large bulls:100 cows) even though annual harvest was highly skewed toward bulls ($\bar{x}$ = 87%). Another possibility is that an unknown proportion of the bulls reported harvested in the fall hunt were actually members of the FCH harvested in the White Mountains herd hunt area.

Hunter Residency and Success. The majority of White Mountains caribou were harvested by local resident hunters (Table 4). Success rates were usually quite low in both fall and winter hunts. The low success rates were probably due to the inaccessibility of caribou during both seasons, but may have been further reduced in recent years due to the popularity of the FCH hunts nearby. Many FCH hunters who traveled the Steese Highway also obtained a general season harvest ticket or a RC879 permit for the chance to take a caribou as they passed through the range of the White Mountains caribou herd. This tended to artificially reduce success rates for the White Mountains caribou herd hunts.

Harvest Chronology. From RY90 (when winter seasons opened) to RY09, 87% (401/463) of the harvest occurred during the fall season (10 August–20 September). In RY10–RY11, 85% (39/46) of the harvest occurred during the fall season.

Transport Methods. The most common method of transportation used by successful hunters during the fall seasons in RY10 and RY11 was 3- or 4-wheelers ($\bar{x}$ = 68%; Table 5). Because of limited participation and low harvests, transportation methods for the winter hunts have little meaning, but in hunts where motorized access was allowed during winter, the vast majority of the harvest was by hunters who used snowmachines.

Winter travel in the White Mountains can be difficult for hunters, but extension of developed trails and cabins provided by BLM is making winter access easier. However, access trails have not been well developed in caribou wintering areas, and caribou frequent dense spruce forest in winter, making hunting difficult (Seaton 2011).

HABITAT ASSESSMENT AND ENHANCEMENT

Much of the western portion of the White Mountains herd range burned in 1988, and much of the central portion of their range burned in 2004 and 2005. These fires have appeared to change seasonal movement patterns somewhat, but the long-term implications of these habitat changes are not yet understood. BLM continues to improve access to the White Mountains National Recreation Area, which includes most of the herd's range. This improved access may bring more human activity to portions of the herd's range, and may degrade those habitats for the caribou through disturbance (Seaton 2011).

CONCLUSIONS AND RECOMMENDATIONS

We met the management objective for RY10–RY11 of a fall bull:cow ratio of at least 30 bulls:100 cows. However, we most likely did not meet our objective to maintain a stable or increasing population. It appears from the estimates that the population has been declining since 2008. Successful completion of population censuses has been problematic due to unfavorable weather 2 of the last 3 years. We intend to put additional radiocollars on WMCH caribou during spring 2013, which should aid in conducting a more reliable census in 2013, weather permitting.

Mixing of the Fortymile and White Mountains caribou has and will continue to be a significant challenge in managing these herds as separate populations. Herd overlap, or mixing, already has created harvest allocation issues. Regulatory changes in RY12 that combined the Fortymile and White Mountains caribou herd seasons under one registration permit during the fall and winter hunts and adding Zone 4 to the hunt addresses allocation issues, at least temporarily. If the FCH begins to use the White Mountains for calving, as it did in the past, that would leave us with no functional way of delineating the 2 herds. Likewise, if FCH growth and range expansion continues, it may completely engulf the WMCH whereby management of the 2 herds as distinct populations will be moot.

When the FCH harvest was liberalized in RY00, hunting pressure on the White Mountains caribou herd seemed to decrease. However, with BLM's improved access in this area, increased hunter effort and harvest during fall may occur in the future if opportunities to hunt other Interior caribou herds decline.

By working closely with BLM, we monitored increases in recreational uses and development. We should continue to participate in agency and public meetings about development of BLM lands in the White Mountains caribou herd's range. This cooperation will help effect better management strategies for the White Mountains caribou.

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

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Table 1. White Mountains caribou herd fall composition counts and estimated population size, 1989–2012.

Date	Bulls:100 Cows	Large bulls: 100 Cows	Calves:100 Cows	Calves (%)	Cows (%)	Small bulls (% of bulls)	Medium bulls (% of bulls)	Large bulls (% of bulls)	Total bulls (%)	Composition sample size	Estimate of herd size
10/6/89	50	11	36	19	54	46	33	22	27	744	750–1,000
10/11/91	23	5	24	16	68	44	35	21	15	312	
10/29/91[a]				15						324	761[b]–1,000
10/13/92	39	12	23	14	62	52	18	30	24	247	832[b]–1,200
9/27/93	48	21	22	13	59	34	23	43	28	497	
10/4/94	39	16	25	15	61	34	24	42	24	418	
10/16–17/95	36	10	31	19	60	44	27	29	22	418	
10/2/96	44	9	54	27	50	60	20	20	22	513	
10/2/97	34	11	38	22	58	50	19	31	20	341	
10/2/98	50	11	18	11	60	42	37	21	30	759	961[b]–1,100
9/30/99	62	16	39	20	47	33	40	26	31	644	
9/29/00	54	11	13	8	60	40	40	20	32	399	687[b]–800
9/25/01	57	11	26	14	55	46	36	19	31	441	700–800
9/24/02	34	7	29	18	61	44	35	21	21	405	
10/5/03	30	11	17	11	68	40	22	38	20	308	
10/5/04	35	6	23	15	63	32	49	18	22	321	642[b]–733[c]
10/6/05	44	18	21	13	61	33	27	40	27	391	514[b]
10/16/06	36	9	20	13	64	43	31	26	23	362	
10/10/07	39	7	37	21	57	54	27	19	22	358	590[b]
10/9/08[d]	46	12	42	23	53	42	31	27	24	507	677[b]–762[c]
10/7/09	42	9	15	9	64	44	34	22	27	333	529[b]–605[c]
10/1/10	40	10	23	14	61	49	26	26	25	443	
10/4/11	50	14	24	14	58	42	30	27	29	435	423[b]–517[c]
9/26/12	31	10	15	10	68	25	41	34	21	336	

[a] Conducted with fixed-wing aircraft instead of helicopter.

[b] Minimum count from summer census.

[c] Estimate based on radio-search technique (Valkenburg et al. 1985)

[d] Some mixing with the Fortymile Caribou herd occurred; therefore this data is less representative of the White Mountains herd alone.

Table 2. White Mountains caribou harvest during fall general season[a], regulatory years 2000–2012.

Regulatory year	General season harvest			
	Bull	Cow	Unk	Total
2000	30	20	1	51
2001	15	8	0	23
2002	11	0	1	12
2003	6	0	0	6
2004	12	0	0	12
2005	6	0	0	6
2006	6	0	0	6
2007	11	0	0	11
2008	18	1	0	19
2009	11	0	0	11
2010	21	1[b]	0	22
2011	7	1[b]	0	8

[a] Excludes winter permit hunt harvest.
[b] Illegal take.

Table 3. White Mountains caribou herd harvest by permit hunt, regulatory years 2000–2012.

Hunt	Regulatory year	Permits issued	Did not hunt	%[a]	Unsuccessful hunters	%	Successful hunters	%	Bulls	Cows	Unk	Harvest
RC879	2000	333	137	*41*	186	*95*	10	*5*	4	6	0	10
	2001	405	260	*64*	128	*88*	17	*12*	15	1	1	17
	2002	313	200	*64*	111	*98*	2	*2*	2	0	0	2
	2003	259	198	*76*	60	*98*	1	*2*	1	0	0	1
	2004	137	104	*76*	32	*97*	1	*3*	1	0	0	1
	2005	186	142	*76*	43	*98*	1	*2*	1	0	0	1
	2006	271	222	*82*	49	*100*	0	*0*	0	0	0	0
	2007	410	300	*73*	109	*99*	1	*1*	0	1	0	1
	2008	233	181	*78*	49	*94*	3	*6*	2	1	0	3
	2009	111	62	*56*	39	*80*	10	*20*	9	1	0	10
	2010	275	198	*72*	74	*96*	3	*4*	2	1	0	3
	2011	200	153	*77*	43	*91*	4	*9*	0	4	0	4

[a] Includes those who did not report.

Table 4. White Mountains caribou herd hunter residency and success during fall general seasons[a], regulatory years 2006–2012.

	Successful					Unsuccessful					
Regulatory year	Local[b] resident	Nonlocal resident	Nonresident	Total	%	Local[a] resident	Nonlocal resident	Nonresident	Total	%	Total hunters
2006	5	1	0	6	*8*	44	21	5	70	*92*	76
2007	7	2	2	11	*14*	41	23	4	68	*86*	79
2008	13	3	3	19	*17*	59	31	6	96	*83*	115
2009	6	2	3	11	*10*	62	28	5	95	*90*	106
2010	15	4	3	22	*17*	65	32	7	104	*83*	126
2011	5	2	1	8	*8*	55	30	6	91	*92*	99

[a] Excludes winter permit hunt harvest.
[b] Residents of Units 20 and 25C

Table 5. White Mountains caribou herd percent harvest by transport method during fall general seasons[a], regulatory years 2006–2012.

	Percent harvest by transport method								
Regulatory year	Airplane	Horse	Boat	3- or 4-Wheeler	Snowmachine	ORV	Highway vehicle	Other/Unk	*n*
2006	0	0	0	67	0	0	33	0	6
2007	9	0	9	73	0	0	9	0	11
2008	26	0	0	42	11	16	5	0	19
2009	18	0	0	73	9	0	0	0	11
2010	14	0	5	73	5	0	5	0	22
2011	0	0	0	63	0	0	25	13	8

[a] Excludes winter permit hunt harvest.

SPECIES

MANAGEMENT REPORT

Alaska Department of Fish and Game
Division of Wildlife Conservation
(907) 465-4190 PO BOX 115526
JUNEAU, AK 99811-5526

CARIBOU MANAGEMENT REPORT

From: 1 July 2010
To: 30 June 2012[1]

LOCATION

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

HERD: Teshekpuk

GEOGRAPHIC DESCRIPTION: Western North Slope

BACKGROUND

Archeological and traditional knowledge suggest that caribou have been abundant near Teshekpuk Lake for at least the last 400 years (Silva et al. 1985). Currently, the Teshekpuk caribou herd (TCH) is an important subsistence resource for hunters from several North Slope villages. In recent years, the average per capita harvest of caribou by North Slope villages within the TCH range was estimated at 0.9 caribou per person; most caribou harvested are from the TCH (Carroll 2007).

Based on a calving distribution that was geographically distinct from the adjacent Western Arctic and Central Arctic herds (WAH and CAH), the TCH was first identified as a distinct herd in 1978 (Davis and Valkenburg 1978). The TCH primarily inhabits the central coastal plain north of the Brooks Range during spring and summer, but has a large historical range, encompassing wintering areas across northwestern Alaska (Fig. 1).

Visual counts between 1978 and 1982 indicated that approximately 4,000 caribou used the area near Teshekpuk Lake during post-calving aggregations (Davis et al. 1979, Reynolds 1981, Silva et al. 1985). In 1984, a minimum population of 11,822 was estimated using post-calving aggregation photography (Davis et al. 1979, Carroll 1992). Growth continued through 2008, when the TCH was estimated at over 68,000 individuals (Parrett 2011). The exponential growth rate was 7.0% between 1984 and 2008, based on minimum count estimates (Table 1).

Starting in 1990, cooperative efforts between the North Slope Borough (NSB), U.S. Bureau of Land Management (BLM), and Alaska Department of Fish and Game (ADF&G) led to extensive deployments of satellite collars in the TCH. Major findings include the demonstration of high fidelity to calving areas surrounding Teshekpuk Lake, extensive use of coastal habitats between Cape Halkett and Barrow for insect relief, broad use of the coastal plain west of the Colville drainage in late summer, and highly variable use of winter ranges. Overlap of the TCH with the WAH and CAH can be extensive during fall and winter. These data have been summarized in

[1] This report contains data collected outside the report period at the discretion of the reporting biologist.

multiple publications (Philo et al. 1993, Prichard et al. 2001, Person et al. 2007, Yokel et al. 2009, Wilson et al. 2012, Prichard et al., in press).

MANAGEMENT DIRECTION

MANAGEMENT GOALS

- Provide for subsistence and other hunting opportunity on a sustained yield basis.
- Ensure adequate habitat exists to maintain the TCH.
- Provide for viewing and other uses of caribou.

MANAGEMENT OBJECTIVES

- Encourage cooperative management of the herd and its habitats among state, federal, and local entities and all users of the herd.
- Develop a better understanding of relationships and interactions among North Slope caribou herds.
- Monitor herd characteristics and population parameters (on an annual or regular basis).
- Attempt to maintain a minimum population of 15,000 caribou, recognizing that caribou numbers naturally fluctuate.
- Maintain a harvest level of 900–2,800 caribou using strategies adapted to population levels and trends.
- Maintain a population composed of at least 30 bulls per 100 cows.
- Seek to minimize conflicts between resource development and TCH.

MANAGEMENT ACTIVITIES

- Determine the population size of the herd every 2–3 years.
- Monitor recruitment and calf production through late winter recruitment and summer calving-ground surveys each year.
- Define seasonal habitat areas, such as calving, insect relief, and wintering areas.
- Identify and map the movements and distribution of the herd throughout the year using aerial survey, radiotelemetry, and satellite telemetry data.
- Encourage local participation in research and management decisions.

- Work with the North Slope Borough and the ADF&G Subsistence Division to collect harvest information.
- Determine the sources and timing of mortality in adult and calf caribou.
- Monitor mortality events through radiotelemetry, field observations, and sample collection.
- Work with management agencies, oil companies, and caribou users to minimize conflicts between the herd and major exploration and development projects.
- Maintain a sample size of at least 70 collared females. Capture caribou without the use of immobilization drugs.
- Monitor disease, parasite, contaminant, and body condition levels.
- Involve students in caribou research operations, work with students to track satellite-collared caribou movements, and lecture to school classes about caribou biology.

METHODS

POPULATION STATUS AND TREND

Population Size

Since 1984, we have used the aerial photo-direct count extrapolation technique (Davis et al. 1979), known more commonly as a "photo census", to estimate the minimum population size of the TCH. During the previous reporting period, an extensive effort to quantify error associated with minimum herd size estimates led to adopting methods outlined by Rivest et al. (1998) for producing estimates of abundance and associated variance that account for caribou in groups that do not contain radio collars, as well as protocols for expanding estimates to account for missing collars. This method can also assess the randomness assumption that is inherent to the overall methodology, but notably it is not capable of dealing with variation in photo quality that sometimes causes a large negative bias in the number of observable caribou. This method may also be a useful tool to quantify the mixing of caribou herds during photocensus photography, as caribou that are associated with a different herd at the time of photography can be treated as missing, and the number of caribou that a collar represents can be estimated separately; this adaptation of the technique only has one-way utility, however, as added caribou from another herd cannot be explicitly estimated using the currently described methodology.

A photo census was attempted on 31 July 2010; however, poor photo quality and loose aggregations created difficulties with counting caribou, and an estimate was not finalized. While unsuccessful for estimating abundance, this survey did provide interesting data on herd overlap and mixing.

A photo census was completed on 20 July 2011. A Cessna 182 aircraft with telemetry equipment was used to search for radiocollared caribou while TCH caribou were in insect relief aggregations. A de Havilland Beaver (DHC-2) aircraft was directed toward groups for photography. Photographs were taken with a floor-mounted Zeiss RMK-A camera. The software program Photoman (Rob DeLong, ADF&G, Fairbanks, AK) was used to ensure adequate endlap and sidelap of sequential images during photography and accurate photo layout prior to counting. Immediately following photography, we radiotracked over the area to listen for WAH and CAH collars. There were 231 black and white 9x9-inch photographs developed and printed by HAS Images (Dayton, Ohio). Photo layout occurred in August 2011 and photographs were counted in October 2011.

Productivity, Recruitment, and Mortality Estimates

Each year we attempted to fly early June calving surveys every 1 to 3 days over most of the TCH range using telemetry equipment to relocate collared cows. Calving surveys were flown using a Cessna 182 from 3 June through 10 June, 2011, and with a Bellanca Scout from 6 June through12 June, 2012. For each observation of a collared cow, we recorded the location using a Garmin Global Positioning System (GPS) receiver, the presence or absence of a calf, antler condition (hard, soft, or none) and presence or absence of a distended udder (Whitten 1995). Cows with soft antlers (covered with velvet) were determined to be nonparturient. We continued to observe collared cows through the end of the survey period, or until they were seen with a calf. We estimated parturition rate as the number of adult cows (≥3 years old) seen with a calf or observed with hard antlers or a distended udder (Whitten 1995) divided by the total number of adult cows. A second measure of productivity, termed the calving success rate, was estimated as the number of adult cows which still had a calf at the end of the survey period divided by the total number of adult cows.

Population composition was estimated using two methods of aerial survey, both based on focal animal sampling using collared animals. Fixed-wing surveys were completed using a Cessna 182, and helicopter surveys using a Robertson R-44 with a Piper PA-18 spotter plane radiotracking ahead of the helicopter. Autumn fixed-wing surveys were completed from 12 October through 14 October, 2010 and from 21 through 22 October, 2011, and helicopter surveys were completed from 21 October through 22 October, 2010, while spring fixed-wing surveys were completed from 11 April through 14 April, 2011, and spring helicopter surveys were completed from 4 April through 5 April, 2010. Sampling rates to determine composition were based on the total count of collared animals within a 3–5 mile radius surrounding collared animals, but the rates differed by aerial technique. During fixed-wing composition surveys approximately 100 caribou per radio collar were sampled for composition, and during helicopter composition surveys approximately 200 caribou were sampled per radio collar. Calf:adult, calf:cow, and bull:cow ratios were calculated using cluster sampling methods (Cochran 1977). The long-term trend in short-yearling recruitment rate was analyzed using a weighted regression, weighting annual estimates by 1 over the estimated variance (Zar 1999).

Annual female mortality rate was estimated from the number of detected mortalities divided by the number of active collars on July 1, corresponding to the beginning of a 12-month collar year (CY) aligned with the approximate date when new collars were deployed each year. Very High Frequency (VHF) transmitters were tracked 10–15 times each year, primarily during calving, the insect relief season, rut, and late winter prior to spring migration. When analyzing trends in mortality, we did not use mortality data from collared caribou instrumented with satellite Platform Terminal Transmitters (PTT) from 1990 to 1998 because they appeared to have a much higher mortality rate than those carrying VHF-only collars. Beginning in 2000, major reductions in the transmitter weight of PTTs appeared to eliminate the differential mortality rates; since then, we used data from VHF, GPS, and PTT collars for mortality estimates. We estimated seasonality of mortality for 58 GPS and PTT collared female caribou from 2000 through 2013, and 41 male caribou from 1998 through 2013. The approximate date of death was calculated using movement rates from satellite locations; the second location for a continuous series of paired locations with a movement rate less than the potential error rate in location quality was used as the date of death. Due to duty cycles, this date may be in error by as much as 1 week, particularly in winter. We grouped mortalities by 3-month seasons to examine broad patterns in seasonality of mortality. Although we estimated seasonality of mortality for males, we did not estimate an annual mortality rate for VHF- and PTT-collared bulls due to the small annual sample size, and a collaring bias toward large adults which are likely nearing the end of their natural lifespan.

Capture, Health Assessments, and Body Condition

We captured yearling and adult caribou using a hand-held net gun fired from a Robinson R44 helicopter and restrained them using hobbles, ropes, and blindfolds. We collected blood, fecal, and hair samples and took morphometric measurements, including weight, and made a subjective assessment of body condition (Gerhart et al. 1996). To account for within-year growth while assessing the potential for a long-term trend in capture weight of yearlings, we ran a linear mixed effects model, using Julian date and year as fixed effects, and year as a random effect to account for differences in the pattern of within-year growth by year. In June 2011 and June 2012, we hand-captured 70 and 71 neonatal calves (respectively) as part of a cooperative project with BLM. Calves were weighed during capture, and we compared weights from those two capture events to weights of caribou captured in previous years, and from other herds.

Distribution and Movements

We received satellite-location data from the Service Argos Data Collection and Location System (ARGOS) in Landover, Maryland. Current locations from PTT and GPS collars were plotted periodically throughout the year by ADF&G staff in Nome using ArcMap 9.3 (ESRI, Redlands, CA). Further geospatial analyses of satellite-telemetry data were undertaken as part of the cooperative research program by ABR Inc.—Environmental Research & Services, under contract to BLM. In addition to receiving caribou locations from PTT and GPS collars, we completed periodic VHF radiotracking flights to collect information on caribou movements and distribution.

ArcMap (ESRI, Redlands, CA) was used to map calving period locations based on information collected during calving surveys. For cows seen with a calf, the location the cow was first seen with a calf was assumed to be the approximate calving location (Carroll et al. 2005). For cows that were not observed with a calf, the location nearest in time to the median calving date was used. To document historical use of calving grounds, we used calving locations documented from 1994 to 2012 to produce fixed kernel utilization distributions for each year using Kernel HR (Seaman et al. 1998, Griffith et al. 2002, Parrett 2007). Annual utilization distributions were produced using a 5-km grid, with least-squares cross-validation of bandwidth selection (Seaman et al. 1998). We then summed the observation densities at grid intersections across years and rescaled the densities to sum to one to produce a cumulative calving distribution that is unbiased with respect to annual sample size.

To evaluate potential conflicts with oil and gas development, particularly along recent transportation corridors and proposed roads within the ranges of the TCH, we updated estimates of migratory intensity and winter habitat-use developed by Person et al. (2007) using data collected during the reporting period.

We estimated distribution during fall and spring migration using Brownian Bridge Movement Models (Horne et al. 2007, Sawyer et al. 2009). Estimates of migratory intensity were classified by categorizing the cumulative density of movement paths into four equal categories of increasing relative probability of use, corresponding to low, moderate, high and very high intensity use, as in Sawyer et al. (2009). We delimited the series of locations used for estimating each individual's migratory path by estimating the start and end of each migratory season. We used a net distance squared model (Bunnefeld et al. 2011) to determine the beginning and end of each migratory movement. This technique requires the calculation of the net distance moved from an originating point, and then squares that distance. In each case, the originating point was the location of an individual caribou on 1 July. Directed movements away and toward that origin resulted in a double sigmoid curve, where the vertices of the sigmoid curve could be identified, and those vertices would demarcate the initiation and cessation of migratory movement periods. As in Bunnefeld et al. (2011), we fit a series of sigmoid and linear models to each individual's movement data, using the best fitting model to define individuals as migratory or nonmigratory. For example, individuals with a clear double sigmoid would be defined as migratory, whereas individuals that displayed nondirectional movement through the course of fall and winter would be defined as nonmigratory.

Winter distribution from 2007 through 2012 was estimated using a cumulative kernel based on a 5-km grid, similar to the cumulative calving distribution. Individual locations from satellite telemetry and VHF radiotracking surveys for short yearlings completed in early April were used to generate annual kernel estimates, with sample sizes ranging from 42 to 55 caribou of both sexes. We estimated 50% and 75% volume contours for the cumulative kernel density utilization distribution. The late winter locations are appropriate to use for estimating generalized winter distribution because movement rates are so low in winter (Prichard et al. in press), and spring migration does not start until 4 May for most individuals (median date of spring migration initiation, unpublished data).

HARVEST

Harvest data are summarized by regulatory year (RY), which begins 1 July and ends 30 June (e.g., RY10 = 1 July 2010–30 June 2011). Harvests during RY10 and RY11 were monitored through sealing and permit reporting process, as well as through occasional community harvest surveys.

Previous analyses show the registration reporting system was not effective in estimating caribou harvest within the range of the TCH (e.g., Georgette 1994). Consequently, community harvest surveys are undertaken as an alternate method to quantify harvest; however, during this reporting period, no community harvest surveys were completed within the range of the TCH by the Division of Subsistence. The most recent community harvest estimates for Atqasuk, Barrow, and Nuiqsut have been generated from data collected from 2002 through 2007 (Braem et al. 2011). It is worth noting here that we did not use the 2002–2007 Barrow harvest estimates because sampling issues during community surveys resulted in unreliable estimates. The preliminary results from Barrow surveys reported in previous management reports are now considered gross overestimates of harvest (Braem et al. 2011). Because recent community harvest survey data is lacking, harvests were calculated based on previous estimates of per capita harvest by community. We used the estimated harvest from past survey reports and the human population for the year of the estimate to calculate the per capita harvest, and then applied recent human population estimates from the Department of Commerce, Community, and Economic Development to the per capita harvest rate for each village to estimate the total caribou harvest for RY10 and RY11. We looked at harvest as a function of distance from the village and the estimated abundance of caribou to determine if future per capita estimates of harvest should be adjusted for relative availability of caribou between years as in Sutherland (2005). Because many villages harvest caribou from more than one herd whenever possible, we estimated proportional herd harvest in a given community based on harvest in relation to satellite caribou distribution data where spatially referenced harvest data and satellite telemetry caribou location data were concurrent. For the remaining villages where spatially explicit harvest data were lacking, we used broader knowledge of caribou distribution and harvest patterns to estimate the proportional harvest between overlapping herds. We used monthly fixed kernel estimates of caribou distribution generated for this study and spatially explicit monthly estimates of harvest from Braem et al. (2011) to estimate the proportion of harvest that came from WAH, CAH, and TCH caribou over the course of the harvest monitoring study. We conducted this analysis using mean monthly harvests from spatially explicit areas, along with satellite telemetry locations for caribou from 2003 through 2007. For the villages of Atqasuk, Barrow, and Nuiqsut, we compared the mean monthly harvests from each polygon hunt area to the kernel density estimated for each herd from pooled locations across the study period. To generate kernel density estimates, we subsampled telemetry data for each individual caribou. We randomly selected three locations, each from the first, middle, and last third of the month, for each year available. Pooling locations across years provided a generalized distribution that corresponded temporally to the mean harvests estimated for each month. Additionally, in the case of Nuiqsut, we conducted the analysis using actual monthly harvests and estimated monthly distributions using 3 caribou locations per individual per month from the CAH and TCH. The larger telemetry sample sizes that permitted this finer temporal scale of analysis existed only for the period March 2003–December 2006.

Although we do not have spatially explicit harvest estimates for villages outside of Unit 26A, we attempted to understand the likelihood that caribou harvested in Units 22, 23, and 24 could be Teshekpuk caribou. Using broad areas described by Dau (2011), we used late winter locations to estimate the proportion of the herd that fell within areas of potential WAH–TCH overlap, compared to the proportion of WAH caribou wintering in those areas, assuming that those data were representative of the total abundance of caribou in those areas, and the relative chances of harvest from late fall through winter in those units. Additionally, harvest by nonlocal hunters was determined through harvest ticket reporting, with proportional harvest again estimated using knowledge of caribou distribution at the time of reported harvest to evaluate the likelihood that harvest came from the TCH or from an adjacent herd.

RESULTS AND DISCUSSION

POPULATION STATUS AND TREND

Population Size

During the failed photo census attempt in late July 2010, radiocollared female caribou from both the CAH and WAH were observed in aggregations of predominately TCH caribou. Concurrently, 4 collared TCH caribou were not found during photocensus radiotracking, and were known to be with the CAH. Mixture during the summer appears to be increasingly common. It was also notable that a several day stretch of warm, calm weather was still insufficient time for caribou to form suitable aggregations at that time of the summer, when caribou had already spread across the summer range.

From census photographs taken on 20 July 2011, we counted 52,673 caribou, distributed in 8 groups between Barrow and Cape Halkett. Of 76 collared adult caribou that were known to be active, we located 70 during the 2011 photo census. An additional 2 were known to be with the CAH at the time of the photo census, and 4 were missing, but found alive in autumn. During radiotracking in the hours following photography, we did not hear any WAH frequencies among TCH photocensus groups; however, we did hear 3 CAH collars, all within the largest group, which contained over 23,000 caribou and 40 TCH collars. For developing a minimum count estimate, using all of the deployed collars, including collars on calves and collars recently deployed on adults is appropriate.

For the abundance estimate described by Rivest et al. (1998), random distribution of collars within the population is both necessary and testable. Because of this necessity, it was not advisable to use collars that were recently deployed (both adults and neonates) in the statistical estimate of abundance. Rivest et al. (1998) provided three different models that varied in the assumptions associated with missing collars. The results of choosing different models only vary substantially if a relatively large proportion of collars are missing. Using the Rivest et al. (1998) homogeneity model, which assumes that all collars have an equal probability of being missing, the population estimate was 59,391 (±12%); however, this number includes an unknown number of CAH caribou. By subtracting the approximate number of caribou-per-collar in the CAH in 2010 (the last photo census for that herd), we can provide an *ad hoc* means to subtract those caribou from the TCH estimate. In 2010, there were 57 collars observed during the CAH photo census and 70,008 caribou, for an average of 1,229 caribou per collar. Subtracting 1,229 animals for each of the 4 CAH collars in the large TCH group gives a TCH abundance of 55,704. It is notable that the combination of group sizes and TCH collars observed during the TCH photo census satisfies the randomness assumption ($P = 0.14$), however by removing the estimated number of CAH animals from the largest group, the assumption is rejected ($P = 0.02$).

Only the estimate used for management purposes is reported here; however multiple ways of analyzing the herd mixture and the variety of newly deployed collars were considered independently. The results from these analyses corroborate the above analysis, indicating that the herd likely numbered 50,000–60,000 at the time of the photo census in 2011 (ADF&G memo to file: 2011 Teshekpuk caribou herd photocensus results, 2012) The exponential growth rate (Johnson 1994) from 1984 to 2011 was 7%, and the decline between 2008 and 2011 was 5.0% (Table 1).

In previous years, we evaluated the chances that immigration may have influenced population growth rates (Parrett 2009). The WAH was considered the most likely source of emigrating caribou, as well as the hardest to detect emigration from because of the large size of the herd relative to the low number of collared caribou. We estimated the probability that a collared caribou would be part of an immigrating group of caribou conditioned on a source population (e g., WAH) assumed to be 400,000 animals with 100 randomly distributed radiocollared caribou, and emigrating groups of caribou ranging from 500 to 8,000 animals. The cumulative probabilities over the course of 20 years, with the previous assumptions remaining stable, were also calculated (Fig. 2a). Similarly, we conditioned arriving animals on a source population of 70,000 (e g., CAH), with 100 randomly distributed collars, and an immigration of 500 to 2000 caribou, with cumulative probabilities extending over 10 years (Fig. 2b). When we originally addressed this question in 2009, it seemed clear that detecting an immigration event sufficient to notably influence the growth rate was possible, whether it occurred through a large one-time event, or multiple years of relatively minor movement between herds. Movement from the CAH is even more likely to be detected given the higher collar:caribou ratio in the herd. Any movement of more than 2,000 caribou to the TCH would almost certainly be detected (Fig. 2b), as was witnessed in the 2011 TCH photo census.

Productivity, Recruitment, and Mortality Estimates

<u>Parturition Surveys.</u> In 2011, we monitored 46 adult cows in early June. The parturition rate was 59%, and calving success was 41%. In 2012, we monitored 45 adult cows during the calving period. The parturition rate was 60%, and calving success was 42%. Both parturition and calving success rates were lower in 2011 and 2012 than the long-term averages for parturition (72%, 2002–2012) and calving success (58%, 1999–2012; Table 2), consistent with a long-term trend in declining productivity. The parturition rate of 3-year old females was 43% (*n* = 7) in 2011 and 70% (*n* = 7) in 2012. Boertje et al. (2012) felt that a prolonged (5-year running average) 3-year-old parturition rate of less than 55% was indicative of low nutritional status.

<u>Fall composition counts.</u> During fixed-wing surveys on 12–14 October 2010 we located 26 collared caribou, and classified 5,548 caribou in the vicinity of the collared animals, counting 1,216 calves (28 calves:100 adults; Table 3). A follow-up helicopter flight 7 days later was not successful; the lack of a spotter plane along with rapidly migrating caribou led to poor distribution of sampling effort; only 11 collars were found, and the ratio was 21 calves:100 adults (*n* = 1,208). The change in the ratio was likely due to a concentration of effort at the rear of the migratory path, with likely fewer calves and more bulls present than in the main group. In addition to being a relatively small sample of the collared caribou, the distribution of the helicopter-based sample was highly skewed spatially. As a result, these results may not be representative of the whole TCH population. The bull:cow ratio from that small sample was 46:100 (Table 3).

During fixed-wing surveys on 21 and 22 October 2011, we located 30 collared caribou, and classified 5,792 caribou in the vicinity of the collared animals. The calf:adult ratio was 31:100 (Table 3).

<u>Short-yearling counts.</u> On 11–14 April 2011, we located 48 collared caribou during spring recruitment surveys. We classified 3,653 caribou in the areas surrounding the collared animals

and saw 12% short yearlings (10–14%, 95% CI) or 13 short yearlings:100 adults (Table 2).

On 4–5 April 2012, we located 26 collared caribou during spring recruitment surveys. This survey was the first spring survey flown with a helicopter, as we wanted to attempt to understand the degree of sexual segregation at this time of year, and consequently how well this index reflected calves:100 cows, as opposed to calves:100 adults. Unfortunately, spatial coverage was very poor due to weather issues and there was extensive mixing of the WAH, CAH, and TCH herds within in the area of coverage. We classified 3,291 caribou in the areas surrounding the collared animals but we did not estimate the number of calves:100 adults because of the poor coverage and mixing of herds. It was notable that the bull:cow ratio was reduced to 27:100, almost half of what it had been the previous fall, indicating greater sexual segregation during spring than fall. The percentage of short yearlings in the spring composition counts has declined an average of 0.5% per year since 1990 ($p = 0.01$).

Mortality. Collar year 2010 (CY10; the 12-month collar year period beginning 1 July 2010) started with 68 collared females and the female mortality rate was 19% (11–31%, 95% CI). CY11 started with 66 collared females and the female mortality rate was 12% (6–23%, 95% CI). In both years, most of the mortality occurred in late winter and early spring. These mortality rates compare to a long-term average of 14.5% (12.7–16.4%, 1990–2010; Table 4). Although confidence intervals on mortality estimates are wide in any given year due to small sample sizes, they appear to provide a good index to mortality, and the running average for any three years is likely to provide a solid comparison for mortality rates exceeding the long-term average by more 10%.

There were 77 known-aged females marked as yearlings between 1990 and 2011. Due to small sample sizes at the higher ages, the age-specific mortality analysis was limited to ages 1–8 only. Notable patterns included a higher mortality rate for one-year-olds (11%), followed by a period of very low mortality (<7%) from 2 to 5 years of age. It is interesting to note that the average adult female survival rate calculated from all radiocollared females is almost twice that of the average mortality rate calculated across age classes 1–8 (7.9%), implying that the animals from the larger sample of unknown-aged animals tend to be older than 8. In fact, the mean minimum age of the unknown age sample in 2011, assuming all unknown-aged animals were at least 3 years old when captured, was 7.4 years.

Mortality of satellite collared cows and bulls was highly seasonal, with highest male mortality occurring in fall (September–November) and winter (December–February) (Fig. 3a, $n = 41$), and the highest female mortality occurring in spring (March-May) (Fig. 3b, $n = 58$). Adult mortality was low in summer for both sexes. Although harvest is included in this mortality, it is a small proportion of the mortality for both sexes. The high fall mortality in males is largely natural, and takes place largely following rut. Given the sampling bias toward collaring larger bulls, it is likely that the injuries and exertion associated with rutting activities contributes to the high mortality pattern revealed in fall. Detecting elevated rates of late-winter and spring mortality is precluded in the sample of collared males because a large portion of the sample has already died in most years. Female mortality appeared to climb through the course of the year, implying that there may be a nutritional component to late-winter and spring mortality. Despite this pattern, predation was commonly identified as the proximal source of mortality based on the majority of cases where a cause of mortality could be identified (unpublished ADF&G data, L. Parrett).

Capture, Body Condition, and Calf Weights

Captures. During 21–22 June 2011 we captured 24 female caribou. Twelve were new captures, and 12 were recaptures. A total of 11 VHF, 4 PTT and 9 GPS collars were deployed on females. We captured 4 male caribou which were collared with PTT collars.

During 25–28 June 2012 we captured 24 female caribou and 7 male caribou. Twelve were new captures, and 19 were recaptures. A total of 7 VHF, 7 PTT and 17 GPS collars were deployed (females = 24, males = 7).

There were no capture mortalities in 2011, and 3 in 2012; all yearlings.

Body Condition. A likelihood ratio test comparing models with and without year as a fixed effect indicated no support for the additional parameter (χ^2=0.15, p = 0.7), indicating no long-term trend in yearling weights. This result may be in part due to the confounding effects of capture date and year. Early in the summer, daily weight gain appears to be high (0.6 kg/day). Concomitantly, since 1994, the overall trend has been for capture dates to occur earlier in the summer (range 20 June–7 July). Because capture dates have tended to occur earlier in the summer, particularly in recent years, reduced capture weights could be partially or wholly due to earlier capture dates. To best fit this model, a small number of captures (n = 3) that occurred in September were removed because they were highly influential in estimating the daily change in weights, and implied a curvilinear growth rate that would have been difficult to fit accurately given a lack of data in midsummer.

Calf Weights. Female calves weighed 5.7 kg (n = 31) and 5.5 kg (n = 30) in 2011 and 2012, respectively. These weights are lighter than previous average female weights from the TCH from 2006 through 2009 (6.0 kg, n = 77), and from the adjacent CAH from 2001 through 2005 (Arthur and Del Vecchio 2009, 6.6 kg, n = 266). The mean weights in 2011 and 2012 are among the lightest ever recorded in North America (e.g., Couturier et al. 2009; Bergerud et al. 2008)

Distribution and Movements

General patterns of seasonal movement and the highly diverse wintering areas used by the TCH have been previously documented (Philo et al. 1993, Prichard et al. 2001, Carroll et al. 2005, Carroll 2007, Person et al. 2007). The TCH is unique among arctic coastal plain calving caribou in that a substantial proportion of caribou remain on the coastal plain through the winter in most years. Even with that relative consistency, the only times of the year when caribou are predictably distributed is during the insect season and late summer. Winter distribution can be highly variable, and even calving distribution can be unpredictable in some years. However, the 1994–2012 cumulative calving distribution shows the highest density calving area to be to in the areas north, east, and south of Teshekpuk Lake (Fig. 4). Caribou that winter near or with the CAH or WAH frequently calve with those herds, resulting in a broad cumulative calving distribution.

Summer range is typically bounded by the Colville River to the east and southeast, and extends to the southwest as far as a line from Umiat to Icy Cape. Coastal areas from Barrow to Cape Halkett are heavily used for insect relief from late June through early August, particularly the area north of Teshekpuk Lake. Although a few caribou temporarily diverge from the TCH and adopt the summer movement patterns of an adjacent herd, particularly after calving with them, fidelity by TCH caribou to summer range is very high. Adopting summer movement patterns of an adjacent herd is less common than simply sharing a calving range for the period surrounding parturition. The portions of the summer range used for insect relief are typically the coastal areas within 1–15 km of the Beaufort Sea coast. See Wilson et al. (2012) for examples of summer range and habitats used when insect harassment is high or low.

Fall migration routes are variable, as expected in a herd with highly variable wintering locations. Movements could be characterized into 3 broad categories: coastal plain movements that typify wintering concentrations near Nuiqsut, Wainwright and Atqasuk, southeasterly movements toward wintering areas in the central Brooks Range, and southwesterly movements along the Chukchi coast towards wintering areas in Unit 23. Other fall movements occur, but these three movement types are the most common (Fig. 5). Of 314 total collar years (i.e., some individuals were repeated in multiple collar years, spanning 1 July–30 June), 92 (29%) were not defined as migratory based on the criteria used in Bunnefeld et al. (2011). Most nonmigratory individuals were characterized by nondirectional movements in the fall. Although this pattern was more typical for caribou that remained on the coastal plain, some individuals that moved away from the coastal plain were also characterized as nonmigratory because there was no distinct movement direction, but rather a long period of movement with very gradual increases in net distance away from post-calving habitats. In contrast, the migratory portion of the sample included many individuals that stayed on the coastal plain, but had a distinct movement from one portion of the coastal plain to another. This is a function of migration being primarily defined by directed movements, and less by the overall magnitude of movement in the technique described by Bunnefeld et al. (2011).

There were 4 relatively distinct wintering concentrations: the coastal plain between Atqasuk and Wainwright, the coastal plain west of Nuiqsut, the central Brooks Range, and shared winter range with the WAH in the Noatak, Kobuk, and Selawik drainages (Fig. 6). While the winters from RY07 through RY11 represent only a portion of the long-term satellite telemetry dataset, those 4 areas are reflective of the long term as well (e.g., Person et al. 2007).

Spring migration routes are variable, similar to those seen in fall, as would be expected for the return migration to the calving ground (Fig. 7). A major difference is that the individual routes tend to be more direct and less consistent across individuals in the spring. This increased independence in individual movement along common routes results in population-level patterns that are more diffuse. In particular, caribou that migrated together along the coast in the fall were likely to move independently through the mountains and across the interior of the coastal plain in the spring.

<u>Movements During the Reporting Period.</u> In RY10, most caribou calved to the west of Teshekpuk Lake, with the addition of several females that wintered with the WAH calving well to the southwest of Teshekpuk Lake (Fig. 8a). Very few caribou utilized the historical area of concentrated calving, with many calving caribou west of the Ikpikpuk River. It is notable that the Ikpikpuk was reported to be one of the calving areas when the TCH was first reported as a distinct herd (Reynolds 1981). In late June and early July, caribou were spread between Harrison Bay and Barrow in typical insect relief areas, with proportionally more caribou toward the eastern portion of that broad area. By late July, caribou began to spread widely to the south and

east, between the Colville and Ikpikpuk rivers. Few satellite caribou were west of the Ikpikpuk in late summer. In October, approximately one half of the caribou moved south of the Colville River, eventually wintering in the upper Noatak, Alatna, and Kobuk drainages. The remaining half of the herd either remained south of Teshekpuk in the Fish and Judy creek drainages or moved west to winter near Peard Bay and Atqasuk. Also notable was the southern distribution of collared bull caribou, with all but one collared bull migrating to the Brooks Range or points south. The comprehensive use of wintering areas was particularly interesting because many widely disparate areas used individually in previous years were used collectively within a single year, an increasingly common occurrence in recent years.

In RY11, only a small proportion of the parturient caribou utilized the historical calving ground (Fig. 8b), similar to the calving distribution in RY10, although the degree of usage west of the Ikpikpuk was reduced relative to RY10. Similar to previous years, a few collared caribou shared calving areas with CAH and WAH caribou, although largely on the periphery of those calving areas. Following calving, caribou were again distributed around the perimeter of Teshekpuk Lake in late June, with a normal insect season distribution between Barrow and the Colville River Delta. By mid-August, caribou were spread across the coastal plain west of the Colville. In October, a large proportion of the herd moved southeast into the Itkillik, Toolik, and Kuparuk drainages, with the remainder scattered from the Colville River west to Icy Cape. Sexual segregation was apparent, with only one bull collar west of the Colville. Fall migration patterns led to wintering concentrations in the Brooks Range between the John River and the Middle Fork of the Chandalar River, with a small proportion of the herd remaining on the coastal plain, widely scattered from Icy Cape eastward to the Fish and Judy creek drainages. TCH caribou wintering in the Brooks Range were well mixed with caribou from the WAH, CAH, and Porcupine Caribou Herd (PCH).

HARVEST

Season and Bag Limit. The hunting seasons and bag limits were the same for both regulatory years of the reporting period.

RY10 and RY11 Unit and Bag Limits	Resident Open Season (Subsistence and General Hunts)	Nonresident Open Season
Unit 26A		
Resident Hunters: 5 caribou per day; cow caribou may not be taken 16 May–30 Jun	1 Jul–30 Jun	
Nonresident Hunters: 5 caribou total; cow caribou may not be taken 16 May–30 Jun.		1 Jul–30 Jun

Board of Game Actions and Emergency Orders. There were no Board of Game actions or emergency orders associated with the TCH during the reporting period.

Human-Induced Mortality. It has been difficult to estimate TCH harvest because of poor to non-existent reporting, annual variation in community harvest survey effort and location, widely varying wintering distribution of the TCH, and overlapping distribution of adjacent herds within village harvest areas. Typically, annual harvests by communities come from more than one herd, although the proportions can be strongly skewed toward one herd or another. Results from our analysis of proportional harvest from different herds indicate that caribou harvested by Barrow residents have almost exclusively been from the TCH, at least during the period 2002 through 2007. One notable issue is that a large proportion of the Barrow harvest (33% "unknown herd"; Table 5) occurs in locations where caribou abundance is predicted to be so low that the kernel density estimators do not estimate any caribou from any herd. In the case of Barrow, the locations of the unattributable harvest are typically near Barrow, at times when female caribou in particular are unlikely to be near Barrow. Because the harvests are occurring on the northern extent of the estimated distribution of the TCH, it is likely that the harvest did in fact come from the TCH rather than the WAH. Because of this distribution, we attributed unknown herd-source harvest to the TCH. Harvest in Atqasuk had a smaller proportion of unknown-herd harvest (14%, Table 6), and was similarly dominated by TCH harvest. In contrast, Nuiqsut harvest did include an estimated 11% directly attributable to the CAH (Table 7), when using pooled data. Similar to Barrow, however, when using unpooled data, the finer spatial resolution frequently led to harvests occurring where density estimates from both herds were zero, the end result being that instead of the 77:11 ratio estimated for TCH:CAH in the harvest, the ratio dropped to 29:25, with a much larger unknown component (46% vs. 11%). The inconsistency between harvest being reported at times and in locations where caribou abundance estimates are low or zero can probably be explained by three factors: First, harvest tends to be dominated by males in most seasons, but the vast majority of satellite collars are deployed on females. For example, the harvest ratio in Barrow has tended to be 80 bulls for every 20 cows (Braem et al. 2011), yet the sex ratio of caribou carrying satellite collars from 2002 through 2007 was approximately 2 bulls for every 8 cows. Second, the effort put toward harvest, particularly in Barrow, in likely disproportionate to the number of caribou near Barrow. As an example, when you compare monthly harvests to the pattern of abundance, there appears to be some relationship, although harvest in winter is proportionally less than abundance would imply (Figure 9a). In contrast, however, when divided into actual harvest polygons, this relationship falls apart completely, implying that in many cases harvest has little to do with abundance, and more to do with effort (Figure 9b). This appears to be corroborated by the observation that harvest is frequently a function of distance from the village (Figure 9c), implying seasonal ease of access as a major determining factor influencing harvest. Lastly, there can simply be a spatiotemporal relationship, where caribou may be abundant and accessible for a short time, and people take advantage of that situation. Given the high movement rates of caribou, particularly in summer, movements near villages can be difficult to detect by using only a subsample of location from satellite collared cows, yielding low predicted harvest. This temporal mismatch is probably compounded by relatively small samples of collared caribou in any given month being analyzed.

Harvest results previously reported (Parrett 2009) are now considered to be biased high, primarily due to a sampling design in Barrow that led to oversampling of households that were likely to harvest caribou, with an unknown stratification among households (Braem et al. 2011).

Although the magnitude of the bias is unknown among years, it was felt that the sample in 2003–2004, which led to an estimate of 0.7 caribou per Barrow resident, was the most representative during the study. This estimate is still 40% higher than previous per capita harvest estimates for that large and diverse community (Fuller and George 1997, Bacon et al. 2009). Using per capita harvest rates and current population levels for villages within the primary range of the TCH, we estimate that approximately 3,387 TCH caribou were harvested in each of RY10 and RY11 (Tables 8 and 9). Although the proportion of the harvest assumed to be from the TCH, rather than from adjacent herds, has increased, the net increase is countered by the reduction in estimated per capita harvest for Barrow by using data from 1992. The harvest rate from the TCH based on these per capita estimates is approximately 6% of the 2011 population estimate.

With respect to harvest that occurs outside of Unit 26A, some low level of harvest likely occurs in Units 23, 24 and 26B. Given the low levels of harvest in winter in the latter units, as well as seasonal overlap with adjacent herds, it is unlikely that the overall TCH harvest is significant when mixed with other herds. Given the high level of overall harvest that occurs in Unit 23, some harvest there is possible, but is likely overwhelmed by the much greater number of WAH caribou in that unit. For example, in areas of the WAH range where WAH and TCH are likely to overlap in winter (subareas 4, 5, 9; Table 6 and Fig. 15 in Dau 2011), if we assume that each WAH collar in Table 6 represents approximately 5,000 caribou, and each TCH collar in Table 10 (this report) represents 1,000 caribou, WAH outnumbered TCH caribou in the combined subareas 4, 5, and 9 by ratios of approximately 39:1, 6:1, and 17:1 in the winters of RY07, RY08, and RY09, respectively. This illustrates that the TCH is typically well outnumbered in areas of Unit 23, but the ratio can be highly variable, and may be even more variable when examined at a finer spatial resolution.

Permit Hunts. There were no permit hunts for caribou in Unit 26A during the reporting period.

Hunter Residency and Success. Most TCH harvest is from local hunters because the area is remote and largely inaccessible to nonlocal hunters. Nonlocal resident and nonresident hunters took a small proportion of TCH caribou, primarily from the Colville River drainage. Within Unit 26A, which contains both WAH and TCH herds during nonlocal harvest periods, nonlocal hunters took 100 caribou in RY10, and 118 caribou in RY11. Success rates in Unit 26A for nonlocal hunters were 61% in RY10, and 75% in RY11. Successful hunters harvested an average of 1.5 and 1.4 caribou per person in each regulatory year, respectively. Nonlocal hunters have typically been split evenly between nonlocal resident and nonresident hunters; in RY10 nonlocal residents composed 60% of the nonlocal hunters, and in RY11, residents composed 47% of the total. Based on the distribution and timing of harvest, nonlocal residents primarily harvested WAH caribou in Unit 26A, because only 8% of the total harvest RY07–RY11 was from drainages within Unit 26A frequented by TCH caribou when most nonlocal harvest occurred. Even if the entire Unit 26A harvest by nonlocal residents and nonresidents were attributed to TCH caribou, this would still amount to less than 3% of the annual TCH harvest.

Harvest Chronology. Caribou are harvested throughout the year, but most harvest by local residents occurred from July through October in recent years (Braem et al 2011, Parrett 2011). Nonresidents and nonlocal residents harvested over 95% of their caribou in August and September in both RY10 and RY11.

Transport Methods. Caribou hunters in Unit 26A used a wide variety of transport methods. Most residents of the unit used boats and all-terrain vehicles (ATVs) during July, August, and September; they used snowmobiles during the remainder of the year. Some use of aircraft occurs throughout the year, primarily by nonlocal residents and nonresidents, of whom the majority (83–86% in RY10 and RY11) use aircraft to hunt caribou. Hunters occasionally used highway vehicles when caribou moved near the limited local road systems, particularly the gas-well road near Barrow. Some additional harvest of TCH caribou occurs in Unit 26B along the Dalton Highway by hunters using dog teams or highway vehicles for access.

Other Mortality

We have recorded sizable caribou die-offs in past years within the range of the TCH. During the winter of 1989–1990, many dead and lethargic caribou were found in an area between Teshekpuk Lake, Ikpikpuk River, and Colville River. We estimate approximately 2,000–3,000 caribou died in this area, but it is impossible to determine how many were from the TCH since caribou from the WAH and the CAH were also present in the area (Carroll 1992). During the winter of 1992–1993 at least several hundred, and probably over 1,000, caribou died in the area to the east of Teshekpuk Lake and south of the Kogru River during a period of extremely cold, windy weather. Radio collars indicated that most of these animals were from the TCH (Carroll 1995). We did not detect any sizeable die-offs during this reporting period.

HABITAT

Assessment

Results of satellite telemetry studies (Philo et al. 1993; Prichard et al. 2001, Person et al. 2007, Wilson et al. 2012), VHF radiotracking flights (Kelleyhouse 2001, Carroll et al. 2005, Parrett 2007), and composition surveys have indicated that the areas around Teshekpuk Lake, particularly south, east, and north of the lake, have historically been the highest density calving areas used by the TCH. Additionally, the area to the north of the lake is used intensively for insect relief and grazing (Parrett 2007, Wilson et al. 2012), and the narrow corridors of land to the east and northwest of the lake are important migratory pathways to and from the insect relief area (Yokel et al. 2009).

In 1997 BLM began a process of opening the National Petroleum Reserve–Alaska (NPR-A), which encompasses much of the TCH range, to oil exploration and development. The first area to be considered was a 4.8-million-acre planning area in the northeast corner of NPR-A, which includes important TCH calving, insect relief, grazing, and migration areas located near Teshekpuk Lake. After a compilation and review of the available data and many public meetings, it was decided that 87% of the planning area would be available for oil and gas leasing. In recognition of the importance of the land around Teshekpuk Lake as crucial habitat for caribou and geese, much of it was protected. No leasing was allowed in the area north and east of the lake, and no surface structures were allowed in a strip of land to the west and south of Teshekpuk Lake and around the Kogru River (BLM 1998). BLM revised this plan in 2005 and again in 2008 and 2013 (BLM 2005, BLM 2008a, BLM 2013). In 2008, the plan made 90% of the 4.4-million-acre planning area available to leasing, with a 10-year deferral on the remaining 430,000 acres, which included a large proportion of the concentrated calving area, caribou insect relief areas, and important waterfowl and shorebird habitat (BLM 2008b). In the 2013 record of decision, much of the area previously opened to leasing and exploration was closed to leasing, including the areas surrounding Teshekpuk Lake used for calving and insect relief by the TCH, as well as some areas in southwestern NPR-A intended to preserve habitats used by the WAH (BLM 2013). Some areas deferred from leasing in previous plans retained those deferrals.

Enhancement

There were no habitat enhancement activities during the reporting period.

NONREGULATORY MANAGEMENT PROBLEMS/NEEDS

The fate of important caribou habitats and the future of resource development in northeast NPR-A continue to be very important management issues in Unit 26A. They will be determined through an ongoing process involving public input, agency recommendations, and executive decisions. ADF&G will play an important role in providing information relative to this process.

CONCLUSIONS AND RECOMMENDATIONS

The 2011 population estimate of 55,000 caribou was the first since 1995 that showed a decline between photocensus estimates. Based on recruitment data, and to a lesser extent productivity data, continuation of the decline seems likely, although an additional photo census would be desirable to confirm declining status. In contrast to the declining trends in the adjacent WAH, adult female mortality in the TCH has been remarkably stable over the long term, with a presumably shallower decline in abundance as a result.

While the lack of trend in both adult and yearling capture weights does not currently imply a density dependent nutritional problem in the herd, the tendency of caribou to move long distances and encounter a wide variety of habitats and habitat conditions makes timely detection of density dependent effects particularly problematic. Both parturition rate and calving success during the reporting period were two of the lowest observed in the history of TCH studies, continuing a downward trend in these indices of productivity. These metrics have been very variable over the long-term, making it difficult to detect changes in long-term trends.

There is a statistically significant, slowly declining trend in the short-yearling to adult ratio, perhaps an indication of density dependent recruitment. A similar decline may be occurring in bull:cow ratios as well, which may mean that the realized decline in short yearlings is sharper than the metrics show. A calf:adult ratio that includes a declining bull:cow ratio in the denominator could mask or minimize a trend in the actual spring calf:cow ratio. The slope of decline in actual recruitment and the ultimate cause of this decline in recruitment are unknown. Although circumstantial in nature, the potential for nutritionally-mediated predation rates seems a plausible explanation, especially if wolves are capable of both functional and numeric responses through simultaneously increasing kill rates and increasing in abundance. In this case density dependent changes in nutrition could both depress productivity and increase mortality rates leading to sharp declines in short yearling recruitment. Preliminary information from the calf mortality study started in 2011 corroborates the highly elevated late winter-spring mortality and suggests predation as the dominant proximal cause, although some calves do die from apparent starvation each spring.

It would be extremely helpful to document and confirm this long-term trend in declining recruitment through assessments of age structure via analysis of caribou jaws collected from hunter harvest. This management goal persists as a priority; however, we have had very little success establishing a program to receive jaws from local hunters.

Movement and range overlap between herds has been previously observed (Person et al. 2007) and continued through the reporting period. The potential for immigration to influence and inflate populations remains a possibility, evidenced by the occurrence of collared caribou from neighboring herds during abundance estimates. In early years, all movements observed had been emigration of the TCH into the adjacent WAH and CAH. In recent years however, movement, both temporary and permanent, has occurred in both directions. As these large herds move through peak abundance, it is possible that more interchange will occur if prolonged density dependence induces caribou to seek new range.

The current estimated harvest rate is approximately 6% of the current population, similar to the 6–8% harvest rates estimated recently, but lower than the approximate 10% harvest rate estimated for 2002–2005. The poor quality of harvest data makes it difficult to conclude that the herd actually sustained those high harvest levels. Nevertheless, the conservative estimate of 6% is still approximately twice the estimated harvest rates for the adjacent WAH and CAH, and may be unsustainable in a declining herd. This relatively high harvest emphasizes the importance of this herd as a subsistence resource and the importance of making sure that development activities do not reduce its productivity. Carroll (2007) reviewed important habitat use issues to be considered when developing land management plans for the NPR-A. At the heart of these issues is the potential for declines in caribou populations in response to impacts from development on calving and insect relief areas. Further research is needed to quantify this potential, particularly through research regarding fitness in relation to habitat use.

At this time, no regulatory changes are deemed necessary; however, decreasing productivity and recruitment are likely to result in a changing age structure that will perpetuate the recently observed population decline. Future declines may be quite rapid if they are accompanied by a concomitant increase in adult mortality rates. Confirming the trend and magnitude of decline and estimating harvestable surplus in future composition (age structure) and population regimes will be priority issues in future reporting periods.

Research and Management Recommendations

- Improve the probability of detecting emigration/immigration between herds. This may require increased sample sizes of marked animals, increased communication and shared radiotracking between herd managers, or some combination of both.

- Estimate the degree of sexual segregation during time periods where population-level data are being collected, particularly during insect relief aggregations and late-winter recruitment surveys. Improving information on bull distribution will also help in estimating the proportional harvest between overlapping herds.

- Improve our understanding of how habitat influences calf survival and weight gain in areas historically used for calving and insect relief.

- Continue to monitor mortality rates of adult females and attempt to make timely investigations into the sources and timing of mortality. Improve our understanding of additive and compensatory mortality to guide future estimates of harvestable surplus.

- Continue to evaluate the potential density dependent declines in nutrition, and attempt to evaluate the possibility for nutritionally-mediated predation, resulting in both numeric and functional responses by wolves and other predators.

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Table 1. Population estimates and exponential growth rates of the Teshekpuk caribou herd, 1978–2011.

Year	Minimum population estimate	Population estimate (%CV)[a]	r(%)[b]
1978–1982	3,000–4,000[c]	N/A	N/A
1984	11,822[d]	18,292 (44%)	N/A
1985	13,406[c]	N/A	N/A
1989	16,649[d]	19,724 (32%)	6.8%
1993	27,686[d]	41,800 (26%)	12.7%
1995	25,076[d]	32,839 (34%)	-5.0%
1999	28,627 [d]	N/A	3.3%
2002	45,166 [d]	51,783 (9%)	15.2[e]
2008	64,106 [d]	68,932 (8%)	5.8%
2011	52,673[f]	55,704 (12%)[g]	-5.0%

[a] Population estimate derived only from photographed groups that included radiocollared caribou, with expansions to account for missing collars and groups of caribou with no marked caribou as described by Rivest et al. (1998); in some years the data was not collected in such a manner as to allow an estimate.

[b] r= $(\ln(N_{t2})-\ln(N_{t1})/t$, where t= number of years between censuses, N = population estimated at time t.

[c] Derived from visual estimate.

[d] Derived using aerial photocensus minimum count.

[e] It is unlikely that the herd increased at this rate. The 1999 count was probably an underestimation, and the herd had increased since 1995.

[f] Minimum count includes an unknown number of CAH caribou

[g] This estimate is based on the number of caribou estimated using only collars deployed prior to 2011, with an estimated 3,687 CAH caribou removed from that estimate. CV was calculated from the original estimate, and biased low as a result, because it accounts for no error associated with estimating the number of CAH caribou .

Table 2. Teshekpuk caribou herd calving and short-yearling survey results, 1999–2012[a].

	Calving surveys (June)			Short-yearling surveys (April)			
Year	Cows observed	Parturition[b] (%)	Live calves[c] (%)	N	Short yearlings: 100 adults	Short yearlings (%)	95% confidence limits[d]
1999	36	–	67	2,040	27	21	13–25%
2000	29	–	85	1,985	25	20	14–26%
2001	36	–	44	1,369	17	15	7–22%
2002	32	94	71	2,270	10	9	7–11%
2003	34	94	65	2,141	26	20	15–26%
2004	36	58	48	2,692	22	18	11–23%
2005	30	73	56	1,564	9	8	0–16%
2006	40	88	82	2,177	20	16	11–22%
2007	48	69	60	2,357	23	19	15–23%
2008	42	74	67	3,718	19	16	13–19%
2009	48	50	40	4,491	14	13	11–14%
2010	47	74	47	4,102	15	13	11–16%
2011	46	59	41	3,653	13	12	10–14%
2012[e]	45	60	42				
AVERAGE	39	72	58	2,658	18	15	

[a]Data from 1990-1998 included in previous reports; see Parrett (2009).

[b]Number of collared cows with calf + collared cows with no calf with but hard antler or udder / number of mature collared cows observed.

[c]Number of collared cows with live calves at the end of calving surveys / number of mature collared cows observed.

[d]Calculated based on Cochran's cluster sampling method (1977). Cluster data unavailable for 1990–1992, 1994, 1997–1998.

[e]No spring short-yearling estimate was derived for 2012 due to extensive herd mixing and poor spatial coverage of the samples.

Table 3. Teshekpuk caribou herd post-calving and fall composition counts, 1991–2011

Date	Helicopter surveys (Jul/Oct)						Fall fixed-wing surveys (Oct/Nov)		
	Bulls:100 Cows	Bulls (%)	Calves:100 Cows	Calves (%)	Cows (%)	N	Calves:100 adults	Calves (%)	N
1991	25	13	66	35	52	3,673	–	–	–
1992	93	34	80	29	37	3,047	–	–	–
1993	98	37	39	15	38	2,959	–	–	–
1994	–	–	–	–	–	–	37	27	1,681
1995	68	29	73	30	41	1,987	36	27	1,931
1996	–	–	–	–	–	–	–	–	–
1997	32	18	46	26	56	3,771	–	–	–
1998	75	31	67	28	41	3,302	25	20	458
2000	49	23	63	30	47	3,921	–	–	–
2001	–	–	–	–	–	–	13	11	1,458
2002	–	–	–	–	–	–	26	21	3,510
2004	–	–	–	–	–	–	6	5	658
2005	–	–	–	–	–	–	22	18	1,700
2006	–	–	–	–	–	–	32	25	3,371
2007	–	–	–	–	–	–	23	19	2,213
2008	–	–	–	–	–	–	19	16	1,895
2009[a]	46	28	18	11	61	6,576	–	–	–
2010	46		29			1,208	28	22	5,548
2011	–	–	–	–	–	–	31	23	5,792

[a]From 2009 onward, the helicopter survey took place in October.

.

Table 4. Annual mortality of adult female radiocollared Teshekpuk Caribou, 1990–2012.

Collar year[a]	Sample size[b]	Mortalities[c]	Mortality rate[d] (%)	95% Binomial confidence
1990–1991	13	2	15	4–42%
1991–1992	21	3	14	5–35%
1992–1993	21	3	13	5–35%
1993–1994	30	4	13	5–30%
1994–1995	29	5	17	8–35%
1995–1996	31	4	13	5–29%
1996–1997	25	6	24	12–43%
1997–1998	28	4	14	6–32%
1998–1999	39	3	8	3–20%
1999–2000	37	5	14	6–28%
2000–2001[e]	45	5	11	5–24%
2001–2002	40	7	17	9–32%
2002–2003	36	4	11	4–25%
2003–2004	52	13	25	15–38%
2004–2005	46	8	17	9–31%
2005–2006	43	4	9	4–22%
2006–2007	60	5	8	4–18%
2007–2008	55	10	18	10–30%
2008–2009	61	8	13	7–24%
2009–2010	65	10	15	9–26%
2010–2011	68	13	19	11–31%
2011–2012	66	8	12	6–23%
Average			14.5	12.7-16.4%

[a] Collar year defined as 1 July–30 June.
[b] Sample size – the total number of active radio collars at the beginning of the collar year.
[c] Number of radiocollared caribou that died during the collar year.
[d] Mortality rate = Known Mortalities/ Number of Active Female Collars.
[e] Beginning in 2000–2001, caribou that were collared with PTT, GPS, or VHF radio collars were used in the analysis. Before 2000–2001 only VHF-collared caribou were used.

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Table 5. Proportional caribou herd harvest based on monthly kernel-based utilization distribution of estimated average monthly harvest at Barrow, Alaska, 2002–2007 (from Braem et al. 2011). Kernel-based utilization distribution generated from collared caribou locations pooled over that same time period as harvest. Harvest estimates are thought to be biased in magnitude, but not necessarily in timing, or in spatial reference.

	Teshekpuk		Western Arctic		Unknown herd		Total average harvest
Month	%[a]	Avg[b]	%[a]	Avg[b]	%[a]	Avg[b]	
JAN	59	(55)	0		41	(39)	94
FEB	67	(62)	0		33	(30)	92
MAR	32	(12)	0		68	(24)	36
APR	76	(31)	0		24	(10)	41
MAY	57	(35)	0		43	(27)	62
JUN	31	(300)	0		69	(670)	971
JUL	77	(649)	0		23	(194)	843
AUG	92	(889)	0		8	(74)	963
SEP	63	(331)	2	(12)	35	(180)	524
OCT	92	(385)	9	(36)	0		421
NOV	10	(12)	0		90	(102)	113
DEC	47	(27)	16	(11)	47	(34)	72
Yearly	66	2,787	1	60	33	1,384	4,231

[a] Proportion (%) of each herd represented in total monthly caribou harvest.

[b] Estimate of average (avg) monthly number of caribou harvested.

Table 6. Proportional caribou herd harvest based on monthly kernel-based utilization distribution of estimated average monthly harvest at Atqasuk, Alaska, 2002–2007 (from Braem et al. 2011). Kernel-based utilization distribution generated from collared caribou locations pooled over that same time period as harvest.

	Teshekpuk		Western Arctic		Unknown herd		Total average harvest
Month	%[a]	Avg[b]	%[a]	Avg[b]	%[a]	Avg[b]	
JAN	100	(3)	0		0		3
FEB	100	(0.2)	0		0		0.2
MAR	100	(0.2)	0		0		0.2
APR	100	(0.2)	0		0		0.2
MAY	50	(2)	50	(2)	0		4
JUN	14	(3)	0		86	(17)	20
JUL	100	(21)	0		0		21
AUG	100	(64)	0		0		64
SEP	99	(41)	1	(0.3)	0		41
OCT	34	(3)	12	(1)	54	(5)	9
NOV	100	(2)	0		0		2
DEC	59	(2)	0		41	(1)	3
Yearly	84	141	2	4	14	23	167

[a] Proportion (%) of each herd represented in total monthly caribou harvest.

[b] Estimate of average (avg) monthly number of caribou harvested.

Table 7. Proportional caribou herd harvest based on monthly kernel-based utilization distribution of estimated average monthly harvest at Nuiqsut, Alaska, 2002–2007 (from Braem et al. 2011). Kernel-based utilization distribution generated from collared caribou locations pooled over that same time period as harvest.

	Teshekpuk		Central Arctic		Western Arctic		Unknown herd		Total average harvest
	%[a]	Avg[b]	%[a]	Avg[b]	%[a]	Avg[b]	%[a]	Avg[b]	
JAN	0		0		0		100	(0.6)	0.6
FEB	0		0		0		100	(0.6)	0.6
MAR	71	(6)	0		0		29	(2)	8
APR	50	(4)	6	(0.4)	0		44	(3)	7
MAY	100	(1)	0		0		0		1
JUN	74	(70)	15	(15)	0		11	(11)	96
JUL	71	(54)	0		0		29	(22)	75
AUG	88	(67)	9	(7)	4	(3)	0		77
SEP	71	(25)	29	(10)	0		0		35
OCT	87	(30)	13	(4)	0		0		34
NOV	100	(6)	0		0		0		6
DEC	100	(1)	0		0		0		1
Yearly	77	263	11	36	1	3	11	39	342

[a] Proportion (%) of each herd represented in total monthly caribou harvest.

[b] Estimate of average (avg) monthly number of caribou harvested.

Table 8. Summary of community-based harvest assessments for communities within the range of the Teshekpuk caribou herd, 1985–2007.

Community	Survey year	Human population	Average Nr caribou harvested/yr	Harvest information reference
Anaktuvuk Pass	1990	314	592	Pedersen and Opie 1990
Anaktuvuk Pass	1991	272	545	Pedersen and Opie 1991
Anaktuvuk Pass	1992	270	566	Fuller and George 1997
Anaktuvuk Pass	1993	318	574	Pedersen and Opie 1993
Anaktuvuk Pass	1994–1995	318	322	Brower and Opie 1996
Anaktuvuk Pass	2006-2007	277	697	Pedersen (pers. comm.)
Atqasuk	1994–1995	237	262	Hepa et al. 1997
Atqasuk	2002–2006	228	198	Braem et al. 2011
Barrow	1987-1989	3,016	1,595	Braund et al. 1991
Barrow	1992	3,908	1,993	Fuller and George 1997
Barrow	1995, 1996, 1999, 2000, 2003	4,378	2117	Bacon et al. 2009
Barrow	2002–2006	4,581	4,478	Braem et al. 2011
Nuiqsut	1985	337	513	Pedersen 1995
Nuiqsut	1992	418	278	Fuller and George 1997
Nuiqsut	1993	361	672	Pedersen 1995
Nuiqsut	1994–1995	418	258	Brower and Opie 1997
Nuiqsut	1999–2000	468	413	Pedersen 2001
Nuiqsut	2000–2001	468	600	Pedersen (pers. comm.)
Nuiqsut	2002–2006	433	398	Braem et al. 2011
Point Lay	1987	121	157	Pedersen 1989
Point Hope	1992	699	225	Fuller and George 1997
Wainwright	1988	506	505	Braund et al. 1993
Wainwright	1989	468	711	Braund et al. 1993
Wainwright	1992	584	748	Fuller and George 1997

Table 9. Estimated harvest of Teshekpuk herd caribou by residents living within Unit 26A during RY10 and RY11.

Community	Human population[a]	Per capita caribou harvest	Approximate total community harvest[a]	Approximate % TCH in harvest	Estimated average annual TCH caribou harvest	Assessments used to estimate per capita caribou harvest[b]
Anaktuvuk Pass	331	1.8	582	30	174	Anak. Pass 1990–1995
Atqasuk	234	0.9	215	98	210	Atqasuk 2002-2007
Barrow	4,290	0.5	2,145	97	2,123	Barrow 1992, 1995, 1996, 1999, 2000, 2002
Nuiqsut	411	1.1	468	86	403	Nuiqsut 2002-2007
Point Lay	191	1.3	247	20	49	Pt. Lay 1987
Wainwright	559	1.3	710	60	426	Wainwright 1988, 1989, 1992
Total Harvest			4,582		3,387	

[a]Population estimates averaged from the 2010 U.S. Census and 2012 Alaska Department of Commerce, Division of Community and Regional Affairs data

[b]Citations associated with each harvest assessment are in Table 8.

Table 10. Geographic distribution of collared TCH caribou in late winter (April), 2008–2012. Each row represents the percentage of collars in each area in a given year, with the total number of collars shown at the bottom.

Area[1]	2007-2008	2008-2009	2009-2010	2010-2011	2011-2012
1	56	45	71	33	18
2	0	0	0	0	0
3	33	0	6	13	13
4	0	10	0	4	0
5	4	17	17	46	58
6	0	0	2	0	0
7	0	0	0	0	0
8	0	0	0	0	0
9	4	29	0	0	0
Out	2	0	4	6	13
Total	45	42	52	55	40

[1]Area Descriptions (see Dau 2011 for map showing each area):

1 North Slope coastal plain west of Colville drainage; 16,378 mi^2
2 Foothills of Brooks Range west of Utukok River; 8,817 mi^2
3 Foothills of Brooks Range east of Utukok River and west of Dalton Highway; 24,082 mi^2
4 Kobuk drainage below Selby River; Squirrel drainage below North Fork; Selawik drainage; Buckland drainage; 18,928 mi^2
5 Kobuk drainage above Selby R; central Brooks Range north of Koyukuk R & west of Dalton Hwy; Noatak drainage above Douglas Creek; 12,436 mi^2
6 Koyukuk drainage south of Brook Range mountains, including Kanuti Flats, Galena Flats; 13,089 mi^2
7 Seward Peninsula west of Buckland and Koyukuk villages; 15,436 mi^2
8 Nulato Hills; 14,418 mi^2
9 Noatak drainage below Douglas Creek; Squirrel drainage above North Fork; Wulik and Kivalina drainages; Lisburne Hills; 16,541 mi^2

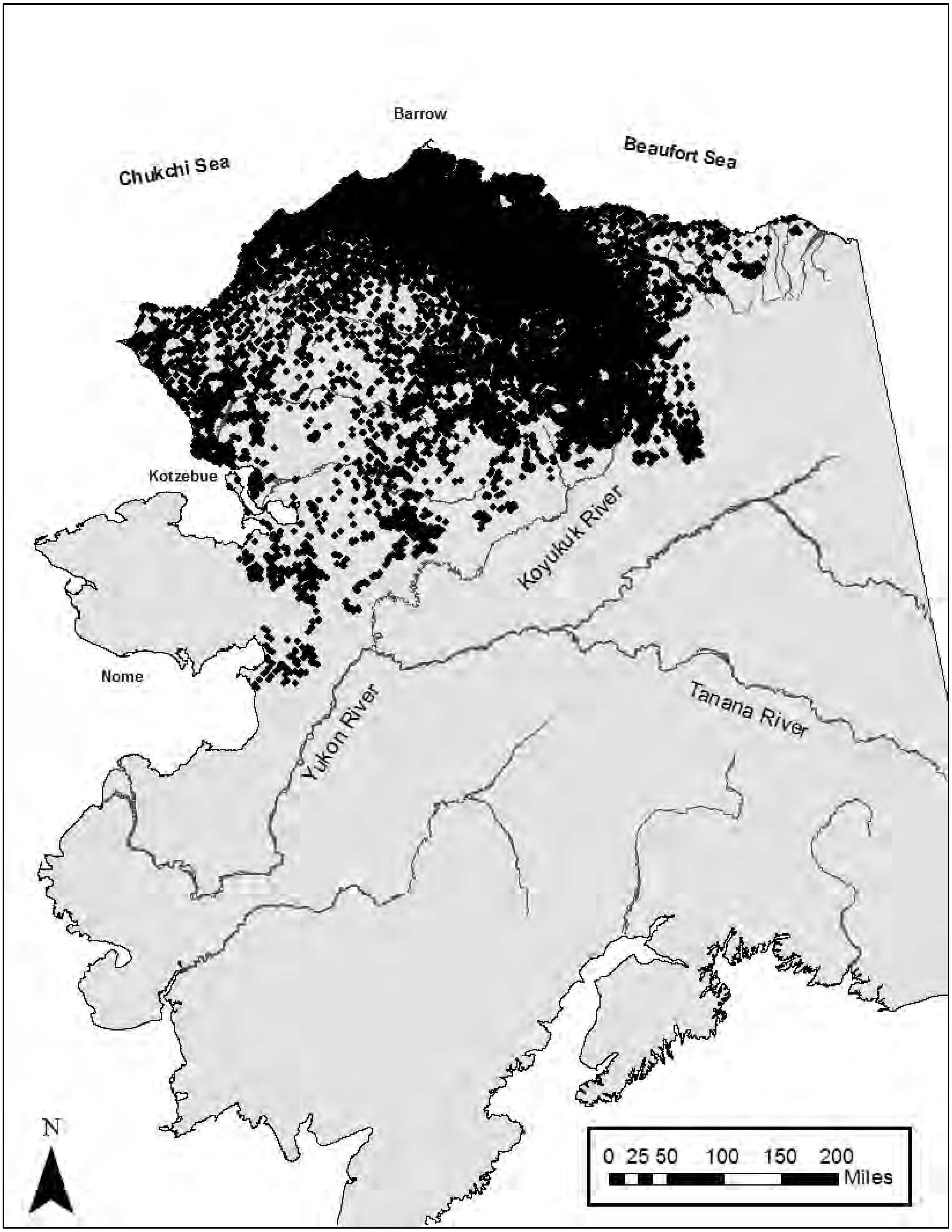

Figure 1. Locations of satellite-collared TCH caribou (GPS and PTT), 1990–2012. Locations were filtered for accuracy and the data set was reduced to no more than one location per-day per-caribou. These data come from collars purchased and deployed as part of a cooperative effort between ADF&G, BLM, North Slope Borough, and Conoco Phillips.

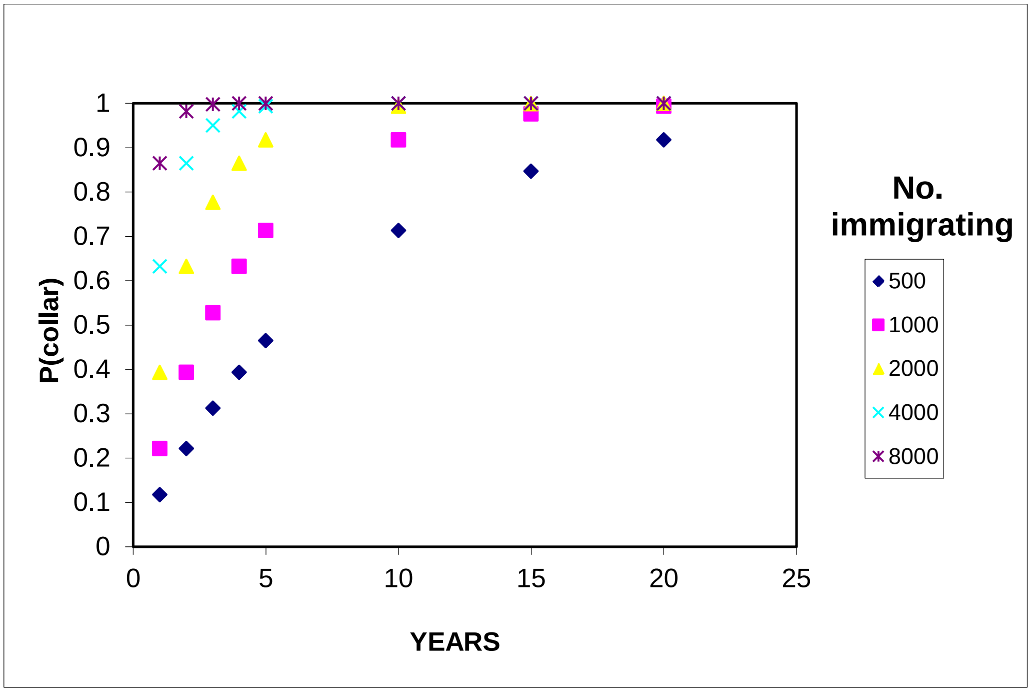

Figure 2a. The probability that an immigrating group of caribou will have at least one collar in the group, given that the source population is 400,000, and there are 100 randomly distributed active collars in the herd (e.g., Western Arctic Herd).

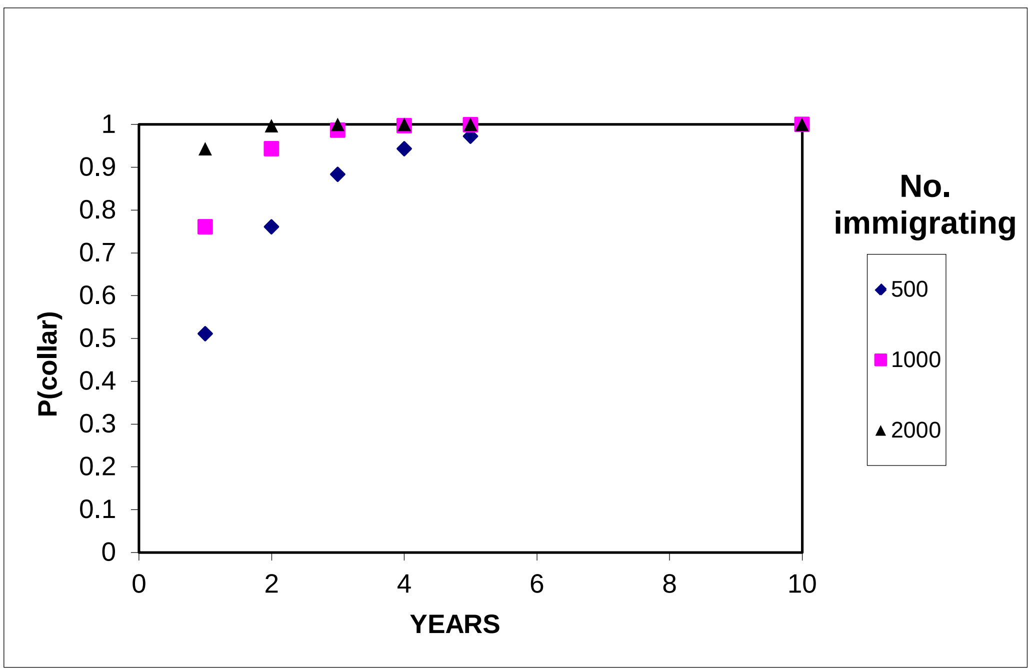

Figure 2b. The probability that an immigrating group of caribou will have at least one collar in the group, given that the source population is 70,000, and there are 100 randomly distributed active collars in the herd (e.g., Central Arctic Herd).

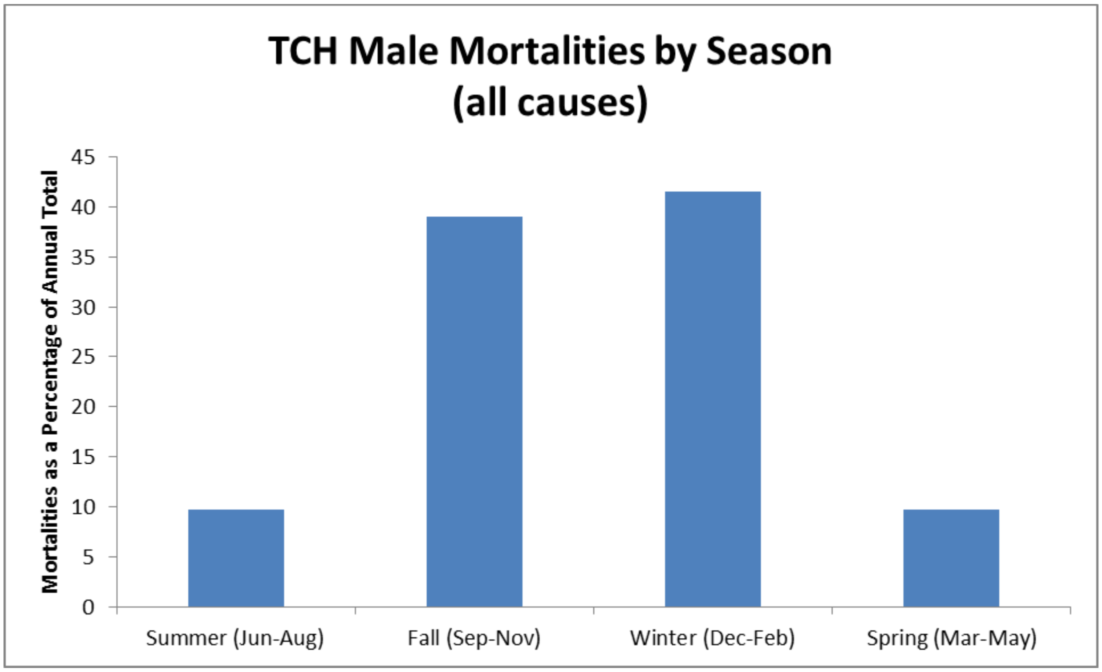

Figure 3a. Seasonal timing of mortality in satellite collared male caribou, 1990–2012 (n = 41). All causes of mortality are included, including harvest.

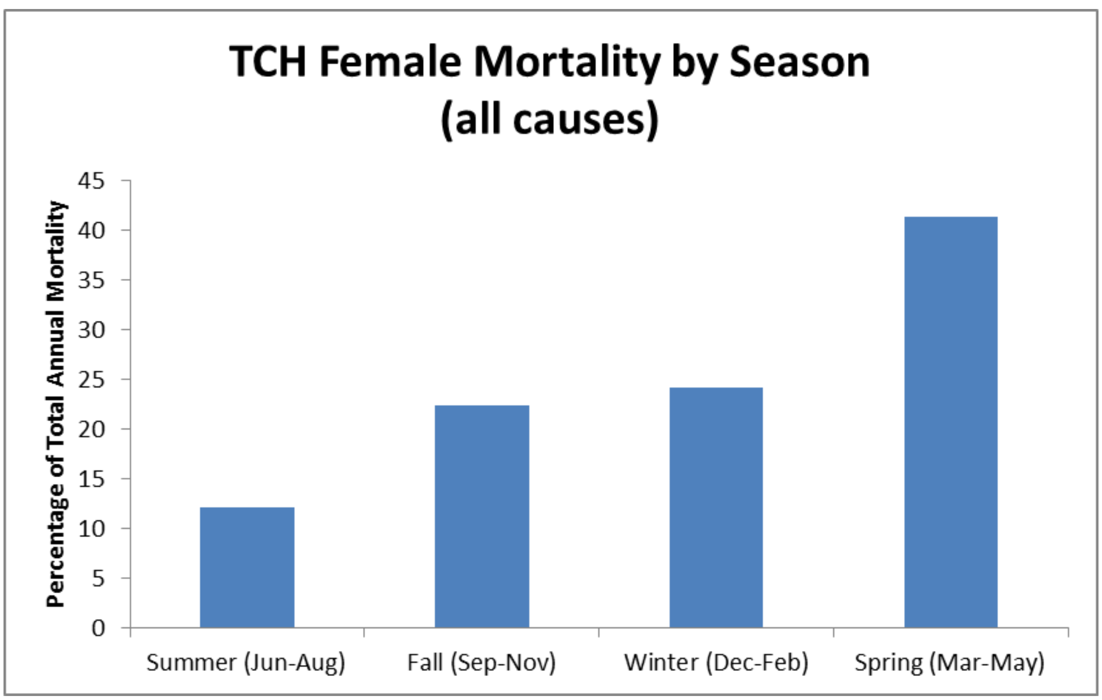

Figure 3b. Seasonal timing of mortality in satellite collared adult female caribou, 1990–2012 (n = 58). All causes of mortality are included, including harvest.

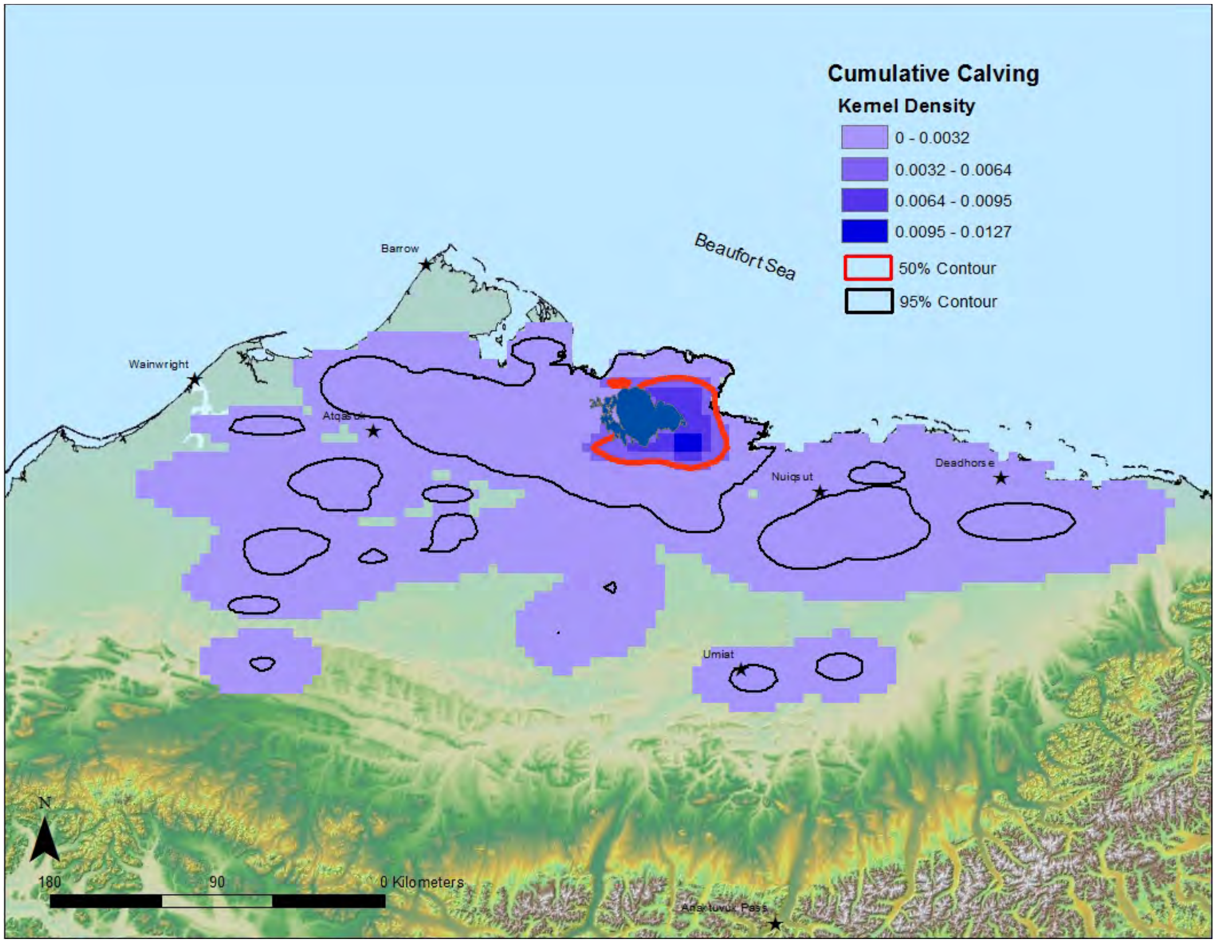

Figure 4. Cumulative calving distribution of the TCH, 1994–2012. Annual kernel density estimates were averaged using a static 5-km grid as the basis for comparison, using locations of parturient collared caribou to generate the utilization distribution. This estimate is unbiased with respect to annual sample size. Occasional use of CAH and WAH calving grounds is depicted by the farthest east and southwest extent of calving. The highest density of calving TCH caribou has historically been within 30 km of Teshekpuk Lake.

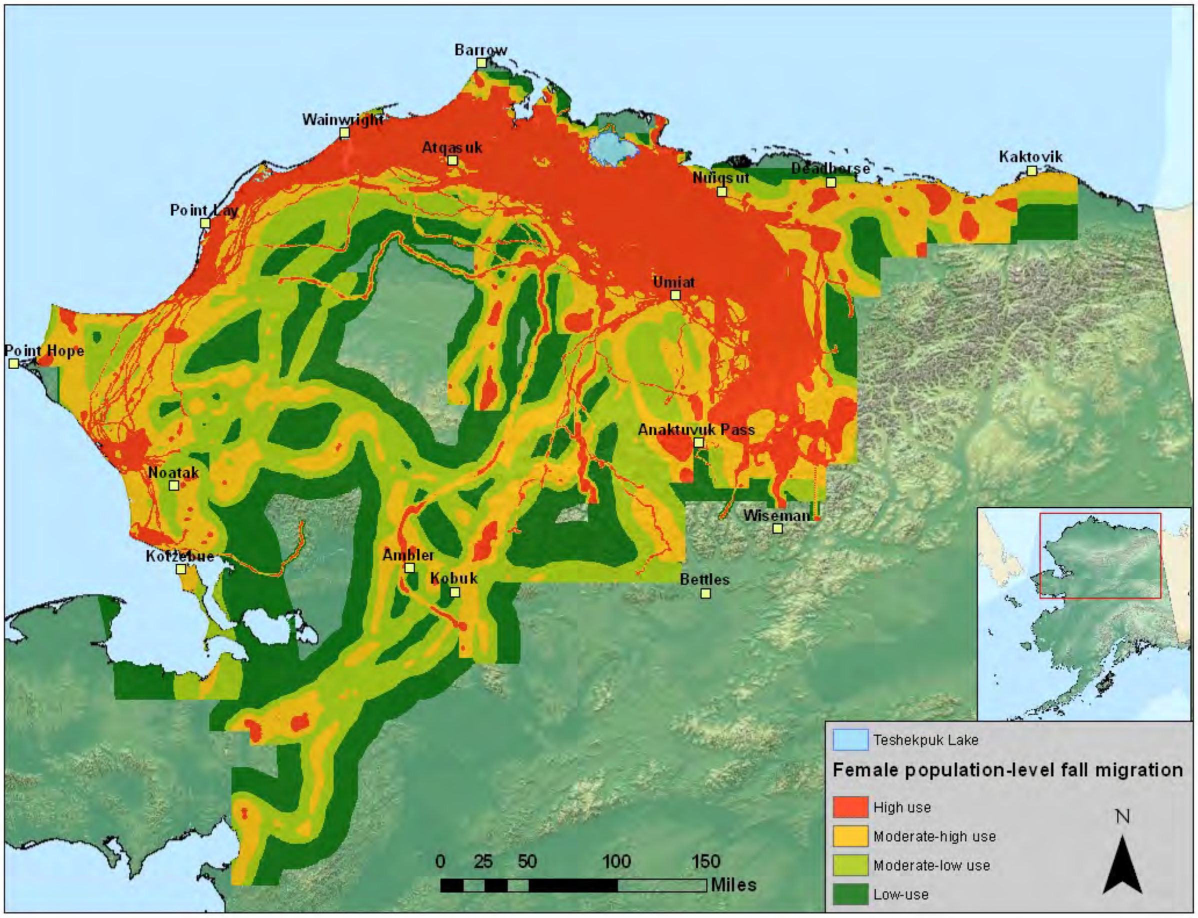

Figure 5. Brownian Bridge estimates of fall migration of the TCH, 1990–2012, with relative intensity depicted. This analysis depicts fall movements of adult female TCH caribou carrying satellite collars. The data is truncated such that only the migratory movements are depicted, with unique start and end dates depicted for each individual.

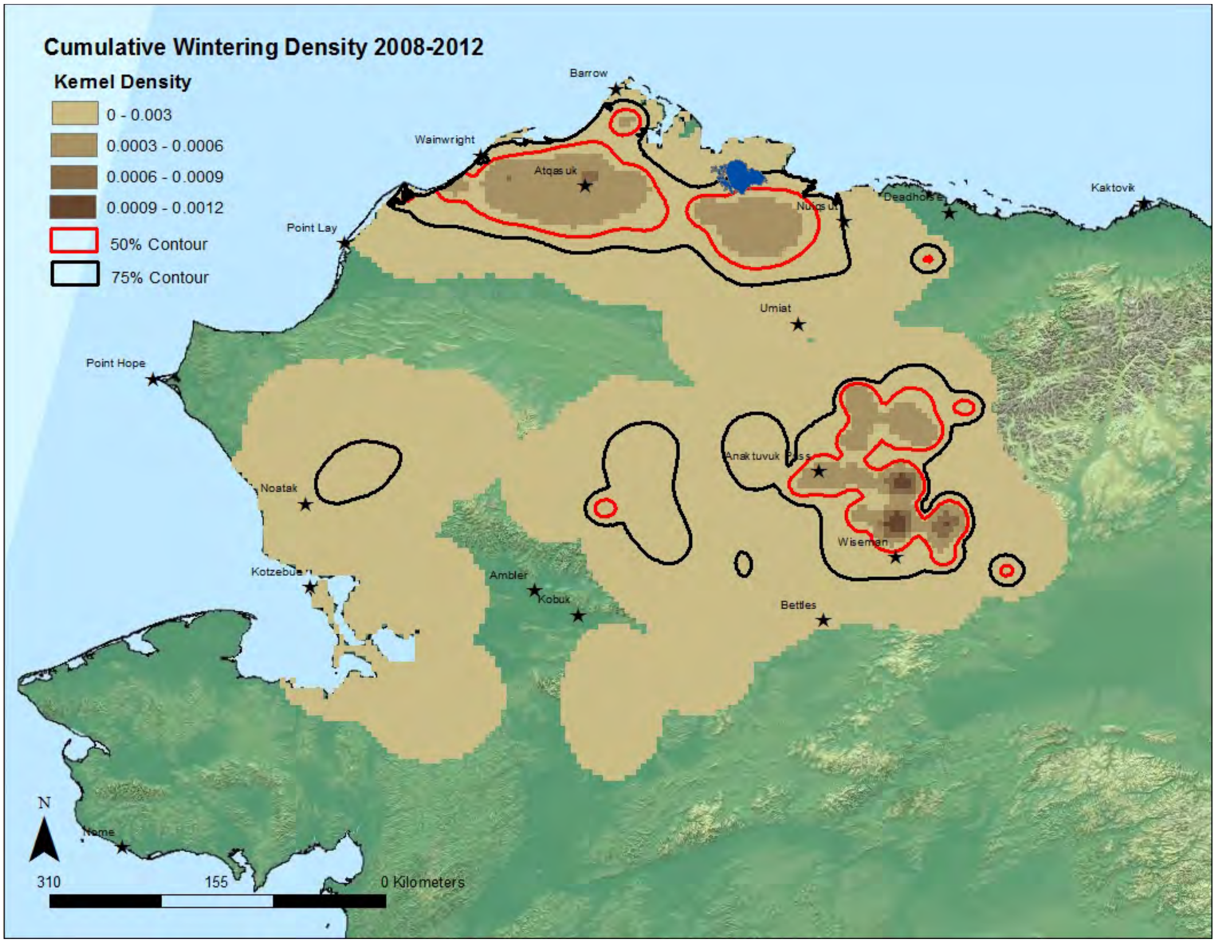

Figure 6. Cumulative winter distribution of the TCH, 2007–2008 through 2011–2012. A single late winter location from each individual found during the course of the winter was used to generate an annual utilization distribution. The 5 yearly winter distributions were then averaged, using the same 5-km grid. Three concentrations are apparent, with peripheral areas in shared winter range with the WAH and CAH. For historical comparison, see Person et al. (2007).

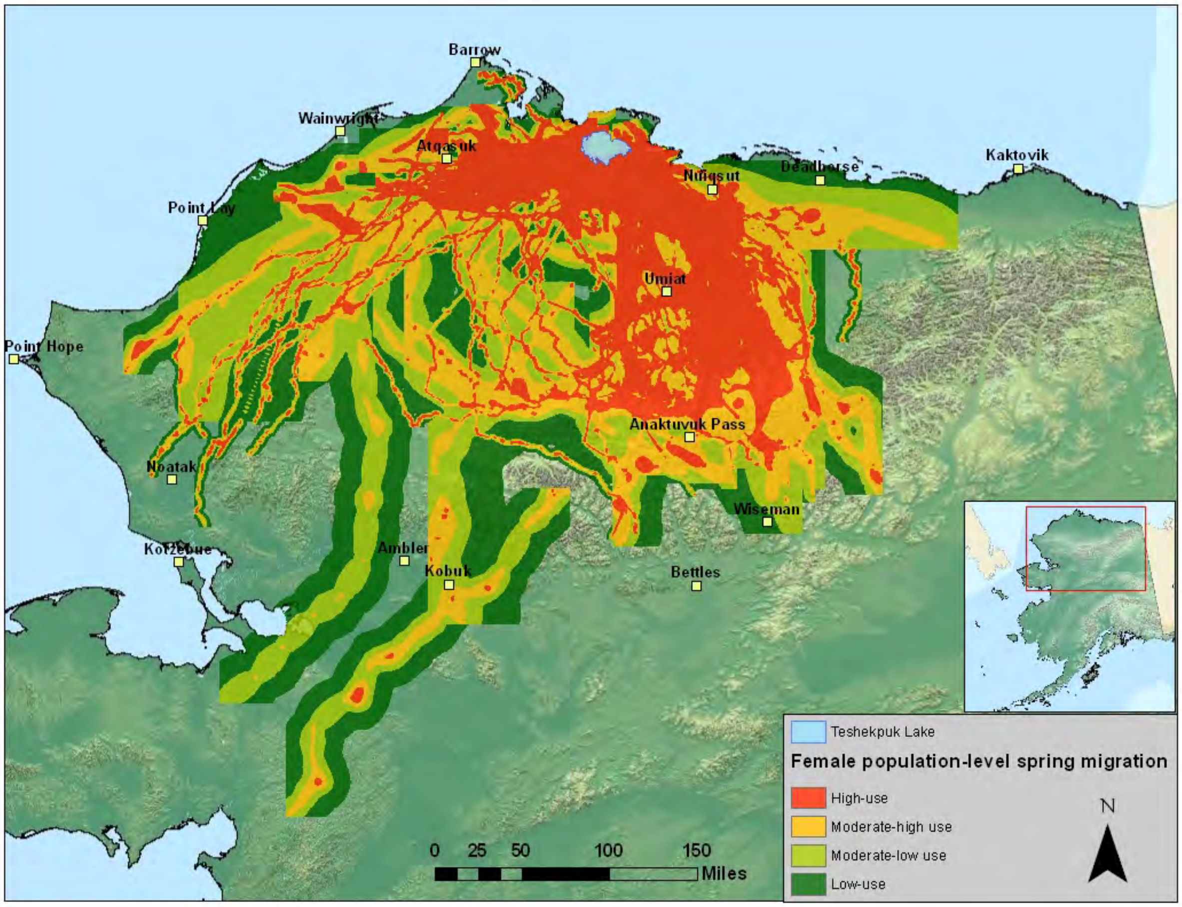

Figure 7. Brownian Bridge estimates of spring migration of the TCH, 1990–2012, with relative intensity depicted. This analysis depicts spring movements of satellite-collared adult female TCH caribou. The data is truncated such that only the migratory movements are depicted, with unique start and end dates depicted for each individual.

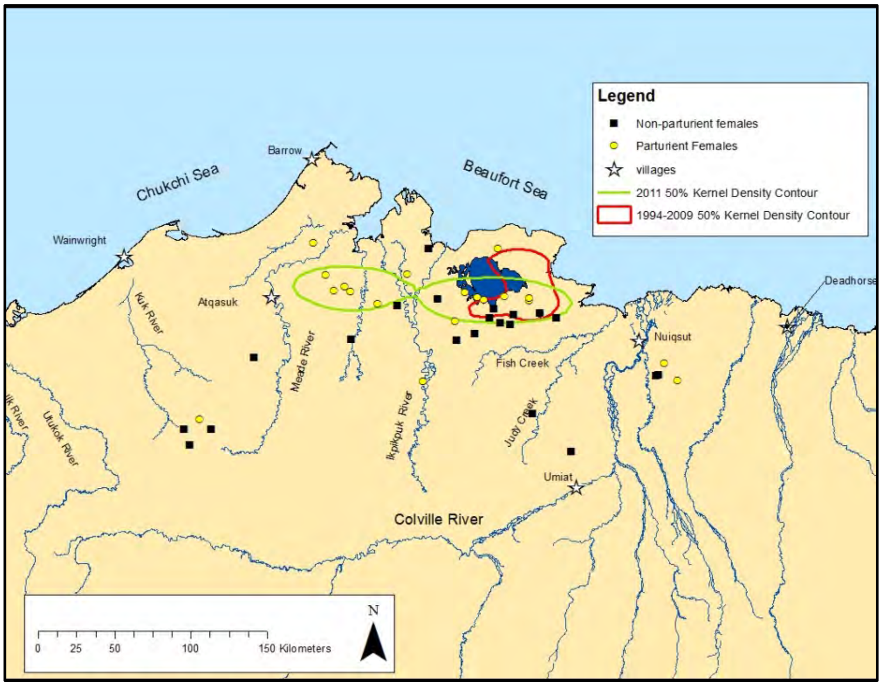

Figure 8a. 2011 calving period distribution of the TCH, with both parturient and non-parturient cows included, showing contour overlap between the historical and annual 50% kernel density contour.

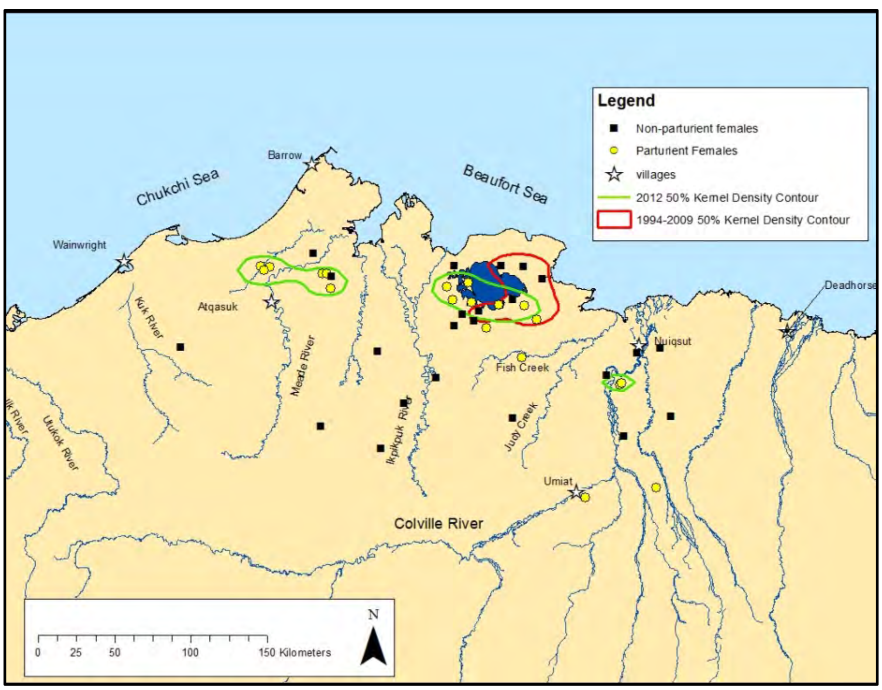

Figure 8b. 2012 calving period distribution of the TCH, with both parturient and non-parturient cows included, showing contour overlap between the historical and annual 50% kernel density contour.

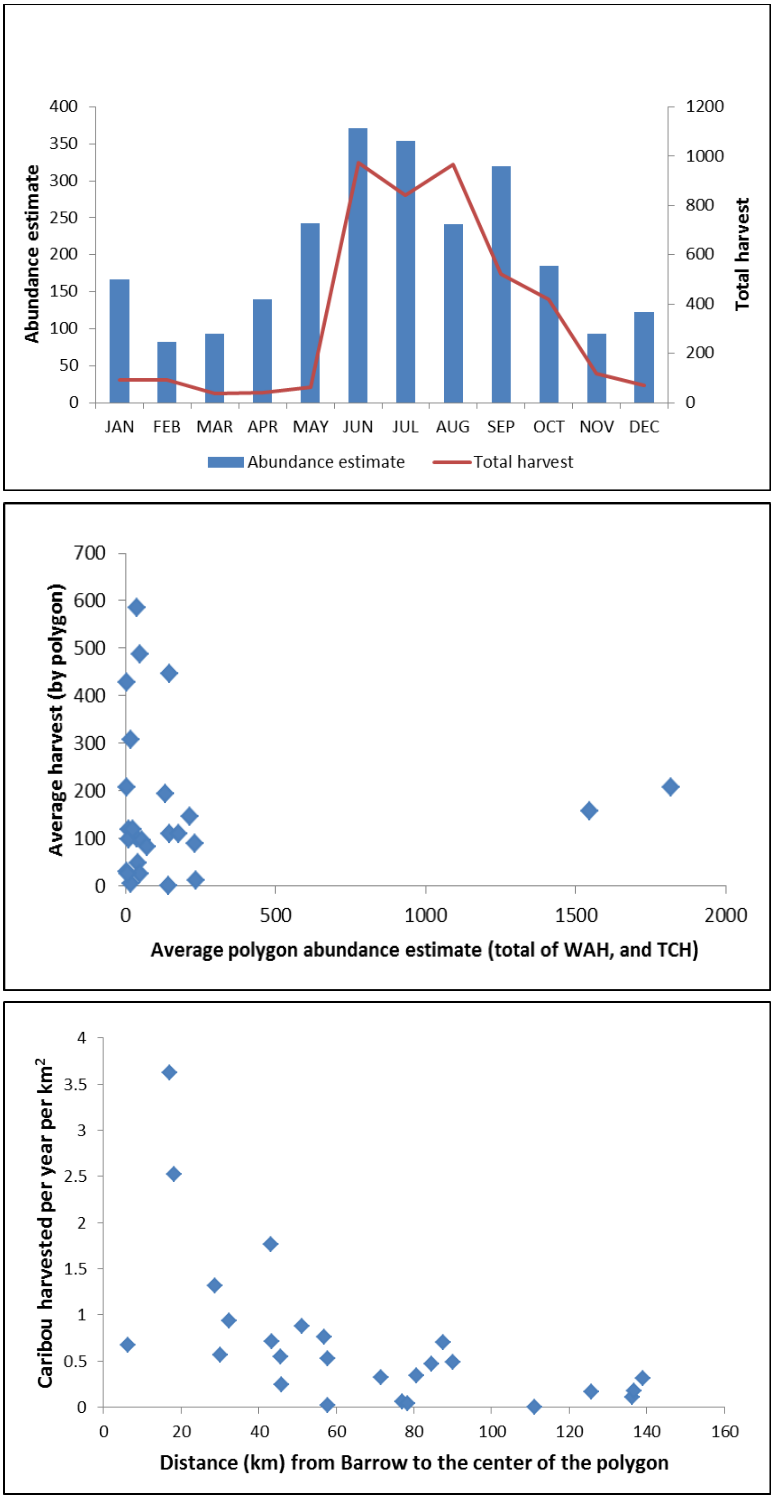

Figure 9a-c. (a) Mean monthly Barrow harvest in relation to estimated mean monthly abundance in Barrow hunt area polygons, derived from pooled estimates of satellite collar distribution, 2002–2007 (from Braem et al. 2011, but see issues related to positive bias in estimates); (b) Average annual Barrow harvest in relation to average annual caribou abundance in each of 26 harvest polygons, 2002–2007; (c) Barrow caribou harvest, corrected for area of hunt polygons, as a function of the distance from Barrow, 2002–2007.

SPECIES

MANAGEMENT REPORT

Alaska Department of Fish and Game
Division of Wildlife Conservation
(907) 465-4190 PO Box 115526
Juneau, AK 99811-5526

CARIBOU MANAGEMENT REPORT

From: 1 July 2010
To: 30 June 2012[1]

LOCATION

GAME MANAGEMENT UNITS: 26B and 26C (25,787 mi^2)

HERD: Central Arctic

GEOGRAPHIC DESCRIPTION: Central Arctic Slope and Brooks Range

BACKGROUND

In the mid-1970s the Central Arctic caribou herd (CAH) was recognized as a discrete herd, and in 1975 it was estimated at 5,000 caribou (Cameron and Whitten 1979). By 1983 the CAH increased to approximately 13,000, and by 1992 to more than 23,000 caribou (Valkenburg 1993). In 1995 the herd declined to 18,100 and then stabilized for a few years. By 2000, herd size increased substantially to more than 27,000 animals, and in 2002 the herd was estimated at 31,857 caribou (Table 1). The increase was due to low adult mortality (<10%), high parturition rates (≥85%), and good fall calf recruitment to October (≥50 calves:100 cows) during 1998–2002 (Lenart 2007).

Reported harvest on the CAH changed over time as a result of regulatory modifications and changes in hunting pressure. In regulatory year (RY) 1986 (RY = 1 July through 30 June, e.g., RY86 = 1 July 1986 through 30 June 1987), more restrictive regulations were adopted, and harvest decreased substantially through RY90. Beginning in RY91, harvest and hunting pressure increased on the CAH, likely because hunting was severely restricted on several Interior Alaska caribou herds (e.g., Delta, Macomb, Fortymile), which displaced hunters to hunt the CAH, and the CAH had become accessible by road because the Dalton Highway became officially open to public traffic in 1991. During RY00–RY10 the total number of hunters and reported harvest increased, although harvest rates remained less than 3% of the herd.

The CAH traditionally calves between the Colville and Kuparuk rivers on the west side of the Sagavanirktok River and between the Sagavanirktok and the Canning Rivers on the east side. During the early 1990s, the greatest concentration of caribou that calved in western Unit 26B shifted southwest as development of infrastructure related to oil production occurred in what was originally a major calving area (Lawhead and Johnson 2000; Wolfe 2000). No directional shift in

[1] At the discretion of the reporting biologist, this report may contain data collected outside the report period.

distribution of caribou that calved east of the Sagavanirktok River was noted (Wolfe 2000). The CAH summer range extends from Fish Creek, just west of the Colville River, eastward along the coast (and inland approximately 30 miles) to the Katakturuk River. The CAH winters in the northern and southern foothills and mountains of the Brooks Range. The herd's range often overlaps with the Porcupine caribou herd (PCH) on summer and winter range to the east, and with the Western Arctic (WAH) and Teshekpuk (TCH) herds on summer and winter range to the west.

Within the range of the CAH, oil exploration and development began in the late 1960s and continues at present. Beginning in the late 1970s, the Alaska Department of Fish and Game (ADF&G) implemented long-term studies on population dynamics, distribution, movements, and effects of development on the CAH. During the 1980s, calving activity was rare in the Prudhoe Bay oil field, where it was known to occur before development (Whitten and Cameron 1983). In addition, cows and newborn calves were underrepresented along the trans-Alaska pipeline corridor and around oil production facilities in the early 1990s (Cameron and Smith 1992; Cameron et al. 1992). By the mid-1980s, major movements of CAH caribou through the Prudhoe Bay oil field in summer had ceased, and caribou distribution and movements within the Kuparuk oil field were altered substantially (Smith and Cameron 1983, 1985*a,b*; Whitten and Cameron 1983, 1985; Curatolo and Murphy 1986). In the mid-1990s, research on the CAH was reduced substantially, and efforts were focused on monitoring population parameters and their relationship to management objectives. During the mid-1990s, some of the CAH management goals and objectives were developed in response to concerns arising from research conducted during 1978–1993. Based on the hypothesis that displacement of sufficient magnitude would be harmful to the CAH (Cameron 1983), we worked with the oil industry to minimize disturbance to caribou movement due to physical barriers created by oil development. In addition, given that stress is cumulative, ADF&G reduced hunting activity in areas adjacent to the oil field and the Dalton Highway and also restricted the cow harvest through the late 2000s. Although measures to mitigate disturbance to caribou were put into effect, we have not determined the success of these measures. Yet, the overall population grew substantially during the mid-1990s through 2010. Research was renewed during 2001–2006 to study the effects of oil field development on production, growth, survival, and movements of cow caribou and calves (Arthur and Del Vecchio 2009).

MANAGEMENT DIRECTION

During 2000–2010, the CAH grew substantially. Current management goals and objectives reflect this increase in population size, as well as intensive management (IM) population and harvest objectives that the Alaska Board of Game (board) established for the CAH. An IM designation means the board must consider intensive management if a reduction in harvest becomes necessary because of dwindling caribou numbers or productivity. In March 2000, the board established the IM population objective for the CAH as 18,000–20,000 caribou, and the harvest objective as 600–800 caribou (Title 5 Alaska Administrative Code [5 AAC] 92.108). In 2004 the board increased intensive management objectives to a population of 28,000–32,000 caribou and harvest of 1,400–1,600 (5 AAC 92.108), in order to reflect the 2002 population estimate.

Management Goals

Goal 1: Minimize the adverse effects of development on CAH caribou.

Goal 2: Maintain a CAH population level that will support a harvest of at least 1,400 caribou without precluding population growth.

Goal 3: Provide the opportunity for a subsistence harvest of CAH caribou.

Goal 4: Maintain opportunities to view and photograph CAH caribou.

Management Objectives

Objective 1: Maintain a population of at least 28,000–32,000 caribou. (Goals 1, 2, 3)

Objective 2: Maintain accessibility of seasonal ranges for CAH caribou. (Goal 1)

Objective 3: Maintain a harvest of at least 1,400 caribou if the population is ≥28,000 caribou.

Objective 4: Maintain a ratio of at least 40 bulls:100 cows. (Goals 1, 2, 3)

Objective 5: Reduce conflicts between consumptive and nonconsumptive uses of caribou along the Dalton Highway. (Goal 4)

Management Activities

- Conduct a photo census every 2–3 years. (Objective 1)
- Conduct annual fall composition surveys. (Objectives 3 and 4)
- Radiocollar 10 yearling females annually. (Objectives 1 and 2)
- Radiotrack during early summer, fall, and winter to determine seasonal distribution. (Objectives 1 and 2)
- Estimate parturition rate and late June calf:cow ratios for radiocollared females. (Objective 1)
- Monitor harvest through harvest ticket reports and Division of Subsistence harvest surveys. (Objectives 3)
- Work with the oil industry and other agencies to minimize disturbance to caribou from resource development. (Objectives 1 and 2)
- Regulate caribou hunting along the Dalton Highway to reduce conflicts between consumptive and nonconsumptive uses. (Objective 5)

METHODS

POPULATION STATUS AND TREND

Population Size

Population size was estimated in July 1997, 2000, 2002, and 2008 using the modified aerial photo-direct count technique (Davis et al. 1979). Postcalving aggregations of caribou were located by radiotracking radiocollared animals. These aggregations usually occurred when temperatures were >55°F and wind was <15 mph. Groups of caribou were photographed with a Zeiss RMK-A aerial camera mounted in a de Havilland Beaver aircraft or caribou were counted directly from the Beaver or radiotracking airplane. Caribou were counted directly from photographs. No population estimates were conducted during 2003–2007 or 2012 due to lack of suitable weather, poor aggregation quality, or both.

Radiocollaring

We maintained 60–80 radio collars (including VHF [very high frequency transmitters], GPS [Global Positioning System] transmitters, and PTT [Platform Terminal Transmitters]) in the CAH. All 3 transmitters operate using emission of an electromagnetic signal at a specified frequency which is detected by receivers tuned to the frequency. PTT and GPS also use orbiting satellites to receive and relay transmitter signals, resulting in automated tracking. Caribou were captured using a handheld netgun from an R-44 helicopter and manually restrained with hobbles and hood while we collected measurements and fitted the radio collars. In most years, 10–20 ten-month-old calves were captured annually and fitted with conventional VHF radio collars in March–April or June–July. Calves captured in March–April were weighed. Adult female caribou were recaptured and fitted with new VHF radio collars approximately 4–6 years after radio collars were originally deployed.

During 2003–2006, approximately 25–50 GPS radio collars were deployed and maintained. No PTT or GPS satellite radio collars were on CAH caribou during June 2006–June 2008. During July 2008–2011, 0–14 GPS satellite radio collars were deployed on CAH annually (Lenart 2011). In 2012, PTT satellite radio collars were deployed on 6 adult males and 6 adult females (recaptures) and 7 GPS radio collars were deployed on recaptured adult females.

During captures, we measured the metatarsus and jaw of some caribou, assessed general body condition, and recorded sex and age. During 2008–2011, we drew blood from either the jugular or cephalic veins for serologic disease surveillance, and trace mineral analysis.

Parturition and Early Calf Survival

Parturition and early calf survival (survival to 2 weeks) data were stratified between Unit 26B West (west of the west bank of the Sagavanirktok River) and Unit 26B East (east of the west bank of the Sagavanirktok River) because Arthur and Del Vecchio (2009) determined CAH caribou maintained fidelity to these calving areas from year to year (92%, n = 46 for radio-collared CAH cows with calving locations obtained in ≥5 calving seasons during 1997–2006). Because some overlap occurred, we arbitrarily chose the Sagavanirktok River as the line separating Unit 26B West, where there was substantial oil exploration and development, from Unit 26B East, where little exploration and development occurred.

Parturition rate was determined by observing radiocollared females ≥2 years old from a fixed-wing aircraft during the first half of June. Caribou observed with calves, hard antlers, or distended udders were classified as parturient (Whitten 1991). The regularity at which these caribou were relocated during calving varied over the past 25 years, potentially affecting our estimation of the parturition rate. During 1988–1993, caribou were relocated 2–3 times during 30 May–14 June. During 1995–2002, caribou were located once, with a target date of 3–9 June , just prior to peak calving. During this period of reduced relocation frequency, parturient caribou may have been misclassified because some cows did not have hard antlers or distended udders, particularly if a calf was born early and died or was born late and not observed (Whitten 1995). During 2003–2006, caribou were located 2–3 times during 30 May–14 June concomitant with a research project (Arthur and Del Vecchio 2009). In 2007 and 2008, caribou were located twice during the first week of June. During 2009–2012, caribou were located once during 1–7 June. Data were stratified based on the location of caribou east and west of the Sagavanirktok River, as described above.

The proportion of calves:100 cows (early calf survival) was determined by observing radiocollared females ≥2 years old from a fixed-wing aircraft after the peak of calving likely occurred. If a cow was observed with a calf, she was classified as “with calf.” If distended udders were detected but no calf was seen, we assumed the cow had recently lost a calf and she was classified as “without calf.” Thus, these proportions are a conservative estimate of early calf survival. During 1988–1994, calves:100 cows were determined from surveys conducted any time from the last half of June through mid-August. Since 1994, calves:100 cows has been determined during 15–30 June. This technique provides an indication of early calf survival or net calf production and is referred to as late June calf:cow ratios. Similar to parturition estimates, data were stratified based on the location of caribou east and west of the Sagavanirktok River using locations from the current summer. In 2004 only GPS-collared females with radiocollared calves were relocated (in conjunction with an ongoing research project; Arthur and Del Vecchio 2009). In that year we were unable to observe whether a cow was with a calf unless both were radiocollared because the caribou were aggregated too tightly.

Parturition rates and the proportion of calves:100 cows were calculated for 2 categories: known-age females and females ≥4 years old. Beginning in 2004, we randomly captured some adults and classified them as “young,” “medium,” and “old” based on tooth wear. Caribou classified as “medium” or “old” were included in the “females ≥4 years old” category. Data for females ≥4 years old were stratified based on the location of caribou east and west of the Sagavanirktok River.

Peak of calving was defined as the date at which 50% or more of the radiocollared parturient females ≥3 years old gave birth. For years 1988–1991 and 2002–2006, radiocollared females were relocated daily or every 2–3 days until a calf was present. If observations of parturient females with no calf were followed by observations of females with a calf present, the range of days between observations was determined as the estimated date females had calved. For years 1997–2000 and 2007–2012, the estimated date of peak of calving was determined using the following criteria based on the proportion of ≥3-year-old females with calves to parturient ≥3-year-old females at the last date of radiotracking: 1) ≤25%, a span of 3 days was added following the last radiotracking date; 2) 26–39%, 2 days were added; 3) 40–49%, 1 day was added, 4) 51–59%, 1 day was subtracted and included the last day of radiotracking; 5) 60–74%, 2 days were subtracted; and 6) ≥75%, a span of 3 days were subtracted. The date of the point estimate was determined by deriving the midpoint between the estimated dates for peak of calving. The mean of the date of the point estimate (and standard error of the mean) was calculated to determine the mean estimated date of peak of calving.

Population Composition

During 2009–2012, sex and age composition during fall was estimated by classifying caribou from an R-44 helicopter near peak of rut to take advantage of the presumed mixing of bulls, cows, and calf caribou. Peak rut was estimated as the date 228 days (gestation period) prior to the median calving date of the CAH. Caribou groups were located by radiotracking radiocollared caribou from a fixed-wing aircraft. Approximately 200 caribou were classified per radio collar per group utilizing a cluster sampling scheme (Cochran 1977). If less than 200 caribou were present in a group, all or most of the caribou in that group were classified. Bull:cow and calf:cow ratios were generated using pooled data and confidence intervals were estimated from between-cluster variance. Caribou were classified as cows; calves; and small, medium, or large bulls. Composition surveys were conducted on the north side of the Brooks Range, mostly east of the Dalton Highway to the Lupine River and on the south side of the Brooks Range east of the Dalton Highway to the East Fork Chandalar River, and north of the North Fork Chandalar River.

No fall composition surveys were conducted during 2003–2008 because harvest was low compared to population size and bull:cow ratios were not a concern, lack of funding, and lack of an adequate sampling design. Fall composition was estimated from a helicopter in mid-October 2000, 2001, and 2002 by locating random groups and groups with radio collars. The composition surveys during 2000–2002 occurred in the Brooks Range in the Chandalar Shelf, Atigun Pass, Galbraith Lake, and upper Sagavanirktok River areas.

Distribution and Movements

Distribution of the CAH was monitored during calving, postcalving, summer, rut, and winter by relocating radiocollared females during June, July, mid-October, and late March or early April. Distribution was also monitored using PTT or GPS satellite radio collars.

HARVEST

Harvest and hunting pressure by Alaska residents who lived south of the Yukon River and by nonresidents were monitored using harvest reports submitted by hunters. Total harvest, residency and success, chronology, and transportation were summarized by regulatory year.

Alaska residents who lived north of the Yukon River were not required to obtain caribou harvest tickets and report cards. However, they were required to register with ADF&G or an authorized vendor. ADF&G Division of Subsistence estimated caribou harvested by residents of Kaktovik and Nuiqsut (S. Pederson, ADF&G files, Fairbanks). Caribou harvested by hunters from Nuiqsut included animals from the TCH and WAH herds, as well as some CAH caribou (Braem et. al. 2011).

RESULTS AND DISCUSSION

POPULATION STATUS AND TREND

Population Size

2012 photo census. We made 2 unsuccessful attempts to complete a photo census in July. Our first attempt was on 12 July when caribou were distributed along the coast from Prudhoe Bay to the Canadian border. Conditions deteriorated as we photographed some groups. Fog rolled in near the Canning River where 10,000–15,000 caribou were aggregated, and temperatures cooled east of Barter Island where thousands of unphotographed caribou began to disperse. We aborted this attempt when conditions became inadequate to obtain a good photo census. Our second attempt was on 23 July after the caribou had moved south into the mountains. Caribou were tightly aggregated in small groups, but many groups did not contain radio collars. We aborted this attempt because of the likelihood that many groups without radiocollared animals would not be found and photographed

2010 photo census. We completed a photo census on 9 July, resulting in 70,034 caribou (Table 1). Caribou were counted primarily from photographs taken from the de Havilland Beaver. Some small groups were not photographed, but were counted directly by biologists in radiotracking aircraft. Conditions were considered good with an initial temperature of 60°F and winds from the west ≤15mph. We located 57 of 62 active CAH radio collars. Three of the 5 missing radiocollared caribou may have joined with the PCH caribou. Sixteen groups of caribou were photographed from the Beaver aircraft with 3 of those groups along the coast between Milne Point and Kalubik Creek, west of Prudhoe Bay. East of Prudhoe Bay, 4 groups were on the Sagavanirktok River Delta, 5 groups were between Bullen Point and Point Thompson, 3 groups were on the Canning River Delta, and 1 group was in the Sadlerochit Mountains. We counted 69,820 caribou from photographs. From the de Havilland Beaver and radiotracking aircraft, biologists counted an additional 214 caribou that were not photographed, resulting in 70,034 caribou. We located 2 PCH and 2 TCH radio collars in 3 of the groups. These caribou represent an unknown number of caribou from the PCH and TCH herds; however, based on a 2008 census of the TCH and a 2010 census of the PCH (Lenart 2011, Caikoski 2011), we estimated that these radio collars represented approximately 5,000 caribou (7.1%; 850 caribou per TCH radio collar and 1,690 PCH caribou per radio collar) that potentially were not CAH animals.

We did not estimate the number of caribou represented by the 5 missing CAH radio collars or caribou represented by groups with no radio collars that were not located. Rivest et al. (1998) described a model to estimate abundance by adjusting the population upwards to account for missing radio collars and for caribou not located in radiocollared groups. We were unable to use this model because it did not meet the assumption that no caribou from other herds were in the groups. A group of approximately 10,000 caribou had 13 CAH, 1 TCH, and 1 PCH radio collars.

2008 photo census. A photo census on 3–4 July 2008 resulted in 66,772 caribou (Table 1). We located all 60 active CAH radio collars. We photographed 14 groups from the Beaver aircraft: 1 group on the Sagavanirktok River Delta, 3 groups on the Kadleroshilik River near the coast, 4 groups on the Staines River, 1 large group on the Canning River Delta, and 5 groups scattered from just east of the Canning River to the mouth of the Hulahula River. From those photographs we counted 66,475 caribou. From the radiotracking airplanes, biologists counted an additional

297 caribou that were not photographed, resulting in 66,772 caribou. We located 2 PCH and 2 TCH radio collars in 2 of the groups. These caribou represent an unknown number of caribou from these herds; however, based on a 2008 census of the TCH and a 2010 census of the PCH, we estimated that these radio collars represented approximately 5,000 caribou (7.5%; 850 caribou per TCH radio collar and 1,690 PCH caribou per radio collar) that potentially were not CAH animals.

Historical population size and summary. Population size was not estimated during 2003–2007; however, the CAH has increased substantially since 1995 when the herd was estimated at 18,100 caribou. The annual rate of increase between 1995 and 2010 (15 years) was 9.4%. Between photo censuses the annual rate of increase was 4% from 1995 to 1997, 11.2% from 1997 to 2000, 8.4% from 2000 to 2002; 13.1% from 2002 to 2008, and 2.4% from 2008 to 2010 (Table 1). High parturition rates, good calf survival, and low adult mortality since 1997 contributed to the increase in population size (Tables 2 and 3). We determined that immigration from the PCH and TCH likely played a minor role in contributing to the increase. High annual rates of increase (≥12%) have been reported for other Arctic caribou herds (Carroll 2007, Dau 2007).

A photo census represents the caribou that were located and present during the photo census; we do not locate all caribou in the herd, and caribou from other herds may be present. However, we conduct photo censuses during optimal conditions when caribou are aggregated and we attempt to locate all radio collars. We note when radio collars from other herds are present and estimate how many caribou those radio collars may represent.

Parturition and Early Calf Survival

Parturition rates. Parturition rates of radiocollared females ≥4 years old throughout Unit 26B were 91% (n = 35) in 2011 and 92% (n = 24) in 2012. Except for 2009, parturition rates were high during 1998–2012 (≥83%; Table 2). ADF&G staff also observed lower parturition rates in the Teshekpuk caribou herd in 2009 (Parrett 2011). Parturition rates were similar between Unit 26B West and Unit 26B East (Table 2). Parturition rates for 3-year-olds were 50% (n = 4) in 2011 and 71% (n = 7) in 2012, and were slightly lower during 2009–2012 ($\bar{x}$ = 62%, n=21) compared to previous years (Table 3). Boertje et al. (2012) used a 4-year moving weighted average for the CAH for years 2009–2012 and also determined an average parturition rate of 62% compared to 85% during 2004–2008. Boertje et al. (2012) considered 5-year moving weighted averages of 55–80% to be moderate parturition rates. A high parturition rate, particularly in 3-year-olds, is indicative of good nutritional condition, although variability in parturition rates can be relatively high among 3-year-old cows. Even though the utility of this measure for arctic caribou remains unknown (Valkenburg et al. 2000, Boertje et al. 2012), in 1995 when the population appeared to decline no 3-year-old CAH females were pregnant (n = 4) and the parturition rate for females ≥4 years old was also low (56%, Tables 1 and 2).

We observed no significant differences in parturition rates between Unit 26B West and Unit 26B East during 1994–2012, although Unit 26B East had higher point estimates most years (Table 2). For 1988–1994, Cameron (1995) and Cameron et al. (2002) detected a significantly lower mean parturition rate in Unit 26B West compared to Unit 26B East (P = 0.003; Table 2). This occurred during part of the period when the herd was declining (1992–1995).

Peak of calving. In 2011, 32% (11 of 34) of the radiocollared cows ≥3 years old that were considered pregnant had a calf by 3 June. Therefore, the estimated date range for peak of calving in 2011 was 4–5 June (Table 4) and the point estimate was 4.5 (Table 3). In 2012, 52% (14 of 27) of the radiocollared cows ≥3 years old that were considered pregnant had a calf by 7 June. The estimated date for peak of calving in 2012 was 6–7 June (Table 4) and the point estimate was 6.5 (Table 4).

The mean estimated date of peak of calving during 1988–1991 was 5 June (mean point estimate ± SE = 4.75 ± 0.75). In 2001–2012 the mean estimated date was also 5 June (mean point estimate ± SE = 5.38 ± 0.58; Table 4; ADF&G unpublished data, Fairbanks; Arthur and Del Vecchio 2009; Lenart 2011; R. Cameron, retired ADF&G, personal communication 2012).

Early summer calf survival. The late June calf:cow ratio of radiocollared females ≥4 years old throughout Unit 26B was 77:100 (n = 30) in 2011 and 69:100 (n = 26) in 2012 (Table 3). The late June calf:cow ratio was good in 2010 (85:100, n = 39) and low in 2009 (52:100, n = 42). The low value observed in 2009 reflects the lower observed parturition rate. However, the lower value observed in 2012 was not related to a low parturition rate.

Except in 2009 and 2012, the late June calf:cow ratio has been relatively high since 1997 (≥71:100; Table 3), indicating consistently high productivity and early calf survival, which contributed to the increase in population size observed during 2000–2010. During years when the herd was declining or stable (1994–1996), late June calf:cow ratios were lower (≤69:100; Table 5). Late June calf:cow ratios were similar between Unit 26B West and Unit 26B East (Table 5).

The late June calf:cow ratio for radiocollared 3-year-olds was 50:100 (n = 4) in 2011 and 43:100 (n = 7) in 2012 (Table 6). Calves born to 3-year-olds tended to have lower survival rates compared to cows >4 years old, although sample sizes were small (n = 4–14; Table 6). We also reported calf:cow ratios of cows ≥4 years old between Unit 26B West and Unit 26B East but noted no pattern among years (Table 5).

Population Composition

In October 2012 we sampled 11 groups of caribou for age and sex composition. Fifty-one percent of the active radio collars (n = 62) were distributed among these groups. Most sampled groups were distributed on the north side of the Brooks Range between the upper Sagavanirktok and Lupine drainages. A few groups were on the south side of the Brooks Range in the upper Chandalar River drainages. We classified 4,016 caribou and observed ratios of 56 bulls:100 cows and 61 calves:100 cows (Table 7).

In October 2011 we sampled 22 groups of caribou for age and sex composition. Fifty-nine percent of the active radio collars (n = 56) were distributed among these groups, which were distributed on the north side of the Brooks Range between the upper Sagavanirktok and Lupine drainages and the upper Kuparuk and Itkillik rivers. Only one group was sampled south of the divide in the upper North Fork Chandalar River. We classified 5,199 caribou and observed ratios of 69 bulls:100 cows and 56 calves:100 cows (Table 7).

In 2009 and 2010, we observed ratios of 50 bulls:100 cows during both years and 33 calves:100 cows and 46 calves:100 cows, respectively (Table 7). The observed ratio of 33 calves:100 cows was lower than previous years; however, these results reflected the lower parturition and early calf survival rates of radiocollared cows we observed during calving surveys in June 2009 (Tables 2 and 5). Surveys in 2009–2011 may be biased toward locating groups representing more cows because we had radio collars deployed only on female caribou. No fall composition surveys were conducted during 2003–2008. Bull:cow ratios have been high since 1976 (≥50:100), indicating harvest had little effect on sex ratios. Calf:cow ratios also have been high, implying summer calf survival rates were relatively high and contributed to the growth of the herd.

Distribution and Movements

Calving distribution. Distribution of calving in 2011 and 2012 was similar to the 9 previous years, except 2 caribou with calves were located farther south in 2012 compared to previous years. During 2002–2012 the greatest concentration of calving in Unit 26B West occurred between the headwaters of the Kachemach and Miluveach rivers and the Kuparuk River on the north side of the White Hills, including the Itkillik Hills. In Unit 26B East the greatest concentration of caribou calving occurred between the Shaviovik and Canning rivers in 2002, and between the Sagavanirktok and Shaviovik rivers in 2003–2012, with the highest concentrations on the Kadleroshilik River. Some calving does occur as far east as the Katakturuk River. In 2001, snowmelt and spring migration was delayed and calving occurred over a larger area than during most years (Lenart 2003; Arthur and Del Vecchio 2009).

Summer and Early Fall Distribution. In most years, the CAH summer range extends from the Colville River to just east of the Katakturuk River and from the coast inland to the foothills. Post-calving movements during summer are influenced by insect abundance. Generally, when the temperature is >55°F and wind speed is <15 mph, caribou are found along the coast or on large gravel bars. Caribou tend to concentrate along the coast during warm weather but move inland on cool and windy days. In general, the CAH begins migrating toward the foothills of the Brooks Range during August, and by September most caribou are found along the foothills of the Brooks Range, particularly around Toolik Lake, Galbraith Lake, Accomplishment Creek, the Ivishak River, and the upper Sagavanirktok River. When unusually warm temperatures persist in September, the CAH sometimes remains on the coastal plain as far north as the White Hills and Franklin Bluffs, moving back and forth from the coastal plain to the foothills until about mid-October.

In 2011 some of the CAH moved east toward Kaktovik during mid-July. By the end of July, 7 of the 9 caribou with satellite collars had moved into the foothills between the Kavik and Sadlerochit rivers. In addition, several thousand CAH caribou were in Unit 26A west of the Colville River and east of Teshekpuk Lake in July. During early August the caribou redistributed in all directions: north, south, east, and west. By the end of September, most of the caribou were on the coastal plain and 2 caribou that had crossed the Brooks Range in August returned north to the coastal plain.

In 2012 the CAH moved east toward the Canadian Border along the coast during early July. By 20 July a large proportion of the satellite collars were in the foothills and mountains between

Juniper Creek and the Canning River. By the end of August many of the caribou redistributed west of the Dalton Highway to the Itkillik River and north of the mountains. Generally, the caribou moved into the foothills during early September. However, by the end of September most of the caribou moved north onto the coastal plain before eventually moving south toward the mountains for rut.

Fall Distribution. During the rut in October, large concentrations of caribou can be found on the south side of the Brooks Range on Chandalar Shelf near Your and Thru creeks, the North Fork and Middle Fork Chandalar River, and as far east as the East Fork Chandalar River. On the north side of the Brooks Range, caribou can be located around Galbraith Lake, Accomplishment Creek, and in the upper Sagavanirktok River drainage.

In 2011 and 2012, most of the CAH were on the north side of the Brooks Range by mid-October. During 2008–2010 most of the CAH were on the south side of the Brooks Range by mid-October. In 2007 no radiotracking flights were conducted during mid-October and no satellite or GPS radio collars were on CAH animals. In fall 2006 most CAH animals remained on the north side of the Brooks Range during rut.

Winter Distribution. During RY01–RY11 most of the CAH wintered on the south side of the Brooks Range between the Dalton Highway, north of the Upper South Fork Koyukuk River and the latitude of the confluence of Middle and North Fork Chandalar rivers, east to the East Fork Chandalar River (Table 8; Lenart 2011, 2009). This was similar to winter distribution observed during the late 1990s. It appears that the CAH has been expanding its winter range during the previous 10–15 years, which may be related to herd growth. Caribou that wintered on the north side of the Brooks Range were usually found east of the Dalton Highway, along the foothills in the upper Sagavanirktok River, Accomplishment Creek, and Lupine River drainages, with some caribou as far east as the Canning River. In some years, CAH caribou can also be found west of the Dalton Highway in the foothills of the Brooks Range along the Itkillik, Kuparuk, and Toolik rivers.

In RY11, distribution of CAH satellite collars in February 2012 indicated that 80% of the PTT satellite and GPS radio collars (n=10) were on the south side of the Brooks Range (Table 8). During 19–24 April 2012, 20 of 33 radiocollared caribou located (61%) were on the south side of the Brooks Range, east of the Dalton Highway in the Chandalar River drainages and Ackerman Lake; and west of the Dalton Highway in the drainages of Clear, Hammond, & Dietrich rivers. On the north side of the Brooks Range, radiocollared caribou were distributed in the upper Itkillik River, upper Toolik River, Ivishak River and middle Kuparuk River. Distribution of caribou during the end of April did not necessarily represent winter distribution because caribou were beginning their spring migration back to the calving grounds.

In RY10, 50 radio collars were heard or located during 8−9 March 2011 (Table 8). Three were located north of the Brooks Range. Therefore, 94% (n=50) of the radio collars were on the south side of the Brooks Range between the Dalton Highway and the East Fork Chandalar River.

Mixing with Other Herds. During RY11, portions of all 4 North Slope herds (Western Arctic, Teshekpuk, Porcupine, and Central Arctic) wintered on the south side of the Brooks Range east of the Dalton Highway to Arctic Village as far as just south of the Chandalar River.

Teshekpuk Caribou Herd — Mixing with TCH caribou frequently occurs in both summer and winter because herd ranges overlap along the Colville River in summer and early fall in particular. Since 2002 there has been extensive overlap during winter in Unit 26B West and on the south side of the Brooks Range in the North Fork Chandalar River and west of the Dalton Highway in Gates of the Arctic National Wildlife Refuge. In RY03 some mixing occurred when the TCH traveled to the Arctic National Wildlife Refuge for the winter (Lenart 2009).

In addition, mixing during calving also may have occurred. Annually since 2004, 1–5 radiocollared TCH cows have calved with the CAH. These animals frequently switch back and forth between the Teshekpuk and Central Arctic herd from year to year. In 2011, during the TCH photo census, 3 CAH radio collars were found with TCH radio collars.

Porcupine Caribou Herd — Mixing with the PCH during fall and winter occurred frequently during RY01–RY12. In RY11, mixing occurred west of Arctic Village during rut and winter. In RY12, most of the PCH had moved into Canada by mid-October; therefore little mixing occurred during fall and winter. In RY08 and RY10, mixing occurred west of Arctic Village to the Dalton Highway. In RY09 no mixing occurred because the PCH wintered near the Canadian border and in Canada. During RY01–RY07 mixing occurred in years when a large proportion of the PCH wintered in Alaska near Arctic Village and most of the CAH wintered on the south side of the Brooks Range (Lenart 2007).

Mixing with the PCH during summer occurred less frequently during RY01–RY09 (summers 2000–2010). In 2011 and 2012, a large proportion of the PCH satellite collars were near the coast between the Canning and Hulahula rivers during the end of June and most likely mixing occurred with some CAH animals. In 2010, mixing occurred during postcalving aggregations at the end of June and first part of July between the Canning River and Kaktovik along the coastal plain and into the foothills. No mixing was observed in 2009. In 2008, 2 radiocollared PCH caribou were located among 10,000–20,000 CAH caribou during CAH postcalving flights and a CAH photo census. These 2 PCH radio collars had been missing and it is possible that a group of PCH wintered in the Sadlerochit Mountains and joined the CAH in the summer. It is unlikely that mixing with the PCH occurred during summers 2002–2007 because the PCH returned to Canada shortly after calving. In 2001 some mixing may have occurred during the summer when approximately 10,000 Porcupine caribou inhabited the Sadlerochit Mountains, and Central Arctic caribou were located near the Canning River, 10–20 miles away.

Western Arctic Caribou Herd — Mixing with the WAH occurs occasionally during winter. Likely, no mixing occurred in RY12 because the WAH wintered in western Alaska. As noted previously, some WAH wintered south of the Brooks Range and east of the Dalton Highway in RY11, mixing with CAH animals. In RY09 and RY10, no known mixing occurred. In RY08, a few WAH satellite radio collars were near the Dalton Highway and some mixing with the CAH may have occurred. Some mixing with WAH caribou may have occurred during winter RY03 when approximately one-third of the WAH wintered on the south side of the Brooks Range, west of the Dalton Highway in Gates of the Arctic National Wildlife Refuge (J. Dau, ADF&G unpublished data, Kotzebue). This occurrence was not repeated in winters RY04–RY07. During the early 1990s, we suspected some mixing with the WAH occurred during September on the north side of the Brooks Range when large groups of caribou (>5,000) were observed. No mixing of CAH and WAH during summer has been documented.

MORTALITY

Harvest

Most harvest occurred in Unit 26B, but some also occurred in Units 24, 25A, 26A, and 26C. However, harvest in units other than Units 26B and 26C (in summer and early fall) may be recorded as harvest from a different herd (e.g., PCH). In addition, parts of the TCH and WAH occasionally mixed with the CAH in fall and winter, and some of these animals may have been harvested and recorded as harvest from the CAH.

<u>Season and Bag Limit (5AAC 85.025)</u>.

RY08–RY09 seasons and bag limits:

Unit and location	Resident open season and bag limit	Nonresident open season and bag limit
Unit 25A	1 Jul–30 Apr; 10 caribou	1 Jul–30 Apr; 5 caribou
Unit 26B, that portion north of 69°30′ and west of the east bank of the Kuparuk River to a point at 70°10′N latitude 149°04′W longitude, then west approximately 22 miles to 70°10′ latitude 149°56′W longitude, then following the east bank of the Kalubik River to the Arctic Ocean	1 Jul–30 Apr; 10 caribou	1 Jul–30 Apr; 5 caribou
Remainder of Unit 26B	1 Jul–30 Apr; 2 caribou; however, cow caribou may be taken only from 1 Oct–30 Apr	1 Jul–30 Apr; 2 bulls
Unit 26C	1 Jul–30 Apr and 23–30 Jun; 10 caribou; however, only bull caribou may be taken 23–30 Jun	1 Jul–30 Apr; 5 caribou
Unit 26C	1 Jul–30 Apr; 10 caribou; however, only bull caribou may be taken 23–30 Jun	1 Jul–30 Apr; 5 caribou

RY10 and RY11 seasons and bag limits:

Unit and location	Resident open season and bag limit	Nonresident open season and bag limit
Unit 25A, those portions east of the east bank of the East Fork Chandalar River extending from its confluence with the Chandalar River upstream to Guilbeau Pass, Unit 25B, and the remainder of 25D	1 Jul–30 Apr; 10 caribou	1 Aug–30 Sept.; 1 bull
Remainder of Unit 25A	1 Jul–30 Jun; 10 caribou; however, cow caribou may be taken only from 1 Jul–15 May	1 Jul–30 Jun; 5 caribou; however, cow caribou may be taken only from 1 Jul–15 May
Unit 26B northwest, that portion north of 69°30′ and west of the east bank of the Kuparuk River to a point at 70°10′N latitude 149°04′W longitude, then west approximately 22 miles to 70°10′ latitude 149°56′W longitude, then following the east bank of the Kalubik River to the Arctic Ocean	1 Jul–30 Jun; 5 caribou per day; however, cow caribou may be taken only from 1 Jul–15 May	1 Jul–30 Apr; 5 caribou
Unit 26B, south of 69°30′N latitude	1 Jul–30 Jun; 5 caribou; however, cow caribou may be taken only from 1 Jul–15 May	1 Jul–30 Jun; 5 caribou; however, cow caribou may be taken only from 1 Jul–15 May
Remainder of Unit 26B	1 Jul–30 Apr; 5 caribou	1 Jul–30 Apr; 5 caribou
Unit 26C	1 Jul–30 Apr and 23–30 Jun; 10 caribou; however, only bull caribou may be taken 23–30 Jun	1 Aug–30 Sept; 1 bull

Additional state regulations that affect caribou hunting include special restrictions along the Dalton Highway. These restrictions conform to Alaska Statutes (AS) 16.05.789 and 19.40.210. The Dalton Highway Corridor Management Area (DHCMA) extends 5 miles from each side of the Dalton Highway from the Yukon River to the Prudhoe Bay Closed Area, which encompasses most of the Prudhoe Bay oil field. The DHCMA is closed to hunting with firearms. Big game, small game, and fur animals can be taken by bow and arrow only by hunters who possess a valid Alaska Bowhunter Education Program card or a recognized equivalent certification. In addition, no motorized vehicles except licensed highway vehicles on specified publicly maintained roadways, aircraft, and boats may be used to transport game or hunters within the DHCMA.

Federal subsistence hunting regulations also apply on federal lands within the DHCMA. Beginning in RY92, federal regulations allowed the use of firearms for hunting on federal land within the DHCMA by qualified rural subsistence hunters. During the first year of the regulation, qualified hunters included any rural resident. Subsequently, qualified hunters included residents of the corridor and the nearby villages of Anaktuvuk Pass, Wiseman, Nuiqsut, and Kaktovik.

Alaska Board of Game Actions and Emergency Orders. Caribou seasons and bag limits within the CAH range remained the same during RY96–RY07. However, several regulations related to bow hunting along the Dalton Highway were put into effect in RY02 and rescinded in RY04 (Lenart 2009).

During the March 2008 Board of Game (board) meeting, the bag limit for caribou within the DHCMA during 1 July–30 September was changed from 1 bull caribou to 2 bull caribou.

During the March 2010 board meeting, the season and bag limit for caribou was changed in Units 26B and 25A (winter range of CAH). In northwestern Unit 26B, the bag limit for resident hunters was changed from 10 caribou to 5 caribou per day and the season was changed from 1 July–30 April to no closed season; except cows could be taken only during July 1–May 15. This change in seasons and bag limits was comparable to Unit 26A caribou regulations reflecting similar hunting patterns and regulations for residents of Nuiqsut in particular. The nonresident season and bag limit did not change in this portion of Unit 26B. In Unit 26B south of latitude 69° 30' North, both the resident and nonresident seasons were changed from 1 July–30 April to no closed season. Bag limits were liberalized for both resident and nonresident hunters to a bag limit of 5 caribou and cow caribou could be taken only during July 1–May 15. This was a change for resident hunters from a bag limit of 2 caribou and cow caribou could only be taken only during October 1–30 April and for nonresident hunters from a bag limit of 2 bulls. The bag limit was changed similarly in the remainder of Unit 26B, but the season continued to end 30 April because this portion of Unit 26B includes the calving grounds of the CAH.

Regulations in Unit 25A were also changed to increase harvest opportunity on the winter range of the CAH. In Unit 25A east of the east bank of the East Fork Chandalar River extending from its confluence with the Chandalar River upstream to Guilbeau Pass, regulations were changed to reflect appropriate harvest regimes for the PCH range, similar to changes made in Unit 26C. A summary of these changes are described by Caikoski (2011). In the remainder of Unit 25A, where the CAH winters, the resident and nonresident seasons were changed from 1 July–30 April to no closed seasons; however, only bull caribou could be taken 16 May–30 June. The bag limits remained 10 caribou for resident hunters and 5 caribou for nonresident hunters.

Hunter Harvest, Success, and Residency. In RY10, 1,610 hunters reported hunting and 860 hunters reported harvesting 1,220 caribou (53% success rate; Tables 9 and 10). In RY10, 615 hunters harvested one caribou, 170 hunters harvested 2 caribou each, 49 hunters harvested 3 caribou each, 17 hunters harvested 4 caribou each and 10 hunters harvested 5 caribou each. In RY11, 1,366 hunters reported hunting, 764 hunters reported harvesting 1,129 caribou (56% success rate; Tables 9 and 10). In RY11, 518 hunters harvested one caribou, 171 hunters harvested 2 caribou each, 44 hunters harvested 3 caribou each, 19 hunters harvested 4 caribou each, 11 hunters harvested 5 caribou each and 1 hunter harvested 6 caribou. Reported harvest steadily increased beginning in RY04 (Table 9); but is still <2% of the estimated CAH population level. Success rates in RY10 and RY11 were similar to previous years and success by hunters who hunt the CAH has always been good (at least 40% and frequently ≥50%; Table 10). Fluctuation in success rates and harvest numbers are related to caribou distribution and accessibility.

In RY10, 1,201 Alaska residents reported hunting and 616 resident hunters reported harvesting 926 caribou (51% success rate). A total of 371 nonresidents reported hunting and 232 of these reported harvesting 276 caribou (63% success rate). In RY11, 1,045 residents reported hunting and 553 resident hunters reported harvesting 877 caribou (53% success rate). A total of 264 nonresidents reported hunting and 184 nonresident hunters reported harvesting 215 caribou (70% success rate). Success rates for both resident and nonresident hunters were high. A small proportion of hunters were nonresidents (23% in RY10 and 19% in RY11), similar to previous years (Lenart 2005, 2007, 2009, 2011). Nonresidents took 23% and 19% of the harvest.

Bowhunters accounted for 24% and 28% of the harvest in RY10 and RY11, respectively (Table 9). They accounted for an average of 26% of the harvest during the previous 5 years (RY07–RY11; Table 9). The success of bowhunters using the DHCMA is closely related to caribou distribution.

Reported harvest of cows during RY10 (227) and RY11 (327) was higher than previous years (Table 9). This was expected because the cow season was lengthened. The harvest of cows by Nuiqsut residents was estimated at 8% of their annual harvest during RY02–RY06 (Pedersen 2008).

Braem et al (2011) estimated a 5-year average of 61 caribou harvested annually (RY02–RY06) by Nuiqsut residents, who likely represent most of the local harvesters. Because Nuiqsut residents tend to hunt west of their village, only 13% of the total harvest was estimated to be from the CAH, based on the timing and location of harvest and distribution of caribou (Braem et al. 2011). Additional local harvest of the CAH likely occurs in other units when the caribou are distributed near Kaktovik in summer (Unit 26C) and Wiseman and Coldfoot (Unit 24A) and Arctic Village in fall and winter (Unit 25A).

Harvest Chronology. Most reported harvest occurred in August during RY10 (64%) and RY11 (58%), similar to previous years (Table 11). The remaining harvest occurred primarily in September. In RY11, the number of caribou harvested in April (150) was substantially higher than previous years compared to 7–67 during RY00–RY10. Some of this increase was likely due to a change in bag limit from 3 to 5 beginning in RY10. Harvest by Nuiqsut residents typically occurs in July, August, September, March, and April (Braem et al. 2011). A little more than 50% of the harvest taken by Nuiqsut hunters occurs in summer and fall.

Transport Methods. Because of restrictions on the use of off-road vehicles within the DHCMA and the remoteness of Unit 26B, most hunters used highway vehicles and aircraft for access. During RY10 and RY11, the proportion of successful hunters who used highway vehicles to access caribou was 42% and 43%, respectively (Table 12). Airplanes were the second most common transport method in RY10 (29%) and RY11 (28%). The proportion of successful hunters using airplanes increased beginning in RY07 (Table 12). In previous years, either airplanes or boats (including airboats) were the second most common transport method. There has also been an increase in the use of boats (including airboats), particularly in the Ivishak and Echooka drainages. During RY02–RY11, the proportion of successful hunters who used boats and airboats increased to 16–29% compared with 5–15% during RY92–RY01 (Lenart 2007). Few hunters used horses, dogs, snowmachines, or ATVs as a transport method (Table 12), except in RY11, when a higher proportion of caribou were harvested (6%) using dogs as a transport method in April, compared to previous years. Residents of Unit 26 used boats during summer and fall and snowmachines during the spring. Nuiqsut residents primarily hunted from the Colville River and Fish Creek in Unit 26A during summer and Kaktovik residents hunted along the coast to Camden Bay (ADF&G files, Fairbanks).

Natural Mortality

Radiocollared caribou were relocated infrequently in fall and winter, making it difficult to accurately estimate adult mortality or determine causes of mortality. Natural mortality of CAH caribou during calving and postcalving is relatively low because calving occurs in areas near the coast where there are few wolves, and predation by golden eagles appears to be rare compared to the Porcupine caribou herd (Murphy and Lawhead 2000). Winter mortality was probably higher during the 1990s than in previous years because more CAH caribou wintered on the south side of the Brooks Range, where wolves were more abundant and snowfall is deeper than on the north side. However, there have been no studies of predation rates on the CAH. During RY97–RY11, we determined minimum mortality rates of 4–19% among radiocollared cow caribou ≥1 year old (Table 13).

CONCLUSIONS AND RECOMMENDATIONS

High parturition rates, early summer calf survival, and low adult mortality during 2002–2010 contributed to a population increase of 120% in the CAH in 8 years (10% annually; Tables 1–3). During this time, the population increased an average of 13% annually between the 2002 and 2008 photo censuses, but at a lower rate (2.4% average annual increase) during 2008–2010. Distribution during calving and postcalving in 2002–2012 was similar among years. During summers, the CAH was distributed mostly east of Prudhoe Bay, particularly near the Canning River, and further east in some years. The CAH appears to have expanded its winter range on the south side of the Brooks Range south into more timbered areas, and east toward Arctic Village. In some years, substantial overlap with the PCH occurs on the wintering grounds.

Reported harvest increased beginning in RY00 but remained <2% of the herd (Table 8). Most hunters who lived outside of Unit 26 primarily used highway vehicles as a means of access, and most harvest occurred in August. However, the use of boats (including airboats) and airplanes has increased in recent years. The DHCMA is valued by bowhunters because caribou are accessible from the road and there is no competition with rifle hunters within 5 miles of the road.

Harvest by bowhunters averaged 31% of the overall harvest since RY00. Hunters who resided in Unit 26 used boats to take approximately half of their caribou harvest in July, August, and September, and used snowmachines in March and April to take the other half of their harvest. The CAH has provided substantial hunting opportunity. Regulatory change in 2010 to increase the bag limit and liberalize the season added to this opportunity. In addition, liberalizing the season and bag limit for RY10 did not negatively affect the bull:cow ratio in the population. We observed 69 bulls:100 cows during the most recent fall composition survey in 2011.

We met our first goal, to minimize adverse effects of development on caribou, by working with various industry companies in developing mitigation measures to decrease disturbance of caribou, particularly during calving. We met our second goal, to maintain a population level that will support a harvest of at least 1,400 caribou without precluding population growth, because the herd grew and sustainable harvest exceeded 1,400. We met our third goal, maintaining an opportunity for a subsistence harvest, by providing liberal hunting seasons. We met our fourth goal, to maintain viewing and photographing opportunities, because these opportunities were adequate when taking into account the unpredictability of caribou movements.

We met our first and third objectives, to maintain a population of at least 28,000–32,000 caribou and a harvest of at least 1,400 caribou if the population is ≥28,000. In 2008 and 2010 the population size was >66,000 caribou and could provide a harvest of at least 1,400 caribou. Although we were unable to complete a photo census in 2012, there is no indication of a population decline during the report period. We also met our second objective, to maintain accessibility of seasonal ranges for CAH caribou. Based on radiotelemetry and anecdotal observations, CAH animals were able to access calving, postcalving, summer, fall, and winter ranges. We met our fourth objective, to maintain a ratio of at least 40 bulls:100 cows. In October 2010 and 2011 the bull:cow ratio was ≥56 bulls:100 cows. We met our sixth objective, to reduce conflicts between consumptive and nonconsumptive uses of caribou along the Dalton Highway. Few conflicts between consumptive and nonconsumptive use appeared to arise during RY10–RY11.

For the next reporting period, we will remove Goal 2 to maintain a CAH population level that will support a harvest of at least 1,400 caribou without precluding population growth because this Goal is reflected in the objectives.

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Table 1. Central Arctic herd estimated population size, 1978–2010.

	Population survey		Estimated
Year	Date	Method[a]	size
1978	Jul	STS	5,000
1981	Jul	AC	8,537
1983	Jul	APDCE	12,905
1991	18–20 Jun	GM	19,046[b]
1992	8–9 Jul	APDCE	23,444
1995	13 Jul	APDCE	18,100
1997	19–20 Jul	APDCE	19,730
2000	21 Jul	APDCE	27,128
2002	16 Jul	APDCE	31,857
2008	2–3 Jul	APDCE	66,772[c]
2010	9 July	APDCE	70,034 [c]

[a] STS = Systematic transect surveys; AC = Aerial count; APDCE = Aerial Photo Direct Count Extrapolation (Davis et al. 1979); GM = Gasaway method (Gasaway et al. 1986; Valkenburg 1993). Methods except Gasaway represent a total minimum count of the herd.
[b] Ninety-percent confidence interval was 14,677–23,414.
[c] Includes 2 PCH and 2 TCH radio collars found during the censuses. These caribou represent an unknown number of caribou from these herds; however, we estimated that these radio collars represented approximately 5,000 caribou (~850 caribou per TCH radio collar and ~1,690 PCH caribou per radio collar).

Table 2. Central Arctic herd caribou percent parturition of radiocollared females, 1994–2012.

		Percent parturition by subunit for females ≥4 years old[a]		
Year	Date	26B West (*n*)	26B East (*n*)	All 26B (*n*)
1994	10–14 Jun	67 (6)	78 (9)	73 (15)
1995	7–8 Jun	75 (4)	40 (5)	56 (9)
1996[b]				
1997	6 Jun	77 (13)	46 (13)	61 (26)
1998	3–4 Jun	93 (14)	83 (12)	88 (26)
1999	5, 9 Jun	94 (16)	92 (12)	93 (28)
2000	6–7 Jun	89 (9)	100 (16)	96 (25)
2001	3–9 Jun	90 (20)	93 (15)	91 (35)
2002	4–7 Jun	89 (27)	96 (23)	92 (50)
2003	30 May–8 Jun	93 (29)	100 (25)	96 (54)
2004	31 May–11 Jun	88 (40)	96 (28)	91 (68)
2005	31 May–9 Jun	86 (35)	80 (25)	83 (60)
2006	29 May–8 Jun	94 (32)	100 (22)	96 (54)
2007	2–6 Jun	88 (32)	100 (24)	93 (56)
2008	2–4 Jun	100 (26)	96 (20)	98 (46)
2009	1–3 Jun	74 (19)	76 (25)	75 (44)
2010	2–5 Jun	91 (11)	100 (26)	97 (37)
2011	2–4 Jun	83 (12)	96 (23)	91 (35)
2012	3 & 7 Jun	83 (12)	100 (12)	92 (24)

[a] Data for females ≥4 years old were stratified based on the location of caribou east and west of the Sagavanirktok River. In some years, we captured unknown-age adult females and these were included in the ≥4 years old sample.
[b] Survey not completed.

Table 3. Central Arctic herd caribou percent parturition of known-age radiocollared females, 1994–2012.

Year	Date	2-year-olds (*n*)[a]	3-year-olds (*n*)	4-year-olds (*n*)	5-year-olds (*n*)	≥6-year-olds (*n*)
1994	10–14 Jun	0 (5)				73 (15)
1995	7–8 Jun	0 (8)	0 (4)			56 (9)
1996						
1997	6–7 Jun	0 (2)	0 (1)	29 (7)	100 (2)	67 (3)
1998	3–4 Jun	0 (6)	100 (2)	0 (1)	88 (8)	100 (3)
1999	5, 9 Jun	9 (11)	100 (7)	100 (2)	100 (1)	100 (17)
2000	6–7 Jun	13 (8)	80 (10)	100 (5)		94 (16)
2001	3–8 Jun	8 (13)	77 (13)	100 (10)	75 (4)	94 (16)
2002	4–7 Jun	(0)	77 (12)	73 (11)	100 (9)	100 (20)
2003	30 May–8 Jun	0 (8)	(0)	100 (12)	85 (13)	100 (23)
2004	31 May–11 Jun	0 (6)	88 (8)	(0)	90 (10)	88 (32)
2005	31 May–9 Jun	0 (7)	86 (7)	83 (6)	(0)	82 (34)
2006	29 May–8 Jun	0 (7)	71 (7)	100 (6)	100 (6)	96 (25)
2007	2–6 Jun	– 0	100 (4)	100 (6)	100 (7)	96 (25)
2008	2–4 Jun	0 (6)	– 0	66 (3)	100 (7)	100 (24)
2009	1–3 Jun	0 (6)	60 (5)	– 0	75 (4)	79 (28)
2010	2–5 Jun	0 (1)	60 (5)	100 (4)	– 0	96 (24)
2011	2–4 Jun	0 (5)	50 (4)	83 (6)	100 (5)	89 (18)
2012	3 & 7 Jun	– 0	71 (7)	50 (2)	100 (5)	93 (15)

[a] A 2-year-old parturient caribou was classified based on presence of hard antlers only. No calf or udder was observed.

Table 4. Estimated date of peak of calving[a] for CAH for years 1988–2012[b].

Year	Survey dates	Number of radiocollared parturient cows ≥ 3 years old	Estimated dates for peak of calving[c]	Point estimate for calving date[d]
1988	2–14 Jun	16	3–4 Jun	3.5
1989	30 May–10 Jun	5	6–7 Jun	6.5
1990	31 May–14 Jun	17	3–4 Jun	3.5
1991	2–8 Jun	12	5–6 Jun	5.5
1992	6–12 Jun	13	< 7 Jun	–[e]
1993	7–12 Jun	11	< 7 Jun	–[e]
1994	10–14 Jun	11	< 11 Jun	–[e]
1995	7–8 Jun	5	< 8 Jun	–[e]
1996	No survey			
1997	6 Jun	16	4–5 Jun	4.5
1998	3–4 Jun	25	1–3 Jun	2.0
1999	5, 9 Jun	33	8– Jun	8.5
2000	6–7 Jun	32	8–10 Jun	9.0
2001	3–8 Jun	43	9–10 Jun	9.5
2002	4–7 Jun	55	4–6 Jun	5.0
2003	30 May–8 Jun	52	4–6 Jun	5.0
2004	31 May–11 Jun	69	4–6 Jun	5.0
2005	31 May–9 Jun	56	4–6 Jun	5.0
2006	29 May–8 Jun	57	4–6 Jun	5.0
2007	2–6 Jun	56	7–8 Jun	7.5
2008	2–4 Jun	32	1–2 Jun	1.5
2009	1–3 Jun	36	4 Jun	4.0
2010	2–5 Jun	39	2–5 Jun	3.5
2011	2–3 Jun	34	4–5 Jun	4.5
2012	3 & 7 Jun	27	6–7 Jun	6.5

[a] Peak of calving was defined as the date when 50% or more of the radiocollared parturient cows ≥3 years old gave birth.

[b] References for years 1988–2001 (ADF&G unpublished data; R. Cameron retired ADF&G, personal communication); 2002–2006 (Arthur and Delvecchio 2009); and 2007–2011 (Lenart 2011).

[c] For years 1988–1991 and 2002–2006, radiocollared females were relocated daily or every 2–3 days until a calf was present. If observations of females determined parturient with no calf were followed by ones with a calf was present, the range of days between observations was determined as the estimated date the females had calved. For years 1997–2000 and 2007–2012, the estimated date of peak of calving was determined using the following criteria based on the proportion of ≥3 year old females with calves to parturient females ≥3 years old at the last date of radiotracking: 1) ≤25%, a span of 3 days was added following the last radiotracking date; 2) 26–39%, 2 days were added; 3) 40–49%, 1 day was added; 4) 51–59%, 1 day was subtracted and included the last radiotracking date; 5) 60–74%, 2 days were subtracted; and 6) ≥75%, a span of 3 days were subtracted.

[d] The date of the point estimate was determined by deriving the midpoint between the estimated dates for peak of calving.

[e] Insufficient data to make a determination.

Table 5. Central Arctic herd caribou late June calf cow ratios (calves:100 cows) of radiocollared females ≥4 years old, 1994–2012.

		Late June calf:cow ratios (calves:100 cows) by subunit for females ≥4 years old[a]		
Year	Date	26B West[b] (*n*)	26B East (*n*)	All 26B (*n*)
1994	27–29 Jun	50 (6)	75 (8)	64 (14)
1995	27, 30 Jun	75 (4)	50 (4)	63 (8)
1996	15–16 Jun	60 (10)	83 (6)	69 (16)
1997	29–30 Jun	85 (13)	64 (11)	75 (24)
1998	29–30 Jun	79 (14)	80 (15)	79 (29)
1999	22–24 Jun	92 (13)	67 (12)	80 (25)
2000	17–19 Jun	79 (14)	72 (18)	75 (32)
2001	23–25 Jun	78 (18)	81 (16)	79 (34)
2002	23–25 Jun	78 (28)	83 (24)	81 (52)
2003	24–26 Jun	77 (26)	78 (27)	77 (53)
2004[c]	24 Jun	78 (27)	87 (17)	82 (44)
2005	24 Jun	77 (35)	61 (23)	71 (58)
2006	23–24 Jun	82 (22)	94 (33)	89 (55)
2007	22–23 Jun	87 (32)	71 (21)	81 (53)
2008	23–24 Jun	100 (3)	90 (42)	91 (45)
2009	23–24 Jun	56 (17)	48 (25)	52 (42)
2010	22–23 Jun	92 (12)	81 (27)	85 (39)
2011	20–21 Jun	80 (10)	75 (20)	77 (30)
2012	26–27 Jun	64 (11)	73 (15)	69 (26)

[a] Data for females ≥4 years old were stratified based on the location of caribou east and west of the Sagavanirktok River. In some years, we captured unknown-age adult females and these were included in the ≥4 years old sample.
[b] Unit 26B West is west of the west bank of the Sagavanirktok River and Unit 26B East is east of the west bank of the Sagavanirktok River.
[c] Only GPS radiocollared females with radiocollared calves were relocated because the caribou were aggregated tightly, making identifying a calf with the correct cow impossible.

Table 6. Central Arctic herd caribou late June calf:cow ratios (calves:100 cows) of known-age radiocollared females, 1994–2012.

Year	Date	2-year-olds (*n*)	3-year-olds (*n*)	4-year-olds (*n*)	5-year-olds (*n*)	≥ 6-year-olds (*n*)
1994	27–29 Jun	0 (4)	(0)	(0)	(0)	64 (14)
1995	27–30 Jun	0 (6)	0 (3)	(0)	(0)	62 (8)
1996	15–16 Jun	(0)	71 (7)	50 (4)	(0)	83 (6)
1997	29 Jun	(0)	0 (1)	57 (7)	100 (3)	100 (3)
1998	29–30 Jun	<1 (7)	50 (2)	0 (1)	86 (7)	100 (5)
1999	22–24 Jun	<1 (10)	33 (6)	100 (2)	100 (1)	80 (15)
2000	17–18 Jun	0 (11)	60 (10)	71 (7)	0 (1)	75 (20)
2001	23–25 Jun	0 (3)	38 (13)	78 (9)	80 (5)	80 (20)
2002	23–25 Jun	(0)	57 (14)	75 (12)	100 (10)	82 (22)
2003	24–26 Jun	(0)	(0)	100 (12)	50 (12)	78 (23)
2004[a]	24 Jun	(0)	(0)	(0)	100 (1)	75 (20)
2005	24 Jun	(0)	40 (5)	83 (6)	(0)	74 (31)
2006	23–24 Jun	(0)	71 (7)	100 (6)	83 (6)	96 (25)
2007	22–23 Jun	(0)	75 (4)	86 (7)	83 (6)	80 (25)
2008	23–24 Jun	(0)	(0)	50 (4)	83 (6)	95 (23)
2009	23–24 Jun	0 (4)	60 (5)	(0)	75 (4)	55 (29)
2010	22–23 Jun	(0)	40 (5)	75 (4)	(0)	92 (25)
2011	20–21 Jun	(0)	50 (4)	83 (6)	50 (4)	75 (16)
2012	26–27 Jun	(0)	43 (7)	50 (2)	50 (6)	75 (16)

[a] Only GPS radiocollared females with radiocollared calves were relocated because the caribou were aggregated tightly, making identifying a calf with the correct cow impossible.

Table 7. Central Arctic caribou herd fall composition surveys, 1976–2012.

Date[a]	Bulls: 100 cows	Calves :100 cows	Percent calves (no. calves)	Percent cows (no. cows)	Percent bulls (no. bulls)	Sample size	No. groups	No. collars (no. bull collars)
Oct 1976	122	44	17	38	46	1,223		
Oct 1977	118	55	20	37	43	628		
Oct 1978	96	58	23	39	38	816		
Oct 1980	132	49	18	35	47	1,722		
Oct 1981	81	64	26	41	33	1,712		
16–18 Oct 1992	96	47	19 (473)	41 (1,016)	40 (980)	2,469		
22 Oct 1996	61	67	29 (898)	44 (1,344)	27 (820)	3,062		
12 Oct 2000	84	57	24 (784)	42 (1,388)	35 (1,163)	3,335		
13 Oct 2001	73	54	24 (978)	44 (1,803)	32 (1,311)	4,092		
24 Oct 2002	67	72	30 (523)	42 (722)	28 (487)	1,732		
13–14 Oct 2009	50	33	18 (1,193)	55 (3,641)	27 (1,814)	6,648	19	37 (0)
23 Oct 2010	50	46	23 (889)	51 (1,930)	26 (968)	3,787	12	21 (0)
13 Oct 2011	69	56	25 (1,303)	44 (2,306)	31 (1,590)	5,199	22	33 (0)
14 Oct 2012	56	61	28 (1,132)	46 (1,845)	26 (1,039)	4,016	11	31 (5)

[a] Beginning in 2009, sampling methods differed slightly from previous years. See methods.

Table 8. Winter distribution of radiocollared CAH caribou south of the Brooks Range, regulatory years 2001−2012.

Regulatory year	Date of Radiotracking	Percent of CAH on south side of Brooks Range	Number of radio collars located
2001	29–31 Mar	69	103
2002	26 Feb	68	89
2003	15 Mar	87	100
2004	11, 17 Mar	60	111
2005	9 Mar	54	76
2006	Mar	60	54
2007	27 Mar	2	43
2008	10–11 Mar, 7 Apr	95	58
2009	29, 30 Mar, 18 Apr	91	53
2010	8–9 Mar, 13 Apr	94	50
2011[a]	2012 Feb	80	10
2012	19–24 Apr	61	33

[a] In RY11, no radiotracking flights were conducted in March when distribution of caribou can reflect winter distribution. Locations of GPS and PTT satellite collars were recorded during the end of February to capture winter distribution. Locations of radiocollared caribou were also reported for the April survey; although caribou had begun their spring migration to the calving grounds.

Table 9. Reported Central Arctic caribou herd harvest by sex and method of take, regulatory years 2000–2012[a].

Regulatory year	Reported harvest				Total hunters	Percent successful hunters[c]
	Male	Female	Unk	Total (harvest by bow)[b]		
2000	465	28	1	494 (214)	804	52
2001	496	16	4	516 (192)	918	47
2002	389	23	3	415 (96)	851	41
2003	389	11	4	404 (136)	717	48
2004	588	42	4	634 (228)	989	52
2005	635	45	7	687 (239)	1,104	52
2006	798	37	6	841 (301)	1,331	53
2007	620	68	2	690 (183)	1,380	42
2008	669	47	1	717 (180)	1,362	43
2009	745	43	11	799 (221)	1,301	48
2010	967	227	26	1,220 (294)	1,610	53
2011	790	327	12	1,129 (316)	1,366	56

[a] Source: Harvest ticket reports from Unit 26B in ADF&G WinfoNet database.
[b] Harvest by bow is also included in total harvest.
[c] Percent successful hunters calculated by dividing successful hunters by number of total hunters.

Table 10. Reported Central Arctic caribou herd hunter residency and success, regulatory years 2000–2012[a].

Regulatory year	Successful hunters: Alaska resident	Successful hunters: Non-resident	Successful hunters: Unk	Successful hunters: Total (%)	Unsuccessful hunters: Alaska resident	Unsuccessful hunters: Non-resident	Unsuccessful hunters: Unk	Unsuccessful hunters: Total (%)	Total hunters[b]
2000	339	74	3	416 (52)	354	32	2	388 (48)	804
2001	331	101	4	436 (47)	403	76	3	482 (53)	918
2002	247	103	2	352 (41)	428	70	1	499 (59)	851
2003	249	90	5	344 (48)	313	58	2	373 (52)	717
2004	381	127	9	517 (52)	385	78	9	472 (48)	989
2005	421	154	1	576 (52)	425	100	3	528 (48)	1,104
2006	476	213	20	709 (53)	498	98	26	622 (47)	1,331
2007	383	189	8	580 (42)	649	141	10	800 (58)	1,380
2008	411	157	12	580 (43)	603	163	16	782 (57)	1,362
2009	445	172	12	629 (48)	560	83	16	659 (51)	1,301
2010	616	232	12	860 (53)	585	139	14	738 (46)	1,610
2011	553	184	27	764 (56)	492	78	17	587 (43)	1,366

[a] Source: Harvest ticket reports from Unit 26B in ADF&G WinfoNet database.
[b] Total hunters includes hunters who were not determined successful or unsuccessful.

Table 11. Reported Central Arctic caribou herd harvest chronology, regulatory years 2000–2012[a].

Regulatory year	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May/Jun	Unk[b]	Total
	Harvest chronology by month (%)												
2000	42 (8)	263 (53)	109 (22)	32 (6)	11 (2)	0 (0)	2 (<1)	3 (<1)	4 (1)	24 (5)		4	494
2001	28 (5)	218 (42)	117 (23)	127 (25)	7 (1)	0 (0)	0 (0)	2 (<1)	5 (1)	7 (1)		5	516
2002	24 (6)	181 (44)	127 (31)	43 (10)	8 (2)	1 (<1)	1 (<1)	1 (<1)	4 (1)	21 (5)		4	415
2003	17 (4)	223 (55)	116 (29)	24 (6)	3 (<1)	0 (0)	1 (<1)	2 (<1)	1 (<1)	12 (3)		5	404
2004	22 (3)	371 (58)	118 (19)	77 (12)	6 (1)	1 (<1)	0 (0)	0 (0)	17 (3)	19 (3)		3	634
2005	43 (6)	369 (54)	136 (20)	74 (11)	10 (1)	2 (<1)	3 (<1)	2 (<1)	18 (3)	22 (3)		8	687
2006	63 (7)	432 (51)	219 (26)	38 (4)	31 (4)	2 (<1)	4 (<1)	0 (<1)	8 (1)	32 (4)		12	841
2007	27 (4)	333 (48)	165 (24)	65 (9)	8 (1)	6 (1)	1 (<1)	3 (<1)	12 (2)	67 (10)		3	690
2008	30 (4)	439 (61)	149 (21)	38 (5)	6 (<1)	0 (0)	0 (0)	0 (0)	3 (<1)	48 (7)		4	717
2009	16 (2)	446 (56)	237 (30)	18 (2)	1 (<1)	0 (0)	1 (<1)	0 (0)	7 (<1)	59 (7)	3 (<1)	4	789
2010	24 (2)	783 (64)	274 (22)	46 (4)	11 (<1)	0 (0)	0 (0)	0 (0)	5 (<1)	53 (4)	17 (1)	7	1,220
2011	20 (2)	656 (58)	209 (18)	40 (3)	35 (3)	3 (<1)	2 (<1)	1 (<1)	2 (<1)	150 (13)	8 (<1)	3	1,129

[a] Source: Harvest ticket reports from Unit 26B in ADF&G WinfoNet database.
[b] Includes the occasional animal reported taken illegally in May and June prior to RY09.

Table 12. Reported Central Arctic caribou herd, number of caribou harvested by transport methods, regulatory years 2000–2012[a].

Regulatory year	Airplane	Horse/Dog	Boat	Airboat	Snowmachine	4-Wheeler/ Other ORV	Highway vehicle	Unk	Total
	Transport methods (%)								
2000	91 (18)	17 (3)	57 (11)	17 (3)	4 (<1)	1 (<1)	302 (61)	5 (1)	494
2001	108 (21)	7 (1)	50 (10)	18 (4)	0 (0)	5 (1)	324 (63)	4 (<1)	516
2002	112 (27)	10 (2)	54 (13)	11 (3)	1 (<1)	14 (3)	206 (50)	7 (2)	415
2003	78 (19)	2 (<1)	61 (15)	36 (9)	0 (0)	3 (<1)	219 (54)	5 (1)	404
2004	97 (15)	10 (2)	101 (16)	82 (13)	1 (<1)	3 (<1)	335 (53)	5 (<1)	634
2005	120 (17)	7 (1)	119 (17)	60 (9)	0 (0)	2 (<1)	362 (53)	17 (2)	687
2006	191 (23)	10 (1)	133 (16)	56 (7)	0 (0)	1 (<1)	433 (51)	17 (2)	841
2007	205 (30)	22 (3)	72 (10)	40 (6)	3 (<1)	1 (<1)	333 (48)	14 (2)	690
2008	259 (36)	20 (3)	93 (13)	46 (6)	0 (0)	1 (<1)	287 (40)	11 (2)	717
2009	208 (26)	29 (4)	143 (18)	43 (5)	0 (0)	1 (<1)	355 (45)	10 (1)	789
2010	350 (29)	27 (2)	190 (16)	111 (9)	0 (0)	3 (<1)	511 (42)	28 (2)	1,220
2011	322 (28)	71 (6)	172 (15)	60 (5)	0 (0)	2 (<1)	483 (43)	19 (2)	1,129

[a] Source: Harvest ticket reports from Unit 26B in ADF&G WinfoNet database.

Table 13. Mortality rates of radiocollared cow caribou ≥1 year old.

Regulatory year	Number of mortalities	Number of radio collars[a]	% Mortality
1997	2	44	4
1998	2	53	4
1999	7	53	13
2000	12	66	18
2001	4	64	6
2002	11	76	14
2003	4	65	6
2004	17	91	19
2005	8	73	11
2006	5	64	8
2007	7	52	13
2008	10	74	14
2009	10	65	15
2010	5	60	8
2011	9	56	16

[a] Number of radiocollared cow caribou ≥1 year old known to be alive at the beginning of the regulatory year.