Caribou Management Report of Survey-Inventory Activities, 1 July 2012–30 June 2014

Patricia Harper and Laura A. McCarthy, editors

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2015 Set

Alaska Department of Fish and Game Division of Wildlife Conservation

Caribou Management Report of Survey-Inventory Activities, 1 July 2012–30 June 2014

Alaska Department of Fish and Game
Division of Wildlife Conservation
P.O. Box 115526
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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 biologist 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:

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Please note that individual 2015 caribou management unit reports covering the same period that are included in this full report were processed and posted to the ADF&G website as they were completed during 2015–2018. Although this compilation of unit reports was produced in 2018 it is cited as a 2015 set of reports to avoid confusion as it was part of a series that was produced as a full report every two years until the approach to these reports was changed in 2016. This is the set of reports that followed the 2013 caribou management report and most reports were written in 2015.

These reports are available from the Alaska Department of Fish and Game's Division of Wildlife Conservation, P.O. Box 115526, Juneau, Alaska 99811-5526; phone (907) 465-4190; email: dfg.dwc.publications@alaska.gov; website: www.adfg.alaska.gov. The report may also be accessed through most libraries, via interlibrary loan from the Alaska State Library or the Alaska Resources Library and Information Service (www.arlis.org).

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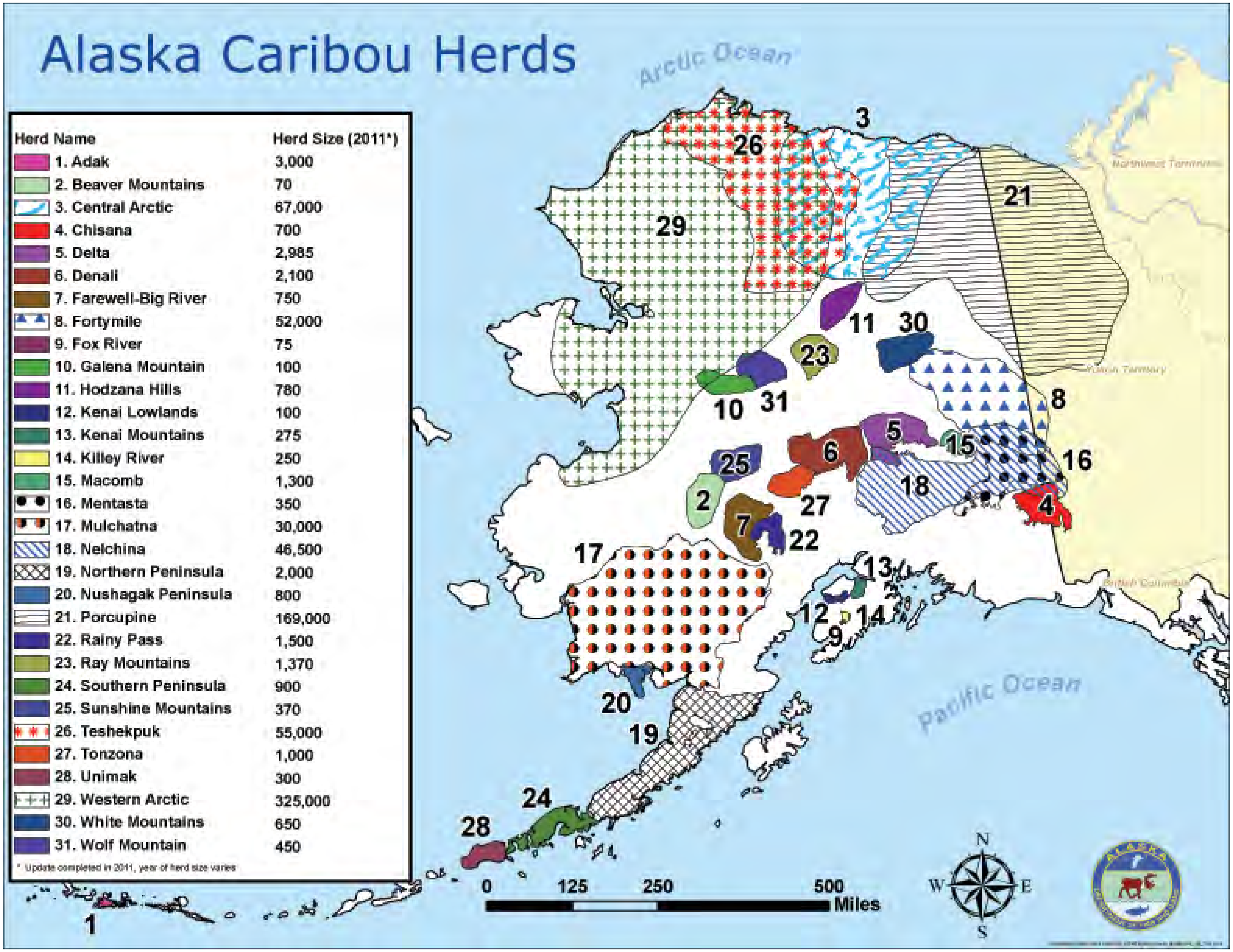
Cover Photo: A band of Mulchatna herd caribou gather on a ridge in Southwest Alaska. ©2014 ADF&G, photo by Nick Demma.

CARIBOU MANAGEMENT REPORT

From: 1 July 2012
To: 30 June 2014


Alaska Caribou Herds
Arctic Ocean
Pacific Ocean
Northwest Territories
Yukon Territory
British Columbia
Herd Name | Herd Size (2011*)
1. Adak 3,000
2. Beaver Mountains 70
3. Central Arctic 67,000
4. Chisana 700
5. Delta 2,985
6. Denali 2,100
7. Farewell-Big River 750
8. Fortymile 52,000
9. Fox River 75
10. Galena Mountain 100
11. Hodzana Hills 780
12. Kenai Lowlands 100
13. Kenai Mountains 275
14. Killey River 250
15. Macomb 1,300
16. Mentasta 350
17. Mulchatna 30,000
18. Nelchina 46,500
19. Northern Peninsula 2,000
20. Nushagak Peninsula 800
21. Porcupine 169,000
22. Rainy Pass 1,500
23. Ray Mountains 1,370
24. Southern Peninsula 900
25. Sunshine Mountains 370
26. Teshekpuk 55,000
27. Tonzona 1,000
28. Unimak 300
29. Western Arctic 325,000
30. White Mountains 650
31. Wolf Mountain 450
* Update completed in 2011, year of herd size varies
0 125 250 500 Miles
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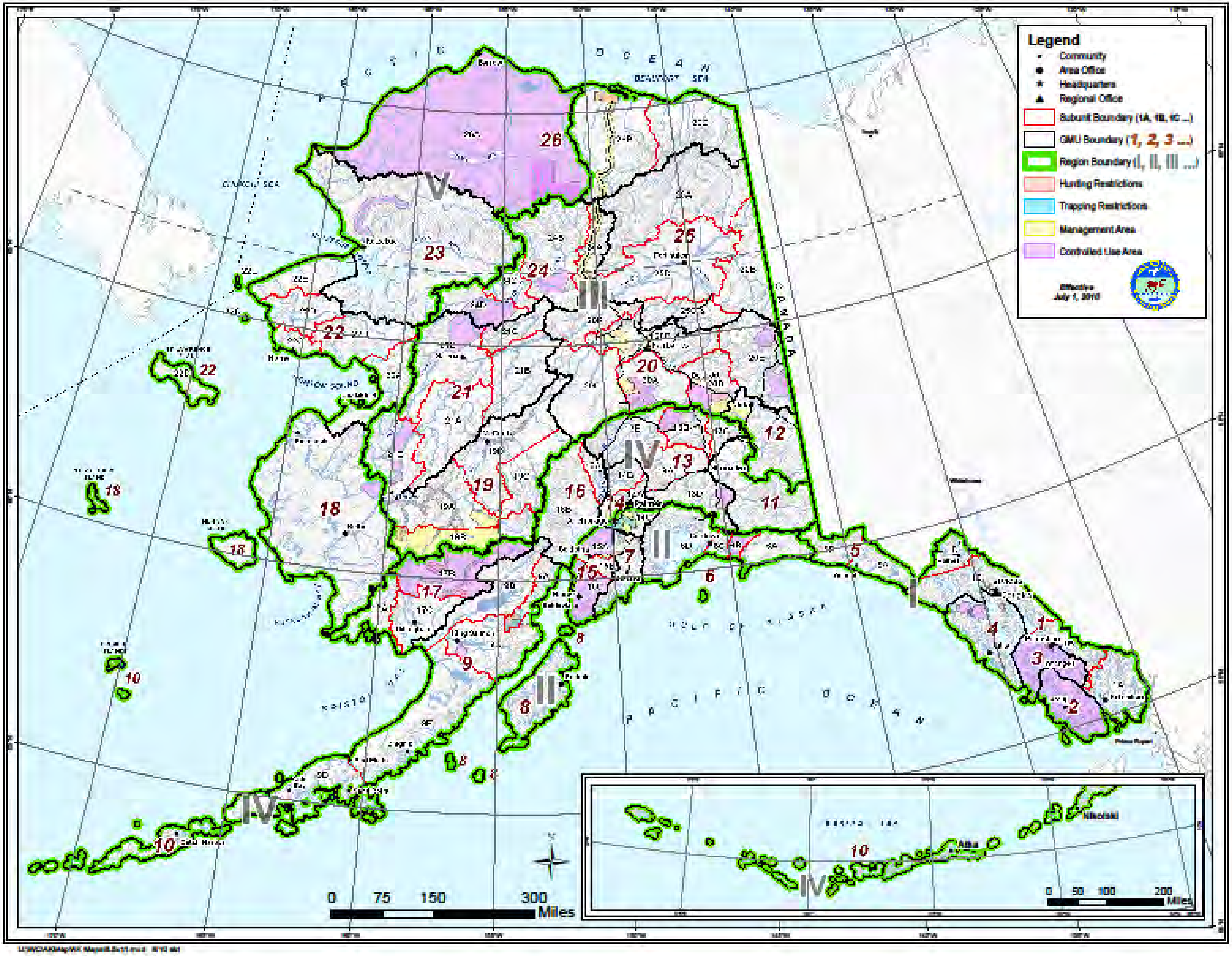
Legend
Community
Area Office
Headquarters
Regional Office
Subunit Boundary (1A, 1B, 1C ...)
GMU Boundary (1, 2, 3 ...)
Region Boundary (I, II, III ...)
Hunting Restrictions
Trapping Restrictions
Management Area
Controlled Use Area
BEAUFORT SEA
CANADA
PACIFIC OCEAN
0 75 150 300
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Division of Wildlife Conservation
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CHAPTER 1: CARIBOU MANAGEMENT REPORT

From: 1 July 2012
To: 30 June 2014

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 established through reintroduction efforts. Reintroductions in 1965 and 1966 established the Kenai Mountain (KMCH) and Kenai Lowlands (KLCH) herds. Additional introductions in 1985 and 1986 established the Killey River (KRCH) and Fox River (FRCH) herds.

KMCH in Unit 7 ranges over 1,400 km^2 primarily 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 (Alaska Department of Fish and Game et al. 1994) and numbered more than 400 by the mid-1980s (Selinger 2003). The population declined twice after it exceeded 400 animals (Alaska Department of Fish and Game et al. 1994, Selinger 2003). In recent years, it has declined to around 130 animals that have become more dispersed in their distribution (Table 1). 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 (Alaska Department of Fish and Game et al. 1994, Spraker 2001). 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.

KLCH summers north of the Kenai airport toward the Swanson River in Subunit 15A and in the extreme northwestern portion of Subunit 15B. The population winters from the headwaters of the Moose River to the outlet of Skilak Lake and in the area around Browns Lake. Its range encompasses about 1,200 km^2, and animals can often be found in and around the communities of Soldotna, Kenai, and Sterling. Numbers slowly increased to what was previously considered a harvestable number in 1981 (Holdermann 1981). Presently the herd numbers about 125–130 individuals. Growth in this population has likely been limited by predation. Free-ranging domestic dogs, coyotes, and wolves are the primary predators. Hunts were held in 1981, 1989, 1990, 1991, and 1992, but no permits have been issued since (Selinger 2005). This is the most visible herd on the Kenai and animals are frequently seen near the towns of Kenai and Soldotna during the summer. While establishing a huntable population remains the primary objective for this herd, it has also become valued for providing viewing opportunities for residents and visitors.

KRCH inhabits over 600 km^2 including the upper drainages of the Funny and Killey Rivers and north to the Skilak River in Subunit 15B. KRCH now numbers around 375–400 individuals. This herd grew steadily to more than 700 animals until 2001, when avalanches killed over a quarter of the population (Selinger 2003). Due to the nature of the habitat, avalanches may be a significant limiting factor for KRCH. KRCH has been hunted since 1994 under a limited drawing or registration permit system.

FRCH 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. FRCH peaked in 1998 (Spraker 2001) and again in 2012 at around 100 caribou. Recent surveys in 2014 counted 90 caribou in the herd. A limited number of drawing permits were issued for this herd from 1995 to 2003 when the population could sustain a harvest (Spraker 2001, Selinger 2005). 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. It is possible there is occasional interchange of animals between KRCH and FRCH. None of the radiocollared caribou have shown this type of movement, but the collar sample is low. If interchange did occur, it would help to explain some of the population fluctuations noted in FRCH. The 2 herds are separated by a narrow (2 miles wide) glacial flat and caribou tracks have been observed in that area.

MANAGEMENT DIRECTION

MANAGEMENT OBJECTIVES

Kenai Mountains Caribou Herd

- Maintain a post hunt population of 300–400 animals.

Kenai Lowlands Caribou Herd

- Increase the herd to a minimum of 150 animals. Hunting will be allowed once this objective is reached.

Killey River and Fox River Caribou Herds

- 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 each year to determine the number, distribution, and composition of caribou herds. Surveys for KMCH, KRCH, and FRCH typically occur in the fall. Unfortunately, there are years where we have been unable to conduct flights due to other priorities or inclement weather. KLCH surveys typically occur postcalving in the spring but minimum counts are periodically conducted in the fall. Additionally, we capture animals from the separate herds periodically to maintain a sample of collared animals to assist with our management efforts. In October 2013, we collared 21 animals distributed among the herds (FRCH = 2, KLCH = 7, KMCH = 6, KRCH = 6). Collars were distributed to try to maintain collared animals in each herd for monitoring. Harvest data are collected through a mandatory reporting requirement for the drawing permit hunts.

POPULATION STATUS AND TREND

Population Size and Composition

Kenai Mountains Herd. The herd currently numbers around 130 animals based on our last minimum count (Table 1). No composition counts were conducted during the reporting period.

Kenai Lowlands Herd. The current herd size is about 120 caribou based on a minimum count of 114 animals conducted by the U.S. Fish and Wildlife Service (USFWS); 25% calves were tallied during the 2013 spring composition survey (Table 2).

Killey River Herd. The herd appears to have increased since the last reporting period when it was estimated at about 250 caribou in 2008 (Selinger 2013). It is now estimated to be between 375 and 400 animals based on a minimum count of 374 conducted by the USFWS (Table 3). No composition counts were conducted during the reporting period.

Fox River Herd. This herd has also increased since the last reporting period to around 100 animals based on our last minimum count (Table 4). No composition counts were conducted during the reporting period.

MORTALITY

Harvest

Season, Bag Limits, and Harvest.

Kenai Mountains Herd — The season for resident and nonresident hunters in Unit 7 north of the Sterling Highway and west of the Seward Highway has been 10 August–31 December since 1999. The bag limit has been 1 caribou by drawing permit (DC001) with 250 permits issued each year since 1996 with an average annual harvest of 21 caribou. The harvest for this reporting period and for the past 5 years was slightly higher at 22 caribou (Table 5). In 2010, the federal subsistence hunt was established, which has had an average annual harvest of 1 caribou.

Kenai Lowlands Herd — The season has been closed since 1993.

Killey River Herd — The season for resident and nonresident hunters in Subunit 15B south and west of Killey River in the Kenai National Wildlife Refuge was 10 August–20 September.

Since 2004, the bag limit has been 1 bull by drawing permit (DC608) with 25 permits issued. There has been an average annual harvest of 6 bulls (Table 6) with little change over the last decade (Selinger 2009, McDonough 2011).

Fox River Herd — The season for resident and nonresident hunters in a portion of Subunit 15C south of Tustumena Glacier is 10 August–20 September. Drawing permits (DC618) were issued for the 2011 season for the first time since 2003 and the hunt has remained open with a bag limit of one caribou. Ten permits have been issued each year with a harvest of 1–3 caribou annually (Table 7).

Alaska 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 KMCH, KRCH, and FRCH caribou hunts are shown in Tables 8, 9, and 10. Resident hunters account for the majority of harvest in these populations. The average success rate for hunters is 22% for KMCH, 47% for KRCH, and 67% for FRCH.

Harvest Chronology. Harvest chronologies for the KMCH, KRCH, and FRCH caribou hunts are shown in Tables 11, 12 and 13. The majority of harvest within these herds occurs during the month of August and tapers off towards the end of each areas respective season.

Transport Methods. Transport methods for the KMCH, KRCH, and FRCH 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 floatplane on limited lakes. KMCH hunters primarily accessed their hunt area by highway vehicle, KRCH hunters by floatplane or boat, and FRCH hunters by boat.

HABITAT AND DISTRIBUTION CHANGES

No recent habitat assessment work has been conducted for Kenai caribou herds. Habitat was last assessed in 2002 indirectly through measurements of 10-month-old calf weights for KMCH and KRCH (Spraker et al. 2002). Department and Kenai National Wildlife Refuge biologists conducted preliminary habitat assessments for KRCH and FRCH before reintroduction in the mid-1980s. These results indicated the KRCH caribou winter range (516 km^2) should sustain a herd of 400–500 caribou, and the FRCH caribou winter range (85 km^2) could sustain approximately 80 animals. KRCH and FRCH are at or above these estimated capacities.

Caribou were reported east of the Harding Icefield near Seward in the mid-2000s and remained there for a few years, but have not been reported since 2009. These animals likely dispersed from FRCH or KRCH. Although caribou inhabited the Seward area more than 100 years ago (Porter 1893), it doesn't appear that a herd will become established at this time.

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. We no longer conduct annual composition surveys on the herds due to the lack of an available local helicopter. We plan to look into future options however, and, if feasible, we will try to increase efforts to obtain herd composition data.

In 2010 the Federal Subsistence Board determined customary and traditional use of KMCH by residents of Hope (and Sunrise) and established a federal season. This determination was made even though 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 to 1965 with limited hunting starting only in 1972. The Federal Subsistence Board determined that the extirpation of caribou was "beyond the control of the community" even though historical accounts suggest that uncontrolled hunting pressure would likely lead to the extirpation of caribou (Allen 1901). This determination was extended to the community of Cooper Landing in 2014. Similar to Hope, 92% of caribou taken by Cooper Landing hunters since 1980 occurred outside of the Kenai Peninsula. Federal seasons may challenge the successful management of the small caribou herds on the Kenai Peninsula if subsistence harvest increases to the point it represents a significant portion of the harvest. A combined management system for KMCH caribou will challenge managers to maintain this herd at sustainable levels.

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Table 1. Kenai Mountains Herd composition counts and estimated population size, Alaska, regulatory years[a] 2009–2013.

Regulatory year	Bulls:100 cows	Calves:100 cows	% Calves	Composition sample size	Minimum count	Estimated herd size
2009				n/a	264	300
2010[b]						
2011				n/a	200	200–250
2012[b]						
2013				n/a	130	130–150

[a] Regulatory year begins 1 July and ends 30 June (e.g., regulatory year 2009 = 1 July 2009–30 June 2010).
[b] No surveys conducted.

Table 2. Kenai Lowlands Herd composition counts and estimated population size, Alaska, regulatory years[a] 2009–2013.

Regulatory year	Bulls:100 cows	Calves:100 cows	% Calves	Composition sample size	Minimum count	Estimated herd size
2009	n/a	n/a	23	102	102	135
2010[b]						
2011[b]						
2012	2	34	25	123	123	125–130
2013				n/a	114	120

[a] Regulatory year begins 1 July and ends 30 June (e.g., regulatory year 2009 = 1 July 2009–30 June 2010).
[b] No surveys conducted.

Table 3. Killey River Herd composition counts and estimated population size, Alaska, regulatory years[a] 2009–2013.

Regulatory year	Bulls:100 cows	Calves:100 cows	% Calves	Composition sample size	Minimum count	Estimated herd size
2009[b]						
2010[b]						
2011[b]						
2012				n/a	340	350
2013				n/a	374	375–400

[a] Regulatory year begins 1 July and ends 30 June (e.g., regulatory year 2009 = 1 July 2009–30 June 2010).
[b] No surveys conducted.

Table 4. Fox River Herd fall composition counts and estimated population size, Alaska, regulatory years[a] 2009–2013.

Regulatory year	Bulls:100 cows	Calves:100 cows	% Calves	Composition sample size	Minimum count	Estimated herd size
2009				n/a	47	50–75
2010				n/a	75	75–100
2011				n/a	46	50–75
2012				n/a	105	105–110
2013				n/a	90	90–100

[a] Regulatory year begins 1 July and ends 30 June (e.g., regulatory year 2009 = 1 July 2009–30 June 2010).

Table 5. Kenai Mountains Herd harvest (DC001, either sex), Alaska, regulatory years[a] 2009–2013.

	State				Federal Subsistence				
Regulatory year	Permits issued	Permittees who hunted	Harvest		Permits issued	Permittees who hunted	Harvest		Total harvest
			Bulls	Cows			Bulls	Cows	
2009[b]	250	111	13	5					18
2010	250	86	13	6	17	11	1	1	21
2011	250	47	21	5	28	9	0	0	26
2012	250	89	12	12	19	12	2	0	26
2013	250	118	13	6	19	13	0	0	19

[a] Regulatory year begins 1 July and ends 30 June (e.g., regulatory year 2009 = 1 July 2009–30 June 2010).
[b] No subsistence season.

Table 6. Killey River Herd harvest (DC608, bull only), Alaska, regulatory years[a] 2009–2013.

Regulatory year	Permits issued	Permittees who hunted	Total harvest
2009	25	12	6
2010	25	15	5
2011	25	12	6
2012	25	18	6
2013	25	9	6

[a] Regulatory year begins 1 July and ends 30 June (e.g., regulatory year 2009 = 1 July 2009–30 June 2010).

Table 7. Fox River Herd harvest (DC618, either sex), Alaska, regulatory years[a] 2009–2013.

Regulatory year	Permits issued	Permittees who hunted	Harvest: Bulls	Harvest: Cows	Total harvest
2009[b]					
2010[b]					
2011	10	2	1	0	1
2012	10	3	2	1	3
2013	10	2	1	0	1

[a] Regulatory year begins 1 July and ends 30 June (e.g., regulatory year 2009 = 1 July 2009–30 June 2010).
[b] No season.

Table 8. Kenai Mountains Herd, state harvest hunter residency and success (DC001), Alaska, regulatory years[a] 2009–2013.

	Successful					Unsuccessful				
Regulatory year	Local[b] resident	Nonlocal resident	Nonresident	Total	Percent success	Local[b] resident	Nonlocal resident	Nonresident	Total	Total hunters
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
2012	0	23	1	24	27	4	59	1	64	88
2013	1	18	0	19	16	4	92	4	100	119

[a] Regulatory year begins 1 July and ends 30 June (e.g., regulatory year 2009 = 1 July 2009–30 June 2010).
[b] Local = Residents of Unit 7.

Table 9. Killey River Herd, hunter residency and success (DC608), Alaska, regulatory years[a] 2009–2013.

Regulatory year	Successful					Unsuccessful				
	Local[b] resident	Nonlocal resident	Nonresident	Total	Percent success	Local[b] resident	Nonlocal resident	Nonresident	Total	Total hunters
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
2012	3	3	0	6	33	6	4	2	12	18
2013	5	1	0	6	67	1	1	1	3	9

[a] Regulatory year begins 1 July and ends 30 June (e.g., regulatory year 2009 = 1 July 2009–30 June 2010).
[b] Local = residents of Unit 15.

Table 10. Fox River Herd, hunter residency and success (DC618), Alaska, regulatory years[a] 2009–2013.

Regulatory year	Successful					Unsuccessful				
	Local[b] resident	Nonlocal resident	Nonresident	Total	Percent success	Local[b] resident	Nonlocal resident	Nonresident	Total	Total hunters
2009[c]										
2010[c]										
2011	1	0	0	1	50	0	0	1	1	2
2012	0	3	0	3	100	0	0	0	0	3
2013	0	1	0	1	50	0	0	1	1	2

[a] Regulatory year begins 1 July and ends 30 June (e.g., regulatory year 2009 = 1 July 2009–30 June 2010).
[b] Local = residents of Unit 15.
[c] No season.

Table 11. Kenai Mountains Herd, state harvest chronology (DC001), Alaska, regulatory years[a] 2009–2013.

Regulatory year	Harvest periods				Total harvest
	8/10–8/31	9/01–9/30	10/01–10/31	11/01–12/31	
2009	10	6	2	0	18
2010	10	6	2	1	19
2011	13	11	2	0	26
2012	18	4	2	0	24
2013	14	3	1	1	19

[a] Regulatory year begins 1 July and ends 30 June (e.g., regulatory year 2009 = 1 July 2009–30 June 2010).

Table 12. Killey River Herd, harvest chronology (DC608), Alaska, regulatory years[a] 2009–2013.

Regulatory year	Harvest periods					Total harvest
	8/10–8/15	8/16–8/31	9/01–9/15	9/16–9/30	Unknown	
2009	1	2	3	0	0	6
2010	1	2	0	1	1	5
2011	1	1	4	0	0	6
2012	2	3	1	0	0	6
2013	2	0	1	3	0	6

[a] Regulatory year begins 1 July and ends 30 June (e.g., regulatory year 2009 = 1 July 2009–30 June 2010).

Table 13. Fox River Herd, harvest chronology (DC618), Alaska, regulatory years[a] 2009–2013.

Regulatory year	Harvest periods				Total harvest
	8/10–8/15	8/16–8/31	9/01–9/15	9/16–9/30	
2009[b]					
2010[b]					
2011	0	1	0	0	1
2012	2	0	1	0	3
2013	0	0	1	0	1

[a] Regulatory year begins 1 July and ends 30 June (e.g., regulatory year 2009 = 1 July 2009–30 June 2010).
[b] No season.

Table 14. Kenai Mountains Herd, state harvest (DC001) by transport method, Alaska, regulatory years[a] 2009–2013.

Regulatory year	Transport method: Airplane	Horse	Boat	3–4 wheel ATV/ORV	Highway vehicle	Snowmachine	Other/Unknown	Foot	Harvest
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
2012	1	2	0	0	13	0	8	0	24
2013	0	3	0	0	13	0	3	0	19

[a] Regulatory year begins 1 July and ends 30 June (e.g., regulatory year 2009 = 1 July 2009–30 June 2010).

Table 15. Killey River Herd, harvest (DC608) by transport method, Alaska, regulatory years[a] 2009–2013.

Regulatory year	Transport method: Airplane	Horse	Boat	3–4 wheel ATV/ORV	Highway vehicle	Snowmachine	Other/Unknown	Foot	Harvest
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
2012	4	0	1	0	1	0	0	0	6
2013	2	1	3	0	0	0	0	0	6

[a] Regulatory year begins 1 July and ends 30 June (e.g., regulatory year 2009 = 1 July 2009–30 June 2010).

Table 16. Fox River Herd, harvest (DC618) by transport method, Alaska, regulatory years[a] 2009–2013.

Regulatory year	Transport method								Harvest
	Airplane	Horse	Boat	3–4 wheel ATV/ORV	Highway vehicle	Snowmachine	Other/Unknown	Foot	
2009[b]									
2010[b]									
2011	0	0	1	0	0	0	0	0	1
2012	0	0	3	0	0	0	0	0	3
2013	1	0	0	0	0	0	0	0	1

[a] Regulatory year begins 1 July and ends 30 June (e.g., regulatory year 2009 = 1 July 2009–30 June 2010).
[b] No season.

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CHAPTER 2: CARIBOU MANAGEMENT REPORT

From: 1 July 2012
To: 30 June 2014

LOCATION

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

GEOGRAPHICAL 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. The reindeer herd was managed by residents of Akhiok, under a contract with the U.S. Reindeer Service (Van Daele 2013). The herd ranged in the Cape Alitak and Olga Lakes area, in tundra vegetation that provided the best reindeer habitat on Kodiak.

In spite of various political and biological issues that arose with reindeer in other areas of the state (Hanson 1952), reindeer on Kodiak were thriving and reached a peak of about 3,000 animals by 1950 (Van Daele 2013). The herd declined in size following a catastrophic cabin fire in the early 1950s, which destroyed hundreds of acres of prime reindeer forage. 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, “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.

During 1960–2000, state and federal management of the herd was passive, neither attempting to sustain or eliminate them. 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 (Van Daele 2013).

In 2002 the Alaska Board of Game authorized same-day-airborne hunting and the reported harvest of feral reindeer increased as lodges and transporters began marketing hunts. The increased pressure on the herd prompted concern of overharvest and 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. At this time the feral reindeer were also officially reclassified as “caribou” for game management purposes.

MANAGEMENT DIRECTION

MANAGEMENT OBJECTIVE

- Maintain a population of 200–500 caribou for use by all user groups.

METHODS

We conducted annual aerial observation surveys opportunistically and collected anecdotal information from hunters, air-taxi operators, and commercial and private pilots. We collected data on harvest and hunting effort from mandatory harvest report cards.

RESULTS AND DISCUSSION

POPULATION STATUS AND TREND

Population Size

Aerial observation surveys indicate a stable population of 300–375 caribou in Unit 8 during this reporting period (Table 1). Survey results have been consistent over the past 5 years ranging from 300 to 353 caribou further suggesting population stability. Although most population demographics (e.g., age, gender) are not regularly collected, Kodiak National Wildlife Refuge (NWR) conducted a comprehensive aerial survey throughout the caribou range in 2011 and identified 319 animals (292 adults, 27 calves). In addition, Alaska Wildlife Trooper and survey pilot Alan Jones conducted aerial surveys in 2011, 2012 and 2013 and counted 353, 300, and 319 individuals, respectively. Despite public concern regarding a potential decline in herd size following increased harvest during regulatory year (RY) 2002 (regulatory year begins 1 July and ends 30 June, e.g., RY02 = 1 July 2002–30 June 2003) through RY08, current survey methods did not indicate a substantial population decline. Compared to historical estimates, recent surveys suggest the caribou herd size on Kodiak Island is stable to slightly increasing. Anecdotal information collected from hunters and pilots supports this assertion.

Population Composition

No current information exists on gender or age composition of this herd.

Distribution and Movement

During the time reindeer were actively managed (1924–1961), little to no herd movement occurred on the island as they were kept in large corrals in the Alitak area or allowed to graze in the vicinity of Olga Lakes. After being declared feral (1965), the herd moved gradually to the west and established their primary range in the upper Ayakulik River and lower Sturgeon River drainages (Fig. 1). Although uncommon, they have occasionally ranged as far north as the Karluk River drainage and south to the Olga Lakes area.

MORTALITY

Harvest

Season and Bag Limits	Resident and Nonresident Open Seasons
Unit 8: 1 caribou (either sex).	1 Aug–31 Jan

Caribou are not listed as a federal subsistence species in Unit 8.

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

Harvest by Hunters. The annual caribou harvest during this reporting period was 24 (14 males, 10 females) in RY12 and 15 (14 males, 1 females) in RY13, resulting in a mean harvest of 19.5 caribou/year (14 males, 5.5 females) up from the mean of 17.4 (13.6 males, 3.8 females) during the previous 5 years (RY07–RY11; Table 2).

Hunter Success and Residency. Overall hunter success was 50.0% in RY12 and 31.9% in RY13. The previous 5-year (RY07–RY11) mean hunter success rate was 45.9%. Overall hunter success rate in RY13 was the lowest in over a decade. This reduction in hunter success may be a reflection of reduced hunter effort and is presumably due to the increased number of harvest tags issued annually. More hunters obtained harvest tags in RY13 with the intent of hunting caribou opportunistically than in previous years. Hunters intending to hunt opportunistically tend to report low success rates, potentially greatly reducing overall mean hunter success. Further, RY13 reported the second highest number of total hunters and the highest number of unsuccessful hunters in over a decade further supporting this contention.

In RY12 Alaska residents accounted for 75.0% of the reported harvest (37.5% local residents, 37.5% nonlocal residents) while nonresidents accounted for 25.0% of the harvest during the same year. Interestingly, Alaska residents accounted for 26.6% of the harvest in RY13 (13.3% local residents, 13.3% nonlocal residents) and nonresidents accounted for 66.7%. The remaining 6.7% was from a hunter of unknown residency. During the previous 5 years, Alaska residents accounted for 59.7% of the annual harvest and nonresidents accounted for 32.9% of the annual harvest (7.4% of harvest was of unknown residency; Table 3).

Harvest Chronology. During this reporting period, most of the reported caribou harvested occurred in September (RY12 = 43%, RY13 = 40%) and October (RY12 = 26%, RY13 = 53%; Table 4). This trend in harvest chronology has been consistent for the past decade with exceptions in RY05 and RY10 when the majority of harvest occurred in October and November. Historically, September, October, and November see the greatest number of hunters across the island rationalizing these findings.

Transportation Methods. Aircraft were the predominant method of transportation for caribou hunters in Unit 8 followed by boats (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 (Reynolds and Garner 1987). We rarely receive reports of caribou that died during winter from sources other than hunting. We estimate 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 having little or no anthropogenic influence. No permanent human settlements, infrastructure, or resource extraction activities currently exist. Hunters and fishermen frequent the river corridors and coastal areas seasonally, but have only localized impacts on the habitat. A small fire was inadvertently started at a hunter camp on Halibut Bay in 2009, but was naturally extinguished after burning less than 10 acres.

NONREGULATORY MANAGEMENT PROBLEMS/NEEDS

In 2010, descendants of the Alitak Native Reindeer Corporation requested information from the department on the history of how 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. No further inquiries have occurred since 2010. 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 Kodiak Island followed a different course than other introduced species on the archipelago in that it began as a domestic animal (as part of an economic enterprise), transitioned into an unmanaged feral animal, and ultimately ended up as a big game species managed for sustained yield. While we have not actively managed the herd for most of the past 50 years, the population seems to have reached equilibrium (n = 300–375). The Kodiak Island caribou herd has established its range in what appears to be the most suitable caribou habitat on the archipelago and rarely ventures from the area. However, there is a notable lack of objective information on population dynamics, habitat use, and movements. In addition, because harvest regulations have historically been liberal with no closed season and no bag limit, obtaining accurate harvest and demographic information has been problematic.

The decision to manage the herd as a sustainable population raised interest 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 NWR raised concerns about the impacts on indigenous vegetation and wildlife caused by encouraging a non-native ungulate population to remain and proliferate within the confines of the refuge.

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

- Monitor population status by initiating comprehensive biannual surveys (post-calving in late June–early July, calf survival in late summer–early fall).
- Obtain herd demographic data (e.g., age, gender) during biannual surveys to monitor shifts in population parameters.
- Improve harvest monitoring techniques to ensure hunters obtain and submit accurate harvest tickets and work with Alaska Wildlife Troopers to improve harvest reporting compliance.
- Design and implement a joint ADF&G-Kodiak NWR research program that incorporates GPS radio telemetry and habitat assessment techniques to acquire population dynamics, movements, and habitat use information.

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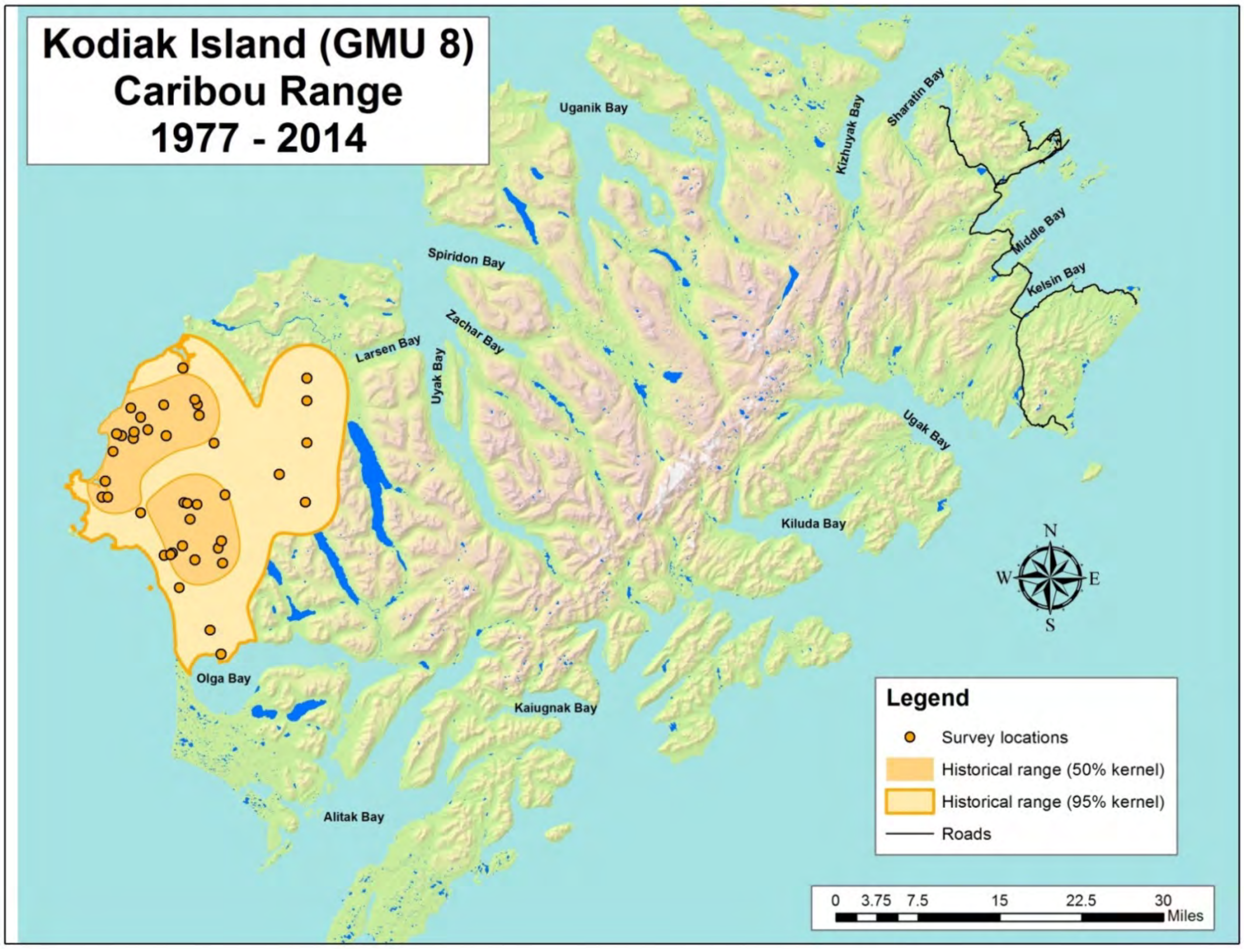

Figure 1. Estimated caribou range for Game Management Unit 8 during 1977–2014 approximated from annual aerial surveys, Kodiak Island, Alaska.

Table 1. Unit 8 aerial composition counts and estimated population, Kodiak Island, Alaska, regulatory years[a] 1924–2013.

Location	Regulatory year	Total caribou observed[b]	Estimated population
Unit 8	1924	32	32[c]
	1930s		500[d]
	1940s		1,400[d]
	1950s	740	3,000[d]
	1960s	768	800[d]
	1970s	250	500[d]
	1980s	225	300[e]
	1990s		250–300[e]
	2000		250–300[e]
	2001		250–300[e]
	2003		250–300[e]
	2004		250–300[e]
	2005		250–300[e]
	2006		250–300[e]
	2007		250–300[e]
	2008	260	250–350[e]
	2009	325	250–350[e]
	2010	336	250–350[e]
	2011	353	300–375[e]
	2012	300	300–375[d]
	2013	319	300–375[e]

[a] Regulatory year begins 1 July and ends 30 June, e.g., regulatory year 2013 = 1 July 2013–30 June 2014.
[b] Maximum number of caribou observed.
[c] Original transplant of domestic reindeer.
[d] Estimates recorded in ADF&G, Alutiiq Museum, and Kodiak National Wildlife Refuge 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).
[e] Based on ADF&G staff estimates.

Table 2. Unit 8 caribou harvest data by permit hunt, Kodiak Island, Alaska, regulatory years[a] 2002–2013.

Hunt area	Regulatory year	Bulls	(%)	Cows	(%)	Unknown	Total harvest[b]
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
	2012	14	(58)	10	(42)	0	24
	2013	14	(93)	1	(7)	0	15

[a] Regulatory year begins 1 July and ends 30 June, e.g., regulatory year 2002 = 1 July 2002–30 June 2003.
[b] Totals do not include illegal and unreported harvest data.

Table 3. Unit 8 caribou hunter residency and success, Kodiak Island, Alaska, regulatory years[a] 2002–2013.

	Successful				Unsuccessful						
Regulatory year	Local[b] resident	Nonlocal resident	Nonresident	Unk	Local[b] resident	Nonlocal resident	Nonresident	Unk	Successful hunters	Unsuccessful hunters	Total harvest[c]
2002	7	2	6	0	1	6	2	0	15	9	18
2003	7	3	1	1	3	8	0	0	12	11	19
2004	7	5	1	1	5	10	0	1	14	16	22
2005	4	6	4	0	2	10	0	0	14	12	17
2006	5	5	4	0	5	16	2	1	14	24	18
2007	13	7	3	0	7	6	2	0	23	15	31
2008	4	4	8	0	4	10	5	0	16	19	18
2009	3	1	5	0	1	7	1	0	9	9	9
2010	9	2	3	0	7	11	6	0	14	24	14
2011	8	2	5	0	9	10	5	2	15	26	15
2012	9	9	6	0	8	6	10	0	24	24	24
2013	2	2	10	1	9	13	10	0	15	32	15

[a] Regulatory year begins 1 July and ends 30 June, e.g., regulatory year 2002 = 1 July 2002–30 June 2003.
[b] Local resident includes hunters who reside in Unit 8.
[c] Totals do not include illegal and unreported harvest data.

Table 4. Unit 8 caribou harvest chronology (%) by month, Kodiak Island, Alaska, regulatory years[a] 2002–2013.

Regulatory	Harvest periods (%)														
year	Aug		Sep		Oct		Nov		Dec		Jan		Other[b]		*n*
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
2012	3	(13)	10	(43)	7	(29)	4	(17)	0	(0)	0	(0)	0	(0)	24
2013	0	(0)	6	(40)	8	(53)	0	(0)	0	(0)	0	(0)	1	(7)	15

[a] Regulatory year begins 1 July and ends 30 June, e.g., regulatory year 2002 = 1 July 2002–30 June 2003.
[b] Includes February–July and all unknown harvest dates.

Table 5. Unit 8 caribou harvest by transport method, Kodiak Island, Alaska, regulatory years[a] 2002–2013.

Regulatory year	Transport method (%)												Total harvest
	Airplane		Horse		Boat		ORV		Highway vehicle		Unknown		
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
2012	21	(87)	0	(0)	3	(13)	0	(0)	0	(0)	0	(0)	24
2013	12	(80)	0	(0)	3	(20)	0	(0)	0	(0)	0	(0)	15

[a] Regulatory year begins 1 July and ends 30 June, e.g., regulatory year 2002 = 1 July 2002–30 June 2003.

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CHAPTER 3: CARIBOU MANAGEMENT REPORT

From: 1 July 2012
To: 30 June 2014

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 described in the journals of agents of the Russian-American Fur Company (Van Stone 1988). In 1818, while traveling through areas now included in 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 1925–1939), 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 MCH's 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 photocensuses 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 photocensus in June 1981, 18,599 caribou were counted, providing an extrapolated estimate of 20,618 caribou. Photocensus estimates of MCH since then have been used to document population size.

MANAGEMENT DIRECTION

MANAGEMENT OBJECTIVES

- Maintain a population of 30,000–80,000 with a minimum bull:cow ratio of 35:100.
- Maintain a harvest of 2,400–8,000.

Additional objective includes

- Manage MCH for maximum opportunity to hunt caribou.

METHODS

ABUNDANCE ESTIMATES

We conducted a photocensus of 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 photocensus conducted during this reporting period was in July 2013. 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, Yukon Delta National Wildlife Refuge and Lake Clark National Park and Preserve; with additional funding provided by the Bureau of Land Management. Biologists, using fixed-wing aircraft, radiotrack caribou 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 de Havilland Beaver (DH-2) or Cessna C-206 aircraft flown by ADF&G staff. We estimate herd size using Rivest et al. (1998), by employing this technique of using radiocollared animals to estimate caribou abundance. This method takes into account collared animals that are located as well as those missed to derive the estimate.

COMPOSITION SURVEYS

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 and a helicopter is used to isolate small groups from the main herd allowing for caribou in each of the following classifications to be tallied: calves, cows, small bulls, medium bulls, and large bulls. Classification of bulls is subjective and based on antler and body size.

CAPTURE OPERATIONS

MCH caribou were captured and radiocollared from 1980 to the present. These capture operations generally occur during late March–early April. Caribou are captured via aerial darting from a helicopter. These are usually cooperative efforts between ADF&G, Togiak National Wildlife Refuge, and Yukon Delta National Wildlife Refuge. During recent years, we have been collaring 20 short-yearling females each spring. This provides us with samples of animals in each age cohort, which in turn allows us to investigate age-specific parameters such as pregnancy and survival. The short-yearlings are weighed and provide an important metric to compare between years as an indirect measure of habitat quality and condition of caribou on the habitat.

PARTURITION SURVEYS

Beginning in May 2000, intensive aerial radiotracking surveys during calving have been conducted to determine the proportion of adult females calving, and more recently, age-specific parturition. A fixed-winged aircraft was used to find calving concentrations and locate individual radiocollared adult females. We attempt to get visuals on as many of the collared females as possible, and record whether they were pregnant (i.e., presence of a calf at heel or retaining hard antlers). Presence of hard antlers prior to calving is generally considered evidence the adult cow is pregnant (Whitten 1995).

RADIOTRACKING

We conducted periodic radiotracking flights throughout the year, mostly associated with parturition surveys, photocensuses, fall composition surveys, and spring captures. Data recorded during general telemetry flights were limited to location and status (live or dead) of each animal, while other more intensive surveys might include presence of a calf or hard antlers (parturition surveys), group size, and aggregation status (photocensus and fall composition).

HARVEST

We monitored the harvest from data collected from statewide harvest reports. During regulatory year (RY) 2012 (regulatory year begins 1 July and ends 30 June, e.g., RY12 = 1 July 2012–30 June 2013) we assessed harvest and effort using at statewide caribou harvest ticket, but in RY13 a registration permit (RC503) was required to hunt Mulchatna caribou. Reminder letters and news releases have been used to increase reporting compliance. We also assisted Alaska State Wildlife Troopers in enforcement during the fall and winter hunting seasons.

RESULTS AND DISCUSSION

POPULATION STATUS AND TREND

Between 1981 and 1996, MCH increased at an annual rate averaging 17%. However, from 1992 to 1994, the annual rate of increase appeared to be 28%, though this may have been an artifact of more precise survey techniques being used at this time. 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. This herd peaked in size during the mid-1990s and by 1999 the summer photocensus indicated the herd had declined from the peak, which probably occurred in 1996 or 1997. Over the next 15 years, this herd experienced a steady decline, and recent photocensuses through summer 2013 indicate this trend has continued.

Population Size

We were able to conduct 2 photocensuses during this reporting period, in both RY12 and RY13. In RY12 the point estimate was 22,809, which continued the trend of a declining herd since the peak in the mid-1990s. The RY13 photocensus estimate was lower still, with a point estimate of 18,308 caribou (Table 1).

Population Composition

In RY12, sex and age composition surveys of the eastern segments of MCH were conducted in all areas east of the Wood-Tikchik Lakes system on 14 October (portions of Units 17C, 17B, and 19B), and of the western population segments in all areas west of the Wood-Tikchik Lakes system (portions of Units 17A and 18) on 15 October. We classified 4,853 caribou overall, with the composition being 23.2 bulls:100 cows and 29.8 calves:100 cows (Table 2). The eastern portion of the herd had 17.4 bulls:100 cows and 22.2 calves:100 cows as compared to the western portion that was substantially higher in both categories, with 29.1 bulls:100 cows and 37.5 calves:100 cows.

In RY13 composition surveys conducted in the eastern segments of the population on 18 October were located almost entirely in Unit 17B with only a few groups found in eastern Unit 17C. The western segment of MCH, in all areas west of the Wood-Tikchik Lakes system, was surveyed on 19 October (portions of Units 17A and 18). We classified 3,222 caribou overall, with the composition being 27.2 bulls:100 cows and 18.6 calves:100 cows. The eastern portion of the herd had 27.4 bulls:100 cows and 13.6 calves:100 cows as compared to the western portion that had 27.0 bulls:100 cows and 23.1 cows:100 cows.

Parturition Surveys

Productivity surveys were flown in May of each year. In RY12, 68 radiocollared female caribou of calf-bearing age (2 years of age and older) were located and visual observations made on the following age classes: 11 2-year-olds, 14 3-year-olds, 15 4-year-olds, and 28 5-years old or older (Table 3). Of the 68 caribou sampled, 48 (71%) were accompanied by calves or had hard antlers. These included 3 of the 2-year-olds, 12 of the 3-year-olds, 10 of the 4-year-olds and 23 of the 5-years old or older cows. The pregnancy rates for the 2- and 3-year-olds suggest these animals are in good condition, and that the population as a whole is at a high level of productivity.

In RY13 we visually observed 55 radiocollared female caribou of calf bearing age including 5 2-year-olds, 8 3-year-olds, 11 4-year-olds, and 31 5-years old or older. Of the 55 caribou sampled, 48 (87%) of these were accompanied by calves or had hard antlers. These included 3 of the 2-year-olds, 8 of the 3-year-olds, 11 of the 4-year-olds, and 26 of the 5-years old or older. Although the sample size for 2-year-olds was only 5 animals, the fact that 3 of these or 60% were pregnant is a positive sign for continued good productivity in this herd.

Caribou Capture

In April 2013 we captured and radiocollared 10 short-yearling female caribou, 5 adult females, and 9 adult bulls. The captures were evenly divided between the western (Unit 18) and eastern (Units 9B and 17B) ranges of MCH. In April 2014 we captured and radiocollared 21 short-yearling female caribou, 1 adult female, and 10 adult bull caribou. As in 2013, these captures were evenly divided between the east and west ranges of MCH. All short-yearling females were weighed for comparison of body condition over time (Table 4).

Short-Yearling Weights

Body weights are recorded for all 10.5-month-old (i.e., short-yearling), female caribou captured and radiocollared. Short-yearling female weights from spring 2013 and 2014 continued to be much heavier than during both the peak of the population and the rapid decline of the herd (Table 4). In 2013, female short-yearlings averaged 127 lb (range 103–149 lb); in 2014, short-yearling females averaged 128 lb (range 107–142 lb).

Distribution and Movements

Wintering Areas. The most significant wintering area for 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. Analysis of radiotelemetry data indicated 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 MCH began wintering in Unit 18 south of the Kuskokwim River and southwestern Unit 19B in increasing numbers.

As has been the case in recent years, during RY12, and again in RY13, 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 to overwinter. The remainder of the caribou stayed on the eastern side of the Tikchik Mountains and were scattered in the Nushagak and Mulchatna drainages over the course of the winter.

Calving Areas. There has been considerable variation in calving areas over the past 30 years for MCH. Taylor (1988) noted the main calving area for 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 Unit 18. Since that time and up to this reporting period, calving areas on the east side of MCH's range have ranged as far north at the Holitna and Hoholitna rivers in Units 19A and 19B (2004), to as far south as the Kokwok River in Unit 17C (2014). In recent years however the main calving areas have been divided into a northern and southern group, east of the Tikchik Mountains. The northern group has been in the area of Tundra Lake, just south of Lime Village in Unit 19A, while the southern group has been south and west of Koliganek in Units 17B and 17C.

During the first year of this reporting period (RY12), the calving sites mimicked those of the previous few years with the northern site being centered on Tundra Lake and the southern site being south and west of Koliganek. This changed somewhat dramatically in RY13, when the northern calving group that had been centered on Tundra Lake the last dozen years, moved south and east to the Bonanza Hills to calve (approximately 60 miles distance). The southern calving group was in their more traditional location being south and west of Koliganek. The large movement by the northern calving group is a mystery, but one that returned them to an area where they had traditionally calved in the early 2000s. During this reporting period, a few of the radiocollared females remained west of the mountains in western Unit 17B and Unit 18 during calving, but we did not have the resources to investigate calving in those areas.

Seasonal Movements. MCH generally does not move en masse as a distinct herd, nor do individuals move to predictable places at predictable times. 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. Over the last several years, some caribou that wintered in the western side remained in Unit 18 to calve, while most of the caribou that winter in Unit 18 migrated east and through the mountains to calve east of the Tikchik Mountains almost entirely in the southern calving group.

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 to minimize insect harassment. In the fall, the caribou again begin forming large groups in the eastern and western parts of the herd's range where they will spend the winter.

Based on observation of movements by radiocollared caribou from 2000 through 2008, it did not appear that individual caribou had any particular affinity to either of the 2 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 has not been evident during the past 8 years, when nearly all the radiocollared cows that wintered on the east side of the range traveled north to calve in the

Tundra Lake area or the Bonanza Hills; and nearly all the radiocollared cows that wintered in the west traveled east to the Kemuk Mountain-southwest Koliganek area, with the exception of a handful of radiocollared cows that apparently calved in eastern Unit 18.

Similarly, nearly all the radiocollared caribou that calved in the Kemuk Mountain or Koliganek area traveled west to winter in Unit 18, and nearly all the caribou that calved near Tundra Lake or the Bonanza Hills wintered on the east side of the herd's range. Although there is some crossover by individual animals, this pattern of separation generally holds true.

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 MCH until the mid-1990s. These subsidiary herds periodically intermingled with the main herd but remained within their traditional ranges. As 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 MCH's range, some remaining distinct from the larger groups with others intermingling during calving. Most notably there seems to be a group of caribou that are seen routinely on the south side of Iliamna Lake, though our best estimate based on anecdotal observations would be in the hundreds rather than thousands.

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	
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

Season and bag limit	Resident open season	Nonresident 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 Unit 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
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

Alaska Board of Game Actions and Emergency Orders. During the spring 2013 meeting, the Alaska Board of Game passed a proposal to replace the caribou harvest ticket with a registration permit for hunting Mulchatna caribou, this included Units 17, 18, 19A&B, 9A&B, and a portion of 9C. This regulation went into effect 1 July 2013.

Harvest by Hunters. The reported harvest from returned harvest report cards for MCH was 339 caribou during the RY12 hunting season and 114 during RY13 (Table 5). The most important factor in the low harvest in RY13 was lack of access to the caribou due to low snowfall and an almost nonexistent spring hunt which is when most caribou are taken. These totals and the number of hunters reporting hunting Mulchatna caribou continued to decline from previous years. Sex ratio of the animals reported taken varies considerably from year to year though bulls continue to make up the majority of the harvest. Since most caribou in recent years have been harvested during the late winter when bulls no longer carry antlers, the selection for bulls almost certainly is related to their larger body size and potential to provide more meat when compared to smaller-bodied cows.

The reported harvest of caribou in MCH is only a portion of what is taken, but what that missing proportion of unreported harvest is remains unknown. In the 1990s when as many as 5,000 caribou were reported to have been taken in a given year, the unreported harvest was estimated at 1,500–2,500 caribou. Today, with the population and harvest at a much lower level one would expect the unreported harvest to be lower as well. Changes in caribou distribution from year to year and variable snow cover necessary 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. The recent regulatory change that required a registration permit to hunt Mulchatna caribou beginning in July 2013 may help with hunt and harvest reporting and provide us with better information on the true level of harvest.

Hunter Residency and Success. Local Alaska residents (living within the range of MCH) made up 76% of those hunters who reported hunting during both RY12 and RY13 (Table 6). Nonlocal Alaska residents accounted for 20% of the reporting hunters during RY12 and 22% during RY13. MCH is not open to nonresident hunters. Of the reporting hunters 57% successfully harvested at least 1 caribou in RY12; in RY13, 21% were successful. The low success in RY13 was related to lack of access during the late winter months due to lack of snow.

Harvest Chronology. Prior to RY06 when MCH was much larger than present, and transporters and guides hauled in hunters who were most often searching for large antlered bulls, much of the reported annual harvest occurred during August and September. It is at this time when the antlers are fully developed (with or without velvet) that bulls are at peak trophy value. However, the percentage of the reported annual harvest during fall months has been declining steadily over time. In RY12 only 10% of the harvest was recorded in August and September, while February and March accounted for 68% of the harvest. This change in the pattern of harvest chronology is due to the transition to a more local hunt where hunters from this area pursue caribou during the late winter months via snowmachines. Good snow cover allows hunters to access terrain in any direction, and with the advent of faster and more reliable snowmachines in recent years, hunters can be highly successful under the right conditions.

During RY13 the harvest chronology was nearly opposite of RY12. The fall harvest increased to 44% while the harvest in February and March was only 16% of the total take. This diversion from the recent trend is easily explained. During winter RY13 very little snow fell and access by snowmachine was almost nonexistent – and the spring harvest reflected this lack of access. The reason for the high fall harvest for RY13 is not because of a change in hunting patterns, but rather a complete lack of a spring harvest that by default inflated the magnitude of the fall harvest (Table 7).

Transport Methods. Aircraft were traditionally the most common means of transportation for MCH hunters, but have been replaced in recent years by snowmachines. During the RY12 hunting season only 9% of the hunters reported using aircraft, while 87% reported using snowmachines. This was a more typical Bristol Bay winter with adequate snow cover for winter travel. In the RY13 season however, 36% of the hunters reported using aircraft while 36% also reported using snowmachines (Table 8). This increasing use of snowmachines is reasonable considering the change in reported harvest chronology to the late winter months. What is most telling in this table for RY13 is the increase in boats and all-terrain vehicles as means of access for successful hunters. Both of these methods of access replaced snowmachines during the winter and spring of RY13.

Other Mortality

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 spring 2011–spring 2014 in 2 calving areas, the Kemuk Mountain-Koliganek area in Units 17B and 17C; and the Tundra Lake-Bonanza Hills area in Units 19A, 19B and 17B. Survival rate of calves from birth to 4 months of age was 61% in the Kemuk Mountain-Koliganek area and 34% in the Tundra Lake-Bonanza Hills area. Over the 4 years of the study, approximately 82% of the mortality in the northern calving ground was predation related, with bears and wolves making up the majority of predation. However, in spring 2014 when the northern group moved to the Bonanza Hills to calve, golden eagles were the most significant predator. In the southern calving area, 68% of mortalities were linked to predation, with bears and wolves again being the most significant predators. In both groups, drowning was a leading cause of nonpredation mortality. The calving areas have small creeks with steep banks hidden in long grass that is deadly for the calves because they have little chance of climbing out once they fall in.

The specific causes for lower survival rates and the subsequent population decline from the late 1990s to present 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 (Northern Alaska Peninsula herd and Southern Alaska Peninsula herd) 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 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 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 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 MCH 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 show signs of heavy use from the period of high density, although few caribou are now present in that area through the winter. Many of the areas that 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.

CONCLUSIONS AND RECOMMENDATIONS

The minimum postcalving population estimates during this reporting period were 22,809 and 18,308 during RY12 and RY13 respectively. This continues the trend of declining abundance since peak numbers of ~200,000 caribou in 1996.

Distribution of this herd continued to be widespread throughout this reporting period. Fall composition count ratios have varied in recent years, but generally have been substantially lower than during the period of rapid herd growth during the late 1980s and early to mid-1990s.

The habitat being used by MCH caribou seems to be in excellent condition given that our indices of parturition rates, age of first reproduction, and weights of short yearlings all are indicative of a healthy herd.

The total reported harvest and the number of hunters afield continued to decline from long-term trends during this reporting period. The change from a general season harvest ticket to a registration permit (RC503) in RY13 will hopefully help with reporting compliance and better information on harvest and effort as we go forward.

MCH continues to present new management challenges as its size and range change. With the decline in population size, the productivity and condition of this herd as measured by pregnancy rates and weights of short yearling females, suggest this herd is in good condition physically with good reproductive potential. These indices provide optimism that this herd is capable of growing in size, barring mortality factors that could offset the reproductive potential we are seeing.

Recommended management actions for the next few years include

1. Conduct an annual photocensus during postcalving aggregations.

2. Conduct annual October composition surveys in both the east and west ranges.

3. Conduct calving-parturition surveys in May of each year.

4. Continue to collar a sample of short-yearling females each spring.

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

6. Continue to deploy SAT collars to provide herd movement and location data.

7. Work toward improved harvest reporting.

8. Continue to work with other land and resource management agencies and landowners toward management of this herd.

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Table 1. Mulchatna caribou herd estimated population size, Southwest Alaska, calendar years 1991–2013.

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
1994	28–29 June	150,000	168,351	180,000
1996	28 June–3 July	200,000	192,818	200,000
1999	8 July	160,000–180,000	147,012	175,000
2001	30 June 2002		121,680	147,000
2004	7 July		77,303	85,000
2006	11 July		40,766	45,000
2008	7 July		20,545	30,000
2012	6 July		15,443	22,809
2013	12 July		12,660	18,308

[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, Southwest Alaska, calendar years 1978–2013.

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]
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	4,592	
2011	21.7	19.0	13.5	71.1	32.2	41.3	26.5	15.4	5,282	
2012	23.2	29.8	19.5	65.3	38.3	38.1	23.6	15.2	4,853	22,809
2013	27.2	18.6	15.4	66.6	37.3	43.0	19.7	18.0	3,222	18,308

[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, Southwest Alaska, calendar years 2000–2014.

	2-yr-old		3-yr-old		4-yr-old		5+ yr-old		
Calendar year	No. radios[a]	No. pregnant	No. radios[a]	No. pregnant	No. radios[a]	No. pregnant	No. radios[a]	No. pregnant	Total caribou located
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
2013	11	3	14	12	15	10	28	23	68
2014	5	3	8	8	11	11	31	26	55

[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, Southwest Alaska, calendar years 1994–2014.

Calendar year	Season[a]	Avg. weight (lb)	No. of calves
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	18
2012	Spring	119.1	13
2013	Spring	127.0	14
2014	Spring	128.0	14

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

Table 5. Mulchatna caribou reported harvest from harvest report cards, Southwest Alaska, regulatory years[a] 1991–2013.

Regulatory	Reported harvest by hunters			
year	Male	Female	Unk	Total[b]
1991	1,353	203	17	1,573
1992	1,184	149	269	1,602
1993	2,268	523	13	2,804
1994	2,631	651	19	3,301
1995	3,345	1,076	28	4,449
1996	1,845	497	24	2,366
1997	2,277	411	16	2,704
1998[c]	3,936	809	25	4,770
1999	3,411	1,019	37	4,467
2000	3,272	789	35	4,096
2001	2,771	1,042	17	3,830
2002	1,875	646	16	2,537
2003	2,047	1,103	32	3,182
2004	1,223	997	16	2,236
2005	1,044	1,118	13	2,175
2006	508	406	7	921
2007	404	353	10	767
2008	256	253	1	510
2009	213	102	6	321
2010	250	220	4	474
2011	233	240	9	482
2012	174	162	3	339
2013	78	34	1	113

[a] Regulatory year begins 1 July and ends 30 June, e.g., regulatory year 1991 = 1 July 1991–30 June 1992.
[b] Includes only reported harvest from harvest cards.
[c] First year that reminder letters were sent to caribou hunters.

Table 6. Mulchatna caribou annual hunter residency and success, Southwest Alaska, regulatory years[a] 1991–2013.

	Successful				Unsuccessful				
Regulatory year	Local resident[b]	Nonlocal resident	Nonresident	Total (%)	Local resident[b]	Nonlocal resident	Nonresident	Total (%)	Total hunters[c]
1991	89	562	599	85	9	136	69	15	1,464
1992	82	542	651	91	12	82	26	9	1,391
1993	47	718	725	85	5	171	77	15	2,394
1994	61	812	896	83	11	227	124	17	2,954
1995	52	1,035	928	87	15	188	86	13	3,127
1996	56	647	824	85	25	139	101	15	1,822
1997	85	564	1,277	84	33	178	152	16	2,301
1998	178	1,130	1,877	78	142	320	414	22	4,131
1999	174	1,024	1,697	72	120	453	553	28	4,039
2000	188	817	1,713	68	148	427	691	32	3,989
2001	270	843	1,377	74	159	351	368	26	3,406
2002	169	556	1,028	63	210	383	450	37	2,831
2003	312	762	1,111	71	181	352	378	29	3,129
2004	256	573	764	62	133	357	501	38	2,634
2005	418	427	485	56	229	322	497	44	2,405
2006	207	208	273	53	182	207	226	47	1,312
2007	334	148	125	58	184	163	105	42	1,084
2008	269	130	61	54	165	140	85	46	850
2009	180	63	0	49	197	82	0	53	540
2010	270	58	0	58	174	66	0	42	589
2011	305	87	0	70	115	53	0	30	575
2012	279[d]	48	3	59	155	67	7	41	572
2013	88[d]	24	1	20	328	96	3	80	545

[a] Regulatory year begins 1 July and ends 30 June, e.g., regulatory year 1991 = 1 July 1991–30 June 1992.
[b] Includes residents of communities within the range of the Mulchatna caribou herd.
[c] 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 1 caribou.
[d] Data from ADF&G's Wildlife Information Network (WinfoNet) harvest information. Local resident includes residents of communities within Game Management Units 9B, 17AB&C, 18, and 19A&B.

Table 7. Mulchatna caribou annual harvest chronology percent by month[a], Southwest Alaska, regulatory years[b] 1991–2013.

Regulatory	Harvest chronology percent by month										
year	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	Total[c]
1991		29.0	43.0	6.0	0.4	2.0	1.0	4.0	12.0	0.0	1,573
1992		30.0	54.0	5.0	1.0	0.3	0.2	1.0	8.0	0.0	1,602
1993		36.0	50.0	5.0	0.4	1.0	1.0	1.0	5.0	2.0	2,804
1994		35.0	50.0	5.0	0.4	1.0	1.0	1.0	5.0	2.0	3,301
1995		33.0	50.0	6.0	1.0	2.0	1.0	1.0	5.0	2.0	4,449
1996		25.0	52.0	5.0	1.0	1.0	1.0	2.0	11.0	2.0	2,366
1997		33.0	53.0	4.0	0.3	0.4	1.0	3.0	4.0	0.3	2,704
1998		25.0	55.0	6.0	0.6	0.6	2.0	2.0	7.0	1.0	4,770
1999	0.1	24.0	52.0	5.0	0.5	1.0	3.0	5.0	8.0	2.0	4,467
2000	0.2	27.0	55.0	6.0	0.3	0.3	2.0	3.0	4.0	1.0	4,096
2001	0.2	23.0	49.0	3.0	1.0	2.0	2.0	4.0	9.0	5.0	3,830
2002	0.2	23.0	55.0	4.0	0.6	1.0	3.0	2.0	6.0	2.0	2,537
2003	0.2	19.0	45.0	4.0	0.5	4.0	5.0	5.0	12.0	2.0	3,182
2004	0.2	20.0	46.0	2.0	1.0	2.0	2.0	2.0	10.0	9.0	2,236
2005	0.2	15.0	32.0	2.0	4.0	2.0	3.0	6.0	25.0	7.0	2,175
2006		13.0	38.0	1.0	3.0	5.0	4.0	10.0	21.0	1.0	921
2007		3.0	26.0	2.0	2.0	6.0	7.0	28.0	26.0	1.0	767
2008		3.0	23.0	3.0	5.0	4.0	6.0	25.0	30.0		510
2009		7.0	12.0	7.0	17.0	5.0	9.0	10.0	30.0		328
2010		3.0	7.0	1.0	3.0	14.0	7.0	19.0	44.0		474
2011		2.0	9.0	2.0	4.0	2.0	18.0	18.0	43.0		482
2012		3.0	7.0	1.0	2.0	12.0	6.0	16.0	52.0		336
2013		16.0	28.0	8.0	18.0	12.0	2.0	8.0	8.0		106

[a] July opening date for Unit 9B established starting 1 July 1999. Starting 2006, opening date 1 August. Starting 2008, all closing dates 15 March.
[b] Regulatory year begins 1 July and ends 30 June, e.g., regulatory year 1991 = 1 July 1991–30 June 1992.
[c] From harvest report cards. Includes unknown harvest date.

Table 8. Mulchatna caribou harvest percent by transport method, Southwest Alaska, regulatory years[a] 1991–2013.

Regulatory year	Harvest percent by transport method								Total caribou[c]
	Airplane	Horse	Boat	3- or 4-Wheeler	Snowmachine	ORV[b]	Highway vehicle	Unknown	
1991	81.0	0.2	9.0	1.0	9.0	0.1	0.2	2.0	1,573
1992	88.0	0.2	8.0	3.0	3.0	0.1	0.1	0.0	1,602
1993	86.0	1.0	10.0	1.0	2.0	0.3	1.0	0.0	2,804
1994	85.0	0.2	12.0	1.0	2.0	0.0	0.2	0.2	3,301
1995	88.0	0.2	9.0	1.0	2.0	0.1	0.1	0.0	4,449
1996	82.0	0.4	10.0	2.0	3.0	0.3	0.7	1.0	2,366
1997	86.0	0.4	8.0	1.0	2.0	0.1	0.2	2.0	2,704
1998	82.0	0.1	10.0	2.0	3.0	0.1	1.0	1.0	4,770
1999	85.0	0.3	6.0	2.0	5.0	0.2	0.7	1.0	4,467
2000	87.0	0.2	6.0	1.0	5.0	0.1	0.1	0.6	4,096
2001	79.0	0.1	7.0	2.0	11.0	0.2	0.2	0.8	3,830
2002	82.0	0.2	8.0	3.0	5.0	0.0	0.0	0.2	2,537
2003	73.0	0.0	6.0	2.0	19.0	0.1	0.0	0.7	3,182
2004	74.0	0.0	7.0	1.0	17.0	0.0	0.0	0.9	2,336
2005	55.0	0.4	6.0	3.0	34.0	0.2	0.3	1.0	2,175
2006	61.0	0.4	7.0	4.0	27.0	0.2	0.3	0.5	921
2007	27.0	0.1	4.0	9.0	58.0	0.5	1.0	0.6	767
2008	23.0	0.0	3.0	10.0	63.0	0.0	0.0	1.0	510
2009	16.0	0.0	7.0	1.0	71.0	1.0	0.0	2.0	328
2010	9.0	0.0	4.0	2.0	85.0	0.4	0.0	0.4	474
2011	10.0	0.4	4.0	4.0	79.0	0.1	0.0	0.4	482
2012	9.0	0.0	1.0	2.0	87.0	1.0	0.0	0.0	339
2013	36.0	0.0	14.0	13.0	36.0	1.0	0.0	0.0	110

[a] Regulatory year begins 1 July and ends 30 June, e.g., regulatory year 1991 = 1 July 1991–30 June 1992.
[b] ORV = off-road vehicles.
[c] From harvest report cards. Includes harvest by unknown transport method.

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CHAPTER 4: CARIBOU MANAGEMENT REPORT

From: 1 July 2012
To: 30 June 2014

LOCATION

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

HERD: Northern Alaska Peninsula

GEOGRAPHIC DESCRIPTION: Alaska Peninsula

BACKGROUND

The Northern Alaska Peninsula (NAP) caribou herd is a relatively small but dynamic herd that ranges from the Naknek River drainage to Port Moller. The herd is important to residents of the Alaska Peninsula as food and for many other nonconsumptive values. Historically, the NAP population has fluctuated widely in size, from 2,000 to 20,000 animals. Peaks of 20,000 occurred around 1899 and in the early 1940s. A crash occurred during the late 1940s when the population dropped to around 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; by 1984 the herd again peaked at approximately 20,000 animals. With the NAP population at this high level, the traditional boundary between wintering grounds of NAP and the Mulchatna caribou herd (MCH) began to blur. By 1986 a portion of NAP began annually wintering between the Naknek River and Lake Iliamna—well north of their traditional wintering grounds—some years with several thousand NAP animals moving into the area (Sellers 1990, 1995). Biologists believed that excellent forage conditions north of the Naknek River would sustain NAP within the population objective of 15,000–20,000. However, at about the same time up to 50,000 caribou from MCH also began wintering in this area (Sellers 1999). Given this change in winter distribution of both herds, and the increasing competition for winter forage, by the late 1980s biologists decided that NAP should be maintained at the lower end of the management objective—i.e., 15,000 caribou. Ultimately, a population objective of 12,000–15,000 was adopted.

During the late 1980s and 1990s there were multiple factors providing evidence that habitat on NAP's range was under moderate stress, including an observed depletion of lichens; low pregnancy rate and calf weights; high prevalence of lungworms; departure of NAP caribou from traditional wintering grounds (with the exception of mild winters); and increase in body size of NAP caribou after being transplanted to ungrazed range on the Nushagak Peninsula (Sellers 1999; Sellers et al. 2000). During regulatory year (RY) 1993 (regulatory year begins 1 July and ends 30 June, e.g., RY93 = 1 July 1993 through 30 June 1994), a record harvest of 1,345 caribou—in part because of road and trail access from King Salmon and Naknek—and natural mortality estimated at >30% combined to reduce the population of NAP from 15,000 to 12,500.

The herd underwent a continued gradual decline to about 2,000 by 2008 (Butler 2009). The herd experienced extremely poor recruitment from 2003 through 2008 as a result of poor calf production and survival. Although indications of nutritional limitations were still evident in 2007, predation became increasingly important in the decreasing herd size. Recruitment began improving in 2009, and ratios of calves:100 cows and bulls:100 cows began slowly improving from 2009 to present.

As the population declined, NAP changed distribution patterns in winter and summer. By 2000, few NAP caribou moved north of the Naknek River into MCH winter range, and by 2004 calving became dispersed with more occurring in mountainous terrain rather than the customary calving grounds between Bear and Cinder Rivers on the Bering Sea flats.

The average annual mortality rate for collared cows during 1980–1984 as the population approached peak size was approximately 7%. Mortality rate increased to 18% during 1985–1989 when NAP numbered about 20,000, and to 25% during 1992–1998 as the population began declining. Annual mortality rates of adult females ranged from 7% to 18% during 2001–2003. 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. Analysis indicated that parasite removal increased pregnancy rates. However, effects of parasite removal on body condition were not biologically significant.

In response to the declining population, biologists evaluated intensive management options for NAP in 1999, 2004–2005, and 2007–2009 and concluded that no viable solutions existed to alter the status of this herd (Butler 2009). A Tier II hunting program was instituted the same year to restrict harvest in 1999, but by 2005 hunting was closed entirely and remains so to present. The major impediments to creating a successful intensive management plan included nutritional limitations, and predator control restrictions imposed on federal lands. In March 2010 the Alaska Board of Game authorized a predator control program under the intensive management law which became active in January 2012. Only 15 wolves were taken under the intensive management program compared to 145 wolves harvested under regular hunting and trapping regulations during RY10–RY12.

During the 1998 study, 35% of radiocollared calves (n = 37) died during their first month of life (Sellers et al. 1998a). Predators, primarily brown bears (*Ursus arctos*), bald eagles (*Haliaeetus leucocephalus*), and wolves (*Canis lupus*) caused most of the mortality of calves <2 weeks old, but disease apparently was an important mortality factor in calves >3 weeks old. During a 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 (Butler 2009). 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).

Age-specific productivity was monitored during 1997–1999 (Valkenburg et al. 1996; Sellers et al. 1998a, 1998b, 1999, and 2000). Overall, this work demonstrated that NAP was under moderate nutritional stress. No 2-year-old females have produced calves (*n* = 32), and only 33% of 3-year-olds (*n* = 18) have been pregnant. Overall pregnancy rates were relatively low at 57% to 78% for cows over 2 years of age during 2005–2008.

Ratios of population composition varied widely as NAP increased and decreased in size (Butler 2009). During 1970–1980 when NAP was growing, the average fall calf 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). From 1990 to 2004, the bull:cow ratio averaged 41:100 (range 31–49), but the ratio dropped to an average of 23 bulls:100 cows from 2005 to 2009 (range 19–27, Table 1) despite hunting closures. From 2003 to 2009 fall calf ratios were the lowest ever recorded for this herd, with an average of 9 calves:100 cows (range 7–16, Table 1). It is likely that poor calf recruitment since 2003 and the relatively short lifespan of bulls compared to cows have decreased the bull:cow ratio in this herd (Butler 2009).

MANAGEMENT DIRECTION

MANAGEMENT OBJECTIVE

- Maintain a population objective of 12,000–15,000 caribou with an October sex ratio of at least 35 bulls:100 cows.

METHODS

POPULATION STATUS AND TREND

Population Size

We conducted aerial surveys to assess population size (i.e., minimum count) in October when weather allowed during this reporting period. In previous years, biologists sometimes conducted population counts during the postcalving period, assisted by the use of photography when postcalving groups are much larger and more difficult to count. Fixed-winged aircraft pilots located caribou groups with radiotelemetry equipment, and biologists aboard a helicopter counted and determined composition of each group. We assessed survey comprehensiveness using the proportion of radiocollared caribou encountered relative to total radiocollared caribou. A minimum count was rejected if we considered sample size or survey coverage inadequate, usually because of poor weather conditions over a portion of the range. Adjusted minimum counts were calculated by dividing the minimum count by the proportion of radiocollared caribou observed.

Population Composition

We conducted sex and age composition surveys during October between Whale Mountain and Port Moller using the above methods. Caribou were classified as calves, cows, and small, medium, or large bulls.

Parturition Surveys

We flew parturition surveys in late May or early June using the above methods. We classified 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 potentially document age-specific pregnancy rates.

Radiotelemetry Data

Caribou were captured and marked with radio collars with the help of funding provided by U.S. Fish and Wildlife Service, Office of Subsistence Management. During each capture, standard measurements and blood samples were taken when feasible. Herd distribution and survival rates are monitored periodically by radiotracking of collared animals. The 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.

Mortality

With the exception of a few ceremonial harvests, hunting for caribou has been closed since 2005.

RESULTS AND DISCUSSION

POPULATION STATUS AND TREND

Population Size and Composition

Department staff conducted composition surveys of NAP in October 2012 and 2013 (Table 1). Although caribou have failed to form large aggregations in recent years, radio collars have been useful in locating adequate samples for the composition count. Based on the number of caribou observed during fall composition surveys the population size of NAP was slowly increasing, as have calf:cow and bull:cow ratios (Table 1).

Parturition Surveys

We flew a 2-day parturition survey (30–31 May 2014) on NAP under cloudy to partly cloudy conditions, light winds, and no volcanos erupting. A low ceiling prevented access to caribou range above approximately 1,000 feet elevation. As a result, we detected only 47% (17 of 36) of active cow collars and obtained visuals on 3 collars. The overall pregnancy rate for NAP was 66% based on an evaluation of 100 cows that were 2 years of age and older, out of a total 259 caribou observed. There was no difference in pregnancy rates between the southern and northern portions of the herd. This was substantially lower than the previous 5-year (2008–2012) average of 81%. We think that this rate was biased low because of our inability to see cows at higher elevations where many have calved in recent years; and that we counted nearly equal numbers of bulls (98) and cows (100) on this survey compared to 31 bulls:100 cows last October. In addition, as this population grows we can expect a somewhat reduced pregnancy rate before young cows reach breeding age.

We observed a difference in phenology of calving periods between NAP where most calves were too old to capture on foot at the end of May, and the southernmost Unimak Island herd where calving was just beginning. Plant phenology observed south of Port Moller was substantially later than that of NAP (Pitcher et al. 1990).

Radiotelemetry Data

We captured 9 cows during April 2013 between the Ugashik and King Salmon River drainages. Body condition of the cows handled was judged to be good to excellent.

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.

The intensive management program to control wolf predation has been unsuccessful on NAP. Intensive management harvest has been low (i.e., 15 wolves versus 204 by regular hunters and trappers, including 55 by nonresidents) during the 2010–2013 operational period. Fuel and operating costs incurred by participants is high, and staff time and paperwork are substantial. We believe that the program fails a simple cost-benefit analysis, particularly when considering that nonresident hunters on the ground have killed nearly 4 times the number of wolves as the aerial predator control program.

Alaska Board of Game Actions and Emergency Orders. There were none during the reporting period.

Harvest by Hunters. Four bull caribou were harvested under ceremonial permits during the reporting period (Table 2).

Hunter Residency and Success. The few caribou harvested were by local residents for educational and ceremonial purposes (Table 3).

Harvest Chronology. Caribou were harvested during winter months (Table 4) using snowmachines (Table 5).

CONCLUSIONS AND RECOMMENDATIONS

Population metrics of NAP indicated an upward trend and improving bull and calf ratios during the reporting period. Assuming this trend continues we recommend opening a Tier II drawing hunt for residents only in RY16. We recommend discontinuing the unsuccessful intensive management program to control wolf predation.

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Table 1. Northern Alaska Peninsula caribou herd fall composition counts and estimated population size, Southwest Alaska, regulatory years[a] 1990–2013.

Regulatory year	Bulls: 100 cows	Calves:100 cows	Calves (%)	Cows (%)	Proportion of bulls (%) Small	Medium	Large	Total bulls (%)	Composition sample size	Estimate of herd size
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[b]
2009	19	16	12	74	30	35	35	14	2,126	2,300[b]
2010	25	18	13	70	30	31	39	17	1,795	
2011	26	20	13	69	26	37	37	18	2,395	
2012	28	22	15	66	24	37	40	19	2,076	2,400[c]
2013	31	21	14	66	26	41	33	20	2,295	2,700[c]

[a] Regulatory year begins 1 July and ends 30 June, e.g., regulatory year 1990 = 1 July 1990–30 June 1991.
[b] Minimum population estimate based on fall composition surveys that were not designed to estimate population size.
[c] Adjusted minimum count from October composition survey adjusted by proportion of radiocollared caribou detected.

Table 2. Northern Alaska Peninsula caribou herd harvest, Southwest Alaska, regulatory years[a] 2003–2013.

Regulatory year	Harvest by hunters: Reported M	(%)	F	(%)	Unk	Total	Estimated unreported	Illegal	Estimated total[b]
2003	118	(95)	6	(5)	0	124	75		200
2004	31	(94)	2	(6)	1	34	30		60
2005[c]						0			0
2006[c]	1	(100)				1	0	15	16
2007[c]	1	(100)				1	0	15	16
2008[c]						0	0	15	15
2009[c]						0	0	15	15
2010[c]	3	(100)				3	0	15	18
2011[c]	3	(100)				3	0	15	18
2012[c]						0	0	15	15
2013[c]	4	(100)				4	0	15	19

[a] Regulatory year begins 1 July and ends 30 June, e.g., regulatory year 2003 = 1 July 2003–30 June 2004.
[b] Estimated total is rounded off.
[c] No Tier II permits issued.

Table 3. Northern Alaska Peninsula caribou herd annual hunter residency and success, Southwest Alaska, regulatory years[a] 2003–2013.

	Successful					Unsuccessful					
Regulatory year	Local resident[b]	Nonlocal resident	Nonresident	Total[c]	(%)	Local resident[b]	Nonlocal resident	Nonresident	Total[c]	(%)	Total hunters[c]
2003	111	13	0	124	(72)	39	10	0	49	(28)	173
2004	34	0	0	34	(69)	13	2	0	15	(31)	49
2005[d]				0	(0)				0	(0)	0
2006[d]	1			1	(100)				0	(0)	1
2007[d]	1			1	(100)				0	(0)	1
2008[d]				0	(0)				0	(0)	0
2009[d]				0	(0)				0	(0)	0
2010[d]	3			3	(100)				0	(0)	3
2011[d]	3			3	(100)				0	(0)	3
2012[d]	0			0	(0)				0	(0)	0
2013[d]	4			4	(100)				0	(0)	4

[a] Regulatory year begins 1 July and ends 30 June, e.g., regulatory year 2003 = 1 July 2003–30 June 2004.
[b] Local residents are residents of Units 9A, 9B, 9C, and 9E.
[c] Includes hunters of unspecified residency.
[d] Tier II hunt closed until herd recovers sufficiently.

Table 4. Northern Alaska Peninsula caribou annual harvest chronology percent by month, Southwest Alaska, regulatory years[a] 2004–2013.

Regulatory	Harvest chronology percent by month									
year	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	*N*
2004	21	14	0	7	28	7	0	0	24	29
2005[b]										0
2006						100				1
2007						100				1
2008										0
2009										0
2010								33	67	3
2011				33			67			3
2012										0
2013							50	50		4

[b] Season closed after 2004.

Table 5. Northern Alaska Peninsula caribou harvest percent by transport method, Southwest Alaska, regulatory years[a] 2004–2013.

Regulatory year	Harvest percent by transport method							
	Airplane	Horse	Boat	3- or 4-Wheeler	Snowmachine	ORV[b]	Highway vehicle	Other
2004			18	44	26	6	6	
2005[c]								
2006								100
2007								100
2008								
2009								
2010					100			
2011					100			
2012					100			
2013					100			

[a] Regulatory year begins 1 July and ends 30 June, e.g., regulatory year 2004 = 1 July 2004–30 June 2005.
[b] ORV = off-road vehicle.
[c] Season closed after 2004.

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CHAPTER 5: CARIBOU MANAGEMENT REPORT

From: 1 July 2012
To: 30 June 2014

LOCATION

GAME MANAGEMENT UNIT: 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 Isanotski Strait. 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 SAP. Both radiotelemetry and genetic studies indicate SAP is also separate from the Northern Alaska Peninsula caribou herd (Zittlau et al. 2009, Mager 2012). 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 Units 9E and 9D and Unimak Island also confirms relatively little genetic interchange between these herds.

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 SAP is due in part to geographic barriers and isolation. SAP has been characterized by wide population fluctuations, ranging from 500 to more than 10,000 caribou. Following a peak of more than 10,000 caribou in 1983, 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 regulatory years (RY) 2008 (regulatory year begins 1 July and ends 30 June, e.g., RY08 = 1 July 2008–30 June 2009) through RY10 following selective wolf removal on the calving grounds.

Recent herd history includes growth from 1996 to 2002, decline from 2002 to 2007, and renewed growth from 2008 to 2011.

Harvest of SAP was fairly high from RY80 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 through RY98. In RY99 a state hunt with a 1 caribou bag limit was resumed in Unit 9D with a resident season 1–20 September and 15 November–31 March. 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 once again closed in RY08 because of concern over the herd's status.

Poor nutrition appears to have played a major role in the decline of SAP in the 1980s and early 1990s. Predation by wolves and brown bears, and human-induced 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 RY99 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 to reduce wolf predation on caribou calves. Selective removal of 28 wolves in RY07 during calving immediately improved calf survival. This program continued with selective removal of 8 wolves in RY08 and 2 wolves in RY09, after which the program was deactivated. Calf recruitment increased dramatically during RY08–RY10 following selective wolf removal on the calving grounds.

MANAGEMENT DIRECTION

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 STATUS AND TREND

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. INWR staff 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

The 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 the U.S. Fish and Wildlife Service, Office of Subsistence Management. During each capture, standard measurements and blood samples were taken when feasible. Herd distribution and survival rates are monitored periodically by radiotracking of collared animals.

Mortality

Harvest was monitored through 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), 2008–2010 (L. G. Butler, ADF&G, unpublished data, King Salmon), and 2013 (D. W. Crowley and T. A. Rinaldi, ADF&G, unpublished data, King Salmon). A calf mortality study scheduled for 2014 was cancelled due to eruption of lava and ash from Pavlof Volcano in the study area. Range conditions were studied in 1991 and 1992 (Post and Klein 1999).

RESULTS AND DISCUSSION

POPULATION STATUS AND TREND

Population Size

In February 2012 the U.S. Fish and Wildlife Service counted 1,061 caribou in SAP (Table 1).

Population Composition

Calf ratio temporarily decreased during the reporting period—an expected result as many immature cows were being recruited into the population following wolf control (Table 1). By RY13, calf ratio rebounded to 40 calves:100 cows. Bull:cow ratios have remained at or above management objectives of 35:100 since RY11 (Table 1).

Distribution and Movements

Data from radiotracking surveys indicate that 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, in the mountains at the headwaters of the Joshua Green River, and in the mountains southwest of Cold Bay and south of Morzhovoi Bay.

MORTALITY

Harvest

Seasons and Bag Limits. For the federal subsistence hunt FC0909 that opened in RY12 the bag limit was 1 bull caribou. The season dates were 10 August–20 September and 15 November–31 March. Starting in RY13 the bag limit for the state's new Tier II TC506 hunt was 1 bull from 1 August through 30 September, and 1 caribou from 15 November through 31 March.

Alaska Board of Game Actions and Emergency Orders. Following the wolf reduction program, when composition counts, bull:cow ratios, and calf survival indicated a surplus of harvestable bulls, the Board of Game established a Tier II subsistence hunt, TC506, effective fall 2013.

Federal Subsistence Board Actions. When ADF&G indicated in late 2012 there was a small surplus of harvestable bulls, the Federal Subsistence Board approved a small subsistence hunt, FC0909 to be managed by INWR.

Harvest by Hunters. In RY12 and RY13, in the FC0909 federal subsistence hunt, 9 and 1 bulls respectively were harvested in this Izembek NWR subsistence hunt, with no reports required (Table 2). It is estimated that 10 caribou were taken illegally each year (Table 2). There were 18 caribou harvested by local residents in RY13 in the TC506 hunt (Table 3). Most caribou were harvested in the fall, and most hunters used highway vehicles (Tables 4 and 5).

Other Mortality

Calf mortality investigations in spring 2013 on SAP indicated that 75% of neonatal calves survived the first 2 weeks of life. The primary source of death was predation by wolves and bears.

HABITAT

Assessment

Adult caribou in SAP appear to be in good overall condition based on evaluation of adult females captured during the reporting period. In 2013 neonate calf weights averaged 7.6 kg (n = 26) for males, and 7.1 kg (n = 25) for females.

In 2013 the overall pregnancy rate in SAP was relatively good based on an evaluation of 122 cows that were older than 2 years of age (84% pregnant). A sample of 16 known-aged adults, fitted with radio collars, exhibited a pregnancy rate of 75% based on physical characteristics prior to giving birth.

CONCLUSIONS AND RECOMMENDATIONS

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 SAP exceeds the objective for population size where hunting can occur, a harvestable surplus of bulls 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 deactivated in 2009.

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Table 1. Southern Alaska Peninsula caribou herd composition and survey results, regulatory years[a] 1987–2013.

Regulatory year	Bulls: 100 cows[c]	Calves: 100 cows[c]	% Calves Summer[d]	% Calves Fall[c]	% Cows[c]	% Bulls[c]	Small bulls (% of bulls)[c]	Medium bulls (% of bulls)[c]	Large bulls (% of bulls)[c]	Composition sample size[c]	Postcalving count[d]	INWR[b] count[e]
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	1	1	87	12	20	47	33	431	600[d]	
2008	10	39	27	26	67	7	3	30	68	570	700[d]	
2009	21	43		26	61	13	50	16	34	679	800[d]	
2010	28	47		27	57	16	28	53	19	532		790
2011	40	20		13	62	25	28	52	20	920		1,061
2012	45	20	17	12	60	27	6	11	10	500		
2013	50	40	20	21	53	26	24	44	32	600	1,720	877

[a] Regulatory year begins 1 July and ends 30 June, e.g., regulatory year 1987 = 1 July 1987–30 June 1988.
[b] INWR = Izembek National Wildlife Refuge.
[c] Estimates based on October composition surveys.
[d] Estimates based on July postcalving counts and the proportion of radiocollared caribou encountered.
[e] Estimates based on winter (conducted between January and April) counts by Izembek National Wildlife Refuge staff.

Table 2. Southern Alaska Peninsula caribou herd harvest, regulatory years[a] 2001–2013.

Regulatory	Harvest by hunters								
	Reported						Estimated		Estimated
year	M	(%)	F	(%)	Unknown	Total	unreported[b]	Illegal	total[c]
2001	52	(93)	4	(7)	0	56	30		90
2002	61	(91)	6	(9)	3	70	30		100
2003	47	(96)	2	(4)	1	50	30		80
2004	68	(89)	8	(11)	1	77	30		110
2005	58	(95)	3	(5)	0	61	30		90
2006	56	(97)	2	(3)	0	58	30		90
2007[d]								10	10
2008[d]								10	10
2009[d]								10	10
2010[d]								10	10
2011[d]								10	10
2012[d]							9	10	20
2013	17	(94)	1	(6)	0	18	1	10	30

[a] Regulatory year begins 1 July and ends 30 June, e.g., regulatory year 2001 = 1 July 2001–30 June 2002.
[b] Unreported includes FC0909 harvest in regulatory years 2012 and 2013 for which there were no reports.
[c] Estimated total is rounded off to the nearest 10.
[d] No permits issued.

Table 3. Southern Alaska Peninsula caribou herd annual hunter residency and success, regulatory years[a] 2001–2013.

	Successful					Unsuccessful					
Regulatory year	Local resident[b]	Nonlocal resident	Nonresident	Total[c]	(%)	Local resident[b]	Nonlocal resident	Nonresident	Total[c]	(%)	Total hunters
2001	26	13	12	56	(70)	12	2	6	24	(30)	80
2002	29	8	25	70	(71)	12	14	2	29	(29)	99
2003	9	13	25	50	(70)	10	6	5	21	(30)	71
2004	24	24	29	77	(73)	14	8	6	29	(27)	106
2005	30	9	20	61	(64)	20	6	8	34	(36)	95
2006	37	4	17	58	(45)	44	6	19	70	(55)	128
2007[d]											
2008[d]											
2009[d]											
2010[d]											
2011[d]											
2012[d]											
2013	18	0	0	19	(72)	6	0	0	6	(24)	25

[a] Regulatory year begins 1 July and ends 30 June, e.g., regulatory year 2001 = 1 July 2001–30 June 2002.
[b] Local residents are residents of Subunit 9D.
[c] Includes hunters of unspecified residency.
[d] No permits issued.

Table 4. Southern Alaska Peninsula caribou herd annual harvest chronology percent by month, regulatory years[a] 2001–2013.

Regulatory year	Harvest chronology percent by month								
	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	*n*
2001	4	41	2	12	16	20	5	0	56
2002	1	39	13	22	18	5	0	2	67
2003	2	63	2	8	15	0	4	6	49
2004	0	36	6	16	33	5	1	3	77
2005	0	46	0	28	13	5	5	3	61
2006	0	2	13	15	31	13	4	22	58
2007[b]									
2008[b]									
2009[b]									
2010[b]									
2011[b]									
2012[b]									
2013	28	28			10	22	6	6	18

[a] Regulatory year begins 1 July and ends 30 June, e.g., regulatory year 2001 = 1 July 2001–30 June 2002.
[b] No permits issued.

Table 5. Southern Alaska Peninsula caribou herd harvest percent by transport method, regulatory years[a] 2001–2013.

Regulatory year	Airplane	Boat	3- or 4-wheeler	Snowmachine	ORV[b]	Highway vehicle	Foot
	Harvest percent by transport method						
2001	23	23	30	0	4	20	0
2002	35	25	23	0	0	17	0
2003	56	6	26	0	0	12	0
2004	39	16	13	1	7	23	1
2005	42	6	20	0	0	32	0
2006	29	31	22	0	2	16	0
2007[c]							
2008[c]							
2009[c]							
2010[c]							
2011[c]							
2012[c]							
2013		17	22		6	49	6

[a] Regulatory year begins 1 July and ends 30 June, e.g., regulatory year 2001 = 1 July 2001–30 June 2002.
[b] Includes unspecified.
[c] No permits issued.

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CHAPTER 6: CARIBOU MANAGEMENT REPORT

From: 1 July 2012
To: 30 June 2014

LOCATION

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

HERD: Unimak

GEOGRAPHIC DESCRIPTION: Unimak Island

BACKGROUND

Caribou numbers on Unimak Island have cycled widely over the decades as have the Northern and Southern Alaska Peninsula (SAP) caribou herds. Although there are historical accounts of caribou moving between Unimak Island and the mainland, and the Unimak caribou herd (UCH) was once considered part of SAP, more recent evidence including fidelity to calving grounds, prolonged genetic isolation, and long-term radio collar data provided enough distinction between island and mainland caribou to classify these as 2 different herds (Butler 2005, Zittlau et al. 2009, Mager 2012). Sellers et al. (1999) summarized a history of UCH, with comparison to the mainland SAP as follows:

> *"Caribou numbers in Unit 9D and on Unimak have fluctuated widely, but not synchronously. In 1925 Murie (in Skoog 1968) estimated 5,000 caribou between Port Moller and the tip of the Alaska Peninsula and another 7,000 on Unimak Island. By 1949 the FWS estimated 500 caribou on the mainland. Surveys in 1949 and 1953 by the FWS reported no caribou on Unimak Island; but by 1960 Skoog (1968) reported* "1,000 *south* (of Port Moller, author's note), *most…being on Unimak Island*". *By 1975 the SAP had increased to at least 2,267 in 9D and 3,334 on Unimak Island (Irvine 1976). The winter of 1975–76 was severe and reports of dead caribou on the island suggested a die off. Conceivably emigration from Unimak could have contributed to population growth in Unit 9D during the late 1970s. By the early 1980s, only a few hundred caribou remained on Unimak. Meanwhile the mainland segment* (the SAP; author's note) *grew continuously to peak at 10,200 by 1983."*

Following the precipitous decline in the late 1970s and early 1980s the UCH population again reversed its course and began increasing. By 1997 the herd had grown to at least 600 caribou and by 2000 to approximately 1,000 animals (Butler 2009). The population was relatively stable until 2005 (or possibly earlier, prior to commencement of annual surveys) when composition surveys began indicating low annual calf:cow ratios. This continued through 2012 when it bottomed out at 3 calves:100 cows. Population size and bull:cow ratios declined correspondingly, and predation on calves was suspected to be the cause of poor calf survival (Butler 2009). Pregnancy rate appeared to be normal in 2008 (85%) but from 2009–2013 pregnancy rate ranged from 65% to 70%. The population currently numbers approximately 200 animals.

State and federal hunts were closed by emergency orders in 1993 when the then-combined SAP and UCH herds declined below 2,500 caribou. The federal subsistence season reopened in regulatory year (RY) 2000 (regulatory year begins 1 July and ends 30 June, e.g., RY00 = 1 July 2000–30 June 2001) when UCH reached 1,000 animals and herd management was officially separated from SAP (Sellers 2003). The state general season reopened in RY01. State and federal UCH hunts were once again closed in RY09 following the most recent decline and remain closed.

Monitoring of the herd using radiocollared cows began in 1997 and satellite collars were added in 2011. Butler (L. Butler, Wildlife Biologist, ADF&G, King Salmon, personal communication) investigated calf survival on Unimak Island in 2010 but poor weather conditions, long-protracted parturition, and too few collars imposed limitations on data collection. Most of the calves died during the first weeks of life when predation was the most suspect cause of death. The efforts in 2010 highlighted the logistical and weather difficulties associated with conducting research on Unimak Island.

Given the herd's declining population size and poor calf survival, the Alaska Department of Fish and Game (ADF&G) recommended implementing a wolf removal program in 2009 when the herd numbered around 400 animals. During peak calving, wolves were to be removed on the calving grounds using the same strategy employed for wolf removal on SAP's calving grounds (Butler 2009). However, because nearly all of the calving grounds are on federal wilderness lands, the program was not supported nor authorized by the U.S. Fish and Wildlife Service. Because of UCH's small population size and isolation from mainland caribou, ADF&G biologists were concerned that caribou could be extirpated from Unimak Island without management intervention. The window of opportunity probably passed as the herd continued to decline to about 200 animals by 2011, and the risk of losing the herd to a stochastic event such as severe icing outweighed the high cost of predator control.

MANAGEMENT DIRECTION

MANAGEMENT OBJECTIVES

No formal management objectives are in place for UCH, and practically speaking, there is little opportunity to actively manage this herd given formidable logistics involved in reaching the island. However, the proposed (but inactive) intensive management program of 2009 recommended a minimum population size of 1,000 caribou with a fall bull:cow ratio of 35 bulls:100 cows.

METHODS

POPULATION STATUS AND TREND

Population Size

Beginning in RY12, ADF&G biologists conducted composition counts in October to determine if better population data could be collected than during the postcalving period. We used 2 fixed-wing aircraft and a helicopter to locate collared cows. If all collars were accounted for during the survey and most of the island flown, we considered the tally a minimum count of the population. In addition, staff of Izembek National Wildlife Refuge (INWR) periodically conduct winter aerial counts along systematic transects to obtain a minimum count of UCH.

Population Composition

Sex and age composition surveys were conducted during October. Caribou were located with 2 fixed-wing aircraft outfitted with telemetry equipment, and were classified as calves, cows, and small, medium, and large bulls from a helicopter.

Parturition Surveys

We used the same methods as above to classify caribou on the calving grounds in early June. Classification included parturient cow (with calf, hard antlers, or distended udder), nonparturient cow, yearling, or bull (Whitten 1995).

Radiotelemetry and Satellite Collar Data

Female caribou were captured for VHF radiocollaring in 2012 and 2013 to maintain a sample of marked animals in the population. A few USFWS satellite collars remained on the air during the reporting period. Occasional radiotracking flights and satellite collar data were used to monitor herd distribution and movements, and locate parturient cows and newborn calves.

Mortality

ADF&G and federal subsistence managers closed hunting of UCH in 2009.

We captured and monitored the survival of neonate calves and investigated cause of death (Butler et al. 2007) during June 2014.

RESULTS AND DISCUSSION

POPULATION STATUS AND TREND

Population Size

We obtained a minimum count of 192 in RY13 during October composition count (Table 1). The survey conducted in October of RY12 was of inadequate coverage to obtain a minimum count, primarily because of low cloud ceiling and gusting winds in the highlands.

Population Composition

Bull ratios were 10 bulls:100 cows during the reporting period, probably the result of poor calf recruitment. Because hunting was closed, harvest did not explain the continued low bull ratio since 2008 (Table 1). The calf ratio did improve to 19 calves:100 cows in 2013.

We monitored collared cows almost daily during 1–14 June 2014 to determine productivity. Approximately 5% of UCH cows with enlarged udders and calves were growing black, fuzzy antlers approximately 1–6 inches long (eyeball estimate from helicopter and photos; Fig. 1). This is greater than the number that had retained hard antlers during pregnancy. Thus cows observed with new antler growth could not be readily classified as non-pregnant, as is the case with other caribou herds in Alaska (Whitten 1995). I suspect this could be related to the protracted calving period observed in UCH (L. Butler, 2010, unpublished data).

Distribution and Movements

UCH has typically calved on the western portion of Unimak Island in the Urilia Bay and Pogromni River flats areas. Calving for UCH is generally more dispersed than for other caribou herds.

In early December 2012, a cow fitted with a GPS satellite collar swam from Unimak to the mainland across Isanotsky Strait (D. Watts, USFWS biologist, Becharof National Wildlife Refuge, personal communication). Two weeks later the cow was observed visually on the mainland with 5 unmarked cows and within 2 miles of 25 other caribou which included a few bulls and calves. Most radiocollared SAP caribou were found over 40 miles from the Unimak cow, hence it is possible the marked Unimak cow was accompanied by 5–30 other caribou when she swam across, but this could not be determined with any certainty.

MORTALITY

Harvest

There have been no state or federal hunts on Unimak Island since RY09 (Tables 2 and 3).

<u>Alaska Board of Game Actions and Emergency Orders</u>. There were no actions taken during the reporting period.

<u>Federal Subsistence Board Actions</u>. There were no actions taken during the reporting period.

Other Mortality

We captured and monitored the survival of 18 neonate calves and investigated cause of death within 24 hours. At time of capture by helicopter, calf ages ranged from a few hours to 4 days, with mode of 2 days. Average weights for captured calves was 8.0 kg for males (n = 6), and 8.1 kg for females (n = 8). UCH calves were surprisingly susceptible to human capture by walking or crawling away from them after being separated from the dam and confused by the helicopter's rotor wash. Using this technique we captured around 8 calves that could have easily outrun us. Our peak captures (and failed chases) occurred 8–9 June. The last day we observed a newborn calf was on 14 June, located at 4,400 feet elevation on the slope of Shishaldin Volcano was 14 June. All other observed caribou calves appeared to be in good health.

Predators were responsible for 3 of the 6 calf mortalities investigated; 2 attributed to wolves and 1 to brown bear. One additional calf died of starvation with the dam nearby. The remaining 2 calves were censored because of capture-related events; 1 due to abandonment and 1 because its death by a brown bear may have been assisted by capture-related events. If we censure the 2 calves then 12 of 16 calves (75%) survived when we departed on 14 June, but many calves had not reached 2 weeks of age.

HABITAT

Assessment

Adult caribou collared on Unimak during the reporting period appeared to be in excellent overall condition. The pregnancy rate for cows >2 years in age remained lower than other Alaska caribou herds in RY13 at 66% (n = 106). These low pregnancy rates were attributed to the low bull ratios observed rather than habitat or nutritional limitations. Healthy caribou calf weights and apparent excellent body condition of cows indicate that nutrition is not limiting UCH population growth or survival.

CONCLUSIONS AND RECOMMENDATIONS

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. However, we should move forward to adopt formal population objectives of a minimum 1,000 caribou and 35 bulls:100 cows as proposed in the intensive management program in 2009. Pregnancy rates of adult cows >2 years of age have remained low since 2009 (from 67% pregnant to 70% pregnant). The low bull ratios observed since 2008 are believed to have reduced the likelihood of cows encountering a bull while in estrus, thus reducing the pregnancy rate. 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 UCH, and collect additional data on causes of calf mortality.

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Figure 1. Unimak Island, 12 June: pregnant cow with 1–2 inch new antlers (left) observed with newborn calf 2 days later with approximately 3–4 inch antlers; cow with new 6 inch antlers with newborn, collared calf (right). Photos by Dave Crowley.

Table 1. Unimak Island caribou herd composition counts and estimated population size, Alaska, calendar years 2000–2013.

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	
2013	10	19	15	78	8	20	40	40	67	192[d]

[a] Count by Rod Schuh, registered guide, in May.
[b] Winter count by Izembek National Wildlife Refuge staff.
[c] May parturition survey by Alaska Department of Fish and Game.
[d] October census of entire island by Izembek National Wildlife Refuge staff.

Table 2. Unimak Island caribou herd harvest, Alaska, regulatory years[a] 2002–2013.

Regulatory year	Harvest by hunters: Reported M	(%)	F	(%)	Unknown	Total	Estimated total
2002	11	(92)	1	(8)	0	12	12
2003	10	(100)	0	(0)	0	10	10
2004	15	(100)	0	(0)	0	15	15
2005	15	(100)	0	(0)	0	15	15
2006	12	(92)	1	(8)	0	13	13
2007	13	(100)	0	(0)	0	13	13
2008	9	(100)	0	(0)	0	9	9
2009–2013[b]							

[a] Regulatory year begins 1 July and ends 30 June, e.g., regulatory year 2002 = 1 July 2002–30 June 2003.
[b] There have been no state or federal hunts on Unimak Island since regulatory year 2009.

Table 3. Unimak Island caribou herd annual hunter residency and success, Alaska, regulatory years[a] 2002–2013.

Regulatory year	Successful				Unsuccessful				
	Local resident[b]	Nonlocal resident	Nonresident	Total[c] (%)	Local resident[b]	Nonlocal resident	Nonresident	Total[c] (%)	Total hunters[c]
2002	0	5	7	12 (92)	0	1	0	1 (8)	13
2003	0	1	9	10 (77)	0	2	1	3 (23)	13
2004	0	3	12	15 (71)	0	5	1	6 (29)	21
2005	0	4	11	15 (94)	0	0	1	1 (6)	16
2006	0	3	10	13 (87)	0	0	2	2 (13)	15
2007	2	1	10	13 (100)	0	0	0	0 (0)	13
2008	0	2	7	9 (75)	0	1	1	3 (25)	12
2009–2013[d]									

[a] Regulatory year begins 1 July and ends 30 June, e.g., regulatory year 2002 = 1 July 2002–30 June 2003.
[b] Local residents are residents of Unimak Island.
[c] Includes hunters of unknown residency.
[d] There have been no state or federal hunts on Unimak Island since regulatory year 2009.

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CHAPTER 7: CARIBOU MANAGEMENT REPORT

From: 1 July 2012
To: 30 June 2014[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 east-central Alaska and southwestern Yukon, Canada. Skoog (1968) assumed CCH was 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). The Alaska Department of Fish and Game (ADF&G) has classified the Chisana herd as *Rangifer tarandus granti 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 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 CCH at 3,000 animals in 1964; however, methodology used to develop this estimate was not reported, making the validity of the estimate questionable. By the mid- to late 1970s the herd likely declined to about 1,000 caribou. Similar declining trends were reported in other Interior caribou herds. During the 1980s, environmental conditions were favorable and the herd was estimated at 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, following a more intensive population survey by the U.S. Geological

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

Survey (USGS) in 2003, the CCH population was estimated at 720 caribou, substantially higher than the 2002 estimate.

During the early 1900s, CCH was an important food source for area residents. However, subsistence use of the herd declined from the 1930s through the mid-1950s (Reckord 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 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 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 ended in Alaska.

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 2004–2013, the population appears to be stable at 694–766 animals (Adams and Roffler 2005, 2007; Bentzen 2011, 2013).

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, and the updated plan was completed in 2012 (Chisana Caribou Herd Working Group 2012).

MANAGEMENT DIRECTION

During 1 July 2012–30 June 2014, 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 objectives match the minimum requirements for a sustainable harvest set in the cooperative management plan.

The Chisana management goal and objectives 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

Objective 1: Maintain fall calf recruitment above a 3-year average of 15 calves:100.

Objective 2: Maintain a fall bull:cow ratio above 35 bulls:100 cows.

METHODS

Since 2003 ADF&G has participated in international cooperative (USGS, NPS, YDE and ADF&G) research and management projects to evaluate the population dynamics and effects of recovery efforts on CCH.

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. Population estimates were developed with this method in 2005, 2007, 2010, and 2013.

The 2013 abundance survey encompassed the known herd range during rut and the general locations of radiocollared caribou located during a radiotracking flight a week before the census, and it included all the areas surveyed in 2005, 2007, and 2010. In 6 hours of helicopter 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 6 hours of helicopter 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 (T. Hagel, YDE, personal communication, 2015).

ADF&G, NPS, and YDE conducted herd composition counts during fall 2008–2013.

Harvest data were summarized by regulatory year (RY), which begins 1 July and ends 30 June (e.g., RY13 = 1 July 2013–30 June 2014). Although ADF&G did not issue permits during RY12–RY13, harvest data since 1990 are included in this report (Table 2).

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, 2015). 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 CCH numbered approximately 766 caribou (719–823; 90% CI) with 13 calves:100 cows and 50 bulls:100 cows (Table 1).

The 11–12 October 2013 abundance survey yielded an estimated 701 caribou (639–763; 90% CI) based on 631 caribou (including 62 with radio collars) sighted by observers in the helicopter and the fixed-wing aircraft (Table 1).

October 2008–2013 composition surveys indicated 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 64:100 in 2012 and 49:100 in 2013.

The fall 2012 estimate of 20 calves:100 cows is consistent with most mountain caribou herds in Canada (20–25 calves:100 cows; Environment Canada 2012). Following winter 2012–2013, which included prolonged cold and deep snow (U.S. Department of Agriculture 2013), the 2013 ratio declined to 16 calves:100 cows.

Radiotracking data during RY12–RY13 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. No Chisana caribou were observed west of the Nabesna River during RY12–RY13.

Due to funding limitations, no spring parturition surveys were conducted during July 2012–June 2014. 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 RY94–RY11. All harvest in Yukon ended in 2001.

Alaska Board of Game Actions and Emergency Orders. During the 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 CCH (Environment Canada 2012). As part of the 2010 proposal the board reviewed whether 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 CCH consistent with the management plan (Chisana Caribou Herd Working Group 2012). Because the Alaska portion of the CCH's 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 CCH since RY93 (Table 2). Past reports from local residents and incidences of radiocollared caribou that were harvested indicate little or no illegal harvest in Alaska during RY12–RY13. 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.

NPS staff issued a total of 9 CCH harvest permits annually in fall 2012 and fall 2013 with a 1–30 September hunting season. In 2012, 8 hunters reported hunting, and 2 bulls were harvested. In 2013, 7 hunters reported hunting, and 3 bulls were harvested.

Other Mortality

ADF&G conducted no activities to evaluate other causes of CCH mortality during RY12–RY13. However, as summarized by Gardner (2003), predation by wolves was identified as the most likely factor limiting herd growth. The limiting role of disease and parasites on 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).

HABITAT

Assessment

No habitat assessment activities were conducted during RY12–RY13. Gardner (2003), Lenart (1997), and Boertje (1984) provided information about habitat within the CCH's 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 RY12–RY13.

NONREGULATORY MANAGEMENT PROBLEM/NEEDS

The process to update the cooperative CCH management plan began in 2008. Participating members in this international planning process included 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 the CCH's 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 CCH to support a stable or increasing population while balancing the differing management concerns and goals of the agencies.

CONCLUSIONS AND RECOMMENDATIONS

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–RY13 (L. Adams, USGS, personal communication, 2015).

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.

When hunting was allowed the primary users of the Chisana herd were nonresidents. During RY90–RY93, 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. 1). 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 CCH was resumed in Alaska in fall 2012. However, the limited number of permits are available to local federally-qualified subsistence users only.

We met our management objective during RY12–RY13 to develop and implement management strategies to maintain a stable or increasing herd with calf recruitment above 15 calves:100 cows and a bull: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 2013, 71 active VHF radio collars remained on Chisana caribou. Radio collars were last deployed in 2006 and have functioned beyond their expected battery life. 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. Long-term monitoring will require radio collars to be deployed in the near future. ADF&G 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 CCH during the next report period.

For the next reporting period the management objectives will remain the same. However, the management goal will be revised to reflect the goal in the 2010–2015 Chisana herd management plan, and management activities will be revised to reflect current management efforts.

The revised goal for the next report period will be:

- Manage Chisana herd for a stable or increasing population trend, within sustainable levels, and without significantly compromising herd health and habitat condition.

The revised activities for the next report period will be:

- Cooperatively with YDE and NPS, develop and implement management strategies to maintain a stable or increasing herd (Objective 1 and 2).

- Conduct annual fall composition surveys (Objectives 1 and 2).

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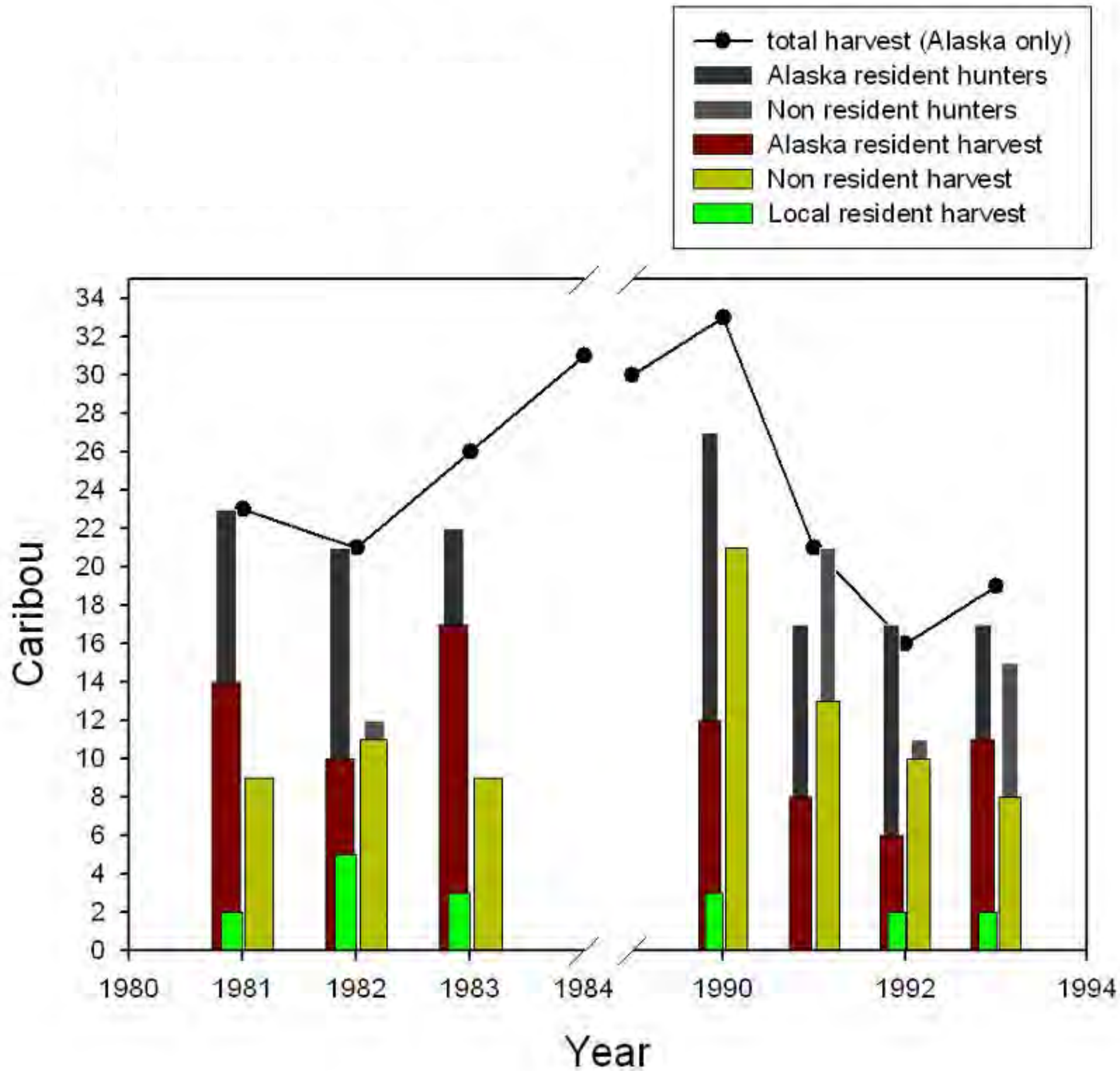

Figure 1. Chisana caribou harvest and hunter residency for 1981–1993 in Alaska only (hunter residency data are unavailable for 1984–1989).

Table 1. Chisana caribou fall composition counts and estimated population size, Alaska, 1990–2013.

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	n/a	26	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]
10/15/12[e]	64	20	11	54	n/a[f]	n/a[f]	n/a[f]	35	215	n/a[c]
10/11–12/13	49	16	10	61	n/a[f]	n/a[f]	n/a[f]	30	631	701[d]

[a] Alaska Department of Fish and Game survey results methods described by Gross (2005).
[b] U.S. Geological Survey survey results. Bulls were not classified to size.
[c] No sightability correction factor was determined, herd size could not be estimated.
[d] Alaska Department of Fish and Game, National Park Service, Yukon Department of Environment survey results using estimation technique developed by Adams and Roffler (2005, 2007).
[e] Due to poor weather conditions in Alaska, the survey was only conducted within the portion of the herds range in Yukon by the Yukon Department of Environment.
[f] Bulls not classified to size.

Table 2. Chisana caribou harvest, Alaska and Yukon, regulatory years[a] 1990–2013.

Regulatory year	Alaska harvest: Reported M	Reported F	Reported Unk	Reported Total	Estimated Illegal	Estimated Total	Yukon harvest: Reported	Yukon harvest: Unreported	Total harvest
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[b]	0	0	0	0	0	0	0	5–20	5–20
1995	0	0	0	0	3	3	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[c]	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[d]	2	0	0	2	0	0	0	0	2
2013[d]	3	0	0	3	0	0	0	0	3

[a] Regulatory year begins 1 July and ends 30 June (e.g., regulatory year 1990 = 1 July 1990–30 June 1991).
[b] No registration permits were issued for the Alaska hunt during regulatory years 1994–2008.
[c] After 2001, Yukon First Nation members in Canada voluntarily stopped harvesting Chisana caribou.
[d] Permits issued to federally-qualified subsistence users only.

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CHAPTER 8: CARIBOU MANAGEMENT REPORT

From: 1 July 2012
To: 30 June 2014[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. MPMA included the area south of the Alaska Highway, draining into the south side of the Tanana River between the east bank of the Johnson River upstream to Prospect Creek, and the east bank of Bear Creek (Alaska Highway Milepost 1357.3).

By 1975 MACH numbered 700–800 caribou, but the apparent increase in herd size from 1972 to 1975 was probably because of increased knowledge about the herd rather than an actual increase in the number of caribou. Hunting pressure and harvest continued to increase on MACH, despite a reduced bag limit and restrictions imposed by conditions of 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 determination that harvest had to be reduced (Davis 1979). In 1978 the bag limit for MACH was

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

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 MACH. With wolf control, fall calf:cow ratios increased from 13 calves:100 cows in 1980 to 33 calves:100 cows in 1981.

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

In 1987 the Alaska Board of Game made a customary and traditional (C&T) use determination for 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 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 MACH's population 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; regulatory year begins 1 July and ends 30 June, e.g., RY92 = 1 July 1992–30 June 1993) 1992 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 caribou. 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 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 caribou to approximately 650 caribou 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, and the RY97 and RY98 hunting season was 10–20 September by registration permit. The season was closed again in RY99 and reopened 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 DCUA (which prohibits the use of motorized vehicles and pack animals for big game hunting during 5–25 August) 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.

In RY06, core season dates during the middle of August (10–25 August) were first established. The season dates were changed slightly in RY08 (10–28 August), and again in RY09 (10–27 August). The middle August core season dates were selected to slow the rate of harvest by conducting the hunt outside of the moose season and utilizing the motor vehicle use restriction of DCUA and MPCUA while providing limited duration motorized access opportunity at the end of the season. In RY10 ADF&G used discretionary permitting authority to raise the harvest quota from 50 to 70 bulls. The new quota reflected additional available harvestable surplus due to increased herd size. The harvest quota remained 70 for RY11. The season dates of 10–27 August were continued in RY10 and RY11.

MANAGEMENT DIRECTION

MANAGEMENT OBJECTIVE

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

METHODS

MOVEMENTS, DISTRIBUTION, AND POPULATION SIZE

We monitored caribou movements and distribution by locating radiocollared caribou postcalving 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 2012, and May and June 2013. 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 2012 and October 2013 to conduct visual and radiotelemetry searches to locate aggregations of caribou and to count total number of caribou throughout MACH's 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.

POPULATION COMPOSITION

We conducted composition surveys in early October (RY12 and RY13) using an R-44 helicopter and Piper PA-18 fixed-wing aircraft. The biologist in the fixed-wing aircraft located caribou, and a biologist in the R-44 helicopter classified caribou. Classification categories consisted of cows; calves; and small (juvenile), medium (subadult), and large (mature adult) bulls. Observers identified bulls by absence of vulva and classified bulls by antler characteristics (Eagan 1993). During both regulatory years, we tallied the composition of each caribou group on a 5-position counter and recorded the tallies on a data sheet.

HARVEST MONITORING

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

RY12. We conducted an aerial census and radiotracking flight on 16 October 2012 that resulted in a minimum count of 1,453 caribou (Table 1). Snow cover was complete throughout the survey area. Weather conditions were calm and clear, and sightability was good from the Delta River to Macomb Plateau. Sightability was fair in the Knob Ridge and Robertson River areas due to low clouds and fog. The aerial census and radiotracking conducted in RY12 cost $4,520 for 9.4 hours of flight time (3.9 hours of Super Cub charter and 5.5 hours of helicopter charter).

RY13. We conducted an aerial census and radiotracking flight on 6 October that resulted in a minimum count of 1,503 caribou (Table 1). Sightability was good with complete snow cover and bright light throughout the MACH range. Weather conditions were calm and clear. The aerial census and radiotracking flights conducted in RY13 cost $4,732 for 10.3 hours of flight time. This cost included 4.7 hours of Super Cub charter and 5.6 hours of helicopter charter.

Population Composition

RY12. We calculated population composition from a sample of 1,453 caribou classified from the helicopter. Composition results were 41 bulls:100 cows, 18 calves:100 cows (Table 1), and 12 large bulls:100 cows.

RY13. We calculated population composition from a sample of 1,503 caribou classified from the helicopter. Composition results were 48 bulls:100 cows, 20 calves:100 cows (Table 1), and 12 large bulls:100 cows.

Distribution and Movements

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. MACH also uses the lowlands of the Tanana River valley as winter range.

RY12. During the 16 October 2012 census and radiotracking flight, caribou were distributed from the Delta River to Macomb Plateau. During this census, 44% (643) of the caribou we located were on the Macomb Plateau. Caribou were also observed in the Bear Creek (west), Berry Creek, upper Johnson River, upper Gerstle River, McCumber Creek, Jarvis Creek, Little Gold Creek, and Ober Creek drainages, and in the Granite Mountains and Donnelly Flats. All (n = 17) radiocollared caribou were located. During a spring rock ptarmigan survey on 26 May 2013 a cow and neonate were observed on top of Donnelly Dome.

RY13. The census and radiotracking flight on 6 October located 1,503 caribou distributed throughout the core MACH herd range from Bear Creek (Richardson Highway) on the west to the Robertson River on the east. Caribou were observed in the Bear Creek (west), Little Gold Creek, Ober Creek, Granite Creek, Jarvis Creek, McCumber Creek, Morningstar Creek, Daugherty Creek, Sheep Creek (west), Sawmill Creek, Bradford Creek, upper Gerstle River, upper Little Gerstle River, upper Johnson River, Bear Creek (east), Sheep Creek (east), Berry Creek, and upper Robertson River drainages, on the Macomb Plateau, and in the Granite Mountains. We observed the highest number of mature bulls high in the Jarvis and Ober Creek drainages and on the Macomb Plateau. Fifteen of 17 radiocollared caribou were located, with 2 radio collars not heard by the tracking plane.

MORTALITY

Harvest

Season and Bag Limit.

RY12 and RY13 — Hunting for 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 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 DCUA had no access restrictions.

Harvest by Hunters. Seventy-two caribou were harvested in RY12, and 64 were harvested in RY13. The intensive management harvest quota of 30–50 caribou harvested/year was met and exceeded (Table 2).

Permit Hunts.

RY12 — Registration permits were issued to 308 people, and 301 permit report cards were received (Table 2). Two hundred thirteen (71%) permit holders hunted, killing 72 bulls for a 34% success rate (Table 2). This harvest was 2 bulls more than the harvest quota of 70 and slightly exceeded the harvest objective.

RY13 — Registration permits were issued to 281 people (Table 2), and 280 permit report cards were received. One hundred ninety-eight (71%) permit holders reported that they hunted, killing 63 bulls for a 32% success rate (Table 2). One cow was also killed (Table 2). This harvest was 7 bulls less than the harvest quota of 70 and slightly below the harvest objective.

Hunter Residency.

RY12 — Eighty-two percent of successful hunters were nonlocal residents of Unit 20D (Table 3).

RY13 — Ninety-one percent of successful hunters were nonlocal residents of Unit 20D (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.

RY12 — Harvest chronology had 26% of the harvest in the first 8 days of the season, 28% during the second 8 days, and 44% during 26–27 August when motorized vehicles and pack animals were allowed (Table 4). One bull was taken after the close of season.

RY13 — Harvest chronology had 28% of the harvest in the first 8 days of the season, 28% during the second 8 days, and 42% during 26–27 August when motorized vehicles were allowed in the DCUA (Table 4). Date of harvest was unknown for 1 bull.

Harvest Location.

RY12 — Most caribou harvest was reported from the Jarvis Creek drainage (53%) followed by the Granite Mountains (18%) and Macomb Plateau (17%) (Table 5).

RY13 — The Jarvis Creek drainage continued as the area with the highest harvest (41%) 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. Harvest increased significantly in the Unit 12 portion of the hunt area (Table 5).

Transportation Methods.

All-terrain vehicles continued to be the single most common transport method for successful hunters (Table 6). However, nonmotorized transport is likely the largest category when all methods are combined. The method of transport entitled “highway vehicle” on the permit report card refers to “how you got to where you started walking to begin your hunt.” For RC835 there are very few areas within the hunt area that are directly accessible by highway vehicle. We expect that the majority of hunters who checked “highway vehicle” as their method of transport were actually walking into the hunt area from their vehicle. Additionally, biking is a popular method of transport within the DCUA; however, “bicycle” is not a choice on the report card, therefore, it is likely that most of the hunters who reported “other” are also nonmotorized users. Given these assumptions, up to 54% of harvest in RY12 was nonmotorized and 61% in RY13.

Other Mortality

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

HABITAT

Assessment and Enhancement

No habitat assessment work occurred for MACH during RY12–RY13.

CONCLUSIONS AND RECOMMENDATIONS

We met our population objective of 600–800 caribou during RY12–RY13. The minimum herd sizes for RY12 and RY13 were >1,000, and the harvest quotas were appropriate to allow opportunity for harvest of the biological surplus during this time period. Harvest in RY12 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 RY12–RY13 hunt structures and harvest quotas.

Harvest increased significantly in Unit 12 during RY13. This increase may have occurred due to a higher number of caribou in Unit 12 during the hunting season, and hunters recognizing motor vehicle use was allowed in this part of the hunt area during the time period when DCUA and MPCUA motor vehicle use restrictions preclude use of motorized vehicles during the RC835 hunt.

Members of the local community and the Delta Advisory Committee continue to 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.

An unknown number of caribou mortalities are caused by motor vehicle collision on the Richardson Highway in Donnelly Flats. It is possible these mortalities could reduce the harvestable surplus of the Macomb herd.

The cow and neonate observed on Donnelly Dome on 26 May 2013 was the first known documentation of possible parturition in this part of the MACH range. ADF&G records and anecdotal reports from past ADF&G staff and members of the local community do not document or recount caribou parturition in the western portion of the MACH range.

Harvest monitoring and regulation will remain the primary methods in managing 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.

We will continue to monitor caribou distribution 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 the 2 days of motorized access hunting.

At this time we recommend the current Tier I registration permit hunt be continued during 10–27 August. We will continue to be prepared to close the hunt by emergency order if the harvest quota is achieved prior to the end of the season. We also recommend working with the Department of Public Safety, Alaska Wildlife Troopers, to enumerate the annual caribou vehicle collision mortalities within the Macomb herd range. In addition, we will increase monitoring effort for parturition in the western part of the MACH range with aerial surveys during calving season. And finally, we recommend continued consultation with the Delta Fish and Game Advisory Committee to address their concerns about the motorized portion of RC835.

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Table 1. Macomb caribou fall composition counts and minimum count or estimated population range, 2000–2013.

Survey date (mm/dd/yy)	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	1,528	1,809
10/23/11										1,373[d]
10/16/12	41	18	11	63	38	34	28	26	1,453	1,453
10/06/13	48	20	12	60	36	38	25	29	1,503	1,503

[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 registration permit hunt RC835, regulatory years[a] 2000–2013.

Hunt	Regulatory year	Permits issued	Permits reported	Percent did not hunt	Percent successful hunters	Percent unsuccessful hunters	Harvest			Total harvest
							Bulls (%)	Cows (%)	Unk	
RC835	2000[b]	274	271	31	12	88	22 (100)	0 (0)	0	22
	2001[b]	256	256	32	25	75	42 (98)	1 (2)	0	43
	2002[b]	159	157	41	28	73	25 (100)	0 (0)	0	25
	2003[b]	161	159	28	26	74	30 (100)	0 (0)	0	30
	2004	76	76	58	22	78	7 (100)	0 (0)	0	7
	2005	122	117	53	33	67	18 (100)	0 (0)	0	18
	2006	106	103	46	38	63	21 (100)	0 (0)	0	21
	2007	161	161	47	32	68	27 (100)	0 (0)	0	27
	2008	267	267	37	29	71	48 (100)	0 (0)	0	48
	2009	242	242	37	37	63	54 (96)	2 (4)	0	56
	2010	326	326	33	31	69	67 (99)	1 (1)	0	68
	2011	312	312	30	34	66	72 (99)	1 (1)	0	73
	2012	308	301	29	34	66	72 (100)	0 (0)	0	72
	2013	281	280	29	32	68	63 (98)	1 (2)	0	64

[a] Regulatory year begins 1 July and ends 30 June (e.g., regulatory year 2000 = 1 July 2000–30 June 2001).
[b] Hunt closed by emergency order.

Table 3. Macomb caribou hunter residency and success of RC835 registration permit hunters, regulatory years[a] 2000–2013.

Regulatory year	Successful				Unsuccessful				Total hunters
	Local[b] resident	Nonlocal Resident	Nonresident	Total (%)	Local[b] resident	Nonlocal resident	Nonresident	Total (%)	
2000	11	11	0	22 (12)	89	75	0	164 (88)	186
2001	13	30	0	43 (25)	67	64	0	131 (75)	174
2002	10	15	0	25 (28)	30	36	0	66 (73)	91
2003	8	21	0	29 (26)	40	42	0	82[c] (71)	114
2004	1	6	0	7 (22)	12	13	0	25 (78)	32
2005	10	8	0	18 (33)	13	24	0	37 (67)	55
2006	9	12	0	21 (38)	8	27	0	35 (63)	56
2007	12	15	0	27 (32)	14	44	0	58 (68)	85
2008	14	34	0	48 (29)	36	83	0	119 (71)	167
2009	16	40	0	56 (37)	30	67	0	97 (63)	153
2010	14	54	0	68 (31)	30	120	0	150 (69)	218
2011	17	56	0	73 (34)	32	112	0	144 (66)	217
2012	13	59	0	72 (34)	40	101	0	141 (66)	213
2013	6	58	0	64 (32)	23	111	0	134 (68)	198

[a] Regulatory year begins 1 July and ends 30 June (e.g., regulatory year 2000 = 1 July 2000–30 June 2001).
[b] Resident of Unit 20D.
[c] Residency of 3 unsuccessful hunters was unknown.

Table 4. Macomb caribou harvest chronology during registration permit hunt RC835, 2000–2013.

Harvest	Hunt year													
date	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
August														
10							4	5	2	4	3	4	6	8
11							3	0	3	3	4	1	3	3
12							1	1	6	1	2	0	1	3
13							2	3	2	0	3	4	1	1
14							2	1	4	2	0	1	4	1
15			11	19	4	2	0	1	0	3	2	0	1	1
16			4	9	0	3	0	3	1	0	1	0	0	0
17			5	1	0	2	0	0	2	2	1	2	3	1
18			1	1	0	0	2	3	3	0	0	1	5	0
19			1	0	1	1	1	1	0	0	0	2	4	0
20			3	0	0	5	1	2	0	2	3	3	1	2
21			0	0	0	3	0	0	3	2	8	2	1	6
22			0	0	0	0	0	0	0	1	2	1	1	0
23			0	0	1	0	1	4	2	1	0	1	2	1
24			0	0	0	0	2	0	1	0	5	0	1	3
25			0	0	1	1	1	3	1	3	7	5	5	6
26									12	23	17	28	27	19
27									4	8	10	18	5	8
28									1				1	0
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				1
n	22	43	25	30	7	18	21	27	48	56	68	73	72	64

Table 5. Macomb caribou harvest location during registration permit hunt RC835, regulatory years[a] 2000 through 2013.

Regulatory year	Harvest location/drainage							
	Jarvis Creek	Little and 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	23	0	0	0	6	1	0	0
2004	2	0	1	0	2	1	0	1
2005	4	0	2	1	10	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
2012	38	4	13	0	12	1	4	0
2013	26	3	10	0	14	0	11	0

[a] Regulatory year begins 1 July and ends 30 June (e.g., regulatory year 2000 = 1 July 2000–30 June 2001).

Table 6. Macomb caribou harvest percent by transport method, regulatory years[a] 2000 through 2013.

Regulatory year	Harvest percent by transport method									
	Airplane	Horse	Boat	ATV[b]	Snowmachine	Other ORV[c]	Highway vehicle	Walking	Other	*n*
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	60	27	3	30
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	56
2010	1	12	1[d]	34	0	0	33	9	9	68
2011	0	15	1[d]	58	0	1	14	3	8	73
2012	0	7	0	43	0	3	29	6	12	72
2013	0	8	0	36	0	3	31	8	14	64

[a] Regulatory year begins 1 July and ends 30 June (e.g., regulatory year 2000 = 1 July 2000–30 June 2001).
[b] ATV = all-terrain vehicle.
[c] ORV = off-road vehicle.
[d] Airboat.

SPECIES

MANAGEMENT REPORT

Alaska Department of Fish and Game
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CHAPTER 9: CARIBOU MANAGEMENT REPORT

From: 1 July 2012
To: 30 June 2014

LOCATION

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

HERD: Nelchina caribou herd

GEOGRAPHIC DESCRIPTION: Nelchina Basin

BACKGROUND

The Nelchina caribou herd (NCH) has fluctuated in size over time. It has been managed for a population 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 hunters in a limited drawing hunt for caribou in Unit 14 have likely harvested a few Nelchina caribou that were moving through the hunt area. More recently, the Board of Game established new drawing hunts for Nelchina caribou in Unit 13, and a Tier I subsistence hunt, 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 resident hunters over the past few decades. Since 1990, more than 66,000 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 surveys 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 are 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 post-hunt population estimates are then calculated from the summer counts and fall composition data. Population data are modeled to determine future population trends and allowable annual 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 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 fitted with radio collars and Argos satellite collars.

To monitor hunt conditions and harvest, 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 fewer than 33,000 caribou from 1998 to 2003. The herd slowly increased, and by 2004 and 2005 population estimates 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 during RY07 and RY08, the 2009 herd estimate of 33,837 (Table 1) remained below objectives. Although 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 completed. 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 also was high as evidenced by a high fall calf-to-cow 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 been partially 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 despite high numbers of yearling and 2-year-old caribou. During 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 fall estimate indicated an increase in the population to 50,646 caribou.

Conditions did not allow for a photo census in the summer of 2013 but aerial surveys were conducted to estimate herd size. The fall estimate for 2013 was 37,257 animals. The drastic decline observed between the 2012 and 2013 estimates is suspected to be a result of poor survey conditions and poor aggregations for the 2013 summer census.

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, the birthrate, of radiocollared cows provides initial spring data on the status of the herd. These data have 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 41%; overall parturition for cows 3 years of age and older has averaged 72%.

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).

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 were 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). Parturition rates for 3-year-olds in 2013 neared the long-time average, with 39% of 3-year-old cows parturient (n = 23). Overall parturition (3 years and older) was above average, at 73% (n = 115).

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 = 31–65:100; 1972–2012), with fall ratios averaging 39:100 (range = 20–55:100) 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 were below average for 2012 and 2013. Summer ratios were 34 and 27 calves per 100 cows, respectively. The fall ratios were 31 and 19 per 100 cows, respectively. Early calf survival may be the largest contributor to higher ratios. The low calf:cow ratio in 2013 is likely due to the combination of several late winter snow events that resulted in a late spring, late migration, and late green-up. Cows began calving during their migration and were crossing rivers that were near flood stage in early June. The timing of calving during migration and the difficult travel conditions likely contributed to higher than normal calf mortality. During the summer composition survey many cows were observed with full udders but no calves.

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 harvest 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 2012) 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 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 8,000 calves. The 19 calves:100 cows observed in the fall of 2013 equates to over 4,000 animals. These calves must go through one full winter before they are considered recruited into the population. Winter mortality for calves varies greatly, from around 15% to 30%.

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 = 119 lb). Annual sample sizes have ranged from 8 to 40. For 2012 and 2013, the average weight of fall calves dropped to 114 lb (2012 range = 96–131 lb; n = 20, 2013 range = 94–129 lb; n = 19). 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.

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 extend past October. The fall bull ratio increased steadily after 2004, reaching 64 bulls:100 cows in 2010. Following higher bull harvest quotas in 2010 and 2011, the ratio declined to 57:100 in 2012 and 30:100 in 2013 (Table 1).

Bulls are also classified by antler size (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 1,500 in 1999 to 1,000 in 2000 and remained at 1,000 until 2005. 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 26% of all bulls; 2007–2013).

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 post-calving and early summer periods. During summer through early fall, caribou disperse north and east. Their fall distribution can extend across the Denali Highway, 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, and has occurred in different areas depending on the year. In 2009 and 2010 rutting was concentrated in the center of the unit, covering portions of Units 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 Units 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. In 2013, the rut occurred from the northwest Alphabet Hills spreading south to Hungry Hollow and East to the upper Chistochina.

Winter habitat for the NCH extends from Cantwell Unit 13E, east across Units 13A and 13B, and northeast into Units 11, 12, and 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 Unit 20E, presumably due to an abundance of lichen in older burns in the vicinity of the Taylor Highway. This shift in winter range use may be another indicator that the herd has begun to overutilize certain portions of its range; if that is the case, Unit 13 winter range may have the opportunity to recover over time as the herd winters elsewhere.

In 2004 much of the preferred NCH winter range in Unit 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 Unit 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 Unit 20E.

In addition to winter habitat loss in Unit 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, is now greater than 50,000 animals, and continues to grow. With the Fortymile Caribou Herd Harvest Management Coalition membership continuing to support further herd growth (Jeff Gross, Area Biologist, Alaska Department of Fish and Game [ADF&G], Tok, personal communication), 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 radiocollar 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 RY12 and RY13, a Tier I subsistence community hunt (CC001) and a Tier I subsistence registration hunt (RC566) were held. The bag limit was one caribou per household and hunters were restricted to participating in only one of the hunt options. In RY12 the caribou season remained open until the end of the winter season, March 31. In RY13 the caribou quota was reached during the fall season, and no winter hunt was held.

Also during RY12 and RY13, 4 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 Unit 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 (opening on 10 August prior to 2012). 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 National Wildlife Refuge during winter months.

Board of Game Actions. During the 2013 Southcentral Board of Game meeting, the board changed the bag limit for drawing caribou from bull to caribou and also provided ADF&G the ability to restrict the bag limit if biologically necessary. In addition, the board increased the number of drawing permits available from 3,000 to 5,000.

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. In order to return the Nelchina caribou population to within objectives, a liberal harvest quota of 4,000 bulls and 1,500 cows was established in RY12. The quota was not met under the available hunt structure; a total of 4,356 caribou were taken.

Given decreased winter survival and a decrease in overall caribou numbers in 2013, the RY13 harvest quota was decreased to 2,500 caribou. A total of 8,026 hunters (both state and federal) reported hunting and harvested a total of 2,645 caribou, exceeding the quota by 145 (Table 2). On October 15, all state hunts were closed by Emergency Order for RY13, and no winter season was held.

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 be high because caribou are often shot while in groups, and more than one animal can be hit with a single shot. Additionally, identifying a specific animal from a group is difficult, particularly cows and small bulls. 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. Wounding loss increases when high numbers of permits are issued and when large numbers of caribou migrate across the Richardson Highway during open hunt periods.

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 entire regulatory year. 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 and have 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 Unit 14B (DC590) has been held each year. Beginning in RY11, 4 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 Unit 13D and the majority of Unit 13A south of the Black River. The DC481 hunt area covers Unit 13E south of the Susitna River, and 13A north of the Black River. The DC482 hunt area covers Unit 13E north of the Susitna River, and Unit 13B west of the MacLaren River. The DC483 hunt area covers Unit 13B east of the MacLaren River, and Unit 13C.

There are 2 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 Unit 14B (a nonsubsistence area). Of these Unit 14B hunters, 93% have been Alaska residents (RY09–RY13). In RY12, 83% of nonresidents and 76% of residents were successful in harvesting a caribou in the DC590 hunt. During RY13, 78% of DC590 were successful (nonresidents 100%, residents 73%).

In RY12, of 5,045 permits issued in the RC566 hunt, 3,781 nonlocal residents and 99 local residents (residents of Units 11, 13, or 12 along the Nabesna Road) reported hunting (Table 3). The nonlocal resident success rate was 66%, while the local resident success rate was 50%. The number of RC566 permits issued increased to 6,878 permits in 2013; of 4,146 permit holders who reported hunting, 38% were successful. The nonlocal success rate was 40% and the local success was 11%.

In the RY12 CC001 hunt, of 402 permits, 143 nonlocal residents and 95 local residents reported hunting. The nonlocal resident success rate was 75%, while the local resident success rate was only 45%. During RY13, 689 CC001 permits were issued. Of 307 hunters who reported hunting, 37% were successful. The nonlocal resident success rate was 45% and the local resident success rate was 11%.

For the Unit 13 drawing hunts (DC480–483) in RY12, 3,001 permits were issued. Of those who reported hunting, 2,056 were nonlocal resident hunters, while only 12 were local residents. Nonlocal residents averaged 49% success, while local residents averaged 58%. In 2013, 5,000 draw permits were issued. Of 2,179 hunters that reported hunting, 28% were successful. Nonlocal resident success was 28% and local resident success was 6%.

The lower success rates for all hunters during RY13 can be attributed to the harvest quota being reached during the fall season, and the winter season being closed by Emergency Order that year.

While nonlocal hunters experienced higher success rates on state hunts, federal hunts were exclusive to local hunters. In RY12 and RY13, 608 and 309 additional caribou, respectively, were taken by local hunters in federal hunts.

<u>Harvest Chronology</u>. 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.

<u>Transport Methods</u>. The most common methods of transportation for Nelchina caribou hunters are all-terrain and highway vehicles (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. While most Nelchina hunts are road or trail accessible, 2 hunts are primarily accessed by aircraft, the drawing hunt in Unit 14B (DC590) and the drawing hunt in southern Unit 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.

Brown bears are considered numerous throughout the NCH summer range and are known to be important predators of caribou (Boertje and Gardner 1998). Between 2006 and 2011 ADF&G staff observed radiocollared brown bears feeding on caribou, in addition to moose, on the Nelchina caribou calving grounds.

Wolves are present throughout the NCH range, and 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.

The NCH is likely benefiting from an intensive wolf management program to improve moose abundance that has been ongoing in Unit 13 since 2001. 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. The highest overwinter mortality documented in recent years was in the winter of 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 Unit 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). Mortality during the winter of 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, 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.

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 was above the objective 2010–2012, with fall estimates averaging 46,897. The quotas were reduced in 2013 due to the low census count, although the count was likely biased low, and not representative of the actual population size.

Habitat diversity, which can be achieved through the return of wildfire or controlled burns, is also important for long-term habitat advancement. The Alaska Interagency Wildland Fire Management Plan (Alaska Wildland Fire Coordinating Group 2010) provides for a natural fire regime that allows fire to function in its ecological role 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. Collins et al. (2011) suggested that there are tradeoffs for habitat enhancement to consider, between early and mid-to-late successional vegetation, with the introduction of fire in caribou habitat. Considering wildfire may play a role in the enhancement of depleted or decadent stands of plant species important to caribou during the spring and summer months, but limit the biomass of lichens important for overwintering caribou, an understanding of which seasonal forage may be limiting is important prior to the application of prescribed fire..

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.

NONREGULATORY MANAGEMENT PROBLEMS/NEEDS

During recent years that has been renewed discussion of constructing a Susitna-Watana Hydroelectric Project, which would be 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 recently in association with this project.

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 the range's carrying 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 crash, followed by a period of herd recovery lasting 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.

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, and productivity remains moderate to high, it may be difficult to control the growth of the population as it begins to exhibit exponential tendencies. Likewise, if the Fortymile caribou herd continues to increase, there could be further negative impacts to the winter range in Unit 20E, and both herds could suffer. Overstocking and subsequent decline 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 hunter conflict, as well as 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 1,000–3,000 caribou each year, with some years being as high as 6,000 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 a decreased 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 2013.

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
2013	30	19	13	67	20	4,256	32,524	37,257

[a] Modeled estimate.

Table 2. Alaska Nelchina caribou harvest data by permit hunt, regulatory years[a] 2009 through 2013.

Hunt No.	RY	Permits Issued	Percent did not hunt	Percent Successful Permits	Bulls	(%)	Cows	(%)	Unk.	Total Harvest
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
	2012	5,045	20	50	1,602	63	939	37	1	2,542
	2013	6,878	37	23	1,374	87	199	13	0	1,573
CC001	2009	477	35	27	127	100	0	0	0	127
(no hunt 2010)	2011	323	44	27	71	82	16	18	0	87
	2012	402	39	37	99	66	51	34	0	150
	2013	689	50	17	101	89	13	11	0	114
FC1302[b]	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
	2012	2,953	49	18	326	61	203	38	8	537
	2013	2,783	53	10	210	76	68	24	0	278
FC1202	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
	2012	152	34	46	35	49	35	49	1	71
	2013	113	39	35	15	42	21	58	0	36
DC590	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
	2012	100	55	34	27	79	7	21	0	34
	2013	100	53	35	29	83	6	17	0	35
DC 480-483	2011	1,127	40	28	313	98	6	2	0	319
	2012	3,001	30	34	1,015	99	7	1	2	1,024
	2013	5,008	56	12	603	99	6	1	0	609
Totals for	2009	3,763	39	21	781	98	14	2	2	797
all permit	2010	7,828	36	31	1,708	70	721	30	9	2,438

Hunt No.	RY	Permits Issued	Percent did not hunt	Percent Successful Permits	Bulls	(%)	Cows	(%)	Unk.	Total Harvest
hunts	2011	7,781	37	36	1829	73	678	27	5	2,512
	2012	11,653	38	37	3,104	71	1,242	29	10	4,356
	2013	15,458	48	17	2,332	88	313	12	0	2,645

[a] A regulatory year begins 1 July and ends 30 June, e.g., regulatory year 2010=1 July 2010–30 June 2011.
[b] This federal hunt has a bag limit of 2 caribou.

Table 3. Alaska Nelchina caribou state hunt annual hunter residency and success, regulatory years 2009 through 2013.

		Successful				Unsuccessful				
Hunt	RY	Local[b] resident	Nonlocal resident	Total[c]	%	Local[b] resident	Nonlocal resident	Total[b]	%	Total[c] hunters
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
	2012	50	2,492	2,542	66	49	1,289	1,338	34	3,880
	2013	10	1,563	1,573	38	84	2,489	2,573	62	4,146
CC001	2009	99	28	127	44	132	29	161	56	288
(no hunt 2010)	2011	52	35	87	50	65	23	88	50	175
	2012	43	107	150	63	52	36	88	37	238
	2013	8	106	114	37	65	128	193	63	307
DC 480-483	2011	1	318	319	47	5	350	355	53	674
	2012	7	1,014	1,023	49	5	1,042	1,048	51	2,071
	2013	1	608	609	28	17	1,546	1,570	72	2,179

[a] A regulatory year begins 1 July and ends 30 June, e.g., regulatory year 2010=1 July 2010–30 June 2011.
[b] Local resident is a resident of Units 11, 13, or 12 along the Nabesna Road.
[c] Total hunters include only those with known community of principal residence.

Table 4. Nelchina caribou Alaska state hunt annual harvest chronology percent by harvest period, regulatory years[a] 2009 through 2013.

		Harvest Periods													
		Weeks[b] (fall)							Months (winter)						
Hunt	RY	1	2	3	4	5	6	7	Oct	Nov	Dec	Jan	Feb	Mar	*n*
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
	2012	19	14	7	9	18	19	14	59	4	1	6	6	26	2,540
	2013	34	13	6	8	13	14	12	No winter hunt						1,573
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
	2012	15	31	8	10	7	11	17	50	27	4	6	0	13	148
	2013	33	22	8	8	4	11	13	No winter hunt						111
DC480-483	2011	-	-	25	9	16	14	17	18						310
	2012	-	-	11	10	14	15	11	20	6	2	1	2	8	1016
	2013	-	-	28	20	20	18	14	No winter hunt						605

[a] A regulatory year begins 1 July and ends 30 June, e.g., regulatory year 2010=1 July 2010–30 June 2011.
b 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. Alaska Nelchina caribou state hunt harvest percent by transport method, regulatory years[a] 2009 through 2013.

		Percent of harvest								
Hunt	RY	Airplane[b]	Horse	Boat	ATV	Snowmachine	ORV	Highway vehicle[b]	Airboat	*n*
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	1,594
	2012	3	0	6	48	5	8	29	1	2,503
	2013	6	0	7	61	0	11	14	1	1,547
CC001	2009	0	2	2	25	9	4	59	0	126
(no hunt 2010)	2011	0	0	7	40	2	9	41	-	87
	2012	1	0	2	43	6	7	42	0	149
	2013	2	0	8	54	0	31	5	0	114
DC480-483	2011	5	1	11	49	0	7	28	-	310
	2012	5	0	5	36	11	6	36	0	1,005
	2013	9	0	9	53	0	9	19	1	601

[a] A regulatory year begins 1 July and ends 30 June, e.g., regulatory year 2010=1 July 2010–30 June 2011.
[b] Aircraft and vehicles weighing over 1,500 lb were illegal in RY07.

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CHAPTER 10: CARIBOU MANAGEMENT REPORT

From: 1 July 2012
To: 30 June 2014[1]

LOCATION

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

MCGRATH AREA HERDS: Beaver Mountains, Sunshine Mountains, Farewell-Big River, 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 1971).

Several small herds continue to exist in the McGrath area. Current data are scant but recognized herds south of the Kuskokwim River include the Tonzona, Farewell-Big River (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 discussed 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 has declined substantially from a peak of over 200,000 animals in the mid-1990s (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, Wildlife Biologist, ADF&G

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

memorandum, 1998, Kodiak). However, coincident with the return of Western Arctic caribou to the Seward Peninsula during the mid- to late 1990s, (Dau 2001) caribou sightings became rare in Unit 21E.

MANAGEMENT DIRECTION

MANAGEMENT OBJECTIVES

Farewell-Big River 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 Mountains and Beaver Mountains herds.

Tonzona herd (Units 19C and 19D)

- Provide for a harvest of up to 50 caribou.

METHODS

We conducted a minimum population count in June 2013 for the Sunshine Mountains 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.

In July 2014 we conducted a similar survey-reconnaissance flight of the Tonzona caribou herd in a portion of the herd's range from the Herron River in the east to the Tonzona River in the west. We did not attempt minimum counts for the Farewell-Big River or Rainy Pass herds during this reporting period; 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., RY13 = 1 July 2013–30 June 2014). These data do not include Unit 19 Mulchatna herd harvest, which is reported elsewhere (Woolington 2013).

The statewide harvest reporting system is used to estimate harvest. The department sends reminders to hunters who fail 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 2013 we counted 488 caribou including 49 calves within the range of both herds combined. This is fewer than the 851 caribou including 113 calves counted during a June 2012 survey. However, the difference is more likely due to better survey conditions in 2012 than a decrease in caribou numbers. Including a correction for caribou we believe we missed, we assume that the Beaver Mountains and Sunshine Mountains caribou herds combined are at least stable with 1,000–1,250 caribou.

Tonzona. We searched the area reported by Del Vecchio et al. (1995) as summer range during our survey in July 2014. We were only able to find 11 caribou (8 adults and 3 calves), but trees and lack of radio collars hampered this search. We received reports from experienced guides operating within this area that there are more caribou than what we found, and we made multiple additional opportunistic observations of groups of over 50 caribou and tracks suggesting that more caribou were present. We believe this herd numbers about 500–750 caribou.

Rainy Pass, Farewell-Big River. We have few population data for the Rainy Pass and Farewell-Big River herds, but we believe each of these herds numbers about 500–750 caribou. During surveys for bison and Dall sheep, we regularly see caribou primarily in groups of 20–50 along with scattered groups numbering from 1–9 up to about 250. 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 RY12–RY13. However, in June 2013 during a minimum count of the Beaver Mountains and Sunshine Mountains herds, 10% of the caribou enumerated were calves.

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 from the public indicate that caribou are found west of the Beaver Mountains. This information is corroborated by our observation of caribou and 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, 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 RY12–RY13.

During our survey of the Beaver Mountains and Sunshine Mountains herd ranges in June 2013, 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.

Farewell-Big River. There is little recent information on the range of the Farewell-Big River 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 Farewell-Big River 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 RY12–RY13.

Herd, Unit, Bag limit	Resident Open Season	Nonresident Open Season
Mulchatna, Farewell-Big River		
Units 19A and 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

Herd, Unit, Bag limit	Resident Open Season	Nonresident Open Season
Tonzona, Farewell-Big River, Rainy Pass		
Unit 19C.		
RESIDENT AND NONRESIDENT HUNTERS: 1 bull.	10 Aug–20 Sep	10 Aug–20 Sep
Beaver Mountains, Tonzona, Farewell-Big River		
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	
NONRESIDENT HUNTERS: 1 bull.		10 Aug–20 Sep
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 herd		
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 RY12–RY13.

Harvest by Hunters. Reported harvest remained low for local caribou herds in the McGrath area during RY09–RY13 (Table 1). Hunter effort increased from 92 in RY09 to 162 in RY13. However, effort is still considered low, with an average of 114 hunters annually over this period (Table 2a). In general, harvest and effort varied by herd during RY09–RY13 but remained low (Tables 2b–2g). The average harvest during RY09–RY13 was 31 animals, of which 98% were bulls (Table 1).

Hunter Residency and Success. During RY09–RY13 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 RY09–RY13 nonlocal residents took 35%, nonresidents took 61%, and hunters with unknown residency took 1% of harvested animals (Table 2a).

Harvest Chronology. Most caribou harvested during RY09–RY13 were taken in August (42%) and September (55%; Table 3).

Transport Methods. Aircraft were the most common means of hunter transportation to access McGrath area caribou herds. During RY09–RY13, 79% of successful caribou hunters used aircraft. Horses (10%) were the next most commonly used method of transportation followed by 4-wheelers (6%). Infrequently, boats (2%), ORVs (<1%), highway vehicles (<1%) and unknown methods (<1%) were also reported (Table 4).

Other Mortality

No specific data were collected concerning natural mortality rates or factors during RY12–RY13.

HABITAT

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

CONCLUSIONS AND RECOMMENDATIONS

Harvest remained low during RY12–RY13 for all McGrath area caribou herds and management objectives were met. The Farewell-Big River herd was managed to provide for a harvest of up to 100 bull caribou and an average of 11 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 14. 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 2 caribou. The Tonzona herd objective was a harvest of up to 50 caribou, and the average reported harvest was 8 caribou.

Recent movement and distribution data for the Farewell-Big River, Rainy Pass, and Tonzona caribou herds in Unit 19C are scant. We recommend deploying radio collars to better define these herds, their numbers, and movements as soon as budgets and office priorities allow.

During RY12–RY13 the number of caribou hunters in the area increased 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 to hunting regulations are recommended.

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Table 1. McGrath area[a] caribou harvest by herd, Alaska, regulatory years[b] 2009–2013.

Regulatory	Beaver Mtns			Farewell-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
2009	0	0	0	12	0	12	11	0	11	0	0	0	2	0	2	0	0	0	25	0	25
2010	0	0	0	11	0	11	12	0	12	1	0	1	2	0	2	0	0	0	26	0	26
2011	2	0	2	14	0	15[c]	10	1	11	1	0	1	1	0	1	0	0	0	28	1	30[c]
2012	0	0	0	9	0	10[c]	7	0	7	0	0	1[c]	7	1	8	4	0	4	27	1	30[c]
2013	0	1	1	10	0	11[c]	20	0	20	1	0	1	7	0	7	5	0	5	43	1	45[c]

[a] Excludes Mulchatna caribou herd animals taken in Unit 19.
[b] Regulatory year begins 1 July and ends 30 June (e.g., regulatory year 2009 = 1 July 2009–30 June 2010).
[c] Includes caribou of unknown sex.

Table 2a. McGrath area[a] caribou hunter residency and success, Alaska, regulatory years[b] 2009–2013.

	Successful					Unsuccessful					
Regulatory Year	Local resident[c]	Nonlocal resident	Nonresident	Unk	Total (%)	Local resident[c]	Nonlocal resident	Nonresident	Unk	Total (%)	Total hunters
2009	1	10	12	2	25 (27)	4	43	15	5	67 (73)	92
2010	0	11	15	0	26 (28)	3	44	20	1	68 (72)	94
2011	0	13	17	0	30 (29)	6	48	16	2	72 (71)	102
2012	2	7	21	0	30 (25)	8	50	32	0	90 (75)	120
2013	1	14	30	0	45 (28)	4	58	54	1	117 (72)	162

[a] Excludes Mulchatna caribou herd animals taken in Unit 19.
[b] Regulatory year begins 1 July and ends 30 June (e.g., regulatory year 2009 = 1 July 2009–30 June 2010).
[c] Local resident is any resident of Units 19C, 19D, 21A, or 21E.

Table 2b. Beaver Mountains herd caribou hunter residency and success, Alaska, regulatory years[a] 2009–2013.

	Successful					Unsuccessful					
Regulatory year	Local resident[b]	Nonlocal resident	Nonresident	Unk	Total (%)	Local resident[b]	Nonlocal resident	Nonresident	Unk	Total (%)	Total hunters
2009	0	0	0	0	0 (0)	2	1	0	0	3 (100)	3
2010	0	0	0	0	0 (0)	1	7	0	0	8 (100)	8
2011	0	0	2	0	2 (67)	0	1	0	0	1 (33)	3
2012	0	0	0	0	0 (0)	4	6	1	0	11 (100)	11
2013	0	0	1	0	1 (10)	2	4	3	0	9 (90)	10

[a] Regulatory year begins 1 July and ends 30 June (e.g., regulatory year 2009 = 1 July 2009–30 June 2010).
[b] Local resident is any resident of Units 19C, 19D, 21A, or 21E.

Table 2c. Farewell-Big River herd caribou hunter residency and success, Alaska, regulatory years[a] 2009–2013.

	Successful					Unsuccessful					
Regulatory year	Local resident[b]	Nonlocal resident	Nonresident	Unk	Total (%)	Local resident[b]	Nonlocal resident	Nonresident	Unk	Total (%)	Total hunters
2009	1	4	7	0	12 (23)	1	29	10	1	41 (77)	53
2010	0	4	7	0	11 (24)	0	22	12	1	35 (76)	46
2011	0	6	9	0	15 (33)	0	22	8	1	31 (67)	46
2012	2	3	5	0	10 (36)	0	12	6	0	18 (64)	28
2013	0	5	6	0	11 (29)	0	21	6	0	27 (71)	38

[a] Regulatory year begins 1 July and ends 30 June (e.g., regulatory year 2009 = 1 July 2009–30 June 2010).
[b] Local resident is any resident of Units 19C, 19D, 21A, or 21E.

Table 2d. Rainy Pass herd caribou hunter residency and success, Alaska, regulatory years[a] 2009–2013.

	Successful					Unsuccessful					
Regulatory year	Local resident[b]	Nonlocal resident	Nonresident	Unk	Total (%)	Local resident[b]	Nonlocal resident	Nonresident	Unk	Total (%)	Total hunters
2009	0	6	3	2	11 (38)	0	10	4	4	18 (62)	29
2010	0	5	7	0	12 (48)	0	11	2	0	13 (52)	25
2011	0	6	5	0	11 (27)	1	23	5	1	30 (73)	41
2012	0	0	7	0	7 (15)	0	24	16	0	40 (85)	47
2013	0	6	14	0	20 (30)	0	18	29	0	47 (70)	67

[a] Regulatory year begins 1 July and ends 30 June (e.g., regulatory year 2009 = 1 July 2009–30 June 2010).
[b] Local resident is any resident of Units 19C, 19D, 21A, or 21E.

Table 2e. Sunshine Mountains herd caribou hunter residency and success, Alaska, regulatory years[a] 2009–2013.

	Successful					Unsuccessful					
Regulatory year	Local resident[b]	Nonlocal resident	Nonresident	Unk	Total (%)	Local resident[b]	Nonlocal resident	Nonresident	Unk	Total (%)	Total hunters
2009	0	0	0	0	0 (0)	0	0	0	0	0 (0)	0
2010	0	1	0	0	1 (33)	1	1	0	0	2 (67)	3
2011	0	1	0	0	1 (25)	3	0	0	0	3 (75)	4
2012	0	0	1	0	1 (50)	1	0	0	0	1 (50)	2
2013	1	0	0	0	1 (50)	1	0	0	0	1 (50)	2

[a] Regulatory year begins 1 July and ends 30 June (e.g., regulatory year 2009 = 1 July 2009–30 June 2010).
[b] Local resident is any resident of Units 19C, 19D, 21A, or 21E.

Table 2f. Tonzona herd caribou hunter residency and success, Alaska, regulatory years[a] 2009–2013.

	Successful					Unsuccessful					
Regulatory year	Local resident[b]	Nonlocal resident	Nonresident	Unk	Total (%)	Local resident[b]	Nonlocal resident	Nonresident	Unk	Total (%)	Total hunters
2009	0	0	2	0	2 (67)	0	1	0	0	1 (33)	3
2010	0	1	1	0	2 (29)	0	1	4	0	5 (71)	7
2011	0	0	1	0	1 (25)	0	0	3	0	3 (75)	4
2012	0	2	6	0	8 (62)	0	2	3	0	5 (38)	13
2013	0	3	4	0	7 (78)	0	0	2	0	2 (22)	9

[a] Regulatory year begins 1 July and ends 30 June (e.g., regulatory year 2009 = 1 July 2009–30 June 2010).
[b] Local resident is any resident of Units 19C, 19D, 21A, or 21E.

Table 2g. McGrath area hunter residency and success for caribou where herd identification was not known, Alaska, regulatory years[a] 2009–2013.

	Successful					Unsuccessful					
Regulatory year	Local resident[b]	Nonlocal resident	Nonresident	Unk	Total (%)	Local resident[b]	Nonlocal resident	Nonresident	Unk	Total (%)	Total hunters
2009	0	0	0	0	0 (0)	1	2	1	0	4 (100)	4
2010	0	0	0	0	0 (0)	1	2	2	0	5 (100)	5
2011	0	0	0	0	0 (0)	2	2	0	0	4 (100)	4
2012	0	2	2	0	4 (21)	3	6	6	0	15 (79)	19
2013	0	0	5	0	5 (14)	1	15	14	1	31 (86)	36

[a] Regulatory year begins 1 July and ends 30 June (e.g., regulatory year 2009 = 1 July 2009–30 June 2010).
[b] Local resident is any resident of Units 19C, 19D, 21A, or 21E.

Table 3. McGrath[a] area caribou harvest chronology by month, Alaska, regulatory years[b] 2009–2013.

Regulatory	Harvest chronology by month								
year	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Unk	*n*
2009	7	18	0	0	0	0	0	0	0	25
2010	8	17	1	0	0	0	0	0	0	26
2011	12	18	0	0	0	0	0	0	0	30
2012	16	12	0	0	0	0	0	0	2	30
2013	23	21	0	0	0	0	0	0	1	45

[a] Excludes Mulchatna caribou herd animals taken in Unit 19.
[b] Regulatory year begins 1 July and ends 30 June (e.g., regulatory year 2009 = 1 July 2009–30 June 2010).

Table 4. McGrath[a] area transportation method of successful caribou hunters, Alaska, regulatory years[b] 2009–2013.

	Harvest by transport method								
Regulatory year	Airplane (%)	Horse (%)	Boat (%)	4-Wheeler (%)	Snowmachine (%)	ORV (%)	Highway vehicle (%)	Unk (%)	*n*
2009	20 (80)	3 (12)	0 (0)	2 (8)	0 (0)	0 (0)	0 (0)	0 (0)	25
2010	20 (77)	4 (15)	0 (0)	1 (4)	0 (0)	0 (0)	1 (4)	0 (0)	26
2011	23 (77)	2 (7)	0 (0)	4 (13)	0 (0)	0 (0)	0 (0)	1 (3)	30
2012	26 (87)	3 (10)	0 (0)	1 (3)	0 (0)	0 (0)	0 (0)	0 (0)	30
2013	35 (78)	4 (9)	3 (7)	2 (4)	0 (0)	1 (2)	0 (0)	0 (0)	45

[a] Excludes Mulchatna caribou herd animals taken in Unit 19.
[b] Regulatory year begins 1 July and ends 30 June (e.g., regulatory year 2009 = 1 July 2009–30 June 2010).

SPECIES
MANAGEMENT REPORT

Alaska Department of Fish and Game
Division of Wildlife Conservation
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CHAPTER 11: CARIBOU MANAGEMENT REPORT

From: 1 July 2012
To: 30 June 2014[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 river drainages. In recent years the herd has also used the upper Nenana and Susitna river 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 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 wolves. From October 1993 to December 1994, state biologists and the public reduced wolf

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

numbers by trapping to halt the decline of DCH. This ground-based predation control program was terminated amid considerable controversy. Valkenburg et al. (2002) summarized the effects of this program on DCH. Research and enhancement of Delta caribou became 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).

Caribou harvest and harvest regulations have varied widely due to population fluctuations and strong hunter interest. The Alaska Board of Game (board) suspended hunting of 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.

MANAGEMENT DIRECTION

MANAGEMENT GOALS

Since the mid-1970s, goals for 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].

MANAGEMENT OBJECTIVES

- Maintain a fall 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 (i.e., intensive managment population objective).
- Sustain an annual harvest of 300–700 caribou (i.e., intensive management harvest objective).

METHODS

POPULATION STATUS AND TREND

Population Size

Due to unfavorable weather and because the herd did not aggregate, we were unable to complete a photocensus-based abundance estimate for DCH during 2012, 2013, and 2014.

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 the majority of the radiocollared caribou (i.e., the Yanert and Upper Wood river drainages, the Gold King Benches, and the Little Delta River and Delta Creek drainages) and also classified caribou encountered while in transit between search areas. We assumed bulls and cows were thoroughly mixed since surveys were conducted during the month of the rut. 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). We either tallied the composition of each group on a 5-position counter and recorded the tallies on a data sheet or recorded composition information on a handheld digital recorder (Sony IC Recorder, model ICD-PX312, Sony Electronics, Inc., San Diego, California) and then downloaded the digital data onto a personal computer for transcription and tabulation.

Distribution and Movements

Our objective was to maintain a sample of 30–40 radiocollared female caribou to monitor distribution and movements and aid in conducting population estimation and composition surveys. Radiocollared caribou were relocated approximately once per month (excluding December and January). When we captured female calf caribou at 10 months of age in April, we weighed them for comparison with previous weights for DCH (Valkenburg et al. 2002, Valkenburg et al., *In prep*) to assess nutritional status of the herd.

MORTALITY

Harvest

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

DCH 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, DCH declined more than the neighboring Denali and Macomb herds. 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. The 2008, 2009, and 2011 minimum herd counts and composition data indicated a possible decline. However, both of these estimates were fraught with difficulties (Seaton 2011).

Population Composition

During fall 2012 we classified 787 caribou: 76 small bulls, 78 medium bulls, 87 large bulls, 476 cows and 70 calves; during 2013 we classified 383 caribou: 46 small bulls, 24 medium bulls, 28 large bulls, 260 cows and 25 calves; and during 2014 we classified 622 caribou: 46 small bulls, 66 medium bulls, 45 large bulls, 399 cows and 66 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 2013 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) indicate the herd was probably stable or increasing during that period. However, weak calf:cow ratios ($\bar{x}$ = 13.9; 2012–2014) along with lower bull:cow ($\bar{x}$ = 38; 2013–2014) and large bull:cow ($\bar{x}$ = 11; 2013–2014) suggest that the population may have declined during 2012–2014.

Weights of 10-month-old females during 2013–2014 ($\bar{x}$ = 53.8 kg) were similar to weights during 1995–2007 ($\bar{x}$ = 55.7 kg; Table 2), 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. Typically, this occurred during the calving and postcalving periods, but some radiocollared Delta caribou could be found south of the Alaska Range all times of the year. 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 DCH 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. We observed no major changes in distribution of the herd during 2012–2014.

MORTALITY

Harvest

Season and Bag Limit (RY12 and RY13).

	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 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 to 200 drawing permits that ADF&G may issue because hunter participation had been declining, and the harvest of bulls was below the recommended allowable harvest of 2–3% of the estimated population of 2,000–3,000 caribou annually. No board actions or emergency orders for the Delta herd were issued during RY12–RY13.

Permit Hunts. We issued 75 permits annually in RY96 and RY97, 100 permits annually during RY98–RY03, and 150 permits annually during RY04–RY13. Since RY09 the percentage of permittees who did not hunt (30–45%) has been relatively high but consistent (Table 3). Similarly, success rates of those who hunted have been consistently high at ≥44% since RY04 when the department began issuing 150 permits annually. 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 all-terrain vehicles 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; Young 2013). This trend continued through RY10 (34 vs. 18), but not RY11 (31 vs. 39) or RY12 (22 vs. 24). Again in RY13–RY14 nonlocal residents and nonresidents harvested more caribou ($\bar{x}$ = 37) than locals ($\bar{x}$ = 18). Success rates of nonresident hunters has typically been higher than that of resident hunters in this hunt (Young 2007; Seaton 2009, 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, and in RY14 resident success (56%) exceeded that of nonresidents (45%).

Harvest Chronology. No clear trends were apparent in harvest chronology during RY12–RY14 (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 (RY09–RY14) primarily used 3- or 4-wheelers ($\bar{x}$ = 48%) and aircraft ($\bar{x}$ = 32%) to harvest caribou (Table 6). The remaining hunters ($\bar{x}$ = 20%) used other modes of transportation, including horses, boats, other off-road vehicles, and highway vehicles.

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, in the early 1990s the board adopted a wolf predation control implementation plan in Unit 20A to reduce wolf numbers to rebuild the caribou population. The wolf predation control plan was no longer utilized after 1994. 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 it 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 have 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, or 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 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 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 2.6% during RY12–RY14, based on the average harvest of 52 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, 1989–2014.

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[c]	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]
10/10/2013	38	11	10	7	68	47	24	29	26	383	–[d]	–[d]
10/19/2014	39	11	17	11	64	29	42	29	25	622	–[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 radio collars (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, 1979–2015.

Year[a,b]	10-month-olds $\bar{x}$ (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
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	3.1	11
2002	130.0	59.0	2.0	15
2003	117.5	53.3	3.5	15
2004	129.4	58.6	3.7	14
2005	127.2	57.7	3.7	14
2007	121.7	55.3	3.5	11
2008	132.2	60.1	2.4	11
2010	120.9	54.8	1.8	7
2011	120.0	54.4	2.5	14
2013	125.8	57.1	4.2	10
2014	112.2	50.9	6.4	9
2015	115.4	52.3	3.6	5

[a] Years 1979–2001 (Valkenburg et al. 2002); Years 2002–2008 (Valkenburg et al. *In prep*).
[b] Missing years because there were too few calves to obtain an adequate sample of 10-month-olds those years.

Table 3. Delta caribou harvest data by permit hunt DC827, regulatory years[a] 2009–2014.

Hunt	Regulatory year	Permits issued	Did not hunt (%)	Unsuccessful hunters (%)	Successful hunters (%)	Bulls (%)	Cows (%)	Unk (%)	Harvest
DC827	2009	150	49 (33)	51 (50)	50 (50)	50 (100)	0 (0)	0 (0)	50
	2010	150	67 (45)	31 (37)	52 (63)	52 (100)	0 (0)	0 (0)	52
	2011[b]	151	45 (30)	36 (34)	70 (66)	70 (100)	0 (0)	0 (0)	70
	2012	150	67 (45)	37 (45)	46 (55)	45 (98)	0 (0)	1 (2)	46
	2013[c]	152	55 (36)	35 (36)	62 (64)	62 (100)	0 (0)	0 (0)	62
	2014	150	62 (41)	40 (45)	48 (55)	48 (100)	1[d] (0)	0 (0)	48

[a] Regulatory year begins 1 July and ends 30 June (e.g., regulatory year 2009 = 1 July 2009–30 June 2010).
[b] Includes one SC827 permit that did not hunt.
[c] Two permits reissued/transferred for active duty military personnel deployed to combat zone.
[d] Illegal take not included in harvest, bulls only hunt.

Table 4. Delta caribou annual hunter residency and success, permit hunt DC827, regulatory years[a] 2009–2014.

	Successful				Unsuccessful				
Regulatory year	Local[b] resident	Nonlocal resident	Nonresident	Total (%)	Local[b] resident	Nonlocal resident	Nonresident	Total (%)	Total hunters
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 (67)	16	18	1	35 (33)	105
2012	24	17	5	46 (59)	21	11	0	32 (41)	78
2013	22	28	11	61[c] (63)	14	19	2	35 (36)	96[c]
2014	14	30	5	49 (55)	17	17	6	40 (45)	89

[a] Regulatory year begins 1 July and ends 30 June (e.g., regulatory year 2009 = 1 July 2009–30 June 2010).
[b] Residents of Unit 20.
[c] Does not include 1 unknown.

Table 5. Delta caribou annual harvest chronology percent by harvest periods, permit hunt DC827, regulatory years[a] 2012–2014.

Regulatory	Chronology percent by harvest periods								
year	Week 6	Week 7	Week 8	Week 9	Week 10	Week 11	Week 12	Unk	*n*
2012	22	22	9	9	17	13	9	0	46
2013	11	18	6	13	16	27	8	0	62
2014	14	18	10	16	6	16	18	0	49

[a] Regulatory year begins 1 July and ends 30 June (e.g., regulatory year 2012 = 1 July 2012–30 June 2013).

Table 6. Delta caribou harvest percent by transport method, permit hunt DC827, regulatory years[a] 2009–2014.

	Harvest percent by transport method							
Regulatory year	Airplane	Horse	Boat	3- or 4-Wheeler	ORV[b]	Highway vehicle	Unk	*n*
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
2013	29	11	3	35	10	11	0	62
2014	37	6	0	51	0	6	0	49

[a] Regulatory year begins 1 July and ends 30 June (e.g., regulatory year 2009 = 1 July 2009–30 June 2010).
[b] Other off-road vehicles.

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CHAPTER 12: CARIBOU MANAGEMENT REPORT

From: 1 July 2012
To: 30 June 2014[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 130 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. FCH is important for consumptive and nonconsumptive uses in Interior Alaska and southern Yukon. Like other caribou herds in Alaska, 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, 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, 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, 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 FCH during the 1920s.

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

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 2000a). 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 FCH, wolf numbers were reduced by 78% to 2 sterilized alpha wolves in each of 15 pack territories (Gardner 2003). During 1996–2002, 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]).

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 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 FCH.

In 1994 the Fortymile Caribou Herd Management Planning Team was established. The team was comprised of 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 *Fortymile Caribou Herd Harvest Plan 2001–2006* (Advisory Committee Coalition 2000). 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.* Those goals provided conditions for continued growth of Fortymile caribou herd to allow it to expand to its former range in Alaska and Yukon. The 2001–2006 harvest plan also 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; regulatory year begins 1 July and ends 30 June, e.g., RY02 = 1 July 2002–30 June 2003) RY02–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* (Advisory Committee Coalition 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 RY06–RY11.

Again in 2011, the original 5 Alaska Fish and Game advisory committees, as well as the Matanuska-Susitna 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 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–RY14, 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 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, 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 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 photocensuses (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 RY12–RY14, we attempted annual photocensus counts of 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 2000b).

When a photocensus 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 1 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 de Havilland 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). In 2013 and 2014, radiocollared females ≥3-years old were radiotracked 3–4 times at approximately 4–5 day intervals during 12–28 May.

Population Composition, Captures, and Body Condition

During RY12–RY14 we conducted aerial surveys and captures during late September through mid-October to estimate herd sex and age composition, deploy radio and satellite 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. On the day of the survey, we tallied the composition of each group using a digital voice recorder. The voice recordings were reviewed at a later date, tallied on a 5-position counter, and totals were recorded 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 during the first 2 weeks of October (late October in RY13) and again in late April. During October, 4- and 5-month-old female calves were captured to collect weights and other biological measurements to help assess nutritional condition of the herd. Twenty to 21 VHF radio collars were deployed annually on these calves to maintain a sample of known-age females for each cohort to assess age-specific parturition rates in the herd.

During April captures, an additional 14–18 female calves were collared annually to bolster the sample size of known-age females/cohorts to provide a high likelihood that at least 20 females/cohorts would survive to age 3. This was intended to maintain a minimum sample size of 20 3-year-old females/cohorts to assess 3-year-old parturition rates in the herd.

Additional adult cows were fitted with satellite radio collars during October captures in RY12–RY14 to maintain a sample size of ≥75 radiocollared females in the herd.

Distribution and Movements

We obtained seasonal herd distribution, movements, and estimates of annual mortality by monitoring 114–161 cows fitted with VHF and satellite radio collars 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 photocensus attempt during June and early July; and sporadically during the remainder of the year.

Harvest

Harvest was monitored using hunter check stations, 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 RY12–RY14 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 allocate 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 RY12–RY14, 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.

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 (Advisory Committee Coalition 2000), 2006–2012 harvest plan (Advisory Committee Coalition 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–RY14. Analysis will be completed and included in the next report.

During RY03–RY14, photocensuses 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 (J. A. Gross, Wildlife Biologist, ADF&G, unpublished data, Tok; R. D. Boertje, Wildlife Biologist, ADF&G, unpublished data, Fairbanks). Successful photocensuses 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 88% (n = 81) in 2013 and 63% (n = 102) in 2014 (Table 2). Parturition rates of 3-year-old radiocollared females were 83% (n = 18) in 2013 and 37% (n = 19) in 2014.

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 (54.6%) 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 59.5% after inclusion of the 2013 3-year-old parturition rate of 83% (n = 18). In 2014 the 3-year-old parturition was 37%, but the 5-year moving average remained above the threshold at 56.8%.

Although the 5-year moving average of 3-year-old parturition rate was above the threshold in 2013 and 2014, nutritional status of the herd is still in question and deserves ongoing scrutiny. Additional information about the nutritional status of FCH can be found in Boertje et al. (2012).

Population Composition

RY12. We conducted the fall 2012 composition survey on 9 October. A total of 4,832 caribou were classified in the vicinity of 55 (69%) of 80 randomly-selected radiocollared animals in the herd, resulting in an estimated 22 calves and 40 bulls:100 cows (Table 1).

RY13. We conducted the fall 2013 composition survey during 6–13 October. A total of 3,921 caribou were classified in the vicinity of 114 (88%) of the 130 total radiocollared animals in the herd, resulting in an estimated 28 calves and 38 bulls:100 cows (Table 1).

RY14. We conducted the fall 2014 composition survey on 9 October. A total of 4,794 caribou were classified in the vicinity of 72 (96%) of 75 randomly-selected radiocollared animals in the herd, resulting in an estimated 25 calves and 34 bulls:100 cows (Table 1).

The bull:cow ratio remained relatively stable during RY10–RY13, ranging between 38 and 43. In RY14, the ratio dropped to 34 but was likely due to uneven distribution of bulls in the herd during the RY14 composition survey rather than a sudden change in the proportion of bulls in the herd. The RY10–RY13 ratios indicate bull numbers are likely stable under the current harvest management strategy. Harvest quotas will remain conservative (~2% of the herd annually) through RY15 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 October 2012, 2013, and 2014, we captured 25, 22, and 25 5-month-old female calves and deployed 21, 20, and 20 VHF radio collars on these calves, respectively. In addition, a total of 28 satellite radio collars were deployed on adult cows in October during these years. Average calf weight was 50.5 kg (111.4 lb) in 2012, 49.5 kg (109.2 lb) in 2013, and 55.1 kg (121.4 lb) in 2014 (Table 3). Fall calf weights have been collected on FCH since 1990. We found a declining trend in FCH fall calf weights (0.20 kg/yr, $P = 0.005$) from 1990 to 2014. However, the 2014 calf weights were the highest observed since 2000, possibly associated with the herd's range expansion in fall-winter 2013–2014.

During April 2012, 2013 and 2014, we deployed radio collars on 18, 15, and 14 11-month-old female calves.

Distribution and Movements

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

In May 2013, 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 river drainages.

In May 2014, FCH primarily calved along the western and southern edges of the Yukon-Charley Rivers National Preserve, in the Joseph Creek drainage of the Middle Fork Fortymile River, and in the headwaters of the Salcha and Goodpaster river drainages. The majority of the herd spent June in the same general area where the herd calved.

Pre-rut and Rut. In late September to mid-October 2012, FCH was concentrated in the upper Seventymile, Charley, South Fork and mainstream Birch Creek, upper Salcha, and upper West Fork Chena river drainages.

In late September to mid-October 2013, FCH made a move from the Seventymile river drainage and American Summit area northeast into Yukon, Canada. The herd concentrated in the drainages flowing into the north and south banks of the Yukon River within 40–60 miles of the Alaska-Yukon border.

In late September through mid-October 2014, FCH was concentrated in the upper Middle Fork Fortymile River, in the areas surrounding Chicken and Boundary, and in the Sixtymile river drainage in Yukon, Canada.

Winter. During November 2012–March 2013, the majority of the herd was concentrated in the White Mountains and Birch Creek areas near the Steese Highway. 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 and Dawson, Yukon Territory.

During November 2013–March 2014, the majority of the herd concentrated within 40–60 miles of the Alaska-Yukon border, in both Alaska and Yukon. The herd ranged from the upper Ladue River drainage to the south to the Tatonduk and Ogilvie river drainages to the north.

During November 2014–March 2015, the majority of the herd was concentrated in the Birch Creek and middle fork of the Chena river drainages near the Steese Highway and Chena Hot Springs Road, in the upper Goodpaster River drainage, and in the northwest portion of the Yukon-Charley Rivers National Preserve south of the Yukon River. A smaller portion of the herd was also distributed in the eastern portion of its winter range, primarily near the Top of the World Highway between Boundary, Alaska and Dawson, Yukon Territory.

MORTALITY

Harvest

Season and Bag Limit. Both fall and winter hunts were in place for FCH during RY12–RY14, 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 the Appendix.

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).

During the January 2013 Alaska Board of Game meeting, a targeted hunt (limited registration hunt) and youth permit hunt were established for the Fortymile herd.

The targeted hunt was developed to allow a few hunters to take caribou along the Steese or Taylor highways when large numbers of caribou are present near the highways, and the unlimited registration permit hunt (RC867) closes because of concerns about exceeding the harvest quota. This hunt is open to Alaska residents only. If conditions warrant, this hunt may be announced by emergency order, and hunters will be allowed to submit an application for participation in this hunt. A few hunters will be randomly selected from all applications to participate in this hunt.

The youth hunt was developed by the board to provide limited opportunity for youth hunters to meet the board's legal mandates to provide youth hunt opportunity where appropriate. This hunt was implemented for the first time during the RY14 hunting season, and details and results of this hunt will be discussed during the next report period.

During the March 2014 Alaska Board of Game meeting, the board reauthorized the portions of the existing upper Yukon-Tanana predation control program in Units 12, 20B, 20D, 20E, and 25C intended to benefit the Fortymile caribou herd.

Harvest by Hunters. We issued 4,701 registration permits in RY12, 3,904 in RY13, and 5,852 in RY14 (Table 6). In RY12, 2,822 hunters reported taking 1,297 caribou; in RY13, 2,637 hunters reported taking 1,186 caribou; and 3,460 hunters took 974 in RY14 (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 1,331 in RY12, 1,269 in RY13, and 1,029 in RY14 (Table 7). To assist herd growth during RY12–RY14, the Tr'ondëk Hwëchîn First Nation members in Yukon, Canada chose not to exercise their constitutional right to hunt FCH; concomitantly all other federal and provincial hunting seasons for FCH were closed in Canada.

Hunter Residency and Success. Nonresidents made up 8–13% of hunters during RY12–RY14 and accounted for 11–17% of the total harvest (Table 8). The success rate for residents (local and nonlocal combined) was 27–43%, whereas success rate for nonresidents was 38–58% (Table 8).

Harvest Chronology. During the fall hunt (RC860) in RY12–RY14, most harvest (85–90%) occurred during the last week in August and first week in September. This coincides with the hunt zones 1 and 3 season openings on 29 August in RY12–RY13 and 3 September opening in RY14 (Table 9).

During the winter hunting season (RC867) in RY12 and RY14, harvest was more evenly spread throughout the season than during the fall hunt (Table 10). However, in RY13, the winter season was cancelled due to the quota being taken during the fall (RC860) hunt. Closures and delayed openings in portions of the hunt area where large numbers of caribou gathered along highways resulted in slower harvest and longer seasons during RY12 and RY14.

Transport Methods.

RC860 Fall Hunts — In RY12–RY14, the types of transportation used by successful hunters varied by hunt zone and depended primarily on the number of all-terrain vehicle (ATV) trails available and whether air taxi companies worked in the area. All successful hunters in the roadless portions of 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 were the primary access points used by hunters with ATVs to hunt FCH in Unit 20E. Walk-in hunters accessed the herd from the Taylor Highway near American Summit in the Glacier Mountain 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 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 FCH using snowmachines and highway vehicles along the Steese and Taylor highways (zones 1 and 3).

Other Mortality

Boertje and Gardner (1998a, 1998b, 1999, 2000b) 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 FCH through RY13. We continued wolf predation control during RY12–RY13 to reduce wolf predation on FCH (Alaska Department of Fish and Game 2014).

HABITAT

Assessment

In 1998, for the first time in 3 decades, 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. In fall 2013, the herd moved farther east and northeast into Yukon than had been observed in many decades. However, more than 40% of the historic Fortymile range remains unused since the 1960s, and the farthest east and southeast portions of the range have not been used since at least the 1940s.

Fecal samples from overgrazed winter ranges frequently 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. Additional data collected during 2000–2004 indicate a high proportion of lichens in fecal samples (W. B. Collins, Wildlife Biologist, 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 (B. W. Dale, Wildlife Biologist, 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 and 2005 burned about 15% of the winter range of 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 FCH remains unoccupied by caribou. Thus, availability of winter range is likely not limiting growth of FCH.

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 FCH range were initiated during RY12–RY14. However, the *Alaska Interagency Wildland Fire Management Plan* (Alaska Wildland Fire Coordinating Group 2010) 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 1995 *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 where FCH is most sensitive to disturbance. Working with the mining community and the U.S. Air Force, we minimized the effects of mining exploration and low-flying military aircraft 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 1999–2014 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 FCH range during RY04–RY14. The plan gives adequate protection against resource development for the Fortymile herd throughout its range and strong protection for the calving and postcalving ranges.

NONREGULATORY MANAGEMENT PROBLEMS AND NEEDS

The 1995 *Fortymile Caribou Herd Management Plan* formally ended in May 2001. Two of the plan's objectives are ongoing: 1) habitat protection and 2) 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 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 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 FCH. A cooperative state-federal program enhancing the viewing, education, and hunting opportunities of FCH would benefit the herd and people interested in the herd.

CONCLUSIONS AND RECOMMENDATIONS

Because we were unable to complete a photocensus during RY10–RY13, 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 FCH harvest plans (Advisory Committee Coalition 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–RY14, we will continue to closely monitor indicators of nutritional condition during the next report period 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, 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–RY13 and will be completed during the next report period.

Harvest was managed following the guidelines in the 2012–2018 harvest plan. During RY12–RY13, the annual quota was 1,000 in both years (including up to 25% cows in all years). We did meet the lower end of the harvest objective (management objective 3) in RY12–RY13, with an annual harvest of 1,297 and 1,186 during these years. Harvest levels allowed fall bull:cow ratios to remain above 35 bulls:100 cows during RY12–RY13, 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 FCH one of the most accessible herds in the state, benefiting hunters and nonconsumptive users. This provides 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. We will continue to monitor this project and its potential impact on the Fortymile caribou during the next report period. The *Alaska Interagency Fire Management Plan* (Alaska Wildland Fire Coordinating Group 1998) allowed for a near-natural fire regime within FCH range in Alaska during RY12–RY13.

For the next report period the management goals and objectives will remain the same. However, some of the management activities will be revised to reflect several recent changes in management and research efforts. The revised activities for the next report period will include:

- 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 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 photocensuses (Objectives 1 and 2).
- Conduct annual fall composition surveys (Objectives 1 and 4).
- Capture 25–30 female calves in October to collect weights and biological measurements to help assess nutritional condition of the herd (Objectives 1–4).
- Deploy 35 VHF collars on calves-of-the-year annually (20 in October and 15 in April), to provide a high likelihood that at least 20 known-age females/cohort will survive to age 3 (Objectives 1–4).
- Maintain a minimum sample size of at least 75 radiocollared females, including a minimum of 50 satellite collars (Objectives 1–4).
- Maintain 20–30 radiocollared bulls, preferably using satellite collars if funding allows (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 viewing and other wildlife-related recreation (Objectives 1–4).

In addition, we plan to continue with the following activity:

- Work with research staff to refine nutrition indices to determine when the herd is becoming nutritionally stressed.

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Table 1. Fortymile caribou fall composition counts and population size, Alaska, regulatory years[a] 1985–2014.

Regulatory year	Date of composition count	Bulls: 100 Cows	Calves: 100 Cows	% Calves	% Cows	% Small bulls	% Medium bulls	% Large bulls	% Bulls	Composition sample size	Photocensus estimate[b]	Estimate of herd size
1985	10/16/85	50	36	19	54	39	23	38	27	1,067	15,307	15,307[c]
1986	10/13/86	36	28	17	61	35	24	41	22	1,381		
1987	9/28/87	40	37	21	57	13	43	44	22	2,253	19,975	19,975[c]
1988	10/2–3/88	38	30	18	59	29	41	30	23	1,295		
1989	10/13/89	27	24	16	66	34	41	25	18	1,781	22,766	22,766[c]
1990	9/27–28/90	44	29	17	58	42	39	19	26	1,742		
1991	10/10/91	39	16	10	64	41	34	25	25	1,445	21,884	21,884[c]
1992	9/26/92	48	30	17	56	37	36	27	27	2,530		
1993	10/3/93	46	29	17	57	48	36	17	26	3,659	22,104	22,104[c]
1994	9/30/94	44	27	19	57	45	33	22	24	2,990	22,558	22,558[c]
1995	10/3/95	43	32	18	57	43	31	27	25	3,303	23,458	23,458[c]
1996	9/30/96	41	36	20	57	46	31	23	23	4,582	25,910	25,910[c]
1997	9/30/97	46	41	22	53	48	28	24	25	6,196	31,029	31,029[c]
1998	9/29/98	40	38	21	56	49	27	24	23	4,322	33,110	33,110[c]
1999	9/29/99	48	37	20	54	55	29	16	26	4,336	34,640	34,640[c]
2000	10/01/00	45	27	16	58	48	28	24	26	6,512		35,900[d]
2001	9/29/01	49	38	20	53	44	32	24	27	6,878		40,800[d]
2002	9/28/02	43	39	21	55	42	28	30	24	6,088	43,375	43,375[c]
2003	9/27/03	50	17	10	60	51	29	21	30	6,296		40,000–44,000[e]
2004	9/28/04	45	28	16	59	31	37	32	25	4,157		40,000–44,000[e]
2005	10/5/05	51	18	10	59	25	23	52	30	2,350		40,000–44,000[e]
2006	10/5/06	43	34	19	57	27	29	44	24	4,995		43,837[f]
2007	10/4/07	36	37	22	58	34	34	33	21	5,228		44,673[f]
2008	10/7–8/08	37	33	19	59	30	43	27	22	4,119	46,510	46,510[c]
2009	10/7/09	59	34	17	52	26	33	42	30	4,503	51,675	51,675[c]
2010	10/2/10	43	32	18	58	27	31	41	24	7,169		–[g]
2011	10/5/11	42	25	15	60	21	42	37	25	3,949		–[g]
2012	10/9/12	40	22	13	62	19	40	41	25	4,832		–[g]
2013	10/6–10/13	38	28	17	60	28	32	40	23	3,921		–[g]
2014	10/9/14	34	25	16	63	34	36	31	21	4,794		–[g]

[a] Regulatory year (RY) begins 1 July and ends 30 June (e.g., RY85 = 1 July 1985–30 June 1986).
[b] 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 during RY00–RY01, RY03–RY07, or RY10–RY14 because caribou were too scattered or visual conditions were inadequate.

[c] 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.
[d] Herd estimates were derived from population models using data from summer census counts, fall composition counts, spring parturition surveys and monthly mortality surveys of radiocollared caribou. Population estimate for 15 May of the current regulatory year.
[e] Based on summer 2009 and 2010 photocensus results, the population estimates for RY03–RY05 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 RY03–RY05. This is based on below-average fall calf:cow ratios (17:100 in RY03 and 18:100 in RY05), spring parturition rates (68% in RY03, 77% in RY05, and 80% in RY06) and overwinter calf survival (56% [n = 16]) during winter 2004–2005.
[f] Average interpolations of herd size, because herd size was not estimated.
[g] Modeled population estimates not yet developed.

Table 2. Fortymile caribou parturition rates of known-age radiocollared females, Alaska, 1993–2014.

Year	Survey date	3-year olds[a] (%)	4-year olds[a] (%)	≥5-year olds[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]	3/9 (33)	5/7 (71)	31/40 (78)	39/56 (70)
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[d] (86)
2012	12–23 May[c]	8/13 (62)	1/2 (50)	41/45 (91)	58/71[e] (82)
2013	14–27 May[c]	15/18 (83)	12/13 (92)	38/44 (86)	71/81[f] (88)
2014	12–28 May[c]	7/19 (37)	12/17 (71)	36/52 (69)	64/102[g] (62)

[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.
[d] Includes 15 adult cows (≥3-years old) of unknown age.
[e] Includes 11 adult cows (≥3-years old) of unknown age.
[f] Includes 6 adult cows (≥3-years old) of unknown age.
[g] Includes 14 adult cows (≥3-years old) of unknown age.

Table 3. Fortymile caribou fall 4-month-old female calf weights, Alaska, 1990–2014.

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 Sep	59.3 (130.7)	15
1998	26 Sep	53.0 (116.9)	17
1999	30 Sep	54.7 (120.5)	15
2000	2 Oct	56.7 (125.0)	15
2001	26 Sep	54.1 (119.3)	17
2002	29 Sep	52.0 (114.7)	15
2003	26-27 Sep	51.1 (112.6)	18
2004	28-29 Sep	53.7 (118.3)	16
2005	24-25 Sep	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
2013	24–28 Oct	49.5 (109.2)	18
2014	7–11 Oct	55.1 (121.4)	25

[a] Weight without radio collar.

Table 4. Fortymile caribou seasons and bag limits managed as joint state-federal registration permit hunts, Alaska, regulatory years[a] 2012–2014.

	Zone 1[b]		Zone 2[b]		Zone 3[b]		Zone 4[b]	
	State	Federal[c]	State	Federal[c]	State	Federal[c]	State	Federal[c]
Regulatory years	Season/Bag limit	Season/Bag limit	Season/Bag limit	Season/Bag limit	Season/Bag limit	Season/Bag limit	Season/Bag limit	Season/Bag limit
2012–2014								
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] Regulatory year begins 1 July and ends 30 June (e.g., regulatory year 2012 = 1 July 2012–30 June 2013).
[b] Zone descriptions are in Appendix A.
[c] 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. However, in Unit 25C, eligible federal subsistence users are all rural residents in the state.

Table 5. Fortymile caribou emergency orders issued during regulatory years[a] 2012–2014, Alaska.

Regulatory year	Effective date	Emergency order number	Permit hunt and area affected	Action taken/reason
2012	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	2 Sep 2012	03-07-12	RC860 accessible from the Taylor Highway in Unit 20E.	Closed area early. Quota met.
2012	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 overharvest and open RC999 limited registration hunt.
2012	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.
2013	30 Aug 2013	03-05-13	RC860 accessible from the Taylor Highway in Unit 20E.	Closed area early. Quota met.
2013	2 Sep 2013	03-06-13	RC860 accessible from the Steese Highway and Chena Hot Springs Road in Units 20B and 25C.	Closed area early. Quota met.
2013	20 Sep 2013	03-07-13	RC860 roadless areas in Units 20B, 20D, 20E, 20F and 25C.	Closed area early. Quota met.
2013	28 Sep 2013	03-09-13	General harvest caribou in southern Unit 25B accessible from the Taylor Highway and Yukon River.	Close to prevent overharvest of the Fortymile caribou herd.

Regulatory year	Effective date	Emergency order number	Permit hunt and area affected	Action taken/reason
2013	1 Nov 2013	03-10-13	RC867 accessible from the Steese Highway in Units 20B and 25C and from the Taylor Highway in Unit 20E.	Cancelled season. Quota taken in fall hunt.
2014	1 July 2014	03-03-14	General harvest caribou in southern Unit 25B accessible from the Taylor Highway and Yukon River and 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 southern Unit 25 and delayed season in portion of RC860 to prevent overharvest of the Fortymile caribou herd
2014	4 Sep 2014	03-05-14	RC860 accessible from the Steese Highway and Chena Hot Springs Road in Units 20B and 25C.	Closed area early. Quota met.
2014	30 Nov 2014	03-06-14	RC867 accessible from the Steese Highway in Units 20B and 25C and the Taylor Highway south of MP 112.6 in Unit 20E.	Close area of RC867 early to prevent overharvest.
2014	22 Feb 2015	03-01-15	RC867 accessible from the Steese Highway and Chena Hot Springs Road in Units 20B, 20D, 20F and 25C.	Closed area early. Quota met.

[a] Regulatory year begins 1 July and ends 30 June (e.g., regulatory year 2012 = 1 July 2012–30 June 2013).

Table 6. Reported Fortymile caribou harvest by joint state–federal registration permit, Alaska, regulatory years[a] 2002–2014[b].

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[c]	4,155	1,397 (34)	138 (3)	2,620 (63)	860[d] (33)	1,760 (67)	663	185	12	860	235	950
2003[c]	5,718	2,135 (37)	143 (3)	3,440 (60)	799[e] (23)	2,641 (77)	612	181	6	799	210	850
2004[f]	4,217	1,540 (37)	180 (4)	2,497 (59)	846[g] (34)	1,651 (66)	592	243	11	846	210	850
2005[f]	4,438	1,786 (40)	169 (4)	2,483 (56)	741[h] (30)	1,742 (70)	557	182	2	741	210	850
2006[f]	3,975	1,295 (33)	75 (2)	2,605 (66)	852[i] (33)	1,753 (67)	601	247	4	852	210	850
2007[f]	4,576	1,361 (30)	33 (1)	3,182 (70)	1,012[j] (32)	2,170 (68)	746	262	4	1,012	210	850
2008[f]	3,582[k]	1,078 (30)	9 (1)	2,471 (69)	913[l] (37)	1,558 (63)	681	217	15	913	210	850
2009[f]	2,765[k]	736 (27)	7 (1)	2,018 (73)	1,083[m] (54)	935 (46)	881	192	10	1,083	210	850
2010[f]	5,113	1,930 (38)	64 (1)	3,119 (61)	725[n] (23)	2,394 (77)	630	89	6	725	200	795
2011[f]	3,771	1,495 (40)	56 (1)	2,220 (59)	1,066[o] (48)	1,154 (52)	935	125	6	1,066	250	1,000
2012[f]	4,701	1,748 (37)	131 (3)	2,822 (60)	1,297[p] (46)	1,525 (54)	1,081	190	26	1,297	250	1,000
2013[f]	3,904	1,229 (31)	38 (1)	2,637 (68)	1,186[q] (45)	1,451 (55)	1,152	14	20	1,186	250	1,000
2014[f]	5,852[k]	1,736 (30)	653 (11)	3,460 (59)	974[r] (28)	2,486 (72)	684	278	12	974	250	1,000

[a] Regulatory year begins 1 July and ends 30 June (e.g., regulatory year 2002 = 1 July 2002–30 June 2003).
[b] Data from RC860, RC863, RC865, RC866 and RC867 harvest reports.
[c] Includes RC863, RC865, RC866 and RC867.
[d] An additional 16 hunters reported harvesting Fortymile caribou on general harvest reports.
[e] An additional 15 hunters reported harvesting Fortymile caribou on general harvest reports.
[f] Includes RC860 and RC867.
[g] An additional 12 hunters reported harvesting Fortymile caribou on general harvest reports.
[h] An additional 4 hunters reported harvesting Fortymile caribou on general harvest reports.
[i] An additional 12 hunters reported harvesting Fortymile caribou on general harvest reports.
[j] An additional 20 hunters reported harvesting Fortymile caribou on general harvest reports.
[k] Differences in permits issued and the sum of did not hunt + fail to report (FTR) + total hunted is due to individual hunters obtaining multiple permits during the same season.
[l] An additional 9 hunters reported harvesting Fortymile caribou on general harvest reports.
[m] An additional 11 hunters reported harvesting Fortymile caribou on general harvest reports.
[n] An additional 4 hunters reported harvesting Fortymile caribou on general harvest reports.
[o] An additional 18 hunters reported harvesting Fortymile caribou on general harvest reports.
[p] An additional 9 hunters reported harvesting Fortymile caribou on general harvest reports.
[q] An additional 58 hunters reported harvesting Fortymile caribou on general harvest reports.
[r] An additional 30 hunters reported harvesting Fortymile caribou on general harvest reports, and 20 hunters reported harvesting Fortymile caribou on DC851 reports.

Table 7. Fortymile caribou harvest, Alaska, regulatory years[a] 2002–2014.

Regulatory year	Reported on registration permit[b,c]				Reported on general harvest report	Estimated			Yukon harvest	Total
	M	F	Unk	Total		Unreported	Illegal	Total		
2002	663	185	12	860	16	5	5	10	1	887
2003	612	181	6	799	15	5	5	10	0	824
2004	592	243	11	846	12	5	5	10	0	868
2005	557	182	2	741	4	5	5	10	0	755
2006	601	247	4	852	12	5	5	10	0	874
2007	746	262	4	1,012	20	5	5	10	0	1,042
2008	681	217	0	898	9	5	5	10	0	917
2009	881	192	10	1,083	11	5	5	10	0	1,104
2010	630	89	6	725	4	5	5	10	15	754
2011	935	125	6	1,066	18	5	5	10	15	1,109
2012	1,081	190	26	1,297	9	5	5	10	15	1,331
2013	1,152	14	20	1,186	58[d]	5	5	10	15	1,269
2014	684	278	12	974	30[e]	5	5	10	15	1,029

[a] Regulatory year (RY) begins 1 July and ends 30 June (e.g., RY02 = 1 July 2002–30 June 2003).
[b] Data from RC863, RC865, RC866 and RC867 harvest reports in RY02–RY03.
[c] Data from RC860 and RC867 harvest reports in RY04–RY09.
[d] Includes 49 general harvest reports from Fortymile herd caribou harvested in southern Unit 25B near Eagle, Alaska in late September.
[e] Includes 20 DC851 reports from Fortymile herd caribou harvested in this Youth Permit Hunt in early August.

Table 8. Fortymile caribou hunter residency and success of hunters who reported residency, Alaska, regulatory years[a] 2002–2014[b].

	Successful					Unsuccessful						
Regulatory year	Local[c] resident	Nonlocal resident	Nonresident	Unknown residency	Total (%)	Local[c] resident	Nonlocal resident	Nonresident	Unknown residency	Total (%)	Unknown success	Total hunters
2002	182	616	57	5	860 (33)	225	1,402	124	5	1,756 (67)	4	2,620
2003	102	609	85	3	799 (23)	226	2,235	163	3	2,627 (77)	14	3,440
2004	109	660	77	0	846 (34)	155	1,375	110	1	1,641 (66)	9	2,496
2005	133	539	68	1	741 (30)	169	1,458	114	0	1,741 (70)	3	2,485
2006	141	623	88	0	852 (33)	203	1,431	118	0	1,752 (67)	1	2,605
2007	119	779	114	0	1,012 (32)	269	1,791	110	0	2,170 (68)	0	3,182
2008	87	713	122	0	922 (36)	215	1,329	70	0	1,614 (64)	0	2,536
2009	111	881	103	1	1,096 (53)	153	751	84	0	988 (47)	4	2,088
2010	112	531	82	0	725 (23)	212	2,048	134	0	2,394 (77)	0	3,119
2011	190	751	125	0	1,066 (48)	175	913	65	0	1,153 (52)	0	2,219
2012	96	1,043	162	3	1,304 (45)	232	1,275	116	0	1,623 (55)	0	2,927
2013	126	855	203	2	1,186 (45)	139	1,163	149	0	1,451 (55)	0	2,637
2014	88	776	107	3	974 (28)	157	2,152	177	0	2,486 (72)	3	3,463

[a] Regulatory year begins 1 July and ends 30 June (e.g., regulatory year 2002 = 1 July 2002–30 June 2003).
[b] Data from RC860, RC863, RC865, RC866 and RC867 harvest reports and general season harvest reports for the Fortymile caribou herd.
[c] 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, Alaska, regulatory years[a] 2002–2014[b].

Regulatory	Harvest by month/day (%)								
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	146 (23)	75 (12)	133 (21)	251 (39)	11 (2)	15 (2)	9 (1)	6 (1)	646
2003	110 (21)	77 (14)	92 (17)	84 (16)	42 (8)	126 (24)	3 (1)	0 (0)	534
2004	129 (24)	80 (15)	126 (24)	87 (17)	47 (9)	51 (10)	4 (1)	3 (1)	527
2005	272 (57)	85 (18)	41 (9)	46 (10)	26 (5)	4 (1)	1 (<1)	0 (0)	475
2006	336 (70)	38 (8)	33 (7)	36 (8)	19 (4)	15 (3)	2 (<1)	1 (<1)	480
2007	444 (74)	24 (4)	18 (3)	44 (7)	38 (6)	18 (3)	3 (1)	10 (2)	599
2008	519 (72)	25 (4)	36 (5)	49 (8)	44 (6)	33 (5)	1 (1)	0 (0)	707
2009	888 (84)	19 (2)	30 (3)	36 (3)	42 (4)	38 (4)	0 (0)	0 (0)	1,053
2010	29 (6)	16 (4)	236 (51)	61 (13)	49 (11)	29 (6)	33 (7)	7 (2)	460
2011	27 (3)	29 (3)	503 (59)	220 (26)	20 (2)	36 (4)	7 (1)	3 (1)	852[c]
2012	32 (3)	29 (3)	673 (67)	228 (23)	18 (2)	16 (2)	1 (<1)	6 (1)	1,003
2013	31 (3)	80 (7)	742 (63)	263 (22)	30 (3)	26 (2)	4 (<1)	0 (0)	1,186[d]
2014	25 (5)	32 (6)	43 (8)	327 (61)	41 (8)	18 (3)	21 (4)	26 (5)	540[e]

[a] Regulatory year begins 1 July and ends 30 June (e.g., regulatory year 2002 = 1 July 2002–30 June 2003).

[b] Data from RC860, RC863, RC865 and RC866 harvest reports for the Fortymile caribou herd that indicated a harvest date.

[c] Includes 7 unknown.

[d] Includes 10 unknown.

[e] Includes 7 unknown.

Table 10. Fortymile caribou winter harvest by month/day, Alaska, regulatory years[a] 2002–2014[b].

Regulatory year	Harvest by month/day (%)								Total
	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	
2002[c]	4 (2)	7 (3)	183 (91)	1 (1)	1 (1)	5 (2)	0 (0)	0 (0)	201
2003[c]	30 (12)	6 (2)	199 (82)	7 (3)	0 (0)	0 (0)	0 (0)	0 (0)	242
2004[c]	23 (7)	21 (7)	224 (72)	24 (8)	4 (1)	1 (<1)	0 (0)	12 (4)	309
2005[c]	68 (26)	5 (2)	42 (16)	42 (16)	33 (13)	19 (7)	17 (6)	38 (14)	264
2006[c]	63 (17)	27 (7)	279 (75)	0 (0)	0 (0)	0 (0)	0 (0)	1 (<1)	370
2007[c]	48 (12)	15 (4)	342 (84)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	405
2008[c]	23 (12)	16 (8)	156 (79)	0 (0)	0 (0)	0 (0)	1 (1)	0 (0)	196
2009[c]	10 (38)	14 (54)	1 (4)	0 (0)	0 (0)	0 (0)	1 (4)	0 (0)	26
2010[c]	1 (1)	0 (0)	5 (2)	14 (5)	65 (25)	28 (11)	57 (22)	52 (20)	265[d]
2011[c]	0 (0)	21 (10)	95 (44)	39 (18)	7 (3)	0 (0)	36 (17)	16 (7)	214
2012[c]	10 (3)	6 (2)	47 (16)	52 (18)	125 (43)	12 (4)	13 (4)	2 (1)	294[e]
2013[f]	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0
2014	33 (8)	12 (3)	199 (46)	31 (7)	44 (10)	43 (10)	30 (7)	43 (10)	435

[a] Regulatory year begins 1 July and ends 30 June (e.g., regulatory year 2002 = 1 July 2002–30 June 2003).
[b] Data from RC867 harvest reports for the Fortymile caribou herd that indicated a harvest date.
[c] Caribou harvested in November, were taken by federally qualified hunters, hunting on federal land only, under federal subsistence regulations.
[d] An additional 43 caribou (16% of total winter harvest) were harvested in March during a season extension opened by emergency order.
[e] An additional 27 caribou (9% of total winter harvest) were harvested in March. The March portion of the season was added by the Alaska Board of Game during their spring 2012 meeting.
[f] Winter hunt was cancelled due to high harvest during fall hunt.

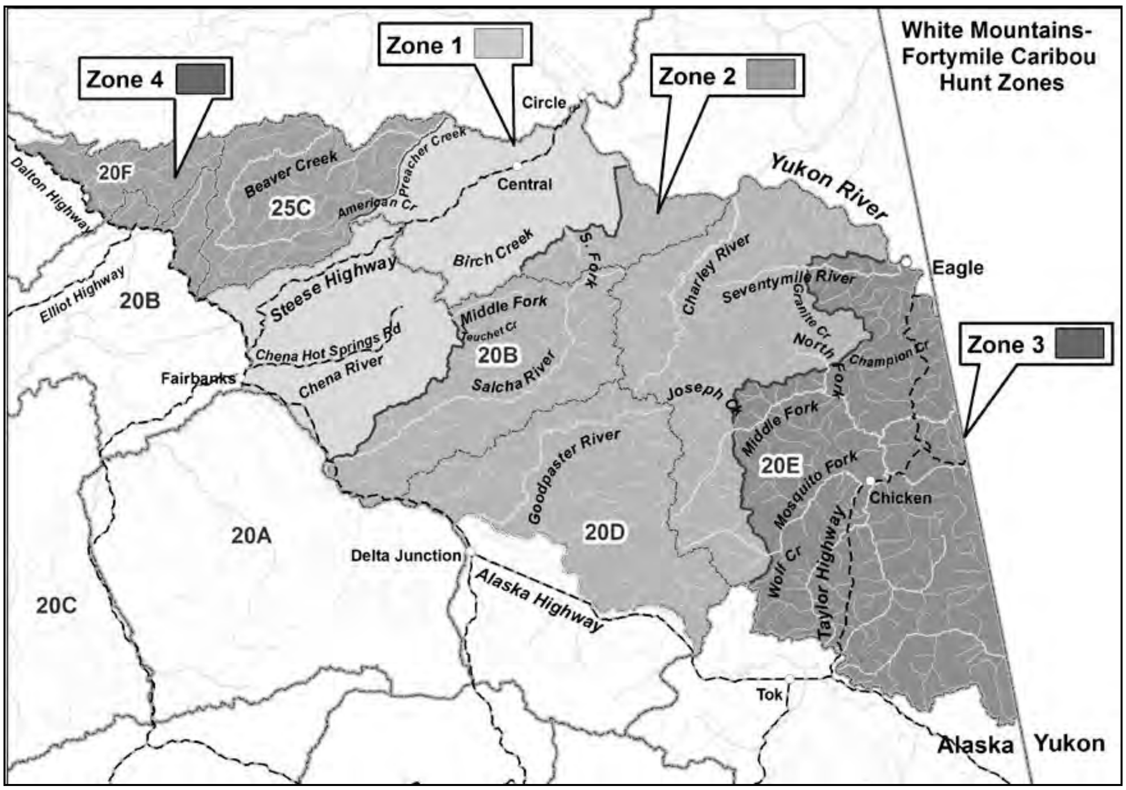
Table 11. Fortymile caribou harvest by transport method, Alaska, regulatory years[a] 2002–2014[b].

Regulatory year	Harvest by transport method (%)									Total
	Airplane	Horse	Boat/Airboat	3- or 4-Wheeler	Snowmachine	ORV	Highway vehicle	Walking	Unk	
2002	64 (7)	0 (0)	26 (3)	341 (40)	132 (15)	36 (4)	229 (27)	2 (<1)	30 (3)	860
2003	103 (13)	0 (0)	47 (6)	276 (35)	158 (20)	34 (4)	116 (15)	44 (6)	21 (3)	799
2004	69 (8)	1 (<1)	43 (5)	319 (38)	199 (24)	34 (4)	135 (16)	12 (1)	34 (4)	846
2005	75 (10)	1 (<1)	63 (9)	274 (37)	97 (13)	58 (8)	164 (22)	4 (1)	5 (1)	741
2006	83 (10)	5 (1)	45 (5)	303 (36)	232 (27)	26 (3)	136 (16)	6 (1)	16 (2)	852
2007	102 (10)	3 (<1)	39 (4)	376 (37)	288 (28)	37 (4)	148 (15)	7 (1)	12 (1)	1,012
2008	135 (15)	0 (0)	55 (6)	409 (45)	137 (15)	29 (3)	114 (12)	18 (2)	16 (2)	913
2009	106 (10)	8 (<1)	50 (5)	670 (62)	5 (<1)	69 (6)	145 (13)	17 (2)	13 (1)	1,083
2010	116 (16)	0 (0)	18 (3)	246 (34)	156 (22)	21 (3)	141 (19)	12 (2)	15 (2)	725
2011	107 (10)	0 (0)	29 (3)	480 (45)	166 (16)	30 (3)	224 (21)	12 (1)	18 (2)	1,066
2012	130 (10)	0 (0)	29 (2)	635 (49)	211 (16)	47 (4)	191 (15)	14 (1)	40 (3)	1,297
2013	145 (12)	3 (<1)	32 (3)	697 (59)	0 (0)	53 (4)	187 (16)	15 (1)	54 (5)	1,186
2014	134 (14)	1 (<1)	40 (4)	281 (29)	348 (36)	26 (3)	101 (10)	9 (1)	34 (3)	974

[a] Regulatory year begins 1 July and ends 30 June (e.g., regulatory year 2002 = 1 July 2002–30 June 2003).
[b] 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* (Advisory Committee Coalition 2006) and *Fortymile Caribou Herd Harvest Plan 2012–2018* (Harvest Management Coalition 2012) combine portions of Game Management Units 20B, 20D, 20E, 20F, and 25C into hunt zones for purposes of hunting 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, 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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CHAPTER 13: CARIBOU MANAGEMENT REPORT

From: 1 July 2012
To: 30 June 2014[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 (GMH), Wolf Mountain, Ray Mountains (RMH), and Hodzana Hills (HCH) 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. GMH (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 GMH are occasionally sympatric on a portion of their ranges near Black Sand Creek in Unit 21C during calving season. RMH (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 RMH. 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 HCH (Hollis 2007). HCH (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 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

[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.

western Alaska. Recent genetic analyses of these herds provides mixed support for this idea with some evidence that GMH 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 GMH beginning in regulatory year (RY; RY = 1 July–30 June, e.g., RY04 = 1 July 2004–30 June 2005) 2004 due to declines observed in that herd (Table 1).

MANAGEMENT DIRECTION

MANAGEMENT GOALS

- Ensure harvest does not result in a long-term 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 are placed on both cows and short-yearlings and are used to locate the herds for composition counts, locate calving areas, and delineate seasonal ranges. The number of radiocollared caribou varies. During RY12–RY13 there were 3–8 active radio collars in GMH, 3–6 in the Wolf Mountain herd, 8 in the RMH, and 9 in the HCH.

Aerial surveys of the GMH 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 RMH and HCH 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 RY12–RY13, 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 are 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. GMH has been difficult to census comprehensively, but the population probably declined from 250 to 500 prior to RY02 to less than 125 caribou by RY05. The highest number of caribou seen since RY05 was 162 animals in April 2012 (Table 1). We did not conduct a thorough survey to estimate population size or composition for GMH during RY12–RY13. The population probably declined because of predation and movement from GMH 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. GMH 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 GMH 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). We did not conduct a thorough survey to estimate population size for the Wolf Mountain herd during RY12–RY13. 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. RMH 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 did not conduct a thorough survey to estimate population size for RMH during RY12–RY13, therefore our most recent estimate is 1,213 caribou from July 2011. This estimate falls within a long-term range of average population sizes calculated by Horne et al. (2014) of 656–1,564 animals for the years 1994–2012.

Hodzana Hills 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 Table 4). Based on analysis of previously collected telemetry data from 2005 to 2009, Horne at al. (2014) estimated 1,000–1,500 animals in HCH. We did not conduct a thorough survey to estimate population size for HCH during RY12–RY13.

Population Composition

During RY12–RY13 comprehensive composition data were not collected on GMH, Wolf Mountain, RMH, or HCH caribou.

Distribution and Movements

Galena Mountain Herd. Based on radiotracking flights conducted in RY12–RY13, seasonal movements of GMH were 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.

Wolf Mountain Herd. Based on limited radiotracking flights, the seasonal movements of the Wolf Mountain herd during RY12–RY13 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).

Ray Mountains Herd. The limited radiotracking data collected during RY12–RY13 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 2007–2014 confirm that these areas are within the range of HCH (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. Results from Horne et al. (2014) showed no overlap in ranges of RMH and HCH from 1994 to 2009 and confirmed that the 2 herds do not undertake significant migrations.

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 (WAH), Teshekpuk, and Central Arctic herds. Seasons and bag limits in those areas reflect harvest recommendations for those herds.

Seasons and Bag Limits during RY12–RY13.

Herd/Unit/Bag Limit	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

Herd/Unit/Bag Limit	Resident/Subsistence Open Seasons	Nonresident Open Seasons
Wolf Mountain Herd		
Remainder of Unit 21C. 1 caribou.	10 Aug–30 Sep	10 Aug–30 Sep
Galena Mountain Herd		
Unit 21D, that portion north of the Yukon River and east of the Koyukuk River. 2 caribou.	Winter season may be announced	No open season
Western Arctic Herd		
Remainder of Unit 21D.		
RESIDENT HUNTERS: 5 caribou per day; however, cow caribou may not be taken 16 May–30 Jun.	1 Jul–30 Jun	
NONRESIDENT HUNTERS: 5 caribou total; however, cow caribou may not be taken 16 May–30 Jun.		1 Jul–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–30 Sep
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 longitude. 1 caribou.	10 Aug–31 Mar	10 Aug–30 Sep

Alaska Board of Game Actions and Emergency Orders. No Board of Game actions were taken during RY12–RY13 and no emergency orders were issued.

Harvest by Hunters. During RY12–RY13, 8 caribou (6 bulls, 2 cows) were reported taken from the 4 herds. All were harvested from the Ray Mountains ($n = 6$) and Hodzana Hills ($n = 2$) 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 RY12–RY13 the 8 caribou harvested in the Ray Mountains and Hodzana Hills herds were taken by 5 local residents, 2 nonlocal residents, and 1 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).

NONREGULATORY MANAGEMENT PROBLEMS/NEEDS

During summer 2014, General Communications, Inc. (GCI) initiated construction of 2 telecommunications towers within the ranges of the Galena Mountain herd (GMH) and Wolf Mountain herd (WMH). The towers are located at 65°05.183′N, 154°07.102′W ("Gold Mountain" site within range of GMH) and 64°53.333′N, 155°31.268′W ("Melozitna" site within range of WMH) in high elevation alpine habitat to maintain line of sight. In addition to the towers, each site will eventually include an enclosed generator for power production and associated fuel tanks. The department worked with GCI and its contractors to minimize potential disturbances to nearby caribou during the calving period (through 20 June) from construction activities by limiting access to the sites while caribou were present within 2.5 miles. Access to the sites for construction activities was granted on 10 June 2014 for the Gold Mountain site and 21 June 2014 for the Melozitna site. It is not known what effect, if any, the towers will have on caribou from these 2 herds and no research or monitoring projects are planned to specifically investigate the issue. While we lack specific data on the extent and concentration of calving areas for these 2 herds, it is believed that most calving takes place in close proximity to the 2 tower sites (G. Stout, Galena Area Wildlife Biologist, ADF&G, personal communication, 2015).

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 GMH and Wolf Mountain herds occasionally overlap. Because the herds overlap only occasionally during calving season and only a small portion of GMH mixes with the Wolf Mountain herd during this time, we classify these as 2 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 RMH and GMH previously indicated good nutrition (Osborne 1995), although in 2005, fall calf weights in RMH were not consistent with this observation (M. Keech, Research Biologist, ADF&G, personal communication 2005).

The decline in GMH 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 GMH 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 WAH caribou in Unit 21D east of the Koyukuk River and to protect the GMH and Wolf Mountain caribou herds, we recommend maintaining the restricted season for the smaller herds when WAH is not present. Maintaining radio collars in the GMH and Wolf Mountain herds will help us to distinguish these caribou from WAH.

The declining number of radio collars in each herd has affected our ability to adequately survey the herds to estimate population size and composition, therefore our recommendation is to maintain a modest number (~10) in each herd. Other management work on these herds will remain a low priority because of low harvest and relatively few animals in these herds.

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Table 1. Galena Mountain caribou composition counts, Interior Alaska, 1991–2012.

Month/ Year	Cows	Calves(%)	Bulls	Unclassified	Total caribou observed
12/91[a]					260
10/92[b]	123	9 (5)	49		181
10/93[b]	165	41 (16)	53		259
10/94[b]	115	46 (25)	25		186
10/95[b]	211	40 (13)	59		310
10/96[b]	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[c]	64	7 (8)	13		84
12/04[a]					95
04/05[a]					78
11/05[c]	58	9 (12)	6		73
01/06[a]					95
06/07[a]					61
05/08[c]	22	12 (34)	1		35
03/09[a]		12 (13)			89
06/09[c]		9 (18)	5		49
03/10[c]	11				46
05/10[c]	22	6 (20)	2		30
06/10[c]	50	13 (19)	6		69
06/11[c]	68	19 (20)	3	3	93
07/11[c]	14	10 (42)			24
08/11[c]	23	5 (15)	6		34
02/12[c]	50	11 (7)	4	82	147
03/12[c]	62	17 (12)		61	140
04/12[c]	127	17 (10)	18		162
06/12[c]	40	9 (17)	2	1	52

[a] Fixed-wing survey, no composition classifications.
[b] Helicopter survey, composition classifications.
[c] Fixed-wing survey, composition classification without photographs.

Table 2. Wolf Mountain caribou composition counts, Interior Alaska, 1991–2011.

Month/ Year	Cows	Calves (%)	Bulls	Unclassified	Total caribou observed
06/91[a]	117	18 (12)	11		146
06/92[b]					595
05/94[a]	337	121 (26)	16		474
01/95[b]					194
10/95[a]	192	51 (15)	103		346
03/96[b]					561
10/96[a]	167	37 (14)	62		266
05/97[b]					423
01/98[b]					163
06/01[b]					489
04/02[b]					455
07/02[b]					319
07/02[c]		27 (5)			516
06/03[b]					271
05/04[b]					146
05/06[b]					95
06/07[b]					268
06/08[b]		45 (18)			244
07/09[d]	312	95 (22)	27		434
03/10[d]	129		18	18	165
06/10[c]		61 (17)			368
10/10[d]	9	10 (17)	1	39	59
06/11[c]					462

[a] Helicopter survey, composition classifications.
[b] Fixed-wing survey, no composition classifications.
[c] Photocensus (fixed-wing).
[d] Fixed-wing survey, composition classifications with photographs.

Table 3. Ray Mountains caribou composition counts and estimated population size, Interior Alaska, 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[e]	37	19	12	64	18	34	47	24	629	629
01/95[c]										684
06/95[f]										1,731
10/95[e]	34	12	8	69	15	37	48	23	994	994
10/96[e]	28	15	10	70	15	40	45	20	1,387	1,387
07/97[c]										1,575
10/97[e]	33	13	9	68	21	27	52	23	1,114	1,114
10/98[e]	26	32	20	63	34	21	45	16	1,756	1,756
10/00[f]	38	19	12	64	41	23	35	24	1,736	1,800
09/01[e]	30	15	11	68	49	25	26	21	1,685	1,800
09/02[e]	51	31	17	55	38	54	8	28	140	
10/03[e]	33	18	12	66	44	26	30	22	921	
06/04[f]									1,705	1,858
10/04[c]									1,403	
10/05[e]	35	20	7	69	42	23	35	24	795	
04/06[c]									1,022	
10/06[e]	27	10	7	73	39	29	32	20	815	
10/07[e]	26	25	17	66	13	28	59	17	785	
09/08[e]	47	28	16	57	45	29	26	27	780	
09/09[e]	36	29	18	61				22	953	
02/10[d]										1,060
07/11[f]										1,213

[a] Includes 50 unclassified adults.
[b] Includes 245 unclassified adults.
[c] Fixed-wing survey, no composition classifications.
[d] Caribou Mountain portion only.
[e] Helicopter survey, composition classifications.
[f] Photocensus.

Table 4. Hodzana Hills caribou composition counts, Interior Alaska, 2003–2009.

Month/Year	Cows	Calves (%)	Bulls	Total caribou observed
10/03[a]	173	43 (14)	90	306
06/04[b]				242
10/04[b]				136
06/05[b]				318
10/05[a]	661	111 (10)	343	1,115
04/06[b]				320
10/06[a]	247	20 (5)	122	389
09/07[a]	201	38 (11)	122	361
09/08[a]	232	64 (16)	99	395
09/08[b]				880
09/09[a]	527	93 (12)	155	775

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

Table 5. Ray Mountains, Galena Mountain, Wolf Mountain, and Hodzana Hills caribou reported harvest, Interior Alaska, regulatory years[a] 2000–2013.

Regulatory	Ray Mountains			Galena Mountain		Wolf Mountain		Hodzana Hills[b]	
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
2012	2	2	0	0	0	0	0	2	0
2013	2	0	0	0	0	0	0	0	0

[a] Regulatory year begins 1 July and ends 30 June (e.g., regulatory year 2000 = 1 July 2000–30 June 2001).
[b] Hodzana Hills caribou were considered part of the Ray mountain harvest prior to regulatory year 2005.

Table 6. Galena Mountain, Wolf Mountain, Ray Mountains, and Hodzana Hills caribou hunter residency and success, Interior Alaska, regulatory years[a] 2000–2013.

	Successful				Unsuccessful				
Regulatory year	Local resident[b]	Nonlocal resident	Nonresident	Total	Local resident[b]	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
2012	3	2	1	6	7	8	3	18	24
2013	2	0	0	2	14	4	3	21	23

[a] Regulatory year begins 1 July and ends 30 June (e.g., regulatory year 2000 = 1 July 2000–30 June 2001).
[b] Residents of Units 20, 21B, 21C, 21D, and 24.

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CHAPTER 14: CARIBOU MANAGEMENT REPORT

From: 1 July 2012
To: 30 June 2014[1]

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 as directly toward the calving grounds as possible; in contrast, bulls and nonmaternal cows lag behind pregnant cows and move toward the Wulik Peaks and Lisburne Hills (Figs. 3 and 4). Cows give birth in the Utukok Hills (Figs. 5 and 6). During the post-calving period, maternal cows and neonates travel southwest toward the Lisburne Hills, where they mix with bulls and nonmaternal cows (Figs. 7 and 8). During summer, WAH caribou move east through the Brooks Range (Figs. 9 and 10); this is the most rapid, concentrated (in terms of 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 slowly disperse back onto the coastal plain (Figs. 11 and 12). Caribou from this herd are more dispersed during fall than at any other time of year as they move south and southwest toward winter range (Figs. 13 and 14). Rut occurs in late October during the fall migration: there is no specific 'rutting ground' for this herd (unlike other ungulates, e.g. moose and Dall sheep). 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 (Figs. 15 and 16). In many years a small portion of the WAH has wintered on the North Slope in the Point Lay-Atqasuk-Umiat area.

In 1970 the WAH numbered approximately 242,000 caribou (Fig. 17) and was thought to be declining (P. Valkenburg, ADF&G, personal communication). By 1976 it had declined to about

[1] Data and analysis from a broader period are included to provide a more comprehensive overview in this report of the status of the herd.

75,000 animals (Table 1, Fig. 17). From 1976 to 1990 the WAH grew at an average rate of 13% annually, and from 1990 to 2003 it grew an average of 1–3% annually. In 2003 the WAH numbered ≥490,000 caribou but from that time until 2011 it declined at an average of 4–6% annually, and from 2011 to 2013 it declined an average of 15% annually, to reach a population size of 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 the herd are misleading, though, because caribou exhibit a "clumped" distribution in space and time. Seasonal densities provide a more useful measure to evaluate 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 occupied less than 25% of this total area. Additionally, the ranges of the WAH and Teshekpuk Herd (TCH) overlap, and caribou from these herds regularly comingle on some seasonal ranges annually. Occasionally, caribou from the Central Arctic Herd (CAH) also move onto WAH range. Additionally, WAH caribou mix with reindeer on the Seward Peninsula. 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.

In 1995 the department took the lead to establish a group of public citizens who use the WAH, representatives of environmental groups, transporters, guides, and agency staff who manage caribou. Although federal management of wildlife in Alaska for subsistence users was still a new development at that time, it was obvious that some type of group representing a broad spectrum of users was needed to bridge the state and federal systems. It was also clear that users and managers needed to work together outside of the politically charged forums of the Board of Game and Federal Subsistence Board to share information in the interest of conserving this herd. The Western Arctic Caribou Herd Working Group (WG) 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 technical committee consisting of agency staff was subsequently established in 2004 to advise the WG about biological and regulatory issues. 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.

TERMS

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 and CAH for Central Arctic 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. This network has not been funded since about 2013 and has not met since 2012.

"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.

"DMTS" is the De Long Mountains Transportation System, erroneously referred to as the "Red Dog road" in previous reports. This is the 53-mi-long road that connects the Red Dog mine to its Port Site.

"DOI" refers to the Department of Interior. The U.S. Fish and Wildlife Service, National Park Service, and Bureau of Land Management are all administered under the DOI.

"FSB" refers to the Federal Subsistence Board.

"FWS" or "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 the year a collar was deployed); or 3) all GPS location data.

"Intensive management" means management of an identified big game prey population consistent with sustained yield through active management measures to enhance, extend, and develop the population to maintain high levels or provide for higher levels of human harvest, including control of predation and prescribed or planned use of fire and other habitat improvement techniques (AS 16.05.255(e)).

"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 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 ≥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 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 are collected from each group. Harvest data for local hunters are collected through community harvest surveys where ‘household’ is the sample unit. For nonlocal hunters, harvest data are 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.

"WACH WG" or "WG" refers to the Western Arctic Caribou Herd Working Group.

METHODS

Population Status and Trend. 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 radiotelemetry program in the WAH were previously reported (Dau 2005).

The first PTTs deployed in the WAH were attached to 2 cows in May 1984 by a private organization (Craighead Wildlife-Wildlands Institute, Missoula, MT) to test the feasibility of this technology for monitoring caribou movements (Craighead and Craighead 1987). Data from these collars were not made available to the department. The department began deploying PTTs in the WAH in 1987 primarily to assist with locating conventionally collared caribou during VHF telemetry flights. 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 and assess the influence of roads on movement patterns. Although we rely heavily on telemetry information to monitor the WAH, we have only collared approximately 0.02–0.03% of the herd annually. This small sample of collars relative to population size has limited our understanding of the complexity or variability of movements and distribution of the herd. Similarly, low sampling intensity has affected confidence intervals associated with estimates of annual mortality (Fig. 18) and other collar-based population metrics. Since the late 1980s we have typically conducted at least 15 to 20 VHF relocation flights annually 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, yearlings are generally too small to be collared with adult collars, it would be difficult to humanely pull a tooth while collaring caribou from boats, we prefer to not remove a tooth for health reasons, and the specific age of adult caribou cannot be determined from samples collected at the time of collaring. Since the late 1980s we have attempted to maintain about 15 collared bulls in the total marked sample primarily to aid in conducting censuses; unfortunately, we have rarely achieved that goal.

Mortality rates for mature bulls have exceeded 60% in some years, bulls are sometimes scarce during the collaring project, and we do not compete with local hunters for bulls. Although we've usually managed to begin each CY with ≥15 collared bulls in the WAH, we've rarely met the objective by retaining a minimum of 15 collared bulls at the end of each CY because of losses to mortalities, slipped collars, and harvests of collared bulls. 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 CY12 with 100 potentially active collars on living caribou (86 cows and 14 bulls). Of these collared caribou, 76 cows and 3 bulls were equipped with a functional PTT or GPS collar. We began CY13 with 103 potentially active collars on living caribou (93 cows and 10 bulls). Of these caribou, 87 cows and 10 bulls had an active PTT or GPS collar. The number of radiocollared caribou reported for each year, regardless of collar type, 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. Since beginning the WAH telemetry program in 1979, we have collared 1,151 caribou, and the batteries in the transmitters on up to 151 of these individuals (10%) were likely exhausted before the animals died (the last time this occurred was in 2009). 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.

We have deployed no VHF collars on adult WAH caribou since 2010. In 2012 we deployed 1 GPS and 19 PTT collars for the department, and 12 GPS collars for NPS. In 2013 we deployed 16 GPS and 3 PTT collars for the department, and 10 GPS collars 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 VHF transmitters contained in department satellite collars (ON 8:00 a.m.–8:00 p.m. daily); the NPS specified this VHF duty cycle as well. All NPS collars were fitted with a Cr-2a breakaway device programmed to release in 5 years (most of the 2009 collars released in early June 2013).

<u>Satellite and GPS Collars</u>. The objectives and limitations of the WAH satellite collar program were previously described (Dau 2007). Both ADF&G and NPS purchase collars for WAH caribou and, during this reporting period, data sharing was negotiated. This report includes data that the NPS had withheld from ADF&G during November 2013 through March 2015, but was later appended to the department data files following completion of a data sharing agreement.

The 1 April 2015 agreement covers only GPS and PTT locations from GPS-collared WAH caribou. It does not include VHF observations of GPS-collared caribou, or any location data

from VHF- or PTT-collared caribou. Data covered by this agreement date from 1 September 2009 and the agreement applies to the incoming data stream. This agreement will remain in effect 5 years from the date it was signed (1 April 2015 through 1 April 2020).

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). We photographed the entire WAH 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.

In this report I present both minimum population counts of census photographs as well as population estimates based on radiocollared caribou following Rivest et al. (1998). Also, I report 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).

Population composition for the WAH was estimated from annual calving surveys during June, fall composition counts during October 2012 and 2014, 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 directly measure.

Calving survey techniques for this herd have been previously described (Dau 1997, Dau 2011). During 2013, calving surveys were conducted using a PA-18 airplane during 5, 7, and 11–14 June. During 2014, they were conducted during 8 and 10–14 June. During 2015 (after this reporting period) calving surveys were conducted during 5–7 and 11–12 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 grew visible velvet antlers. However, each year some cows initially having at least 1 hard antler and no calf were not observed with a neonate by the end of the survey. For kernel analyses, I approximated parturition sites by filtering survey data by two criteria: 1) the first observed location of a cow with a neonate; and 2) the last observed location of a cow with at least 1 hard antler and not accompanied by a neonate. During this reporting period no collared cows were observed >4 times.

Caribou collared at Onion Portage 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 24, 26, and 27 October 2012 and on October 20–22 2014 using techniques previously described (Dau 1997). Survey dates were determined by our estimates of seasonal dates for rut, the availability of an R-44 helicopter, and weather.

In 2013 spring composition (short yearling or recruitment) surveys were conducted on 3, 8, 14, 20 and 25 April. In 2014 recruitment surveys were conducted on 7, 10, 17, and 28 April, and on 2 May. Recruitment survey techniques as well as the strengths and limitations of data collected by these methods 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 19 and 26. In Figure 19 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 26 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 were standardized using the first best location every 6 days throughout each year. Only high quality (LQI values of 1–3) PTT records were used in addition to GPS locations and visual VHF observations.

I used the mean annual growth rate ($N=e^r$) to estimate population size for years between censuses where

N=caribou population estimate

$e=2.7183$

$r=[\ln(N_{t2})-\ln(N_{t1})]/t_2-t_1$

t=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).

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, with the exception of caribou killed, purposely or accidently, by department staff. Department-caused deaths are unique to the sample of collared caribou and do not reflect the overall population. Portions of 3 collar years (CY11, CY12, and CY13) 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 appears to have reduced the number of collars that slip over a caribou's head during winter and are lost.

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 previous 1–3 years.

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 it 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. Department staff continued to invest heavily in determining cause of death for radio collared caribou during this reporting period.

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 these areas would occur only if the collar had been drenched in blood 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 and was 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 or in a location inaccessible to people (e.g. extremely steep terrain) 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 gnawed articulating surfaces of large bones), 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 a mound of vegetation. I was conservative and specified “unknown 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. During RY14, the department administered hunt RC900 in Nome which had a harvest report requirement. During that RY all other communities received harvest registration RC901 that did not include a hunt report requirement. During RY15, the department eliminated RC901 and issued RC900 registrations throughout the range of the WAH. This reporting method requires hunters to submit a harvest report, as Nome residents did during RY14, indicating how many bulls and how many cows they harvested during each of 2 hunting periods, fall and winter/spring. When a nonlocal hunter reported taking >1 caribou, I used the earliest date reported as an index of temporal trends in effort.

Community-based harvest assessments have been conducted in selected communities within the range of the WAH since 1985. The communities composing the sample have changed from year to year. As a result, no single village has a complete record of harvest surveys for the 1996–2014 period. These gaps in harvest data for communities necessitate estimating harvest with a model that uses variables correlated with harvest. The 2 variables for which we have data are village population size and the spatial proximity of WAH caribou to each community. The linear model that we used in the past to estimate caribou harvests by hunters who live within the range of the WAH (Sutherland 2005) had not been updated with additional community harvest data since its development. In February–March 2015 we replaced Sutherland’s model with a new analysis of covariance (ANCOVA) model developed by the department’s Division of Wildlife Conservation Region V (Arctic and Western Alaska) biometrician A. Craig. The new model differs from Sutherland’s original model in several ways:

1. It includes community harvest data for the period 1996–2014 (the Sutherland model used community harvest data collected during 1987–2000).
2. It uses annual estimates of human population size for individual communities from the Alaska Department of Labor (the Sutherland model referenced only 2 years of community population data from the Alaska Department of Community and Economic Development).

3. It considers only 2 classes of availability of caribou: average and far (the Sutherland model identified 3 classes of availability). Caribou availability was determined from caribou telemetry location data.
4. The new model includes an interaction parameter between availability and human population size.

The linear model was fit to the updated harvest data. Proximity of caribou to each community in a given year was defined as the categorical variable 'availability' with 2 possibilities: average or far. We investigated using 3 categories of availability but the data supported using only 2. We also investigated 2 models to estimate harvest: one with an interaction term between availability and community population size, and one without this interaction term. A likelihood ratio test showed that the former model that included the interaction term was a better fit to the data ($P<0.001$). This indicates that harvest increases with community population size differently for the 2 availability classes.

A total annual (i.e., regulatory year) caribou harvest by local residents is estimated with a linear combination of the model parameter estimates (**β**). A matrix was assembled wherein each row contained the correct linear combination (**c**) of model parameters to provide an estimate of total harvest for a particular year. For example, the first row of this matrix for 1996 is a vector comprising 4 quantities:

$$\mathbf{c} = (\text{Total Villages}_{1996}, \text{Total Human Pop.}_{1996}, \text{Total 'Far' Villages}_{1996}, \text{Total Human Pop. 'Far' Villages}_{1996})$$

An estimate of the total caribou harvest for 1996 can then be calculated by the dot or scalar product of $\mathbf{c}^{T}\boldsymbol{\beta}$.

Body Condition and Disease. During each year of the reporting period 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 20 bulls and 25 cows in 2012, 2 bulls and 14 cows in 2013, and 6 bulls and 21 cows in 2014. 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 2014 no tests were conducted on WAH serum because veterinary staff in Fairbanks did not have time to submit the samples.

Calf weights. Since 2008 we've recorded the live weight of calves each year during the Onion Portage collaring project. 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 cow.

It takes 3 individuals to weigh a calf from a small boat. A cow-calf pair is 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).

<u>Mandible collections.</u> Mandibles of harvested WAH caribou have been collected episodically since the late 1950s. During this reporting period we continued to collect jaws during the collaring project and intensified our efforts to collect a jaw from mortality sites of collared individuals. Additionally, we have opportunistically collected jaws from all caribou mortality sites we have encountered in the field. In this report I used total ramus length as an indicator of body size. All mandibles were measured following the CARMA protocol (Gunn and Nixon 2008). 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. All teeth collected since 1990 and aged by counting cementum annuli were processed by Matson's Laboratory, Inc. (Milltown, MT). Most caribou were aged from a first incisor tooth (I-1); however, when an incisor or canine tooth was not available, I usually substituted a first molar tooth (M-1) for aging. The sex of the caribou, tooth type, and approximate time of death were provided to Matson's at the time of sample submission. The WAH mandible collection program has been previously described (Dau 2014).

RESULTS AND DISCUSSION

POPULATION STATUS AND TREND

Population Size

Differences between minimum counts and Rivest estimates have been small relative to the size of the WAH (Fig. 17, Table 1).

We completely photographed the WAH on 7 July 2013 and again on 8 July 2013. 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 collars were randomly distributed among groups on both days (P =

0.80 and 0.78, respectively). 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 was likely 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 caribou census estimates were inconsequential. For example, 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 1 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 of caribou 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. 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 an estimated 325,000 caribou in 2011 to an estimated 235,000 caribou in 2013 represents a 15% average annual rate of decline (Table 1, Fig. 17). 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. 17). However, the adult WAH cow mortality rate (Table 2, Fig. 18) 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. 18). 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, Fig. 19). 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 (See Table 2, Western Arctic Caribou Herd Working Group 2011). Additionally, Appendix II of the cooperative plan recommends several regulatory restrictions under the conservative management level: 1) no harvest of calves, 2) no cow harvest by nonresidents, and 3) restriction of bull harvests by nonresidents. If the WAH continues to decline even just 4–6% annually as it did during 2003–2011, and if mortality and recruitment do not change, this herd could enter the 'preservative' management level within 2–3 years. The plan 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 generally good 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 biennial and triennial census data with annual estimates of adult cow mortality (Table 2, Fig. 18) and recruitment (Table 3, Fig. 19) to fill data gaps between years when censuses are conducted, and to help understand factors that could be driving population size and trend. Trends of increased adult female caribou mortality and decreased recruitment (Fig. 20) are consistent with the decline in population size shown by census data.

Although census data for this herd date back to 1970, satellite location data adequate to calculate total range extends back only to CY99. Since 2000 there has been no correlation between total estimated population size (using average annual growth rates to estimate herd size for years between censuses) and either of 1) total annual range size (Pearson correlation coefficient = 0.66, $P = 0.23$; Fig. 21), or 2) the annual extent of calving (Pearson correlation = -0.19, $P = 0.76$; Fig. 22) or the core calving area (Pearson correlation = -0.44, $P = 0.46$; Fig. 22).

Population Composition

Calf production and survival. Rate and direction of travel of satellite-collared cows during 1988–2012 indicates that peak calving has generally occurred during 9–13 June (Dau and Sutherland, ADF&G unpublished data archived in the Kotzebue ADF&G office WAH files; Fig. 23). However, peak calving can occur before or after these dates in some years. For example, calving probably peaked early during 1987 and 1990, based on the western distribution of collared cows, their uniformly rapid and western direction of travel, and the absence of hard antlers on cows. The earliest reported peak calving date for the WAH is 26 May 1960 (Lent 1966). During calving surveys conducted since 1989, the median date of observation to determine the maternal status of collared cows occurred before 9 June during 10 years, and after 13 June during 2 years. This was partly attributable to weather conditions that affected the timing of calving surveys. During 1987–2015 there was no correlation between median annual date when calving surveys were conducted and the June calf:cow ratio (Pearson rank correlation = -0.21, $P = 0.29$, $n = 28$).

During June calving surveys, we observed 62 calves:100 cows in 2012, 63 calves:100 cows in 2013, and 69 calves:100 cows in 2014 (Table 4, Fig. 24). Historical estimates of calf production suggest parturition rates were more variable 1960–1970 than in recent years (Fig. 24). 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.

Our estimates of parturition are probably conservative because we do not record udder status for collared cows (Whitten 1995) and undoubtedly misclassify some cows that produced a calf as nonmaternal if they lost their antlers and their neonate before we observed them. In 2010 we began relocating individual collared cows multiple times to more accurately determine their maternal status and parturition site. This had little effect on our annual estimate of parturition because, during 2010–2015, only 5 of 20 cows (25%) initially observed without antlers or a neonate eventually had a calf. This sounds like a sizeable proportion until you consider that during this time we observed 433 collared cows during calving surveys. The 20 no calf-no antler cows comprise <5% of the total number of cows observed, and the 5 that eventually had a calf comprise only 1% of the total sample.

Although collecting multiple locations of potentially maternal cows had little effect on our estimates of initial productivity, this approach provided more accurate information regarding their parturition site during the 2010–2015 calving surveys. We looked at 45 cows from 2 to 6 times during 2010–2015 to identify calving sites (this includes only cows that we eventually observed with a calf; some cows, although relocated multiple times, were never observed with a calf). 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 10.8 mi (range = 0.8–39.0 mi; 17 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. During 2010–2015, the median distance traveled by cows that were observed multiple times before giving birth, excluding those initially observed south of the De Long Mountains crest, was 2.2 mi/day (n_i = 42, range = 0.4–7.8 mi/day).

The negative linear relationship between the calf:cow ratio and the proportion of cows with velvet antlers during calving (F = 13.16, P = 0.001, R^2 = 0.34) continued through this reporting period (1988–2015, Spearman rank correlation = –0.58, P < 0.0001, n = 28 years). The mean rank of cows with velvet antlers during years when the calf:cow ratio was ≥70:100 (n = 13) was significantly lower than the median for years when this ratio was <70:100 (n = 15; Kruskal–Wallis test statistic 20.17, P <0.001). 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 1992–2014, a period of slow growth or decline (Table 5, Fig. 25).

We observed 25 short-yearlings:100 cows in spring 2013, 21:100 in spring 2014 and 20:100 in spring 2015 (Table 3, Fig. 26). Recruitment, as reflected in April–May surveys, has slowly declined since the early 1980s (Table 3, Figs. 19 and 26). The persistent, declining trend in recruitment would not be evident without this long-term data set (Fig. 19).

Least squares linear regression indicates that there has been no trend in the June calf:cow ratio during 1982–2015 ($F = 0.00$, $P = 0.97$, $n = 28$, Fig. 24). The fall calf:cow ratio declined linearly during 1982–2015 (correlation coefficient = -0.55, $R^2 = 0.41$, $F = 7.67$, $P = 0.02$, $n = 13$) as did the spring calf:cow ratio (correlation coefficient = -0.62, $R^2 = 0.45$, $F = 20.88$, $P<0.0001$, $n = 28$; Fig. 26).

Calf:cow ratios were estimated during June, the following fall, and the following spring in 13 years between 1992 and 2015 (Fig. 26). 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 = -0.14, $P = 0.64$). In contrast, the fall and subsequent spring ratios were correlated (Spearman rank correlation = 0.63, $P = 0.02$). Calf production has likely had little influence on the population trajectory of the WAH; however, declining calf survival through the summer of their birth year may have contributed to the current decline.

Bull:cow ratios. The fall bull:cow ratio was 39:100 during October 2014. During 1992–2014 the fall bull:cow ratio declined linearly (correlation coefficient = -0.81, $F = 15.23$, $P = 0.002$, $n = 13$, Fig. 27). During this time the median was 49 bulls:100 cows (Table 5, Fig. 27). The bull:cow ratio now appears to have reached the minimum acceptable level identified in the 2011 cooperative management plan (WACH WG 2011).

Sexual segregation and our inability to sample the entire population during fall probably account for more annual variability in the estimated bull:cow ratio than actual changes in population composition. The low value of 38 bulls:100 cows in 2001 was probably a result of 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, the actual values could be higher or lower.

Distribution and Movements

Historical Summary. Our historical understanding of WAH distribution has been previously described (Dau 2001). In recent years we have replaced VHF collars with PTT and GPS collars. This has reduced the need to conduct range-wide VHF telemetry relocation surveys to determine the mortality rate and monitor the distribution of this herd. It has also provided a larger volume of higher quality location data compared to the era of VHF telemetry.

General Movement Pattern: The general movement pattern of this herd was previously reported (Dau 2009). Season dates were determined from rate and direction of travel for male and female caribou (Figs. 23 and 28, Table 6, Dau 2013). Since about 2000, fall movements have appeared to be less predictable and generally later than during the 1980s and 1990s. Despite the increased variability in the timing of movements during recent years, the WAH has exhibited the same general movement pattern among seasonal ranges for at least 50 years.

Spring. It appears that the onset of spring migratory movement is temperature dependent. When average daily ambient air temperature rises to 0°C (32°F), cows begin migrating north (Sutherland and Dau, ADG&G unpublished data archived in the ADF&G Kotzebue office WAH files). From my observations, difficult traveling conditions (e.g., extensive overflow on river ice, open water, deep or rotten snow, etc.) have little effect on the northward migration of either cows or bulls. The only exception occurs when ice pans flowing down rivers during freeze-up and break-up seasons temporarily halt migrating caribou. In these situations caribou accumulate along river banks for up to several days until ice bridges form, allowing them to pass, or the ice pans disappear.

Based on location data collected during 1988–2012 (all years combined), bulls and cows exhibit strikingly different movement patterns following the winter season. Pregnant cows, many accompanied by their 10-month-old calf, generally begin migrating toward the calving grounds around 6 May. In contrast, bulls and many nonmaternal cows don't begin migrating north until roughly 16 May. Pregnant cows head directly toward the calving grounds from wherever they spent the winter. Bulls that winter in the Nulato Hills or on the Seward Peninsula initially follow the same movement corridors traveled by pregnant cows; however, as they cross the Noatak drainage, bulls bypass the calving grounds and head northwest through the De Long Mountains toward the Red Dog–Lisburne Hills area. The 'spring' season for bulls encompasses 3 seasons for cows: 'spring,' 'calving,' and 'post-calving.'

Movements by bulls and cows followed the typical WAH spring movement pattern during 2013 and 2014; however, the timing of spring movements was unusually late during 2013.

Calving grounds. The WAH has exhibited strong fidelity to its calving grounds in the Utukok hills since the late 1950s. For example, the areas identified by Lent (1966) as calving areas in 1960 and 1961 are within the 95% calving kernel for 1988–2012.

The distribution of maternal cows extended unusually far south during the calving season in 2013. This was the first time we had documented a 'core' calving area that extended south of the crest of the De Long Mountains since we began recording parturition sites in 1987. As in 2000 and 2001, when cows were late getting to the calving grounds, breakup was late in spring 2013.

Calving was unusually concentrated during 2014 and 2015 for reasons that are not clear. We have observed relatively few wolves on the calving grounds since around 2005. Brown bears are commonly observed on the calving grounds during June surveys but are only infrequently observed on carcasses of adult or neonate caribou at this time. It seems unlikely that the concentrated calving during 2014 and 2015 was caused by predators.

One GPS-collared cow gave birth to a calf near the mouth of the Buckland River during calving 2015. This is only the second time since the mid-1980s that a collared WAH cow gave birth on the Seward Peninsula. This cow was severely crippled and could travel only with obvious difficulty. She was accompanied by an unusually large calf that survived until at least mid-July. Other than her calf, there were no other caribou seen in this area during numerous flights in June or July. In late August 2015, this cow began migrating west toward Cape Espenberg along heavy trails established since 1996. She is still alive at the time of this report (December 2015) and is wintering on the eastern side of Shishmaref Inlet with tens of thousands of WAH caribou.

Post-calving. The post-calving movement by maternal cows and their neonates from the calving grounds southwest to the Lisburne Hills is one of the most concentrated and predictable movements exhibited by WAH caribou. Rate of travel during this season is second only to that exhibited during summer movements. Post-calving movements were typical during 2013 and 2014 (Figs. 7 and 8).

Summer. The WAH uses the western North Slope and central to western Brooks Range during summer. 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 any other season.

No collared caribou summered on the Seward Peninsula during the summer of 2013. One PTT-collared bull spent the summer of 2014 in the vicinity of Serpentine Hot Springs during the summer of 2014. This bull was harvested on 14 October 2014 near Deering as he was moving west, possibly in search of caribou moving onto the Seward Peninsula as rut approached. We have no evidence to suggest that a nonmigratory caribou herd has established itself on the Seward Peninsula.

Caribou followed the typical WAH summer movement pattern in 2013 and 2014 (Figs. 9 and 10).

Late summer. Following the summer period bulls and cows disperse through the De Long and Schwatka mountains or move slowly north and west back onto the coastal plain. The small percentage of WAH caribou (mostly bulls) on the Seward Peninsula near Serpentine Hot Springs, Cape Espenberg, and Mount Bendeleben remain there during late summer.

In 2012, caribou were widely dispersed throughout the northeastern portion of their range but exhibited 2 areas of weak clustering in the vicinity of Howard Pass and southwest of Umiat (Fig. 11). In 2013, caribou were again widely dispersed throughout the northern portion of their range and showed no evidence of clustering (Fig. 12).

Fall. Caribou from this herd have historically been more widely distributed during fall than at any other time of year. In many years the vanguard of the fall migration will reach the southernmost portions of winter range before some caribou even depart areas occupied during late summer. However, in recent years the migration has been different in both space and time. During autumn of 2012, 2013, and 2014, relatively few WAH caribou migrated through the western portion of Unit 23. During these years the most heavily used fall movement area was within a relatively narrow east–west corridor between the Anisak and Aniuk rivers, through Ivishak Pass, and into the Purcell Mountains or Nulato Hills. As a result, Noatak, Kivalina, and Kotzebue hunters experienced difficulty harvesting caribou in the fall during 2012, 2013, and 2014.

In addition to changes in the fall distribution of migrating WAH caribou, the timing of fall movements has also affected local subsistence and nonlocal recreational hunters. In 2013 and 2014, a segment of the WAH moved through the upper Nigu–middle Noatak area and crossed the middle Kobuk River for 7–10 days during early September. Following that spike in caribou availability, very few caribou appeared along the Noatak, Kobuk, Selawik, or Buckland rivers for the next several weeks. When caribou did resume crossing the Kobuk River, they did so in large numbers just above Kiana. These caribou were heavily harvested by hunters from Kotzebue, Noorvik, Kiana, and even Noatak. We received reports from local residents of poor behavior by some hunters during this brief period of super abundance.

In 2013 and 2014, the delayed fall migration also affected the collaring project at Onion Portage. In 2013, the lack of caribou crossing the Kobuk River allowed us to deploy only 28 of 33 collars, and in 2014 we deployed only 40 of 49 collars. As a result, in 2014 and 2015 we extended the duration of the collaring project to 2 weeks; however, in 2014 even that extended time was insufficient to get all of the collars deployed. In 2015, although department staff planned to conduct the project for 2 weeks if necessary, an abundance of caribou allowed them to deploy 78 collars in just 3 days.

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 serious, recurrent issue dating to the early 1980s. Incomplete camp location information has precluded quantitative assessment of deflection or displacement of caribou by activities associated with commercial operators and their clients (hunters). Even so, despite virtually complete saturation of access points in the Anisak drainage by transporters each year during 2009–2015, caribou from the WAH migrated through this area during each successive year, and in no year did caribou divert away from the Anisak drainage despite persistent hunting and transporter activity. My speculation is that the long-held Inupiaq hunting tradition founded on the understanding that once the 'lead' caribou in the fall migration establish trails, those caribou behind them will continue to use these trails even in the face of hunting applies equally to other disturbance stimuli (e.g., commercial airplane activity, nonlocal hunters, and even trucks or human activity along the DMTS).

Winter Range. Most WAH caribou wintered on the Seward Peninsula or in the Kobuk, Selawik, and Buckland drainages during the winter of 2012–2013 (Fig. 15; subareas 7 and 4, respectively, in Fig. 29; Tables 7 and 8). During the winter of 2013–2014 (Fig. 16), most WAH caribou again wintered on the Seward Peninsula (subarea 7 in Tables 7 and 8 and Fig. 29) with a much lower number wintering in the central Brooks Range (subarea 5 in Tables 7 and 8 and Fig. 29).

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 most years (Tables 7 and 8).

MORTALITY AND RECRUITMENT

Survival rates in relation to collar type and sex have been previously reported (Dau 2009). In past reports I estimated adult caribou mortality separately for bulls and cows based solely 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 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 introduced uncertainty into early estimates of adult caribou mortality.

For this report I examined survival by sex and age using data from the WAH mandible collection. This greatly increased the sample size for cows and especially for bulls. It also eliminated some of the limitations with age data noted above for radiocollared caribou. Survival for male caribou exceeds survival for females through age 4. At age 5 this switches and female survival consistently exceeds that for males for the remainder of their lifespan. The difference in probability of survival between males and females is greatest during ages 5–11, with the greatest difference occurring at age 7 (Fig. 30).

There is also error associated with our estimates of recruitment. We undoubtedly misclassify some 10- and 22-month-old caribou during spring composition surveys because we conduct them from a Piper Cub PA-18 airplane. This provides a briefer view of the animals compared to observations made from a helicopter. However, conducting recruitment surveys from a Cub has been cost effective and has allowed us to consistently collect this data every year since 1982. Given the limited availability of helicopters in northwest Alaska, the vagaries of weather, and limited funding, fewer surveys would likely have been completed had we insisted on using helicopters to conduct these surveys.

The 33% adult cow mortality rate for 2011–2012 was second only to 1983–1984 (Table 2, Fig. 18). The 1983–1984 estimate (36%) is likely inaccurate because no satellite collars were deployed then to facilitate VHF telemetry surveys, few VHF tracking flights were made, and mortalities could go undiscovered for 1–2 years only 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, the actual mortality rate during 1983–1984 was probably much lower than estimated from VHF-collared caribou. 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 in WAH winter range via snow machine. My observations of high caribou mortality 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 and/or impeded 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 on 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 since 1988–1989. The 20% adult cow mortality rate for 2012–2013 was lower than for 2011–2012 but, despite a relatively easy winter, was still substantially higher that the 15% average annual mortality rate during 1985–1986 through 2002–2003 (i.e., prior to the initiation of the current population decline). If predation by brown bears and wolves is a primary driving force behind the high adult caribou mortality, and if numbers of large predators remained high during 2012–2013 as reported by the public, caribou mortality could remain elevated even under favorable winter conditions. Notably, the caribou carcasses I visited during the easy winter of 2012–2013 were consistently more completely consumed than those I observed during the hard winter of 2011–2012. This was particularly evident while retrieving radio collars from mortality sites during July 2012 compared to July 2013. In 2012 skeletal remains were readily apparent at most sites while in 2013, the bones of many carcasses had been crushed and apparently consumed (it was hard to find any bones at some 2012–2013 mortality sites). One explanation for this inter-annual difference is that wolverines, which often crush and consume bones when scavenging carcasses, visited a higher proportion of collared caribou carcasses during 2012–2013 than in the previous years. Alternatively, the effects of deep snow or otherwise harsh winter conditions during 2011–2012 may have made caribou vulnerable to wolf predation, and wolves did not have to consume bones to meet their nutritional needs as perhaps happened during the easy winter of 2012–2013. Adult cow mortality was relatively low during 2013–2014 (15%) and 2014–2015 (17%), both years of light snow that came late in the winter (at least in those areas where caribou were wintering).

Adult mortality has slowly increased while recruitment has slowly decreased since the mid-1980s (Figs. 19 and 20). These trends are consistent with census results (Fig. 17). 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 1985–2015 (Spearman rank correlation = -0.57, $P < 0.0005$, $n_i = 31$).

Collared bulls exhibited higher seasonal mortality rates (deaths/week) than cows throughout the year, and seasonal differences in natural mortality and harvest rates were less pronounced for cows than bulls (Fig. 31). Little harvest of cows or bulls occurred during summer, and few bulls were harvested during spring. In contrast, natural mortality and harvests of bulls both spiked during fall.

A number of factors may have contributed to higher mortality. 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, 2013, and 2014 WG meetings, every representative of communities within WAH range reported very high numbers of wolves in their respective areas. Most representatives also 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.

Habitat changes are probably not yet limiting the size of the WAH. 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). However, despite these changes in winter range, body condition of caribou has remained good based on the 2007 and 2010 health assessments, on our subjective index of caribou body condition during the September collaring project, and from many comments received from caribou hunters. 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 collared caribou have died of natural causes than were killed by hunters since the mid-1980s (Table 9, Fig. 32). Hunters often report being surprised when they approach a caribou they've just killed to find that it was wearing a collar; therefore, we do not think that hunters introduce bias into this data by avoiding taking collared individuals. Of those caribou that perished of natural causes, the majority were killed by predators (Table 9, Fig. 33). Wolves, brown bears, wolverines, lynx, golden eagles, and even coyotes are known to kill WAH caribou but I was only able to identify wolves and brown bears as predators causing deaths based on evidence present at the mortality sites. Of 152 collared caribou likely killed by predators, I could not identify the type of predator that killed 81 of them (53%). For collared caribou killed by a predator or predators that I could distinguish as either wolves or bear, wolves killed at least 3 to 4 times more caribou than bears. A characteristic of wolf kills is that often very few bones are left (only the skull plate, upper and lower tooth rows, pelvis and vertebrae are usually not completely consumed by wolves), and the collar is often moved away from the carcass. In contrast, with adult caribou, brown bears often chew only the ends off large bones but do not crush and eat them, and they bury the carcass and collar under a midden of dirt and vegetation. Therefore, I probably classify a higher proportion of wolf kills that have little material at the site as "unknown natural mortality" or "unknown predator" than I do grizzly kills that tend to contain intact bones and the collar. Undoubtedly, some kills I attribute to wolves or bears were actually killed by other predators; however, I think this error is small. Additionally, I probably erroneously attributed some deaths to predators that were caused by other factors (e.g., disease or starvation) and then later scavenged by predators. To minimize these sources of error I was conservative when assigning cause of death, and classified many mortalities as 'unknown cause of death,' 'unknown natural mortality,' or 'unknown predator.'

Harvest

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

RY12 and RY13 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		

RY12 and RY13 Unit and Bag Limits	Resident Open Season (Subsistence and General Hunts)	 Nonresident Open Season
Bulls Cows		No closed season 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 (Season may be announced 1 May–Sep 30; however, cows may not be taken 16 May–June 30)	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 (Season may be announced 1 May–Sep 30; however, cows may not be taken 16 May-June 30)	1 Oct–30 Apr	
Nonresident Hunters: 5 caribou per year		1 Oct–30 Apr
Unit 22D that portion in the Kougarok, Kuzitrin, American, Agiapuk River drainages Resident Hunters: 5 caribou per day		

RY12 and RY13 Unit and Bag Limits	Resident Open Season (Subsistence and General Hunts)	Nonresident Open Season
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
Unit 23		
Resident Hunters: 5 caribou per day		
Bulls	No closed season	
Cows	1 July–15 May	

RY12 and RY13 Unit and Bag Limits	Resident Open Season (Subsistence and General Hunts)	Nonresident Open Season
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

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 BOG met in Kotzebue 10–13 January 2014 and considered Proposal 23 to review customary and traditional use of the TCH, and to establish amounts reasonably necessary for subsistence. The board passed an amended version of this proposal which clarified that the ANS range of 8,000–12,000 caribou that had been previously established for the WAH also includes the TCH. The board did not increase the existing ANS levels after formally recognizing that it will apply to both herds. In the future, the combined harvestable surplus for both the WAH and the TCH will be used to assess whether these herds should be managed under general hunt, Tier I, or Tier II status. This board action does not affect implementation of intensive management law for either the WAH or the TCH. Thus, the WAH and TCH are now combined with regard to ANS decisions under subsistence law, but each herd will be considered separately with regard to intensive management. At the January 2014 meeting the BOG also passed an amended version of Proposal 177 allowing hunters to use a snowmachine to position a caribou, wolf, or wolverine for harvest, and to shoot caribou, wolves, and wolverines from a stationary snowmachine.

During the March 2015 BOG meeting, a number of actions restricting caribou regulations were taken in response to the current WAH and TCH population declines. These actions constitute the first restrictions to caribou hunting in northwest Alaska in more than 30 years. Proposal 202, submitted by the department to the BOG, was the vehicle for these actions. As submitted, Proposal 202 would mainly have made state hunting regulations consistent with recommendations identified in the WAH cooperative management plan (WACH WG 2011). The only regulatory action recommended in Proposal 202 that went beyond recommendations in the plan was to eliminate the same-day-airborne caribou hunt in Unit 22.

During the year prior to the March 2015 BOG meeting, department staff visited almost every community within Units 22, 23, 26A and Anaktuvuk Pass (located in Unit 24) to present population overviews for the WAH and TCH. Department staff also met with all state fish and game advisory committees (ACs) within Units 22, 23 and 26A, several federal regional subsistence advisory councils (RACs), 2 NPS subsistence resource councils, the Red Dog Subsistence Resource committee, the Northwest Arctic Borough Planning Commission, and the WACH Working Group. Members of the public who attended these meetings quickly deduced that the actions put forth in Proposal 202 would do little to actually conserve caribou. Therefore, over 20 amendments to Proposal 202 for additional restrictions to caribou seasons and bag limits were submitted to the BOG prior to the meeting. The evening before Proposal 202 was scheduled to be considered, all AC representatives present in Anchorage to testify on this proposal met for several hours to discuss Proposal 202. The outcome of this meeting was to recommend a single, unified amendment to the original proposal that created closed seasons separately for bulls and cows. The board accepted this amendment from the combined ACs, added minor changes to seasons in Unit 26A, and passed an amended version of Proposal 202. These regulatory changes went into effect on 1 July 2015 and will be covered in detail during the next reporting period. In short, the changes passed during the March 2015 BOG meeting were as follows:

1. Create closed resident hunting seasons separately for bulls and cows throughout the range of the WAH. Specific season dates vary by GMU because of seasonal differences in caribou availability and hunting patterns. Despite these closures, during no time of the year is caribou hunting completely closed. That is, throughout the year hunters can take either bulls or cows, and during some portions of the year may take a caribou of either sex. The resident bag limit of 5 caribou/day was maintained throughout most WAH range.
2. Prohibit the take of calves by all hunters throughout the range of the WAH.
3. Prohibit the harvest of cows by nonresident hunters.
4. Reduce the nonresident bag limit to 1 bull/year throughout WAH range.
5. Shorten the nonresident caribou season to 1 August–30 September throughout most WAH range (the nonresident season opens 15 July in Unit 26A).

6. Eliminate the SDA winter caribou hunt in Unit 22.

Human-Induced Harvest. The total harvest of WAH caribou was approximately 13,352 caribou in RY12 and 12,713 caribou in RY13 (Table 10). We assumed that 95% of all caribou harvested by nonlocal hunters in Unit 26A were from the WAH and the remainder from the TCH. These levels are within the range of harvest levels reported in previous years (Fig. 34). Total annual harvest during each regulatory year was roughly 4–5% of the population using the 2011 and 2013 population estimates.

Our harvest data do not include wounding losses or caribou killed but not salvaged. My opportunistic observations made while conducting aerial surveys over the past several years and numerous reports from the public suggest that levels of caribou mortality attributable to wounding and failure to salvage, although unknown, may be substantial (at least hundreds of caribou). Caribou movements and distribution combined with the critical importance of caribou as a subsistence food item, as well as the still high abundance of the WAH, all likely contributed to wounding and failure to salvage losses.

The new ANCOVA model to estimate caribou harvests by local residents likely provides reasonably accurate trend information for total harvests but almost certainly does not accurately reflect annual harvest levels, or harvest levels by game management unit. Even though community harvest assessments provide very accurate data regarding caribou harvests for the communities that were surveyed during those specific years, available funding and staff time to conduct these surveys limits them to a handful of communities each year (especially when large communities, e.g., Kotzebue or Barrow, are surveyed). Therefore, we were forced to use 18 years of community harvest data to have an adequate sample to develop this model. As a result, a large change in harvest over a significant amount of time will be necessary for the model to identify a change in harvest level. For example, an estimated average of any parameter that is based on a sample of 1,000 measurements is unlikely to substantially change with the addition of 5 new measurements unless they are extremely different. We examined the sensitivity of this model to changes in harvest levels by manipulating harvest values for Kotzebue and Barrow. By virtue of their large human populations and consistently good access to caribou, these 2 communities take more caribou than any other communities within WAH range. A significant decrease in the estimated harvest did not occur until a hypothetical 70% reduction in harvest for these 2 large communities occurred. Thus, although this model likely reflects long-term trends in annual local harvests reasonably accurately, it is too insensitive to detect short term changes in harvest levels to enable real time management decisions to regulate harvests.

Although we think harvest levels have been relatively stable since 1998, the decline of this herd since 2003 has resulted in hunters taking a higher proportion of the herd in recent years (Fig. 35). During RY99 through RY10, hunters took an average 2.8% of the WAH annually. During RY11 through RY13, this increased to 4.6% annually. Although we don't think that hunting precipitated the current decline of this herd, if these trends continue (i.e., a stable harvest level with decreasing population size) harvests will increasingly affect the sex and age structure of this herd, and possibly its size and trend as well. This is apparent when harvests are evaluated separately for bulls and cows (Fig. 36). Currently, we consider the WAH harvestable surplus to be 15% of all bulls in the population, and 2% of all cows. These percentages may be modified if this herd continues to decline, or if the population sex ratio changes.

The increasing proportion of bulls being harvested from this herd (Fig. 36) will likely have little effect on the population trajectory of this herd other than through the direct numeric removal of bulls from the herd. This is because caribou are polygynous (males mate with >1 female) and because hunters generally prefer to take large bulls for their trophy value or for the high quality of their meat. Thus, many harvested bulls are probably near the end of their natural life (i.e., many of these bulls would soon die anyway if not harvested). The primary effect of maintaining proportionally high annual bull harvests (e.g., 15% of all bulls in the population) will be a rapid skewing of the sex structure. This, in turn, will quickly reduce the total annual harvestable surplus because bulls compose such a high proportion of it (Fig. 37). As the WAH declines, delaying protection of bulls to meet short-term human demand does not promote long-term recovery of the population. Instead, it creates problems with low bull:cow ratios and precludes shifting harvest pressure onto bulls should herd size drastically decline in the future.

In contrast to bulls, even modest increases in the cow harvest above sustainable levels could have a significant effect on the population trajectory of the WAH. This is because of compounding effects with each cow taken: all of her female descendants with their reproductive potential are eliminated from the population when the cow is taken. This effect increases through time if cow harvests are not managed appropriately.

Even though there are considerable uncertainties in our estimates of bull:cow ratios, sex ratio of harvested caribou, and total harvest, it is clear that sustainable harvest will soon be exceeded if current trends continue. Based on declines in herd size and the bull:cow ratio (Fig. 27), and considering uncertainties in harvest and caribou population survey data, current harvest levels of bulls may have exceeded their harvestable surplus during RY14 and, if not, will likely exceed it soon (Fig. 37). Additional negative pressure on population trend has come from recent cow harvest levels that have probably exceeded the harvestable surplus of cows since RY10 (Fig. 37). This is why the BOG and FSB began restricting harvest opportunity during RY15. If current trends in harvest levels, bull:cow ratios, and population size continue, the state will probably have to consider intensive management for this herd within the next several years, and will likely manage harvests under either Tier I or Tier II regulations (Fig. 38).

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) that replaces mandatory harvest tickets. Only nonresidents and residents of Alaska who live south of the Yukon River are required to use statewide caribou harvest tickets. Registration overlays are free, there is no annual quota limiting harvest or the number of people who can register, and the permits are available at license vendors throughout the range of this herd. During the late 1980s and early 1990s, comparisons of registration harvest data and community harvest assessments indicated that only about 10% of the actual harvest was reported through the registration system (Georgette 1994). This disparity prevailed even though: 1) vendors were paid twice as much to issue caribou registrations as they were to issue caribou harvest tickets; 2) the department relieved the public of the responsibility to send in harvest reports and, instead, sent them self-addressed questionnaires that requested only minimal information; and 3) substantial outreach efforts by Department of Public Safety (DPS) and department staff were used to educate hunters about the need for accurate harvest data. The exception to the generally poor compliance with RC900 reporting requirements has been the community of Nome, where compliance is thought to have been good (K. Persons and T. Gorn, ADF&G area biologists, personal communication).

Permit Hunts. There are no registration permit hunts or drawing permit hunts in current regulations. The RC900 registration requirement is often misidentified as a permit hunt, but it is actually a harvest registration option governed by harvest ticket regulations.

Hunter Residency and Success. Hunters living within the range of the WAH have taken roughly 95% of the total harvest since the late 1990s (Fig. 39, Table 10). Local WAH harvest has been relatively stable since the late 1990s. Even though this herd has declined by >50% since 2003, caribou were still abundant enough during this reporting period that local users could still harvest as many caribou as they did in the past. Granted, residents of some communities have had to greatly increase their expenditure of money and effort to maintain these harvest levels, they've had to switch from taking bulls to cows because of temporal shifts in availability, and some communities (e.g., Unalakleet and Noatak), have not met their subsistence needs in many recent years. Using population growth rate to estimate herd size for non-census years, during 1999–2013, estimated harvest by local residents has not been correlated with WAH population size (Pearson correlation coefficient = -0.17, $P = 0.54$, $n_i = 15$).

There has been no clear change in numbers of nonlocal WAH caribou hunters during the fall hunting season since RY98 (Table 11). Since RY98, numbers of nonlocal Alaska residents hunters have been similar to numbers of nonresident hunters who reported hunting the WAH. During this reporting period, numbers of nonlocal hunters were slightly lower than during previous years. This is partly because transporters have reportedly had to fly longer distances to find caribou for their clients so cannot book as many hunters as in years past when caribou could be reliably found close to Kotzebue. It may also be partly because lower success rates during recent years have discouraged some nonlocal hunters from pursuing WAH caribou. Mean nonlocal hunter success during RY98–RY09 was 65% while in RY10–RY14 it was 55%. "Success" was defined as any hunter who harvested ≥1 caribou of either sex. For some hunters, being forced to make the best of a bad situation and take either a cow or a small bull would not be considered successful, so this metric may be an insensitive indicator of hunter satisfaction. As in the past, most WAH caribou taken by nonlocal hunters were harvested in Unit 23 (74% in RY12 and 68% in RY13). Unlike local harvest levels, using population growth rate to estimate herd size for non-census years, there has been a marginal positive correlation between WAH population size and nonlocal harvest levels during 1999–2013 (Pearson correlation coefficient = 0.50, $P = 0.06$, $n_i = 15$).

Communities within the range of the WAH harvest caribou year-round whenever they are available, and cow caribou have always been an important component of the subsistence harvest. Bulls enter rut around 7–12 October and their meat takes on a strong odor and flavor that most people consider unpalatable. From the onset of rut through roughly the end of December, subsistence hunters shift harvests from bulls to cows. 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 (Nikki Braem, Subsistence Resource Specialist, Subsistence Division., Fairbanks, personal communication).

Nonlocal hunters take few caribou after the first week of October, and generally take few cows (roughly 40–80 cows annually). As reported previously (Dau 2013), nonlocal hunters took a higher proportion of cows (15% of their total harvest) during RY12, a year when caribou were not readily available until late September, than in previous years. As the need to protect cows to ensure the conservation of this herd increases, demand for cows by all hunters may also increase.

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 has created conflicts between these groups, as well as guides and transporters, since at least the early 1980s.

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 12). During this reporting period, 76% of nonlocal hunters accessed hunting areas by airplane in each of RY12 and RY13.

Mandible Collections

I resumed collecting mandibles from WAH caribou in 2009 to monitor body size of individual caribou and the age structure of the population. Most WAH jaws have come from harvested caribou. Samples from harvested animals often do not reflect the overall population in terms of age, size, or sex ratios because hunters select for various characteristics of individual caribou, such as body size, trophy size, or meat quality.

To assess the potential for sampling bias in age data attributable to hunter selectivity I compared the median age of harvested caribou with that of natural mortalities for mandibles collected during 2005–spring 2014. There was no difference in the median age of harvested bulls (6 yrs, range = 0.5–19 yrs, $n_i = 807$) compared to bulls that died of natural causes (5 yrs, range = 0.5–16 yrs, $n_i = 45$; Kruskal-Wallis $F = 0.02$, $P = 0.88$). In contrast, the median age of cows that died of natural causes (7 yrs, range = 0.5–20 yrs, $n_i = 150$) was significantly older than those harvested by hunters (6 yrs, range = 0.5–19 yrs, $n_i = 214$, Kruskal–Wallis $F = 5.94$, $P = 0.01$). The statistical significance of this 1-yr difference for cows probably does not reflect a significant biological difference.

Analyses of body size can be affected by the proportion of immature individuals in the sample. This requires some understanding of when skeletal growth ends in WAH caribou (i.e., when growth through time approaches the upper asymptote of size). Skeletal growth of WAH cows appears to last well beyond age 3 when most cows begin consistently producing a calf (Fig. 40). Median ramus length for cows 3 yrs old was significantly shorter than for cows >3 yrs old (257 mm vs. 264 mm, $n_i = 30$ and 171 cows, respectively; Kruskal–Wallis $F = 11.82$, $P = 0.0004$). This was true for cows at age 4 yrs and even 5 yrs (all Kruskal–Wallis P values <0.008). The youngest cohort at which there was no difference in cow median ramus length occurred at age 6 yrs vs. >6 yrs (265 mm vs. 266 mm, $n_i = 20$ and 103 cows respectively, Kruskal–Wallis $F = 0.01$, $P = 0.92$). For bulls (Fig. 41), the youngest cohort at which there was no statistically significant difference in median ramus length occurred at age 7 yrs vs.. >7 yrs old (292 mm vs. 293 mm, n_i = 108 and 136 bulls, respectively; Kruskal–Wallis F = 0.37, P = 0.54). Despite these statistical differences, it appears that the majority of skeletal growth for cows occurs by age 4 (Fig. 40) and for bulls by age 5 (Fig. 41) so I respectively excluded individuals younger than these ages from analyses of temporal changes in size.

Caribou age determined from cementum annuli is superior to age determined from tooth wear and eruption but still has an element of uncertainty associated with it. We submitted, in the blind, an incisor from 13 known-age reindeer or caribou to be aged by cementum annuli (Table 13). For 8 of these individuals we submitted a second incisor also in the blind (teeth were collected from euthanized individuals). There was no difference in the known median age and median cementum age (Wilcoxon signed rank test Z = 1.44, normal approximation of 2-tailed test P = 0.15, n_i = 13). However, the cementum age equaled the known age for only 5 of the 13 individuals although the difference between known and cementum ages was only ±1 year for 9 of the 13 individuals (69%). The greatest differences between known and cementum ages were for 2 old individuals aged 14 and 19 years old (Table 13). Thus, although cementum age is an unbiased indicator of caribou age, 31% of the time it was off by >1 year. Error in cementum age may have been attributable to tooth characteristics rather than from tooth slide interpretation errors because, for the 8 teeth aged twice, the 2 ages were the same for 5 individuals (63%) and varied by only up to ±1 year for the other 3 individuals.

Given the small sample of known-age animals, I also submitted, in the blind, 2 incisors from 40 caribou of unknown age to evaluate the potential for error in cementum age estimates (Fig. 42). There was no difference in the median age of the 2 samples (median=7 vs. 6.5 yrs, Wilcoxon signed rank test Z = 1.17, normal approximation of 2-tailed test P = 0.24, n_i = 40), but the 2 age determinations agreed only 14 times (35%, Fig. 42). Similar to the known age sample, the difference between the replicate cementum ages differed by $\leq$1 yr 68% of the time. Although cementum age estimates are not 100% accurate, they are unbiased and appear to be within ±1 yr roughly two thirds of the time. For most applications of caribou age data, a 1-yr error in age is not biologically significant. For this report, I assume cementum ages are accurate while recognizing the limitations noted above.

Age estimates from tooth eruption/wear were significantly correlated with cementum annuli (Pearson correlation coefficient = 0.69, P = 0.00, n_i = 1,151). There was no significant difference between median age based on tooth wear and cementum age (Wilcoxon signed rank test Z = 0.18, 2-tailed normal approximation P = 0.86, n_i = 1,151). Tooth-wear age equaled cementum age only 20% of the time; it exceeded cementum age 43% of the time, and was less than cementum age 37% of the time. Thus, although estimates of age based on tooth wear are unbiased, they usually differ from the cementum age of individual caribou by 1–3 years and occasionally much more. Thus, age estimates based on tooth wear may allow comparisons of gross temporal changes at the population level but are of less value for accurately determining the age of individual caribou than cementum ages. Of 90 caribou mandibles independently aged using tooth wear by 2 Kotzebue staff (Dau and Hutchins), the 2 estimates were within ±1 yr of each other 76 times (84%). This includes caribou where both wear estimates differed substantially from the cementum age. This suggests that variation in tooth wear among individual caribou of the same age in terms of total wear, and in terms of wear patterns among incisors/canines, premolars, and molars, confounds our ability to accurately age caribou using tooth wear alone. During this reporting period we completed an exhibit of caribou mandibles by age and wear (light, average, and heavy wear) that is displayed in the Kotzebue ADF&G office. We also completed an electronic file (PDF format) showing photos of these mandibles to help people age caribou by tooth wear.

Mandibles have been collected from WAH caribou during 5 periods:

1. 1959 – 1961: Population trend unknown, size 160,000–200,000 caribou (Lent 1966).
2. 1975: Population at the end of a sustained 18% average annual decline, size 75,000 caribou.
3. 1985–1990: Population increasing 13% annually, size 229,000–417,000 caribou.
4. 1991–2003: Population growing 1–3% annually, size 437,000–490,000 caribou.
5. 2004–2015: Population declining 4–15% annually, size 460,000–235,000 caribou; during this period annual sample sizes before 2009 are too small to characterize by year.

Sample sizes are inadequate to assess long-term differences in age among all of these time periods for bulls or for cows.

During recent years (2009–2015) there is no difference among years in the median age of cows (Fig. 43). Although significant annual differences exist in median annual age of bulls during 2009 to 2015, there has been no clear trend in bull age structure (Fig. 44). The statistical significance of pairwise annual differences in age for bulls may be attributable to large sample sizes rather than an indication of biological significance, because the differences are generally <1 year.

Sample sizes for cows are adequate to assess differences in size only for l959–1961 and 2009–2015. Sample sizes for bulls are adequate to assess differences in size only for l959–1961, 1985–1990, and 2009–2015. Adult cows were significantly smaller during 1959–1961 than during 2009–2015 (255 mm vs. 264 mm, n_i = 219 and 174 caribou, respectively; Kruskal–Wallis statistic = 40.45, P<0.0001). Differences in mandible lengths among periods were even more striking for bulls. Median ramus lengths were 272 mm, 295 mm, and 290 mm during 1959–1961, 1985–1990, and 2009–2015, respectively, and each period was significantly different from the others (Dunn's all-pairwise comparisons test, P<0.05).

Calf Weights

During 2008–2015 (all years combined), median live weight of male calves (94 lb, n_i = 93) was significantly heavier than for female calves (90 lb, n_i = 102; Kruskal–Wallis F = 5.93, P = 0.01). Median male calf weight was significantly different among years (Kruskal–Wallis statistic = 19.22, P = 0.004, Table 14) with weight being significantly heavier in 2015 than during 2008, 2009, and 2011 (Dunn's all-pairwise comparisons, P<0.05). Similarly, median weight for female calves was significantly different among years (Kruskal–Wallis statistic = 15.94, P = 0.02) with weight being significantly heavier in 2015 than during 2008 (Dunn's all-pairwise comparisons, P<0.05). There was a marginal difference in calf weight among the 3 body condition categories of the calves' mothers (below average, average, or above average, Table 15) for female calves (Kruskal–Wallis statistic= 4.97, P = 0.08; all years combined, n_i = 6, 43, and 50, respectively), and for male calves (Kruskal–Wallis statistic = 5.53, P = 0.06; all years combined, n_i = 9, 48, and 33, respectively).

Other Management Issues

User conflicts. Many residents of Unit 23 think that the state is generally unwilling to try to reduce user conflicts. This criticism is not wholly deserved. For example, the original Noatak Controlled Use Area (CUA) was established by the BOG in 1988 to reduce hunting-related airplane activity along the main stem of the Noatak River and thus reduce disturbance of subsistence hunters in boats. This CUA was later substantially expanded in both space and time to increase its effectiveness. Additionally, the department has led two Unit 23 user conflict planning processes, the last of which continued to function 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 focus on reducing user conflicts, including posters and brochures that are available on the department's website and as printed copies. Despite these efforts by the state, user conflicts have continued in Unit 23 and subsistence users have increasingly looked to federal agencies to address their concerns.

To try to reduce user conflicts and facilitate caribou hunting by residents of Noatak, around 2012, the NPS effectively created a federal CUA through a concessionaire requirement that prohibited transporters from dropping caribou hunters in the Kelly, Kugururuk, and lower Agashashok river drainages before 15 September. This restriction could be suspended by special action of the Western Area Parklands superintendent during years when caribou migrated through the middle Noatak drainage prior to 15 September and subsistence hunters had met their demand for meat. Even without this special action, transporters can still drop moose, bear, or sheep hunters as well as floaters, hikers, and fishermen in these areas even while the restriction is in effect. This requirement applies only to transporters such that hunters flying their personal planes and guides could still hunt caribou in these areas prior to 15 September. This NPS requirement has probably had minimal effect on numbers or the distribution of nonlocal caribou hunters because few caribou have migrated through the affected area and transporters dropped most of their clients east of the closed area.

Failure to salvage meat. The issue of 'waste' should be addressed soon by the department, federal agencies, fish and game advisory committees, the Alaska Department of Public Safety, and Alaska Department of Law. Everyone agrees that waste is wrong. But while salvage requirements provide guidance regarding what must be salvaged from harvested wildlife, it is by no means definitive with regard to animals affected by disease or trauma and is 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. Allegation of waste was a contentious 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 before the population declines further. The WG could be an effective body to facilitate this discussion. Unfortunately, given sensitivities surrounding this topic, agency staff and the public, are reluctant to discuss it. Failure to address waste could be a disservice to users, managers, and the WAH.

HABITAT

Assessment

The department did not monitor WAH range condition during this reporting period.

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 have been previously reported (Dau 2011). This group continues to receive funding from state and federal agencies. During the 2014 meeting the WG began to focus on regulatory actions to reduce caribou harvests so that human harvests will not accelerate the current population decline or skew sex and age ratios.

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.

The ‘Ambler Road’ is a major development project still under consideration. This project was described in the last WAH management report (Dau 2013). In 2012 the Alaska Industrial Development and Export Authority (AIDEA) assumed leadership of this project from the Alaska Department of Transportation. Along with several other large capital improvement projects, this road was put on hold in January 2015 after the administration of the current governor, Bill Walker, replaced that of the former governor, Sean Parnell. However, in November 2015, the Walker administration announced that it would resume funding the Ambler Road project. The objective of this project is to build an access road into the Ambler Mining District to open the upper Kobuk region to mineral development. This road could have profound impacts on WAH movements, on the distribution and harvest of other wildlife species, especially resident species (e.g., moose, brown bears, black bears, furbearers, and wolves), and on subsistence users. Under the Parnell administration, AIDEA intended to minimize these impacts to wildlife and local users by requiring industry to ultimately finance construction of this road, thus making it privately owned. That would allow industry to control, and presumably limit, access to this road. Of course, private ownership of the road would not guarantee in perpetuity that the road would never be open to the public. For example, although the DMTS was initially closed to all uses outside of the mine’s commercial use, managers of this mine eventually conceded to demands from Kivalina to allow them to use four-wheelers to hunt from the road.

During the previous reporting period I described movements of WAH caribou near the DMTS (Dau 2013). During the fall 2011 migration, approximately 80,000 WAH caribou (roughly 28% of the WAH, Table 16) experienced a 2–6-week delay crossing this road while being deflected as far north as Cape Thompson and the Tigara Peninsula. Although most of these deflected caribou eventually crossed the road, the 4 collared caribou that did not cross it wintered in the western De Long Mountains or Lisburne Hills north or northwest of the road. All 4 of these collared individuals subsequently died the following winter or spring during an icing event. This suggests that the consequences of preventing caribou from reaching their preferred winter range can be severe.

The relatively high proportion of the WAH (28%) that migrated within 30 mi of the DMTS and mine in 2011 was not unprecedented (Table 16). Prior to 2000 sample sizes of satellite-collared caribou were too small to evaluate herd-scale movements near the road. However, during 2001, 2004, and 2005 (all years with $\geq$15 satellite-collared caribou in the WAH), an even higher proportion of the herd migrated through this area. What was unique in 2011 was the high proportion of the herd (28%) that grossly modified its rate or direction of travel as the caribou approached the 30-mile road zone. During the 2013 and 2014 fall migrations, only 8% and 7% of the WAH migrated within 30 miles of the DMTS, and only 5% and 3% of the herd modified its rate or direction of travel, respectively.

During 2015, 14 of 81 satellite-collared caribou (17% of the herd) approached within 30 miles of the DMTS. One of these 14 collars malfunctioned which made it impossible to track the movements of this caribou near the road. Nine of the remaining 13 collared caribou (69%) grossly changed their direction or rate of travel as they approach the road, and 2 of them did not cross it. Four additional collared caribou that moved from Point Lay to the Lisburne Hills never came within 30 miles of the road but joined the 2 collared caribou that had changed their direction at the road. All of these caribou moved back to the vicinity of Point Lay by mid December 2015 and had approached Wainwright by early January 2016.

Given the typically small proportion of the WAH that has migrated near Red Dog during fall (Table 16), this road has had relatively little effect on overall fall movements of the WAH since at least 2000. However, of those caribou that have approached within 30 miles of this road, more than 50% of them have changed their speed or direction of travel as they approached it.

The significance of caribou movements observed near Red Dog is that caribou approaching other roads developed in the future will probably react to them as they have to the DMTS. Indeed, the potential of the DMTS to affect caribou movements is probably much less than for most other roads with higher traffic and use patterns. If new roads are built in areas heavily used by WAH caribou, overall impacts to this herd could be much greater. Movements of caribou near the Red Dog mine should be carefully considered when attempting to predict impacts of new development projects, such as the Ambler Road, on this caribou herd.

Distribution of satellite-collared WAH caribou during winter suggests they may have avoided areas near the Kougarok and Council road systems (near Nome) despite no traffic (other than snowmachines) and little human activity along it during that time (Dau 2013). However, it is not clear whether caribou were actually displaced by these roads or whether they merely selected areas having lower snow depths or better food that were not in proximity to the roads.

School Programs

In September 2012 the Kobuk and Kivalina schools participated in the Onion Portage caribou collaring project. In 2013 the Nome and Unalakleet schools were scheduled to participate in the project but each school cancelled due to the lack of caribou. Each of these schools participated in the project during 2014. In 2015, the Noorvik school participated in the project. 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 Caribou and the Reindeer Industry

A small proportion of WAH caribou have summered on the Seward Peninsula in recent years (Dau 2011, 2013). In response to this, in 2010 some NPS staff began promoting a helicopter collaring program for this area which the Kawerak Reindeer Herder's Association (RHA) has supported. The department has opposed the proposed NPS collaring project because: 1) no one knows the relative proportions of caribou, reindeer and hybrids that compose these over-summering animals; 2) many residents of Game Management Units 23 and 26A oppose helicopter capture methods; and 3) caribou collared at Onion Portage use the Seward Peninsula during summer and winter, thus negating the need to conduct an expensive and potentially controversial helicopter collaring project there. In place of a helicopter capture project, the department has agreed to help collect tissue samples and fund genetic analyses to determine relative numbers of caribou and reindeer that summer on the Seward Peninsula.

Even if most of the *Rangifer* on the Seward Peninsula during summer are caribou, telemetry data indicates that they remain in the area near Taylor, Serpentine Hot Springs, and Cape Espenberg. The primary threat to Seward Peninsula reindeer herds is not from the few thousand caribou that summer in this area; rather, it is from the tens or hundreds of thousands of caribou that winter over extensive portions of the eastern half to two thirds of the Seward Peninsula. These wintering caribou sweep away reindeer as they emigrate from the Seward Peninsula on their northward migration each spring.

If the *Rangifer* that summer near Serpentine are primarily reindeer, NPS, RHA, and the University of Alaska Reindeer Research Project may proceed with telemetry as they see fit. However, if the animals are mostly caribou, then the department will have to decide how to proceed given limited staffing and funding. Additionally, the department will have to consider how this modification of the WAH caribou collaring program will affect the overall caribou survey and inventory program and data interpretation. The department will not conduct helicopter capture operations without first assessing public support for this project.

WAH serology program

The WAH serology program was discontinued after September 2014. The primary objective of this project was to provide a red flag approach for identifying when disease(s) might affect the population dynamics of this herd. Additionally, caribou sera were tested for antigens in response to public concerns regarding the safety of eating caribou meat. The recent lack of caribou at Onion Portage during the collaring project now requires staff to spend up to 2 weeks deploying radio collars. Although serum can be chilled for up to a week without compromising its quality for serological tests, longer periods require freezing to retain sample quality. It is logistically impracticable to bring enough dry ice to this field project to freeze caribou sera for up to 2 weeks. Additionally, the department's veterinary staff does not have the time or storage capability to process and archive WAH sera. For the first time since the early 1990s, no blood was collected from WAH caribou during the collaring project in September 2015.

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 in Kotzebue during May 2013 and May 2014 to share information among agencies and users regarding user conflicts.

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 might suggest that density dependent factors have subtly affected the population dynamics of this herd; however, this is inconsistent with the consistently good body condition of caribou during recent years. Opportunistic observations by department staff and numerous reports from local residents and long-term commercial operators suggest that 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 degree 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 caribou harvest data is becoming increasingly important to the management of this herd (Dau 2013) and the TCH. 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 be able to conduct an adequate number of community harvest assessments annually to be able to detect short-term changes in harvest levels. A statistically-based, comprehensive sampling approach for the community harvest assessment program is one of the greatest management needs for the WAH and TCH. Paper-based harvest report systems have never worked well within the range of the WAH. If the department hopes to change this, it will be necessary to spend substantial staff time visiting communities within the range of this herd to convey the importance of collecting this information for the management of this herd. With adequate compliance with reporting requirements by hunters, a harvest report system could provide accurate caribou harvest information annually throughout the range of this herd, and it could do so at relatively little expense. The greatest obstacle to this has been the lack of participation in voluntary harvest reporting systems by local hunters. This likely will not change without a substantial public outreach program describing why managers need harvest data.

The department should continue to monitor the health of caribou in this herd through health assessments conducted at least once every 5 years. Health assessments should be conducted during spring as well as fall. Analysis of caribou health assessment data should be expanded to include trends and the biological significance of pathogens to caribou at the population level.

A number of large-scale resource development projects 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 expanding roads into historically remote, traditional subsistence areas must be considered. Preliminary analyses strongly suggest that roads significantly alter WAH movements at least during some years. The mechanisms for this and their biological impacts on caribou are still not understood. Even so, the impact to subsistence users and other hunters from delayed or diverted caribou migrations could be serious. Additionally, it has long been clear that subsistence harvests are significantly lower near road systems than away from them (Wolf and Walker 1987). The social impacts of establishing new roads into previously remote areas should be a primary consideration when deciding whether to build new roads within the range of the WAH.

The department should continue to support the Western Arctic Caribou Herd Working Group. The 2011 *Western Arctic Herd Cooperative Management Plan* recommends an incremental approach for monitoring activities and regulatory restrictions that is linked to WAH 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 voluntary responses, as well as regulatory actions, to address the current population decline.

Despite efforts to keep caribou regulations as simple, consistent, and, understandable as possible during the March 2015 BOG meeting, the FSB subsequently created federal caribou regulations that differ substantially from those of the state. The complexity of inconsistent state and federal regulations will probably confuse many hunters and could lead to citations when they unknowingly break state or federal laws. Ultimately, this will not facilitate a spirit of cooperation between managers and the public, nor will it help conserve caribou. It should be possible to promulgate at least very similar – if not completely consistent – state and federal caribou regulations: both sides are dealing with the same caribou herd on adjoining lands used by the same people. A major challenge now facing managers is to reconcile differences in state and federal regulations to make them fair, effective, and understandable to the hunting public. Following the BOG and FSB meetings in 2015, the overall suite of state and federal regulations were unclear even to professional biologists and enforcement officers working within the range of this herd.

During 2014 and early 2015, department staff conducted an extensive and intensive public outreach campaign in GMUs 22, 23, 26A, and Anaktuvuk Pass to inform people of the population status of the WAH and TCH, and to begin discussing how to begin reducing harvests from these herds. If the WAH continues to decline, this level of outreach is going to become a necessity, perhaps on an annual basis, if managers hope to have public support for and compliance with regulatory restrictions and harvest reporting requirements. Throughout these public meetings, a comment frequently repeated was that managers cannot simply reduce harvests to stop or reverse the decline in WAH caribou numbers: they *have* to reduce numbers of wolves and brown bears as well. Given the size and remoteness of WAH range, the presence of large tracts of NPS and FWS lands where predator control is prohibited, the difficulty of finding wolves in areas occupied by large numbers of caribou, and the dismal budget outlook for the State of Alaska as oil revenues decline, it is unlikely that a state-administered predator control program could have a measureable impact on reversing the WAH decline. Even so, if the state hopes to work cooperatively with the public in addressing this WAH population decline, a meaningful attempt to at least reduce the impact of predators on this herd may be necessary even if the intensive management review process deems it infeasible. There is no terrestrial wildlife population in northwest Alaska more important to subsistence users, nonlocal hunters, or commercial operators than the WAH. It will be imperative that managers work with the public in managing this herd through this decline. Failure to do so in such a remote area having limited enforcement capabilities could result in anarchy regarding caribou management.

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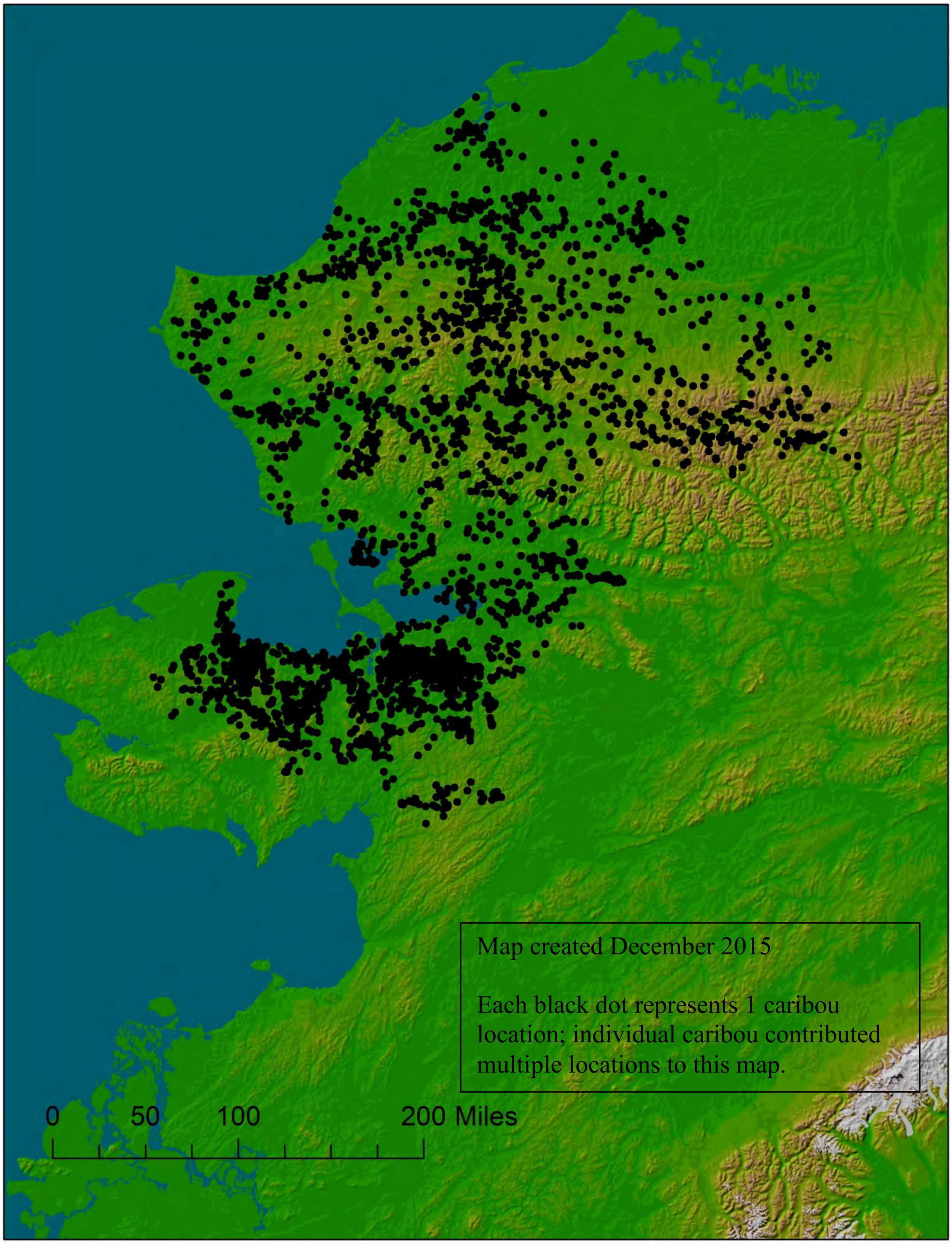

Figure 1. Locations of 105 radiocollared caribou (15 bulls, 90 cows), Western Arctic caribou herd, RY12. Data excludes first 8 months after collaring. All collar duty cycles standardized to 1 location every 6 days (n_i = 4,146 locations).

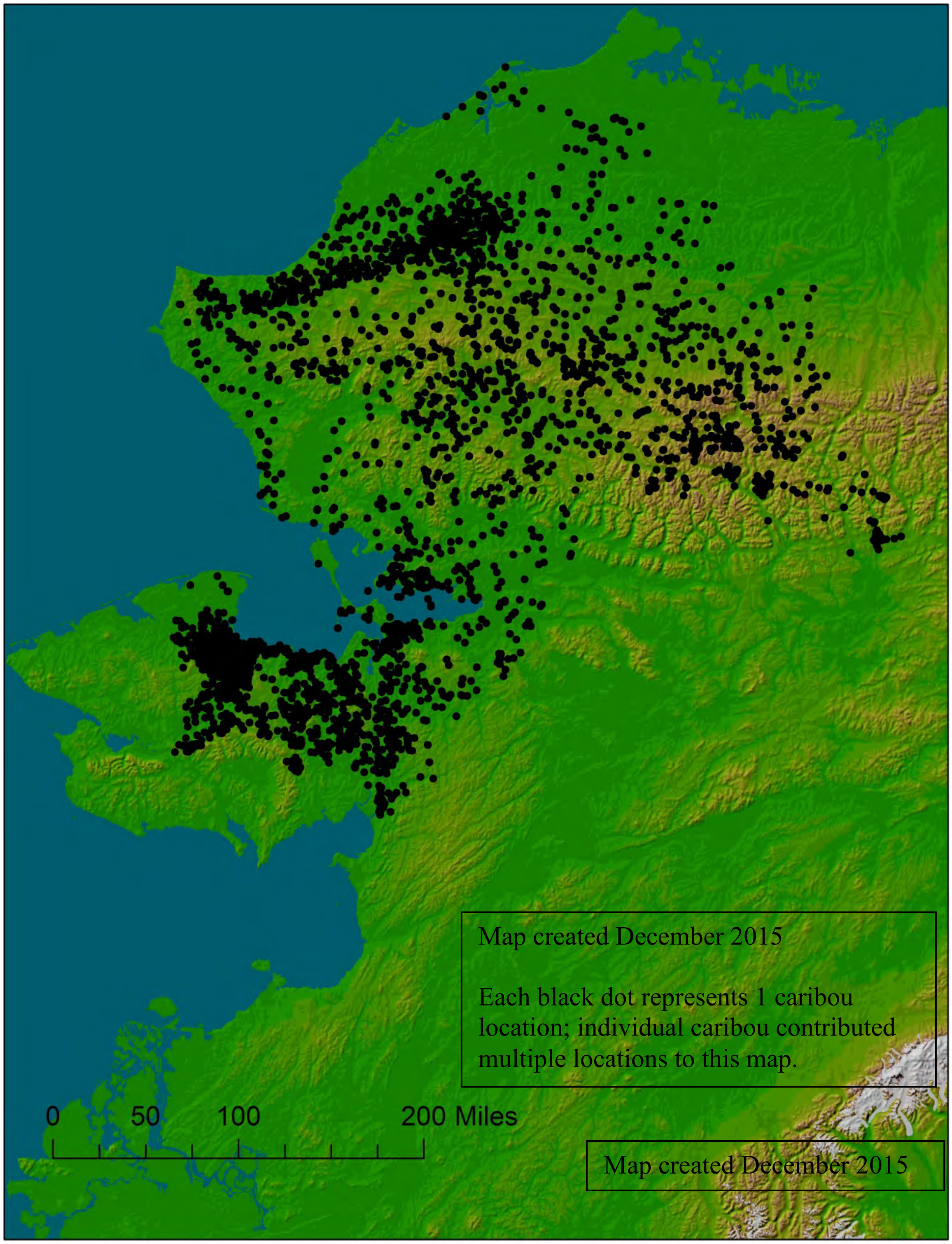

Figure 2. Locations of 108 radiocollared caribou (12 bulls, 96 cows), Western Arctic caribou herd, RY13. Data excludes first 8 months after collaring. All collar duty cycles standardized to 1 location every 6 days (n_i = 4,172 locations).

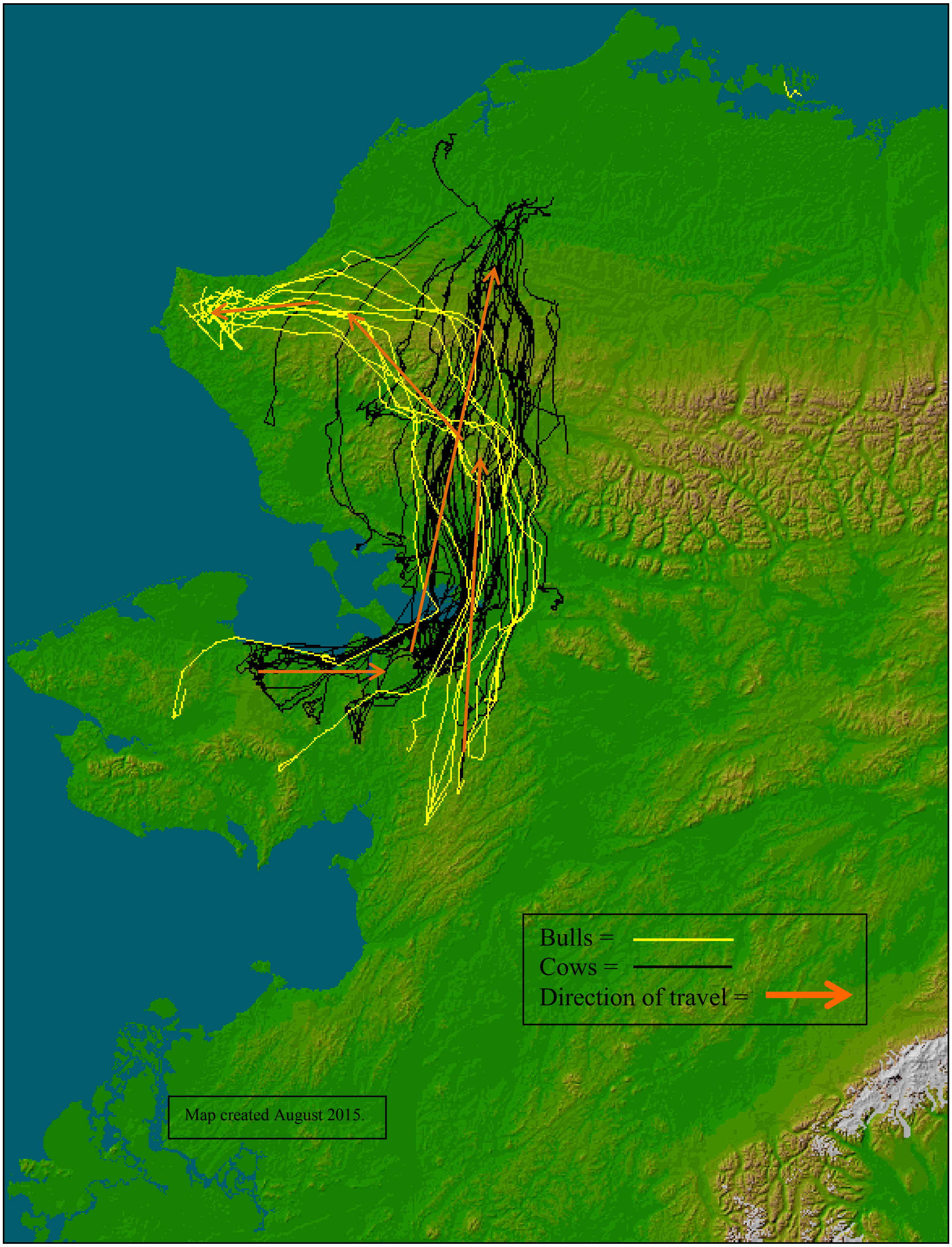

Figure 3. Spring 2013 movements from south to north of satellite-collared caribou; 11 bulls (yellow lines, 16 May–4 July) and 72 cows (black lines, 6 May–8 June), Western Arctic caribou herd (season dates determined from speed and direction of travel, see Table 6).

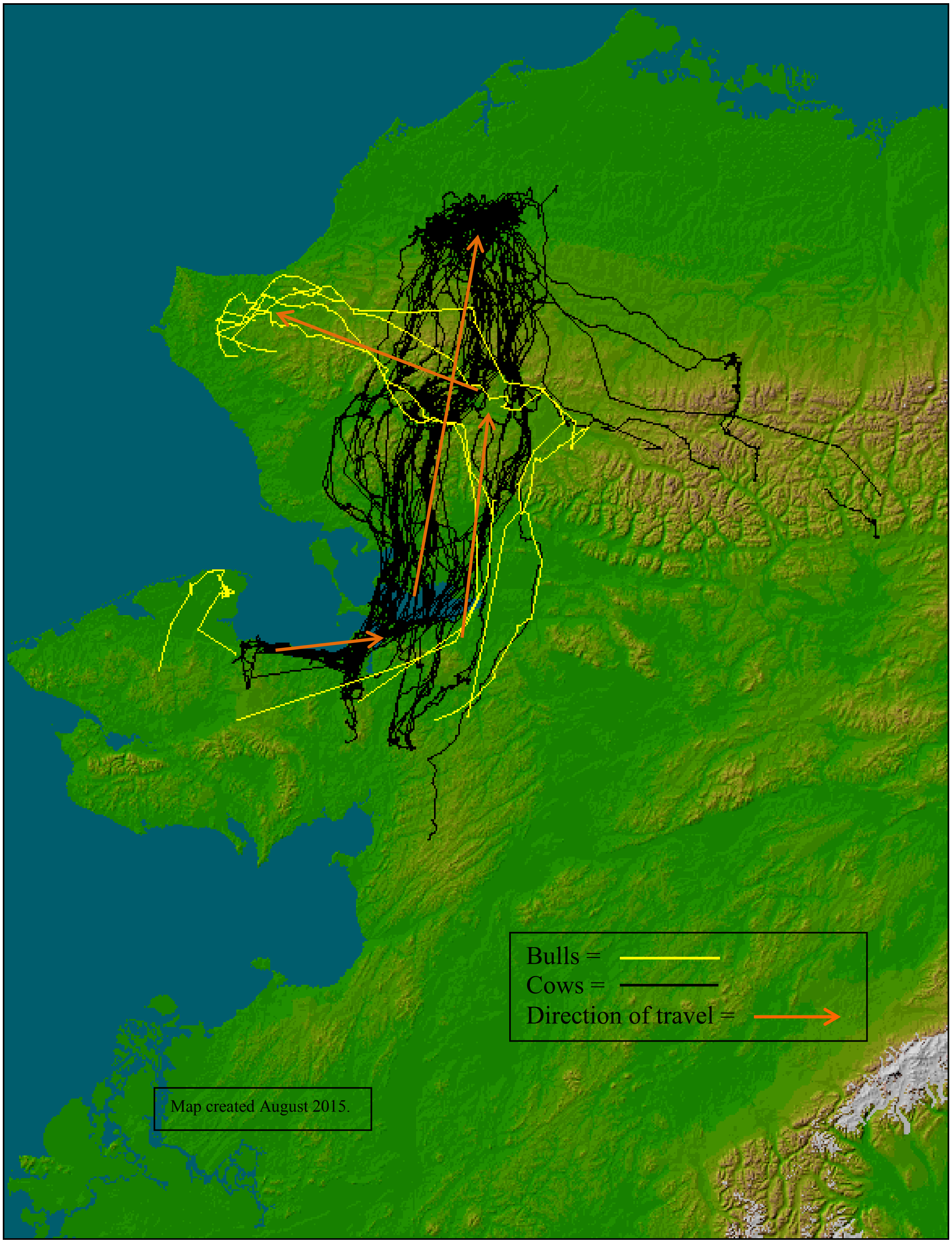

Figure 4. Spring 2014 movements from south to north of satellite-collared caribou; 5 bulls (yellow lines, 16 May–4 July) and 77 cows (black lines, 6 May–8 June), Western Arctic caribou herd (season dates determined from speed and direction of travel, see Table 6).

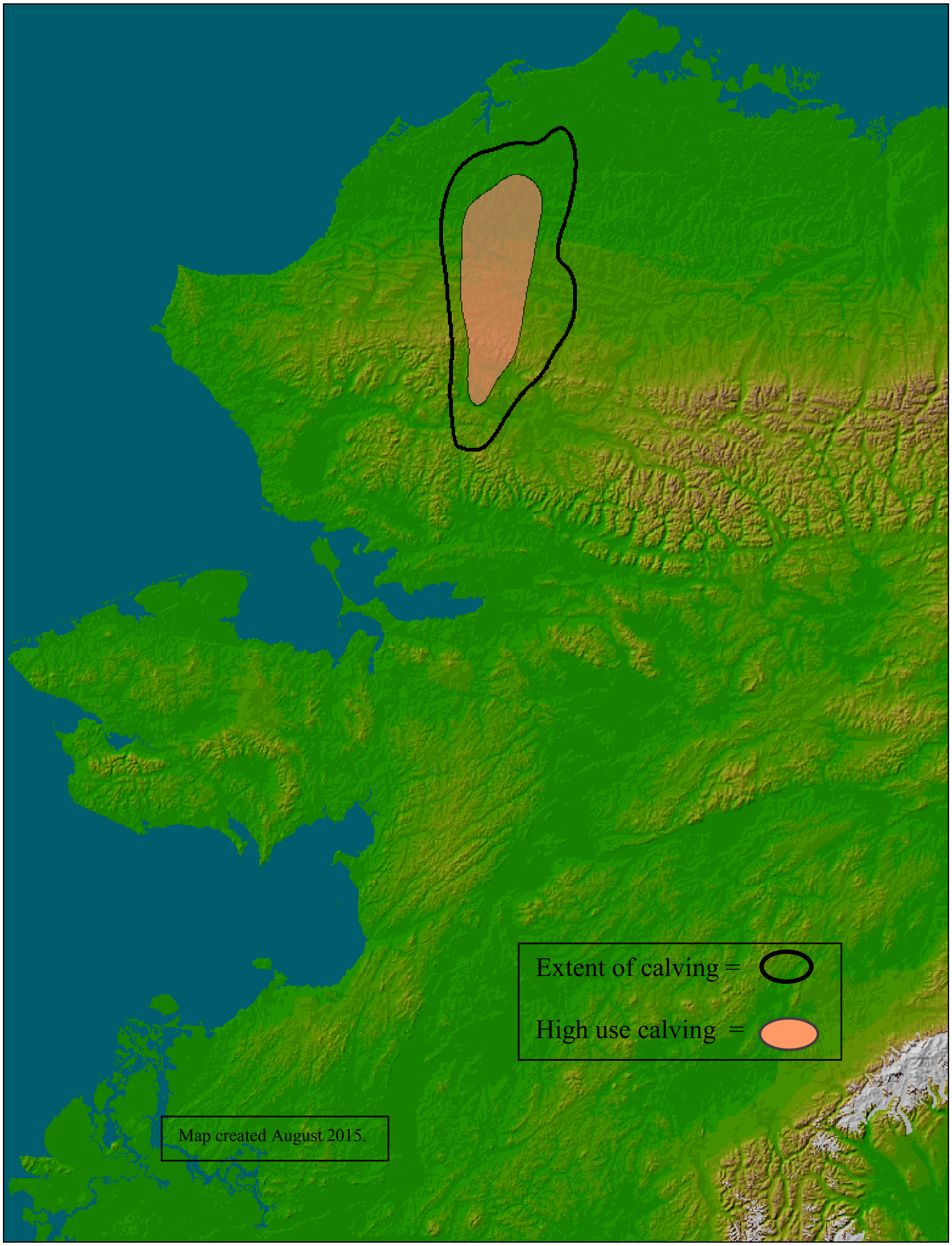

Figure 5. Kernel depiction of calving distribution during June 2013 based on locations of 45 maternal cows, Western Arctic caribou herd. Calving period is 9–13 June (season dates determined from speed and direction of travel, see Table 6). Outer black boundaries represent the 95% isopleth to show the extent of calving. Shaded area (67% isopleth) was selected by a Bayesian model to reflect high use.

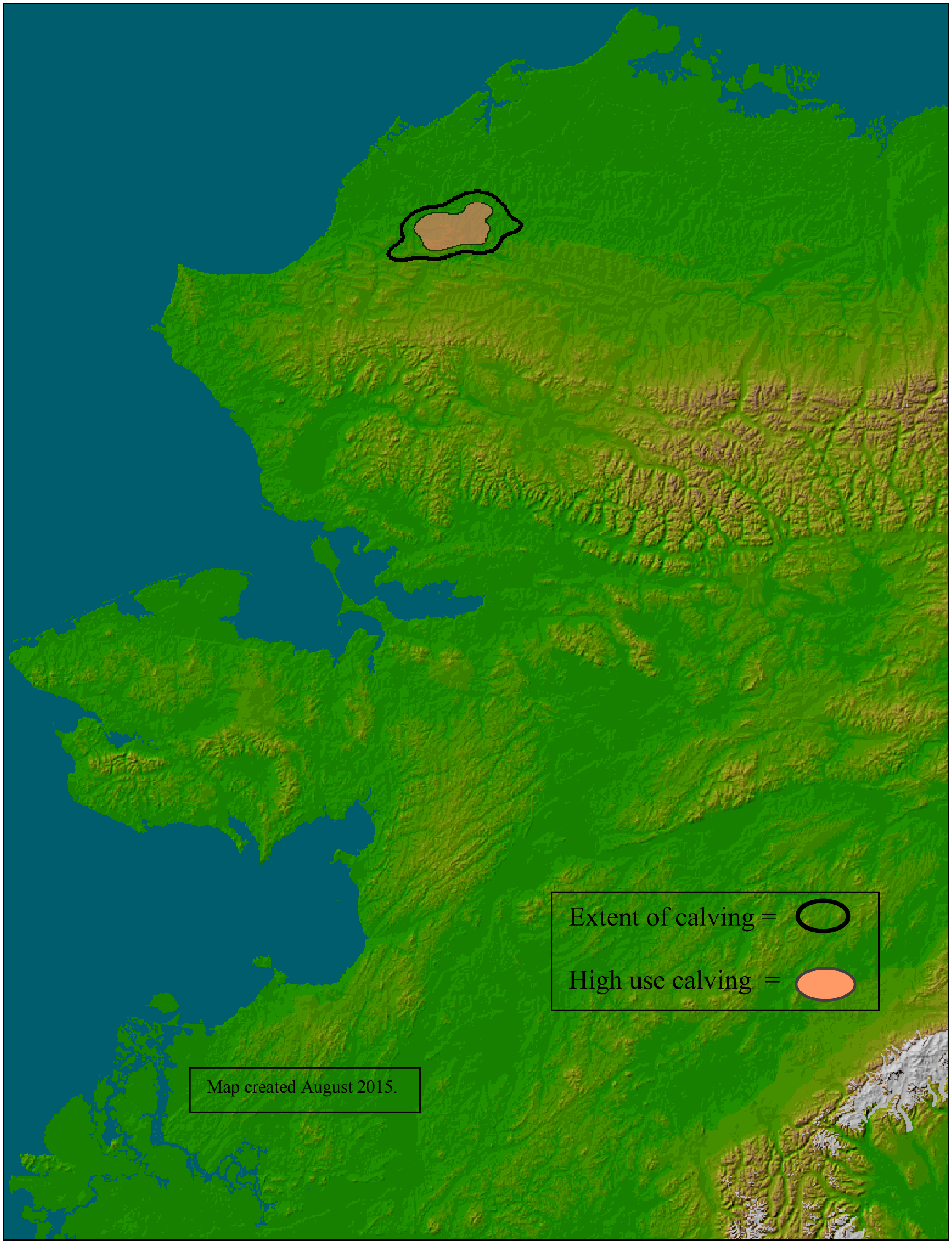

Figure 6. Kernel depiction of calving distribution during June 2014 based on locations of 47 maternal cows, Western Arctic caribou herd. Calving period is 9–13 June (season dates determined from speed and direction of travel, see Table 6). Outer black boundaries represent the 95% isopleth to show the extent of calving. Shaded area (69% isopleth) was selected by a Bayesian model to reflect high use.

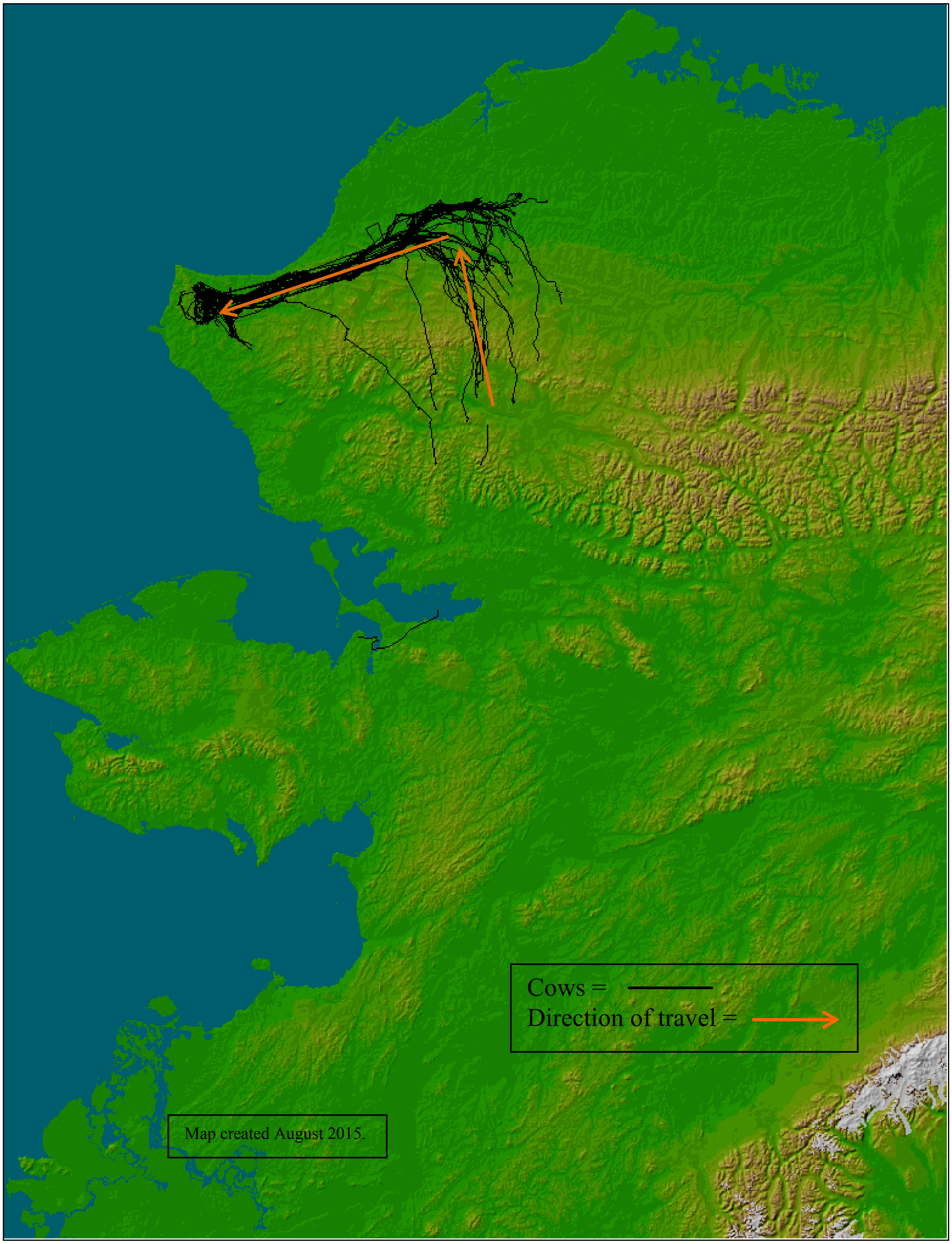

Figure 7. Post-calving movements from east to west of 65 satellite-collared cows, 2013, Western Arctic caribou herd (movement is northward toward the calving grounds, or from the calving grounds southwest toward the Lisburne Hills). Movement period is 14 June–5 July (season dates determined from speed and direction of travel, see Table 6).

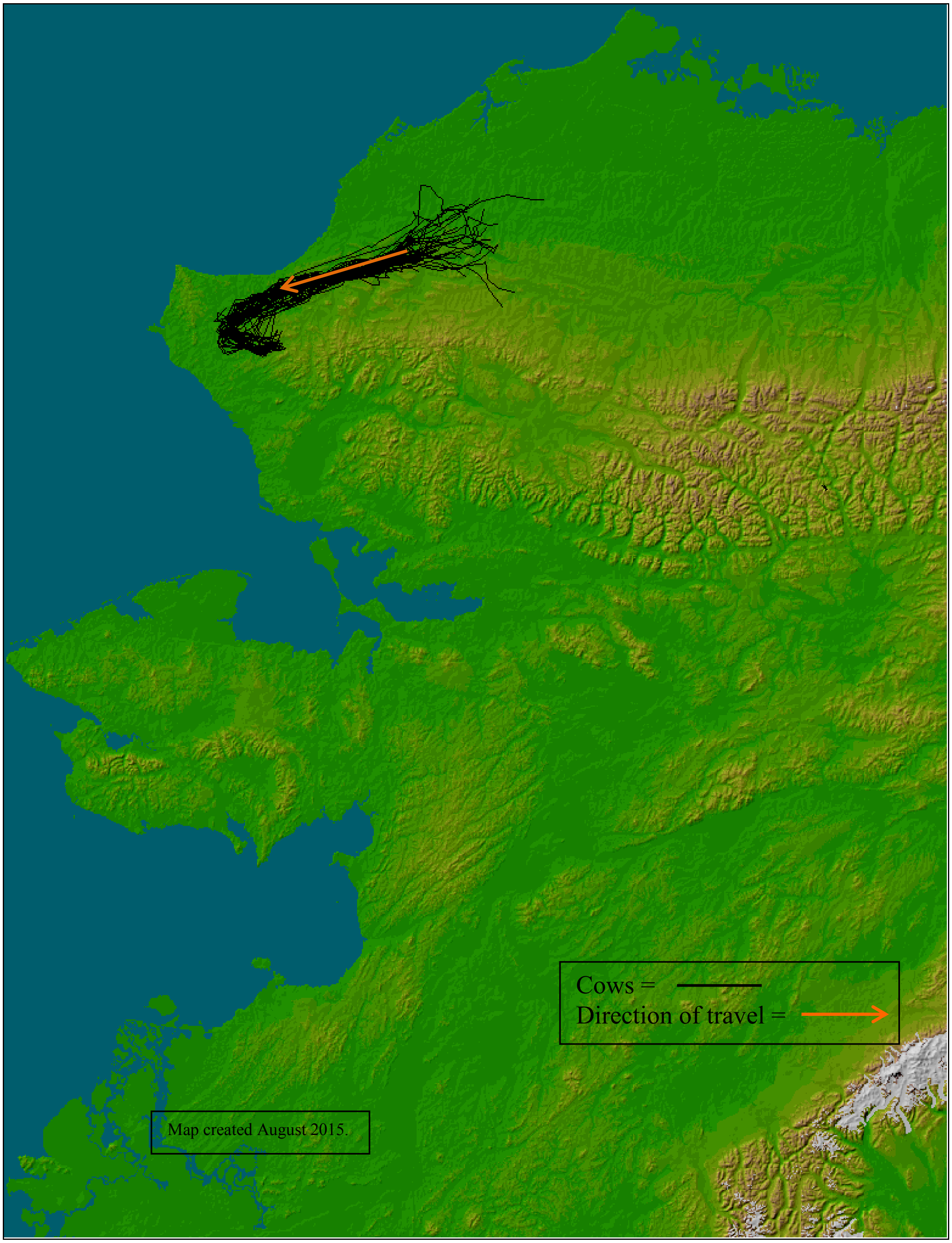

Figure 8. Post-calving movements from east to west of 67 satellite-collared cows, 2014, Western Arctic caribou herd (movement is from the calving grounds southwest toward the Lisburne Hills). Movement period is 14 June–5 July (season dates determined from speed and direction of travel, see Table 6).

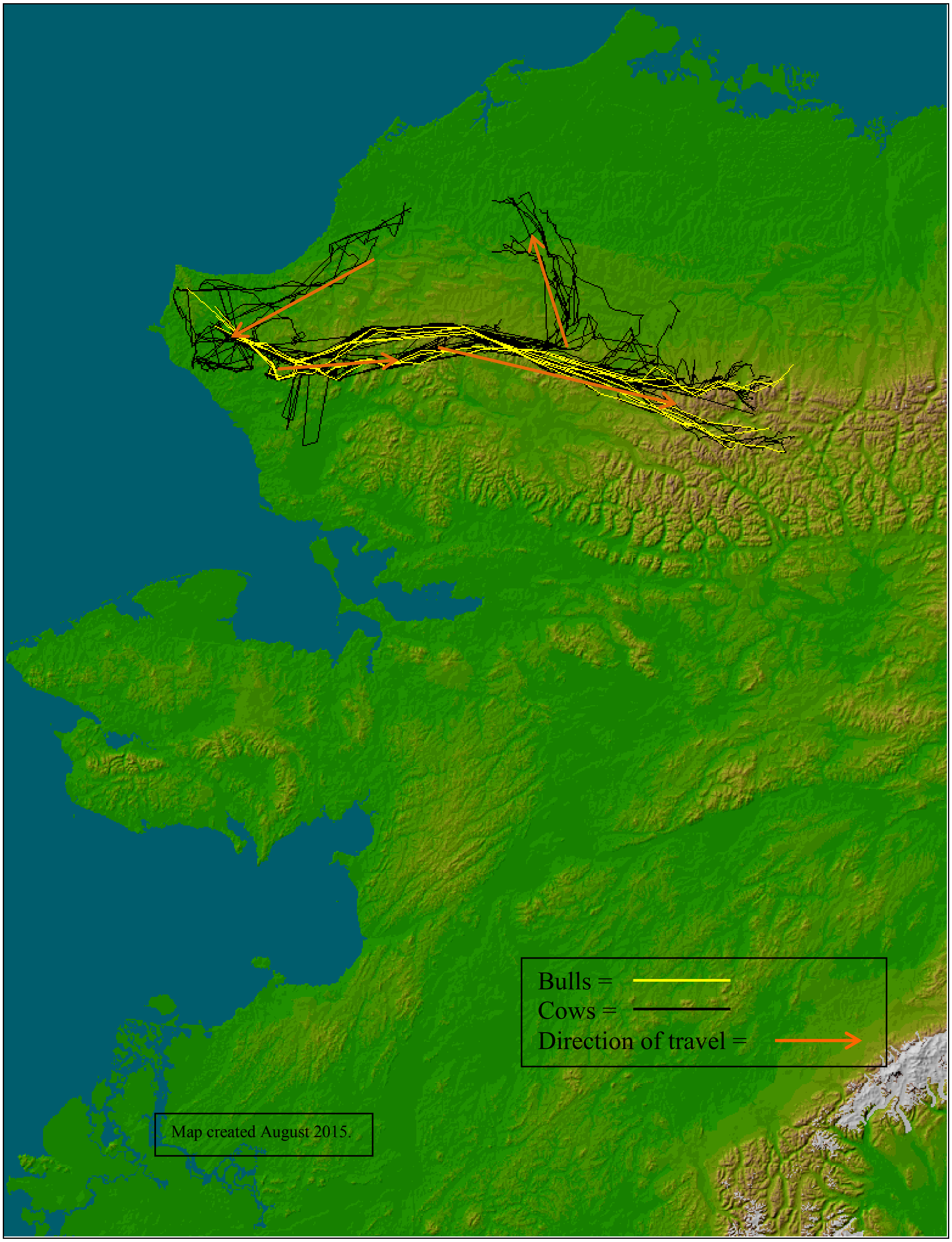

Figure 9. Summer 2013 movements from west to east of 64 satellite-collared cows (6 July–30 July, black lines) and 10 bulls (5 July-2 August, yellow lines), Western Arctic caribou herd (season dates determined from speed and direction of travel, see Table 6).

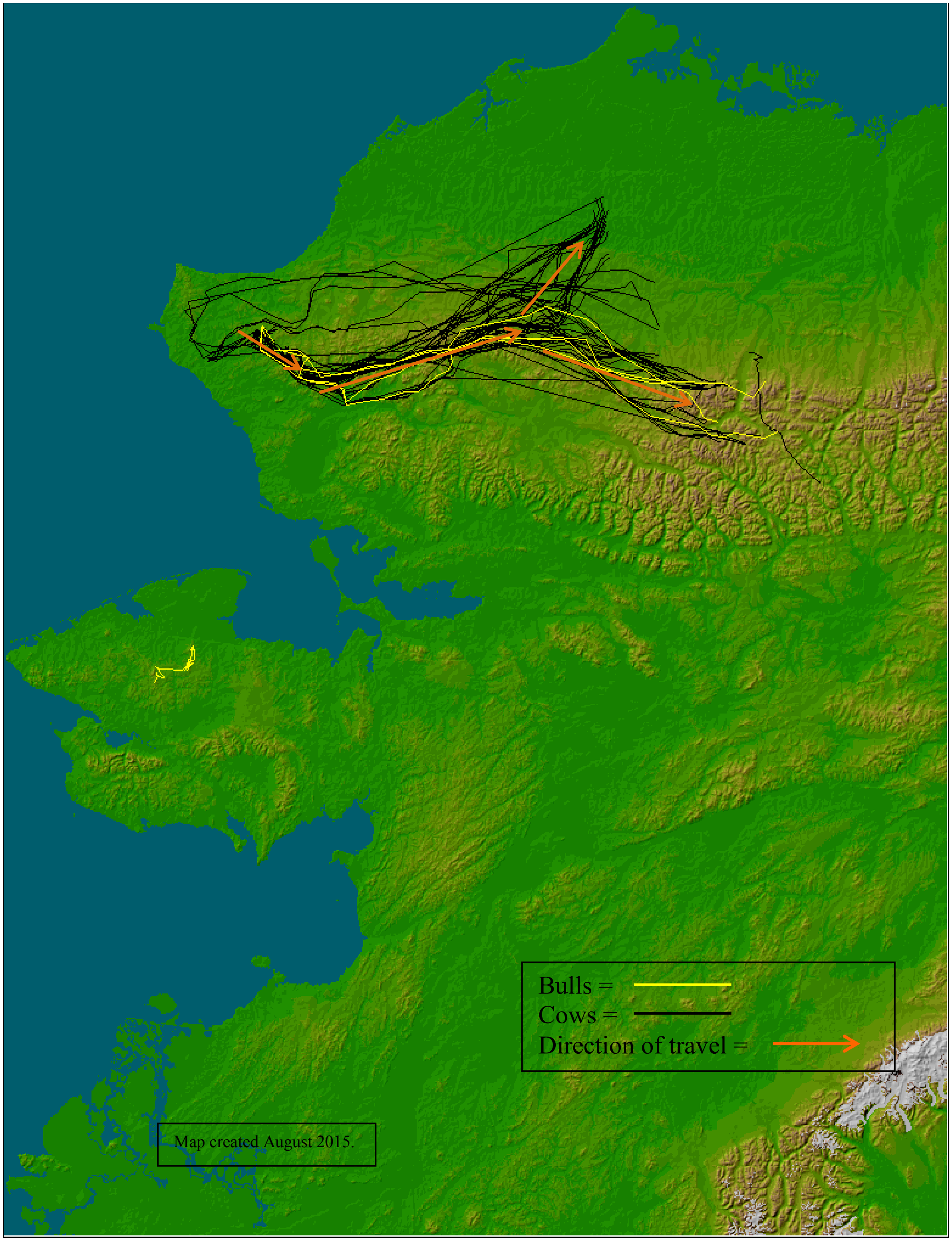

Figure 10. Summer 2014 movements from west to east of 64 satellite-collared cows (6 July–30 July, black lines) and 5 bulls (5 July–2 August, yellow lines), Western Arctic caribou herd (season dates determined from speed and direction of travel, see Table 6).

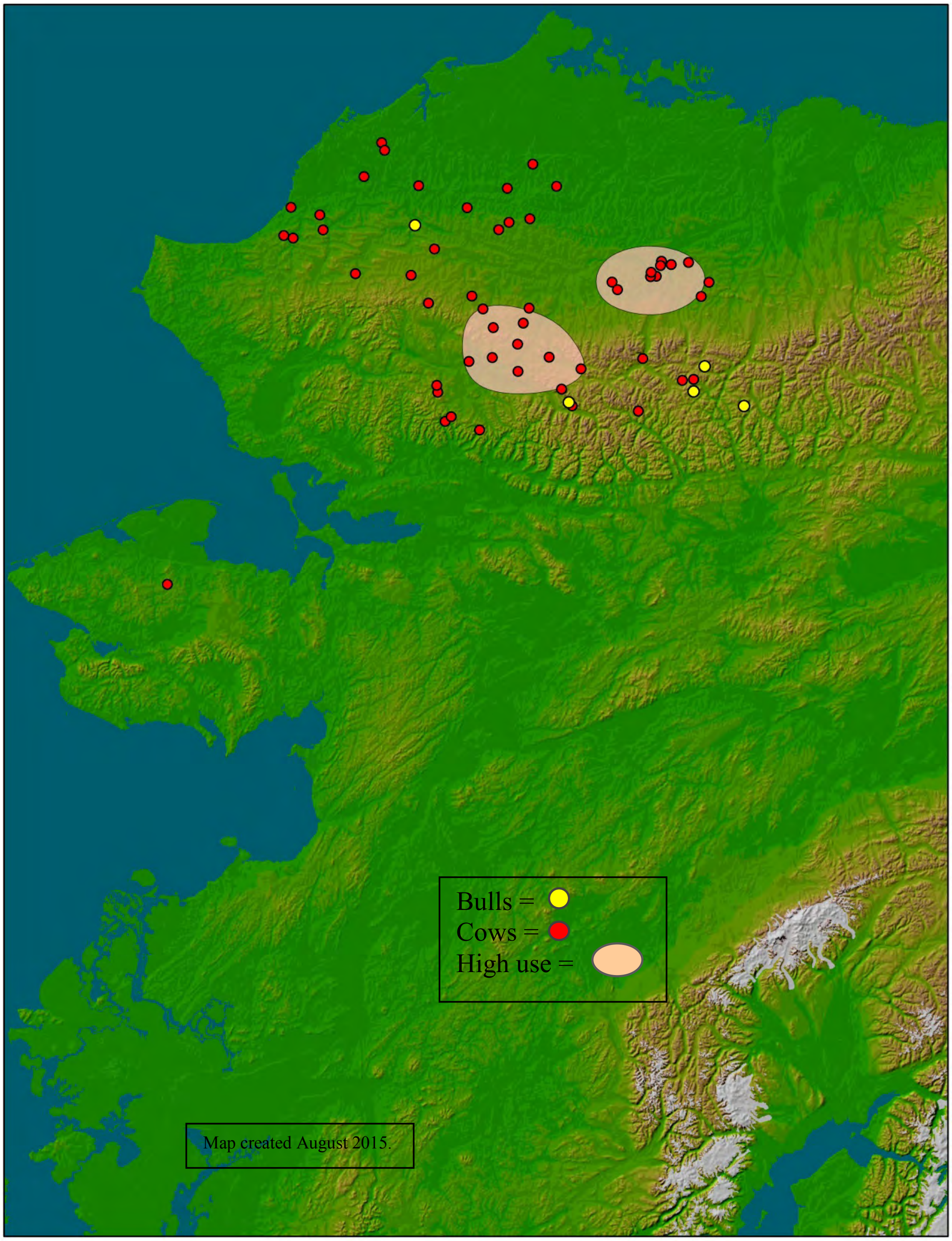

Figure 11. Point locations and kernel areas of late summer (31 July–17 September) distribution for 5 bulls and 55 cows (yellow and red symbols, respectively), Western Arctic caribou herd, 2012 (season dates determined from movement data, see Table 6). Isopleth (15%) was selected by a Bayesian model. The location closest in time to the midpoint date of late summer was selected for each collared caribou.

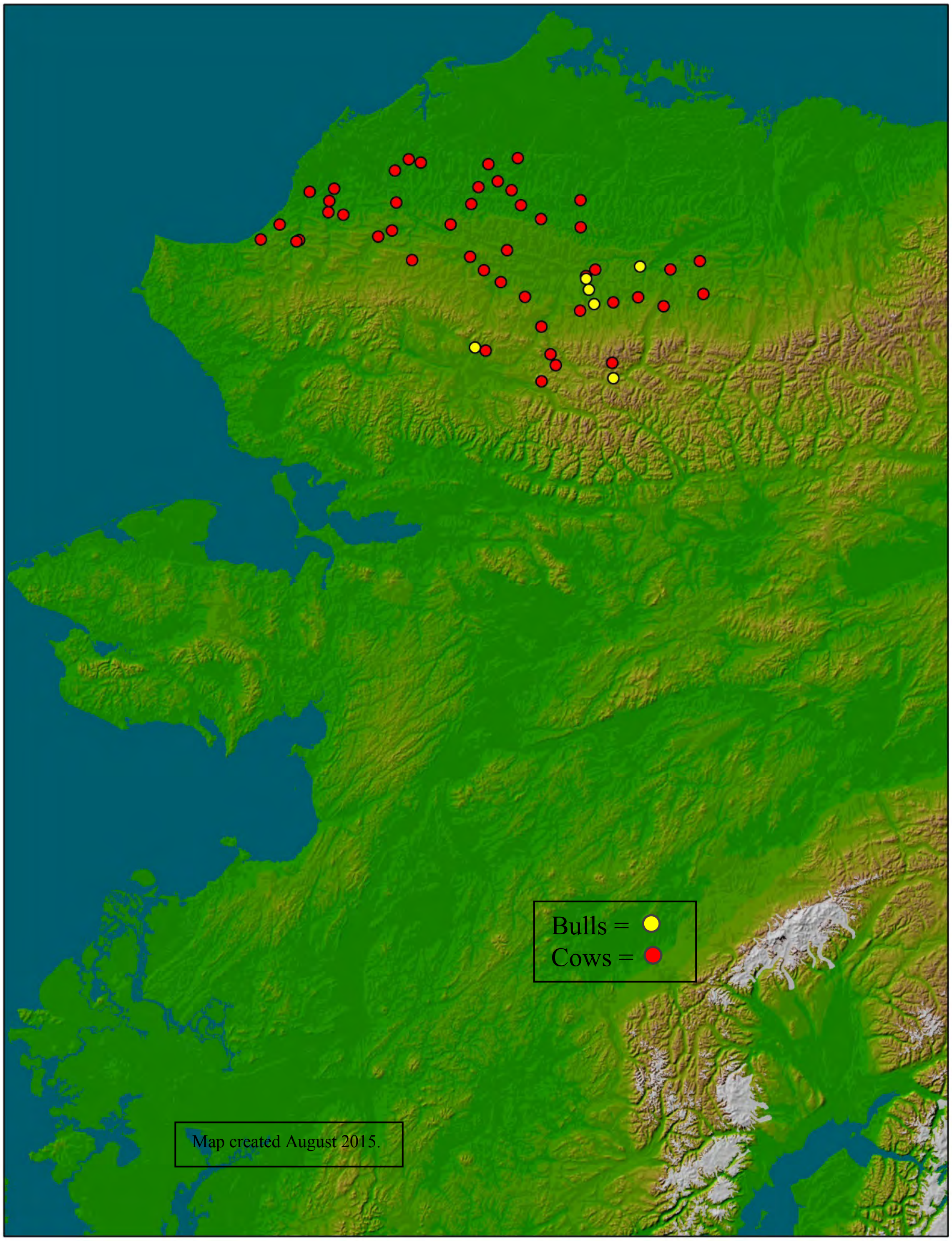

Figure 12. Point locations and kernel areas of late summer (31 July–17 September) distribution for 6 bulls and 47 cows (yellow and red symbols, respectively), Western Arctic caribou herd, 2013 (season dates determined from movement data, see Table 6). There was no evidence of clustering by caribou in late summer 2013. The location closest in time to the midpoint date of late summer season was selected for each collared caribou.

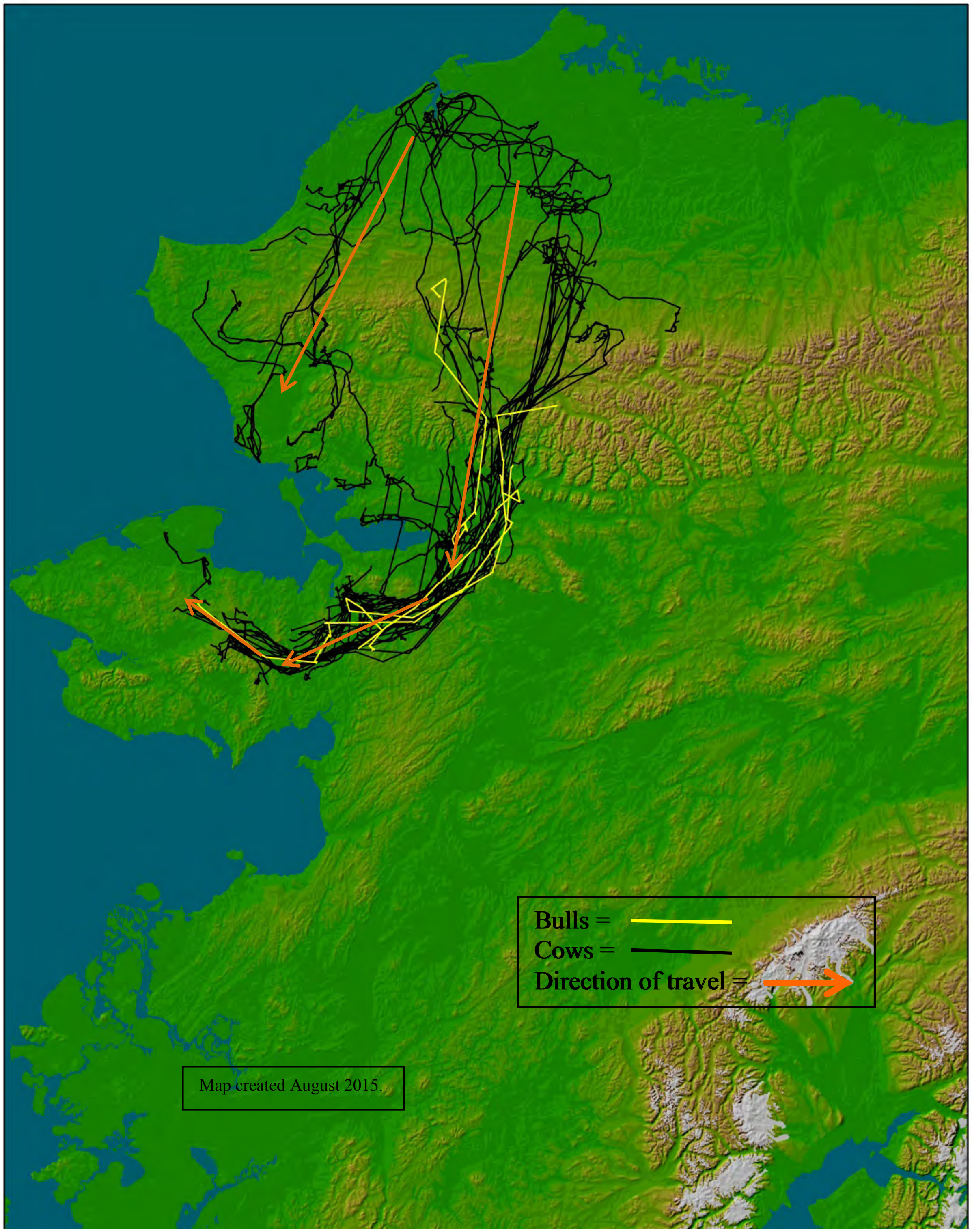

Figure 13. Fall (18 September–7 November) movements from north to south of satellite-collared caribou (4 bulls = yellow lines, 57 cows = black lines), Western Arctic caribou herd, 2012 (season dates determined from movement data, see Table 6). Data through 8 months after collaring are excluded.

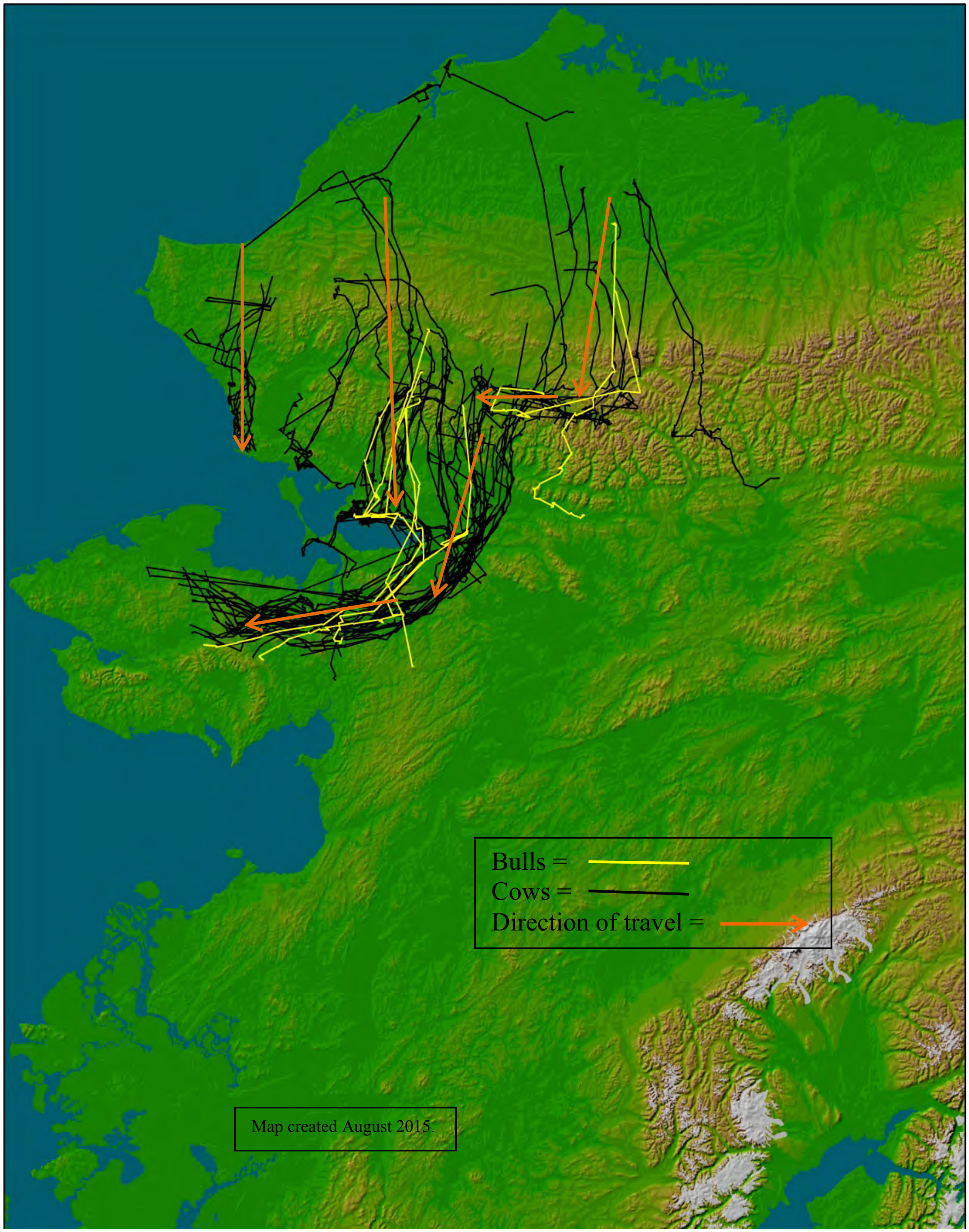

Figure 14. Fall (18 September–7 November) movements of satellite-collared caribou (8 bulls=yellow lines, 61 cows=black lines), Western Arctic caribou herd, 2013 (season dates determined from movement data, see Table 6). Data through 8 months after collaring are excluded.

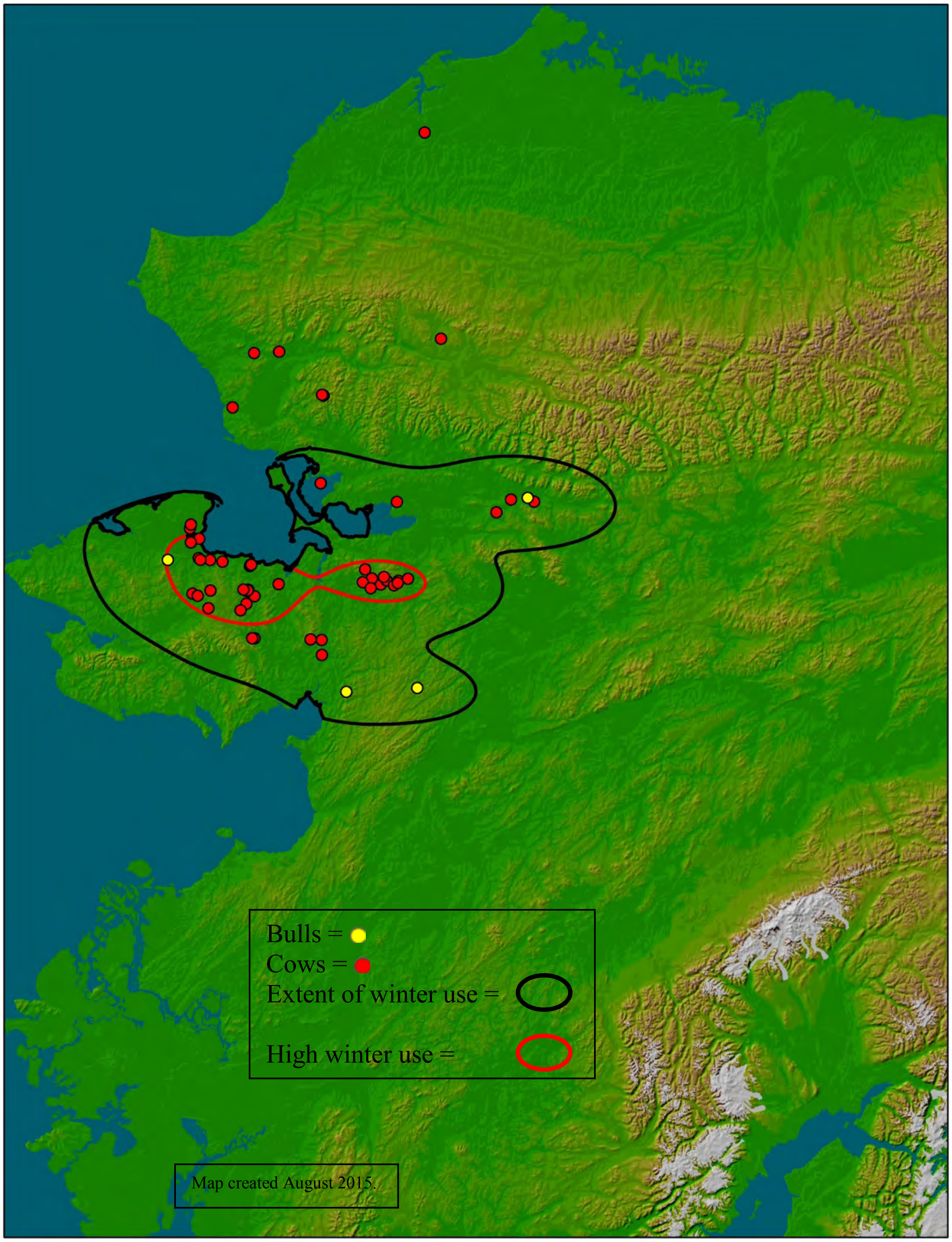

Figure 15. Kernel densities showing winter (8 November–5 May) distribution of satellite-collared caribou, Western Arctic caribou herd, 2012–2013. Points shown are the locations closest to 1 January 2013. Black line = 95% kernel; red line = high use area (34% kernel); yellow dots = bulls ($n_i = 4$); red dots = cows ($n_i = 51$).

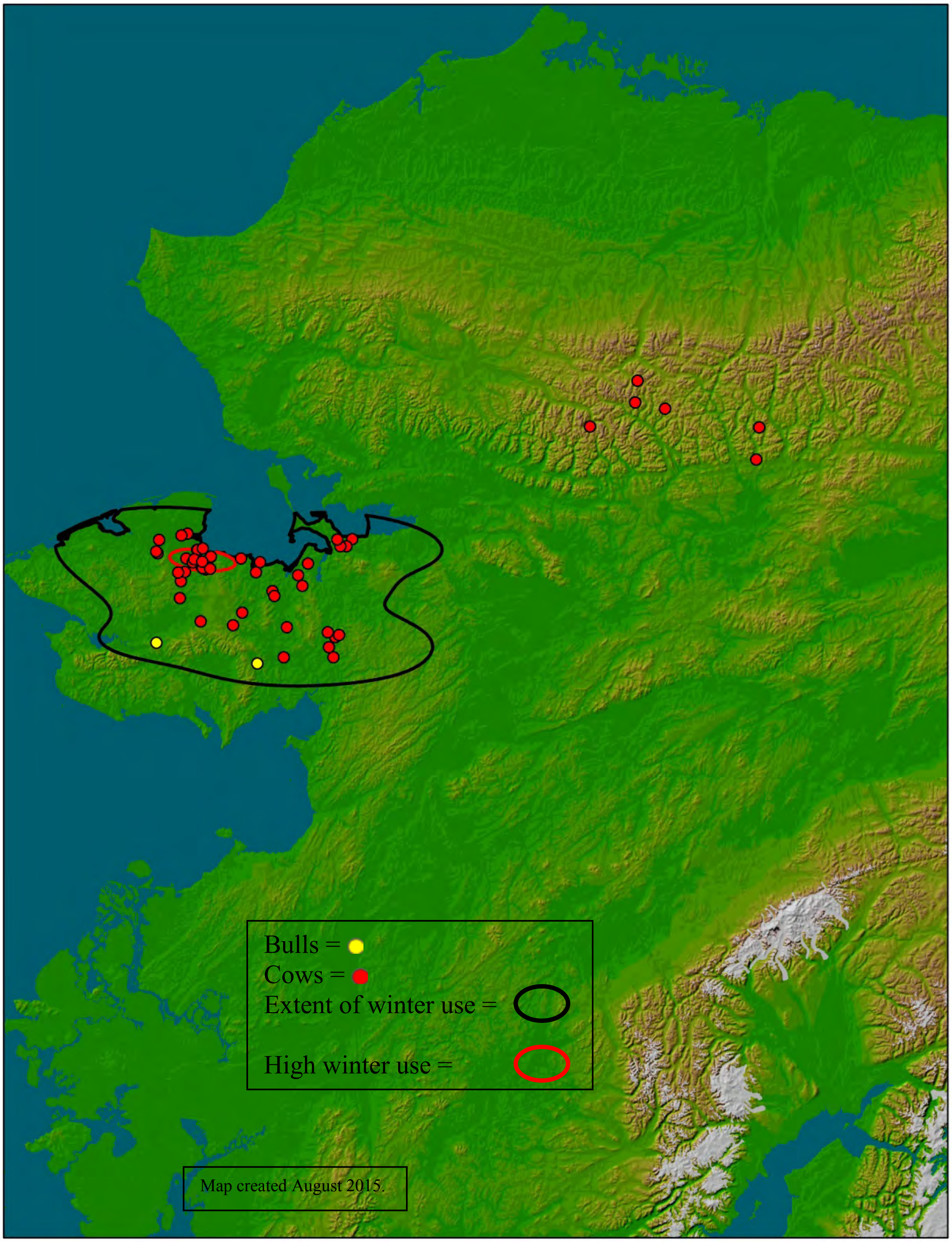

Figure 16. Kernel densities showing winter distribution of satellite-collared caribou, Western Arctic caribou herd, 2013–2014. Points shown are the locations closest to 1 January 2014. Black line = 95% kernel; red line = high use area (85% kernel); yellow dots = bulls ($n_i = 2$); red dots = cows ($n_i = 53$).

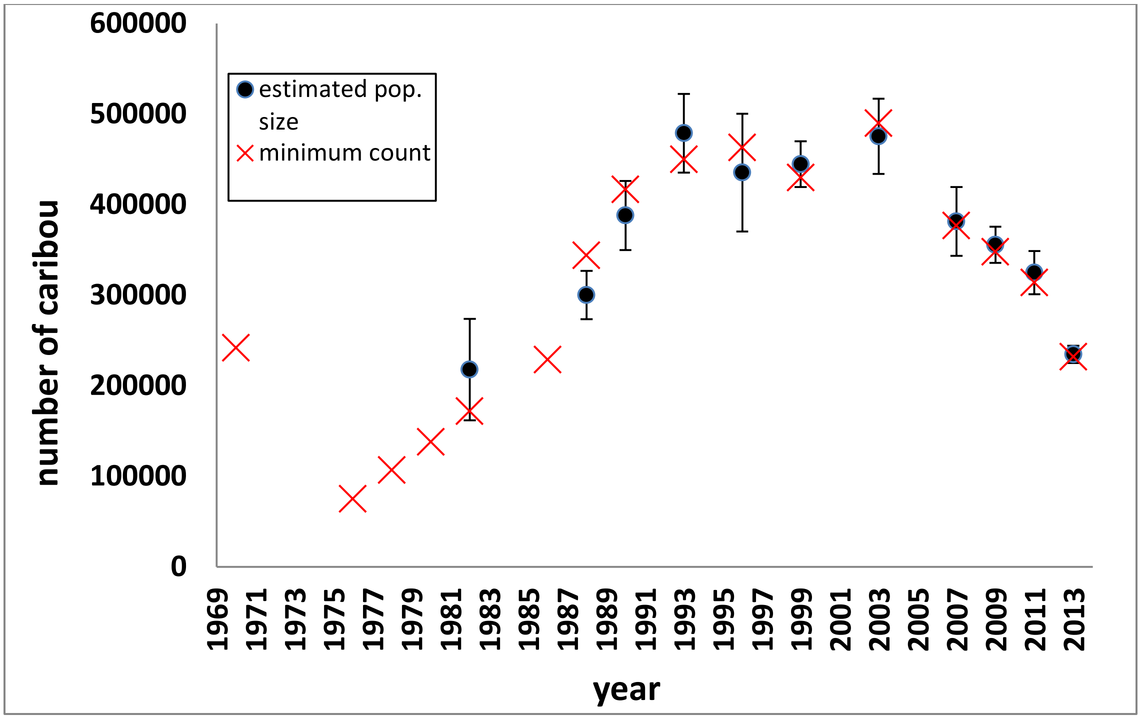

Figure 17. Western Arctic caribou herd photo census results, 1970–2013. Brackets around the open circles represent 95% confidence intervals for Rivest population estimates.

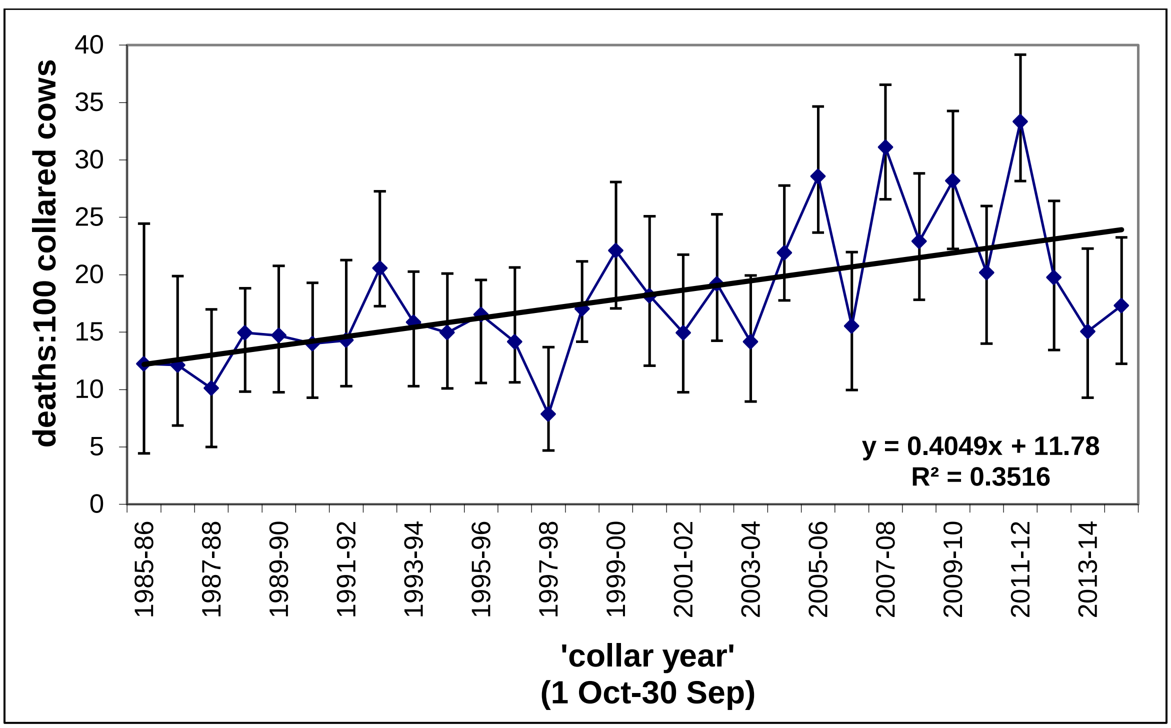

Figure 18. Adult cow mortality, Western Arctic caribou herd, CY85 through CY12 (brackets indicate 80% binomial c. i.; estimates based on radiocollared cows excluding ST-3 and ST-14 satellite collars; estimates not corrected for age bias in sample of collared cows).

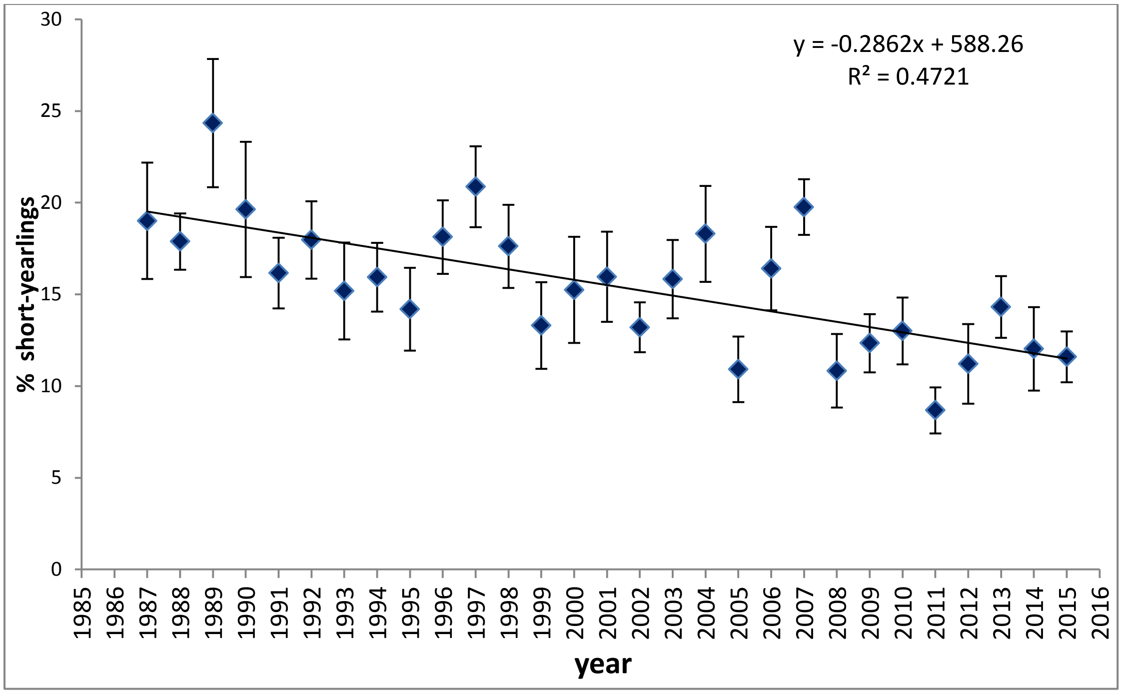

Figure 19. Percent short yearling recruitment for the Western Arctic caribou herd (brackets indicate 80% binomial confidence intervals), 1987–2015.

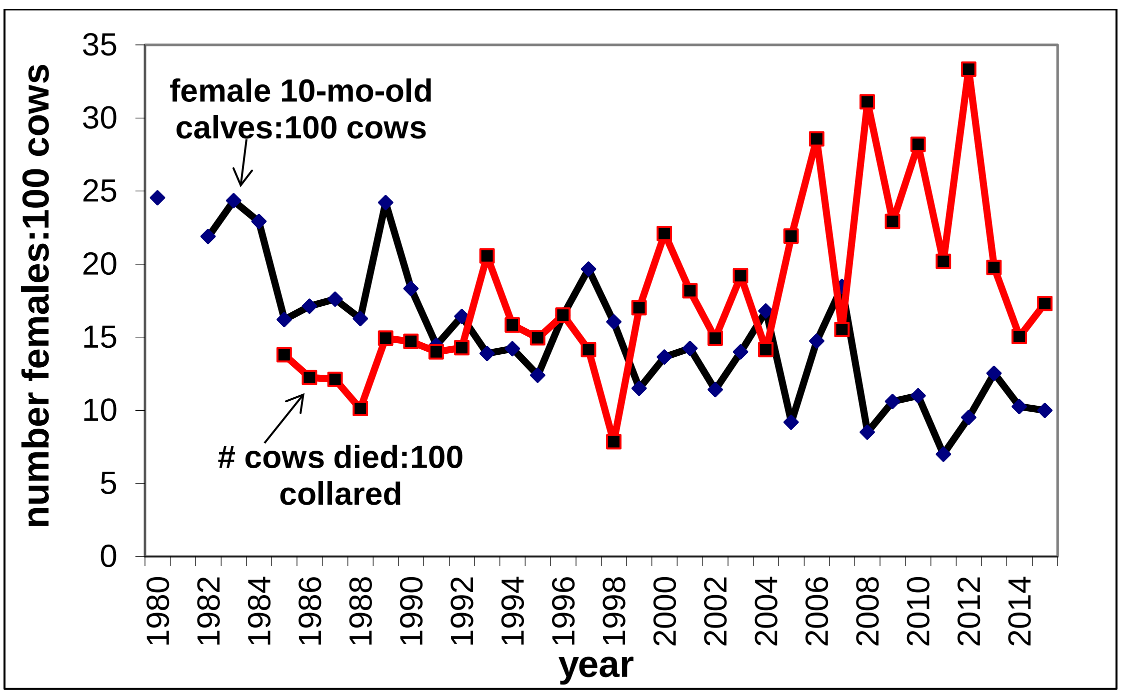

Figure 20. Indices of adult cow mortality and female calf recruitment for the Western Arctic caribou herd, 1980–2015. The spring calf:adult ratio is transformed to female calf:cow ratio based on fall composition data assuming equal male–female sex ratio at birth. Female calf recruitment is adjusted 3.3% down and adult cow mortality is adjusted 3.4% down to correct for age bias in the sample of collared adult cows.

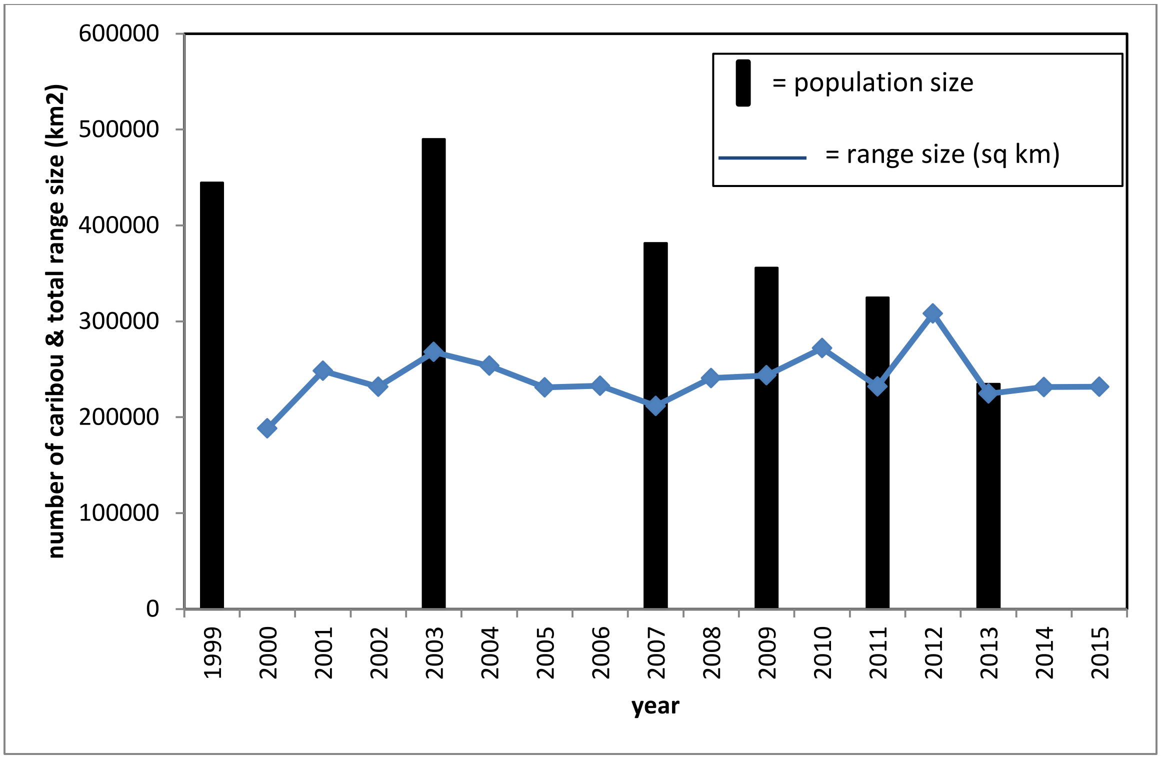

Figure 21. Annual range size (blue line; km^2) in relation to estimated population size (black bars) of the Western Arctic caribou herd, 1999–2015.

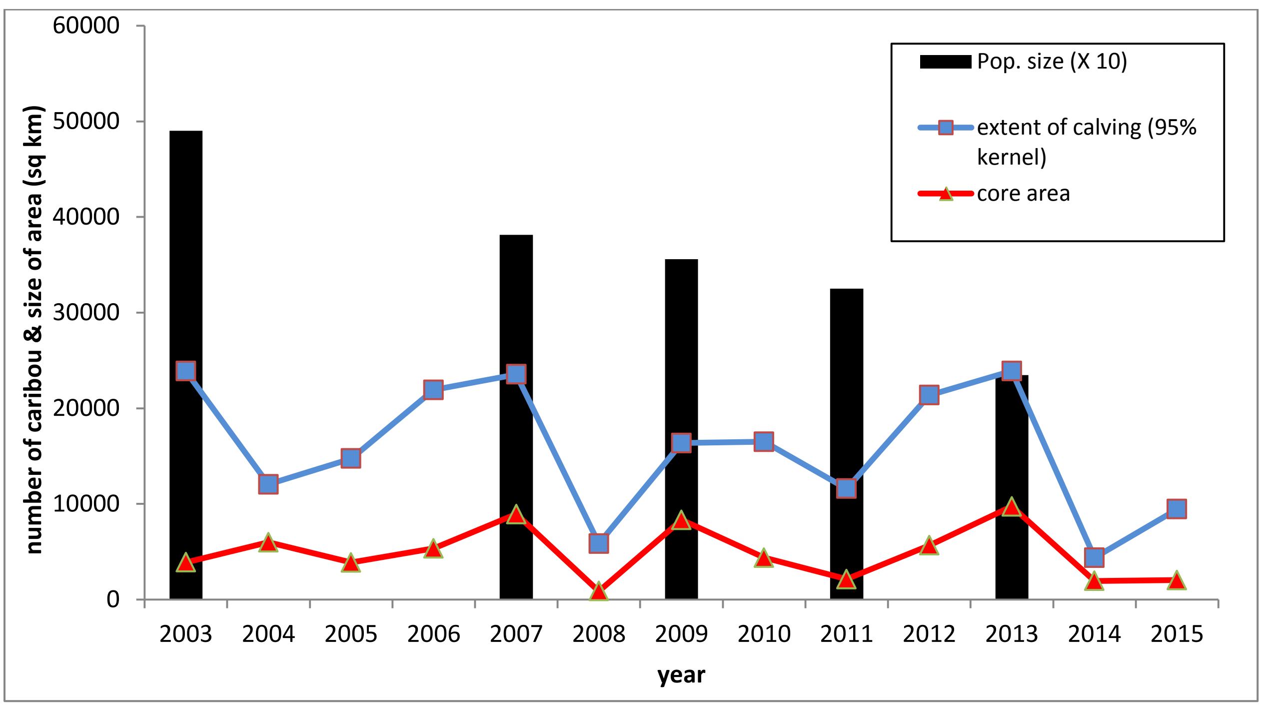

Figure 22. Size (km^2) of calving area extent (blue line, 95% kernel) and core kernel areas (red line, kernel isopleth determined annually) in relation to estimated population size (black bars) of the Western Arctic caribou herd, 1988–2015.

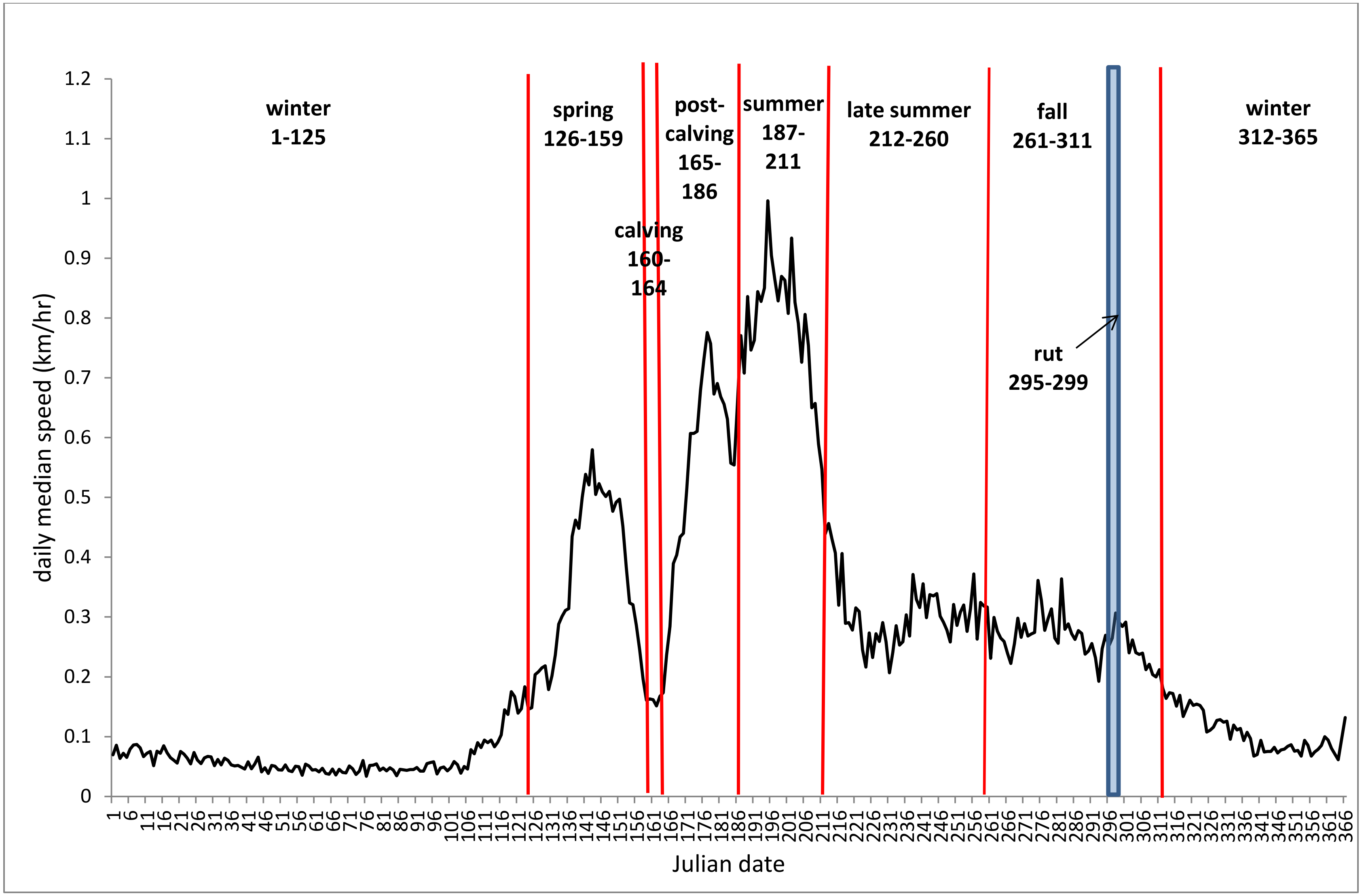

Figure 23. Median daily rate of travel and seasonal periods determined from rate and direction of travel for satellite-collared cow caribou, Western Arctic caribou herd, 1 June 1988 through 20 November 2012 (all years combined).

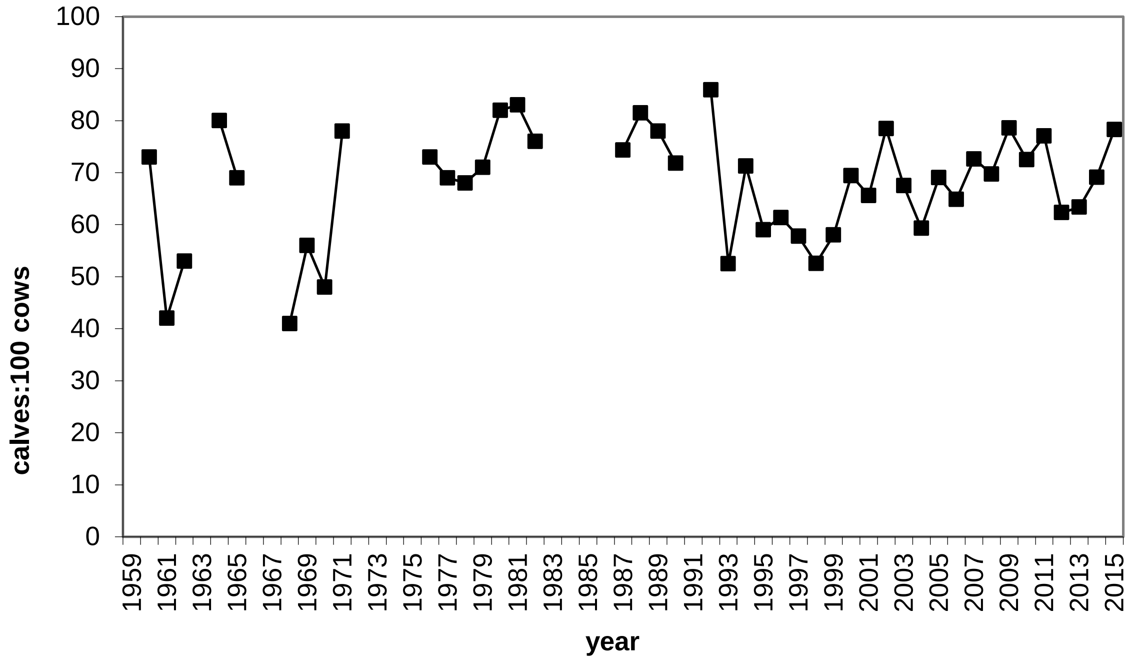

Figure 24. Calving survey results (calf: cow ratio), Western Arctic caribou herd, 1960–2015. Telemetry-based surveys were initiated in 1987. Gaps reflect years when no data were collected.

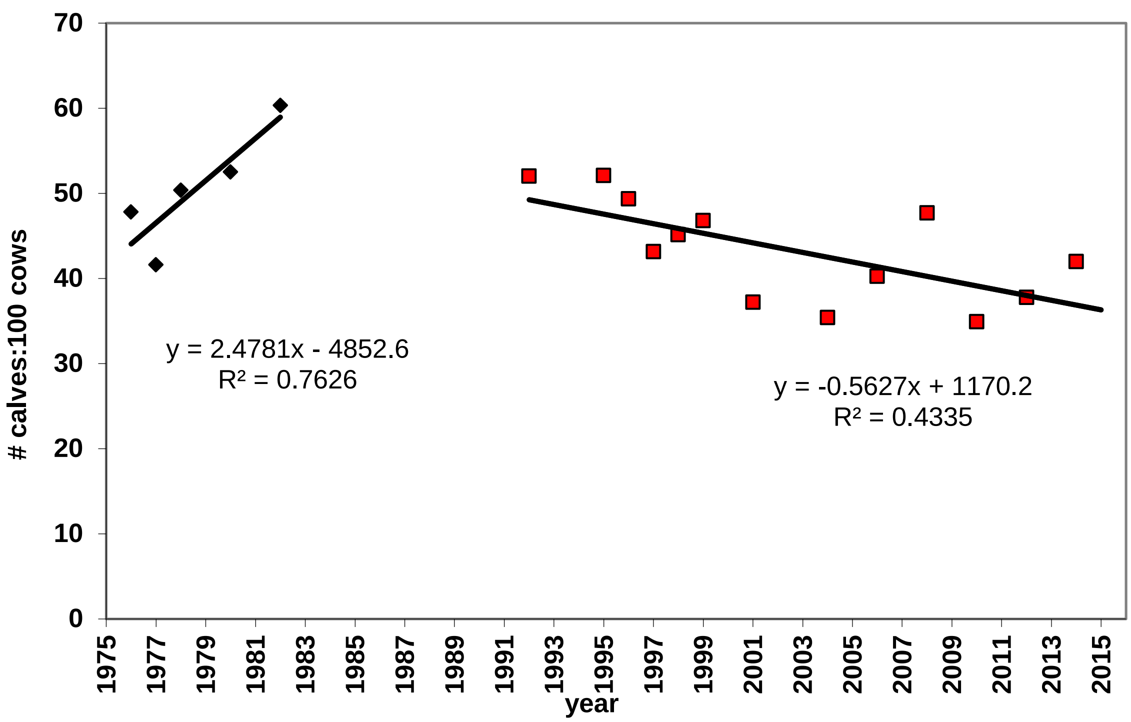

Figure 25. Fall calf:cow ratios with trend lines for the Western Arctic caribou herd, 1976–1982 and 1992–2014. Composition data from 2001 may be biased low due to survey conditions.

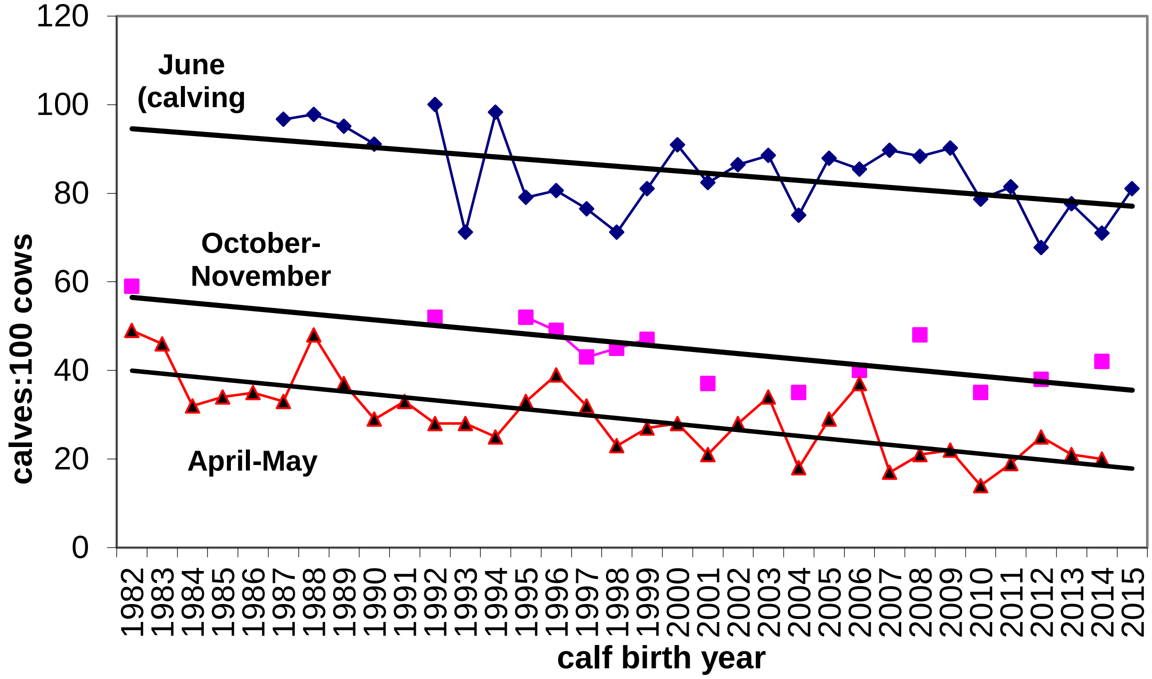

Figure 26. Unweighted least squares linear regression of calf:cow ratios during June (calving), the subsequent fall (Oct–Nov) and following spring (Apr–May, short yearling recruitment), Western Arctic caribou herd, 1982–2013. In this graph the April–May ratio for any specific year is shifted 1 year earlier 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.

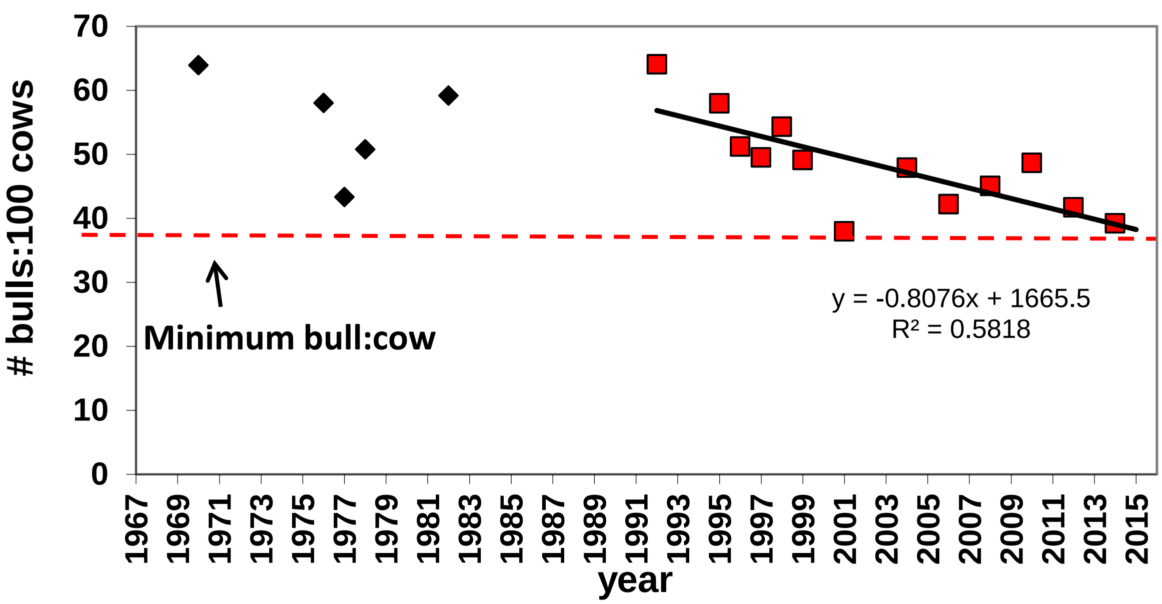

Figure 27. Fall bull:cow ratios, Western Arctic caribou herd, 1976–2014. No trend line shown for 1970–1982 because yearly survey methods varied.

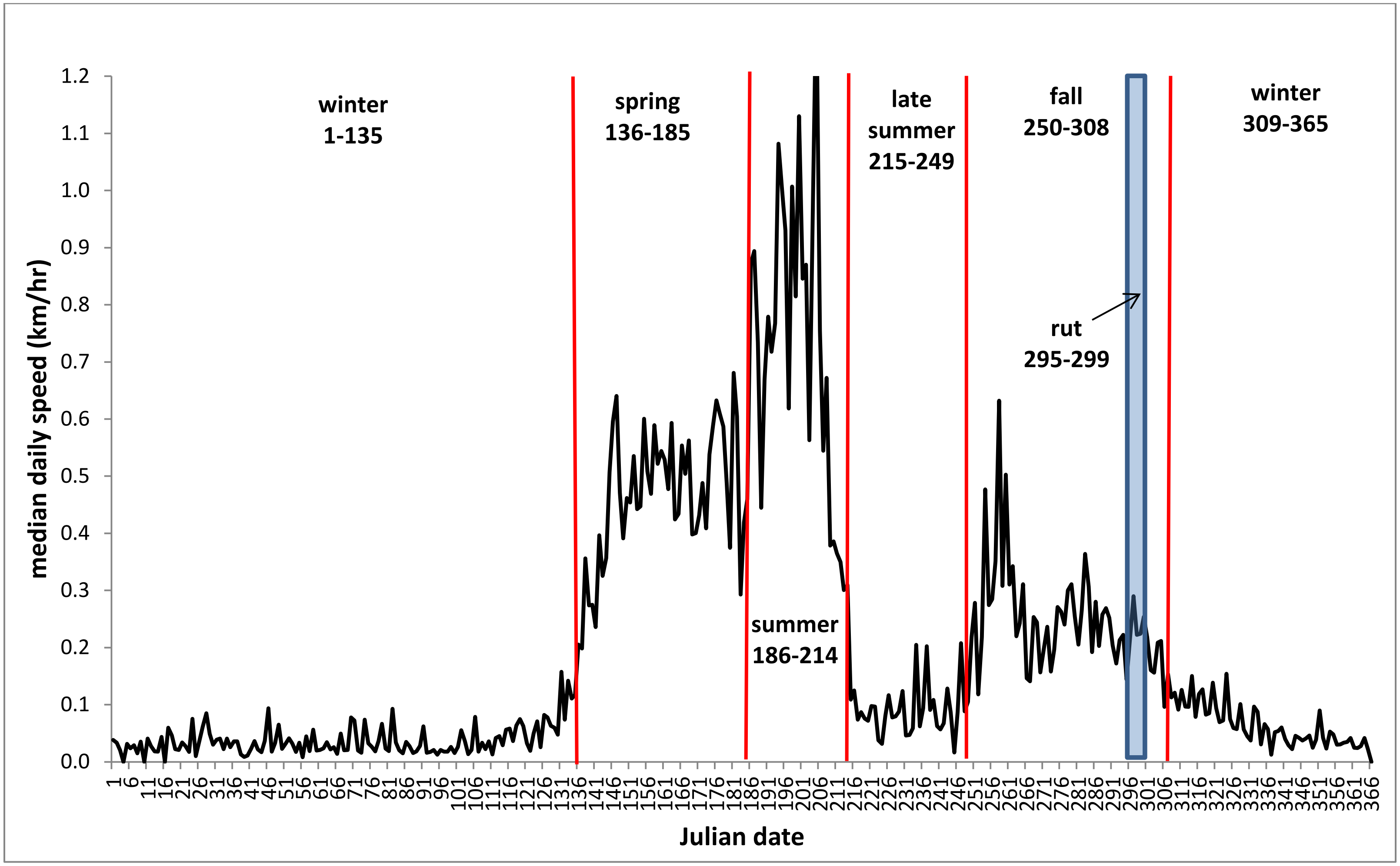

Figure 28. Median daily rate of travel and seasonal period determined from rate and direction of travel of satellite-collared bull caribou, Western Arctic caribou herd, 1 June 1988 through 20 November 2012 (all years combined).

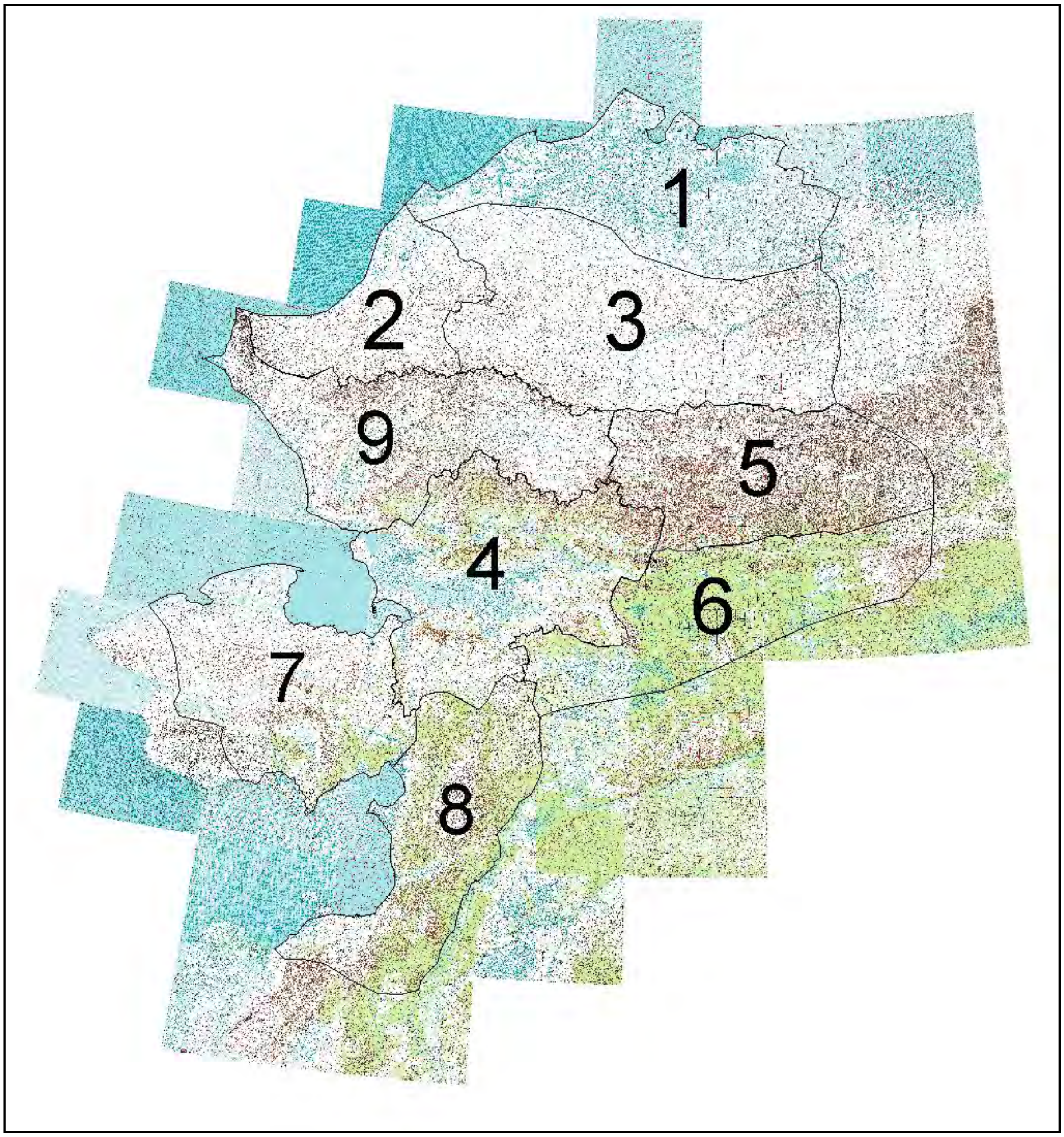

Figure 29. Subareas of Western Arctic herd range used to assess winter distribution (see Table 7 for geographic descriptions).

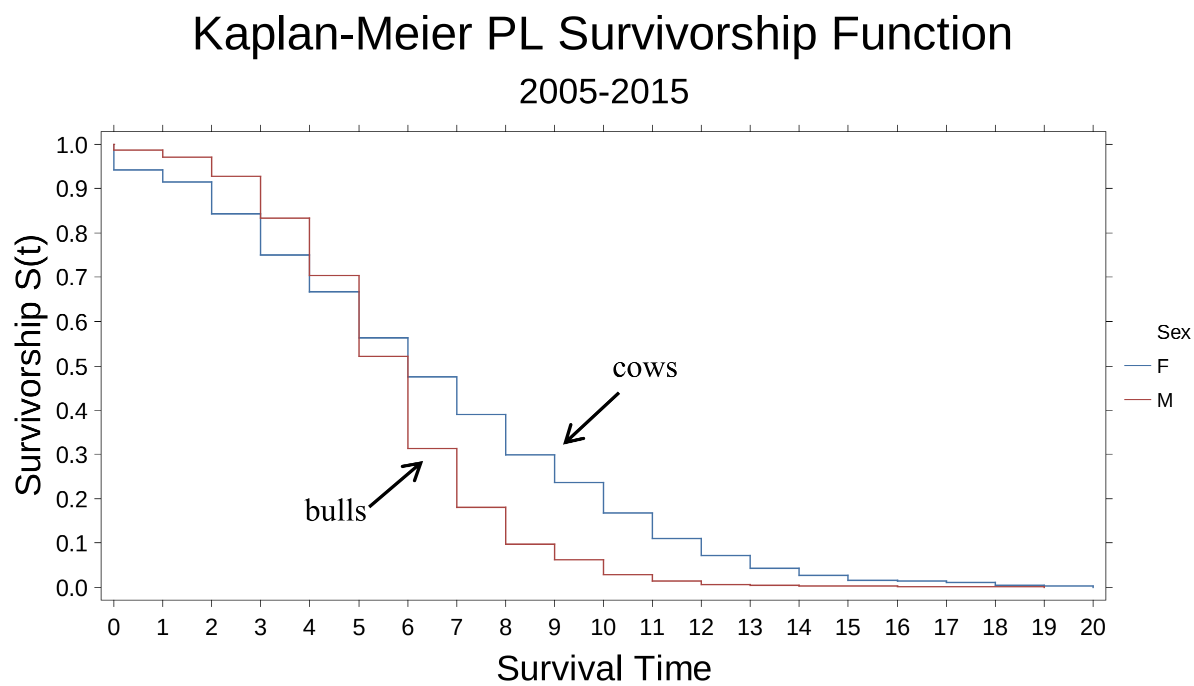

Figure 30. Kaplan-Meier product-limit survival functions for 856 bulls (red line) vs. 364 cows (blue line), 2005–2015. Estimates are based on mandible collections from hunter harvests and natural mortalities.

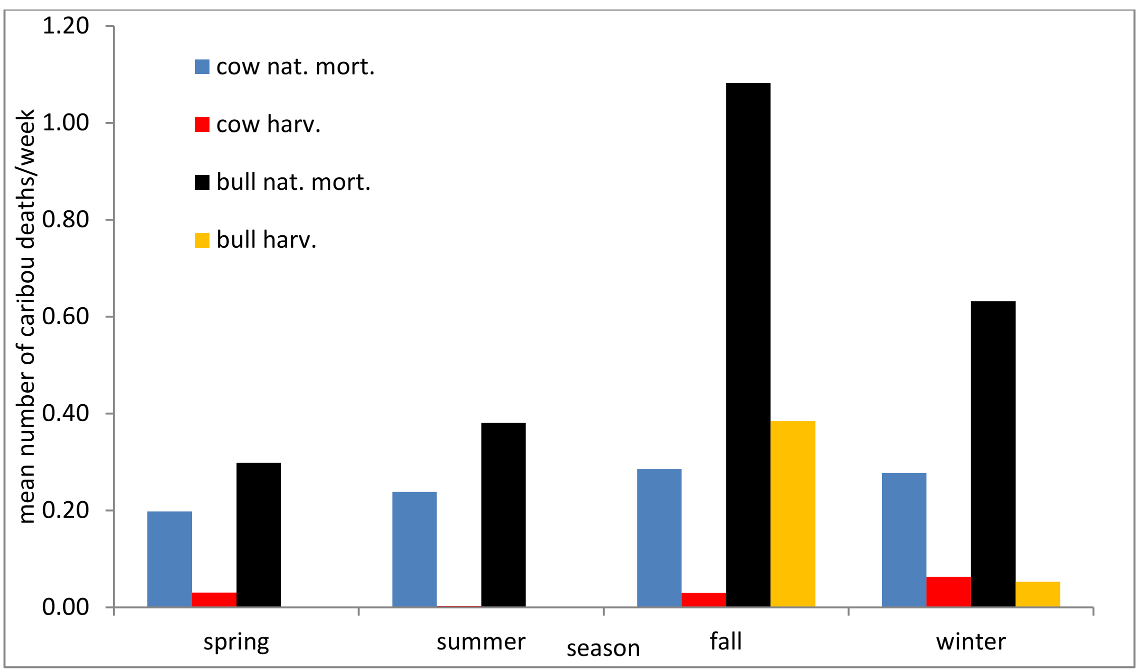

Figure 31. Seasonal mortality of radiocollared caribou by sex, CY92 through CY14 (all years combined); sample sizes for each sex standardized to 100 individuals/yr to compensate for annual differences in the total number of collared individuals and variable sample sizes between bulls and cows.

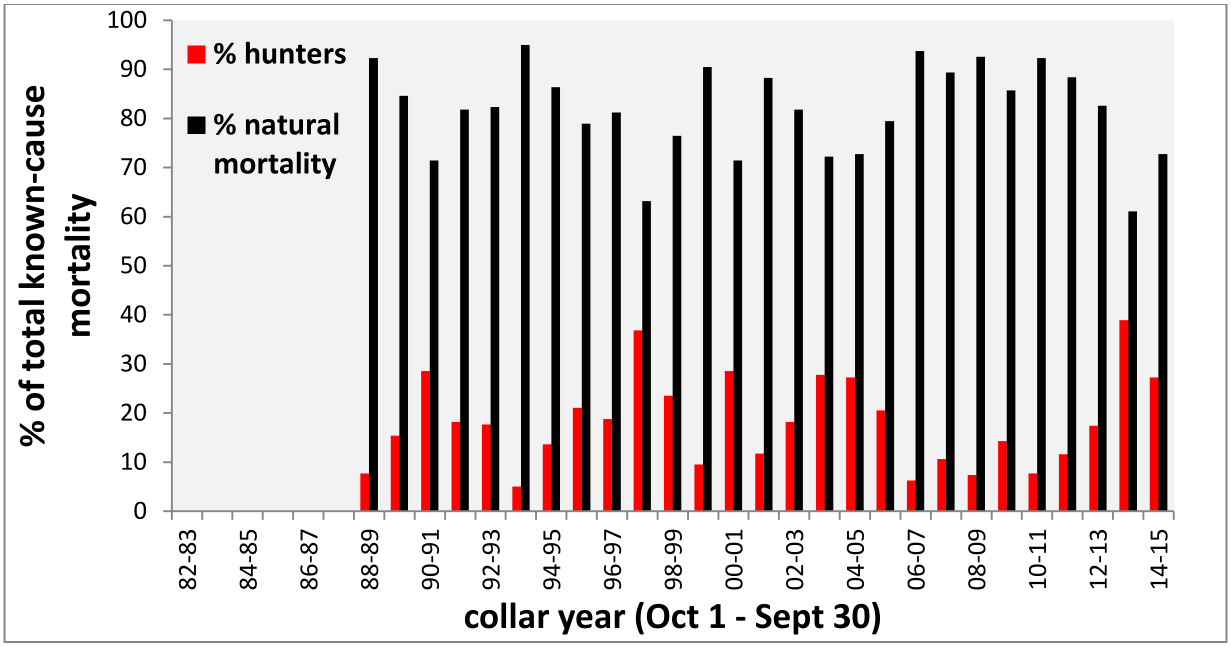

Figure 32. Percentage of total known-cause caribou mortality attributed to hunters (red bars) vs. natural factors (black bars), Western Arctic caribou herd, CY83–CY15. Data based on radiocollared bulls and cows, and excludes all unknown-cause mortalities. Years with <10 known-cause mortalities are excluded.

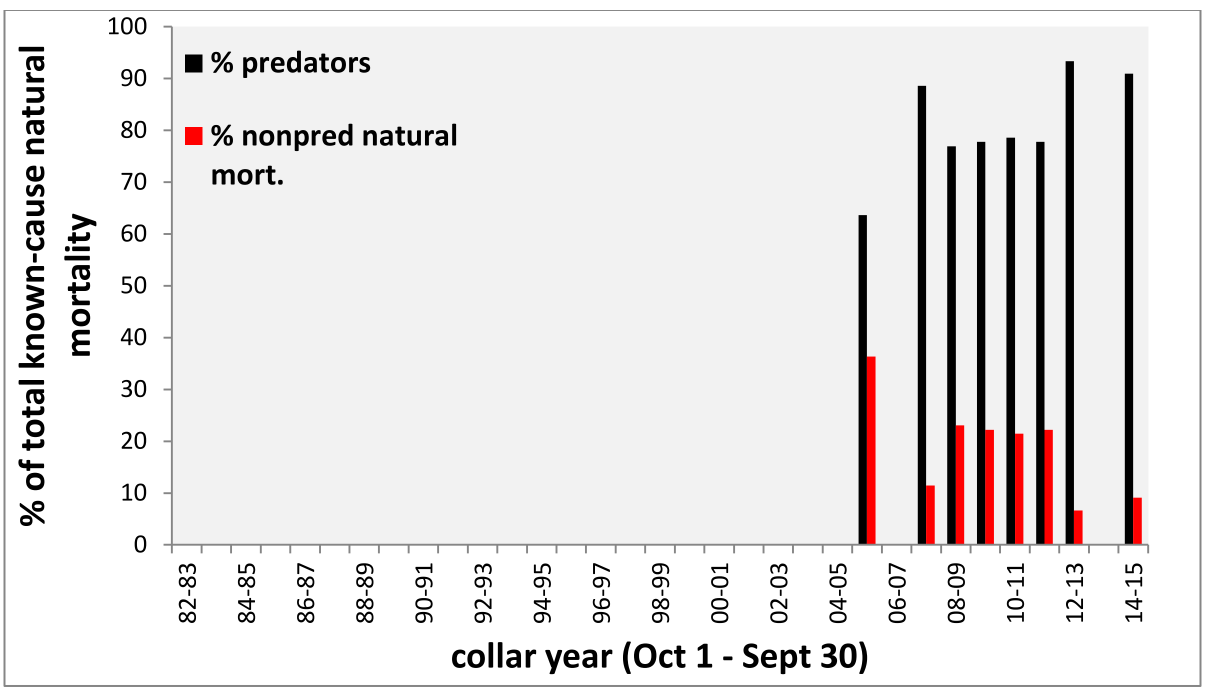

Figure 33. Percentage of total known-cause natural mortality attributed to predators (black bars) vs. other natural causes (red bars), Western Arctic caribou herd, CY83–CY15. Data based on radiocollared bulls and cows, and excludes all unknown-cause mortalities as well as natural mortalities for which cause of death was uncertain. Years with <10 known-cause natural mortalities are excluded.

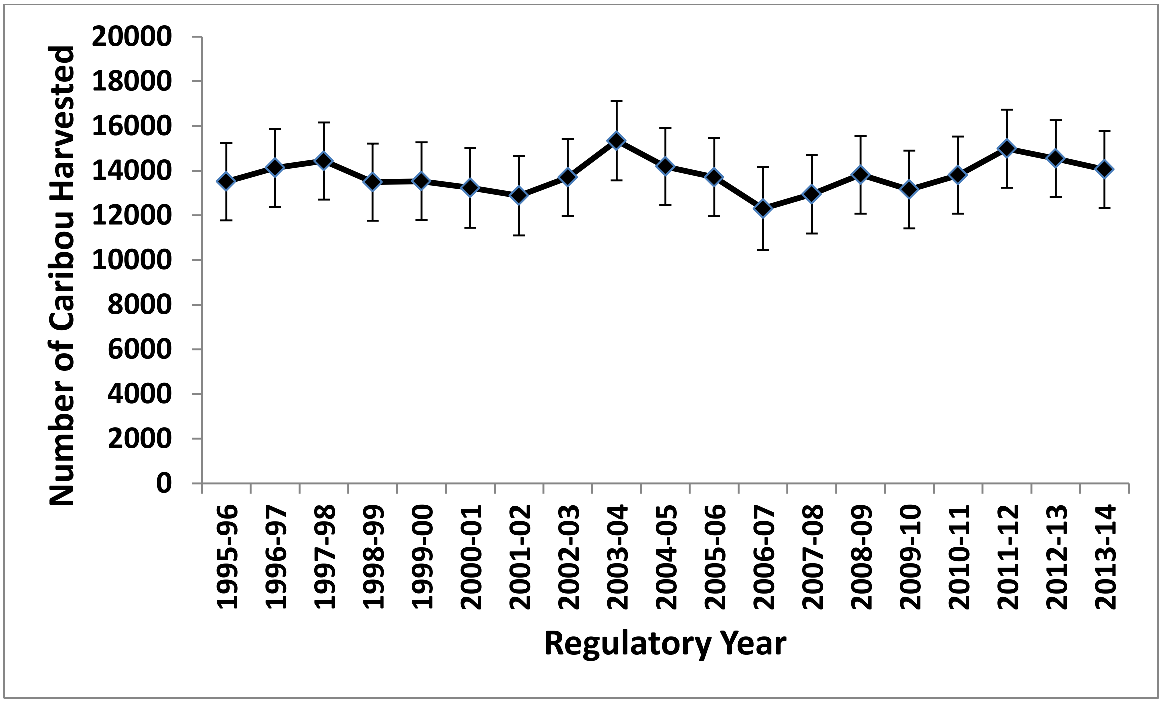

Figure 34. Estimated annual caribou harvest and 95% confidence intervals (vertical lines) by hunters living within the range of the Western Arctic caribou herd, RY95–RY13.

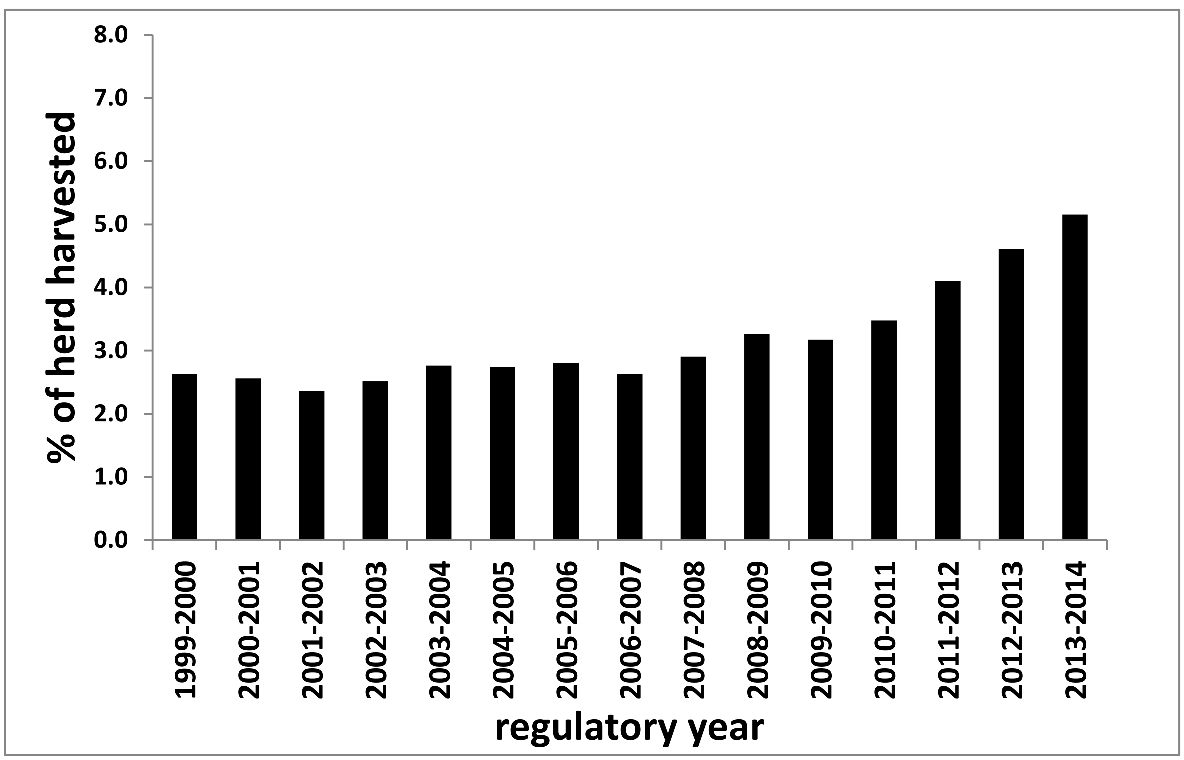

Figure 35. Percentage of the WAH harvested annually, RY99–RY13.

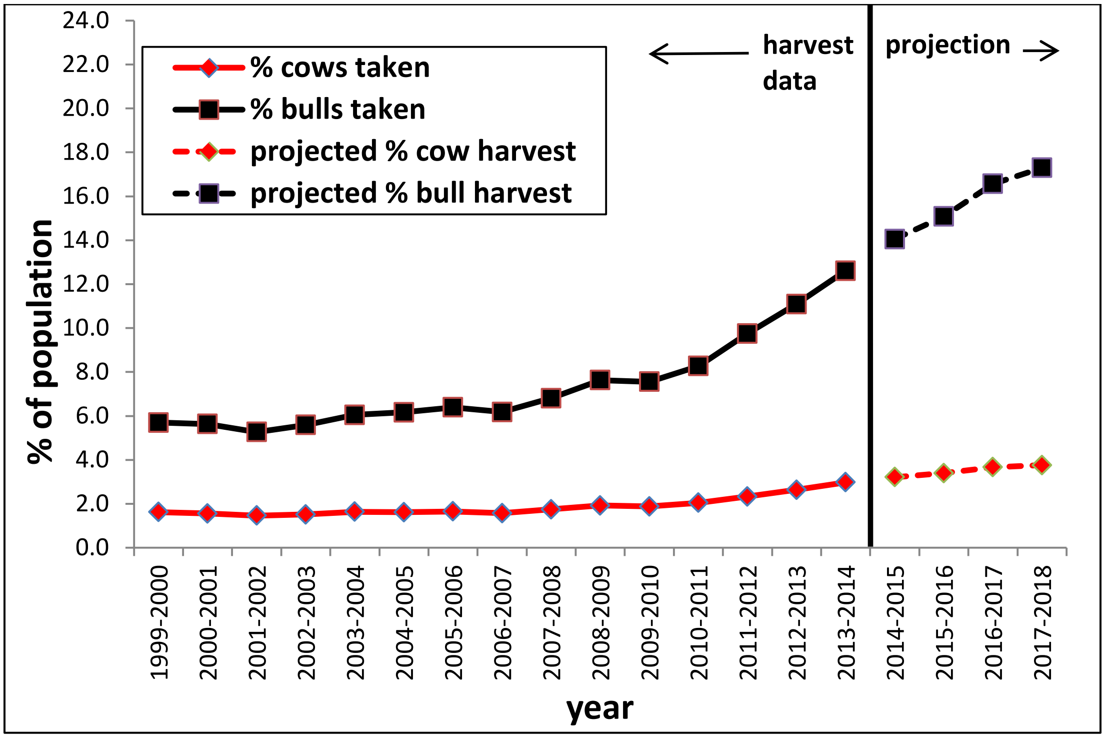

Figure 36. Observed and projected percentage of bulls and cows being harvested annually, Western Arctic caribou herd, RY99–RY17.

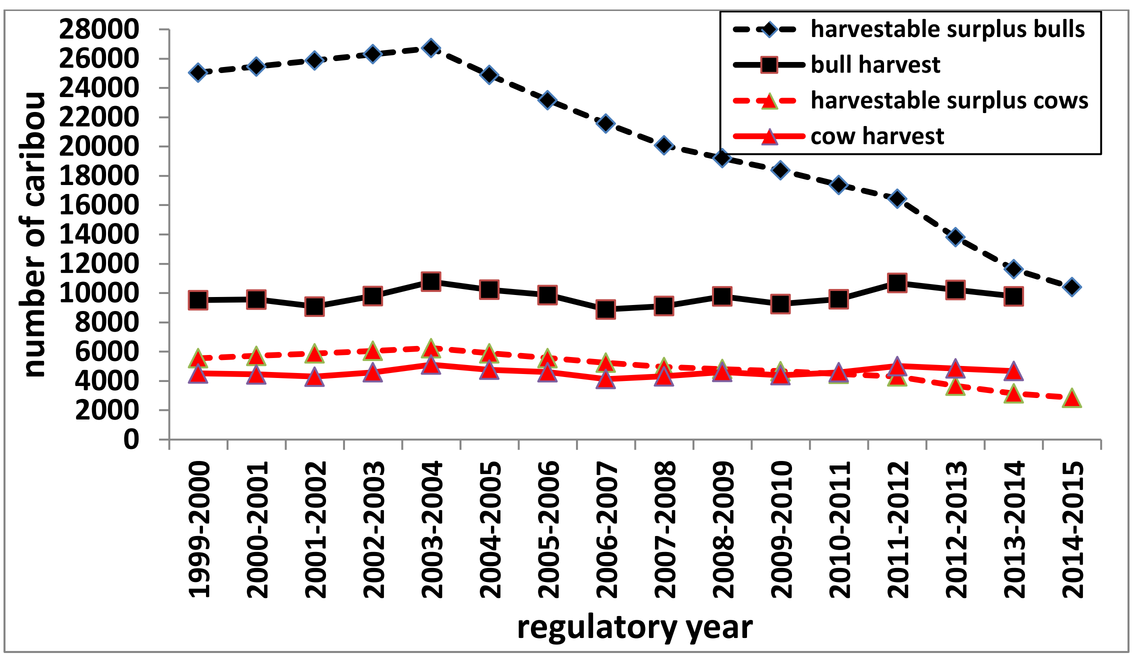

Figure 37. Annual bull and cow harvest relative to their respective harvestable surplus levels (harvestable surplus=15% of bulls and 2% of cows in the population; calves apportioned equally between bulls and cows), Western Arctic caribou herd, RY99–RY14.

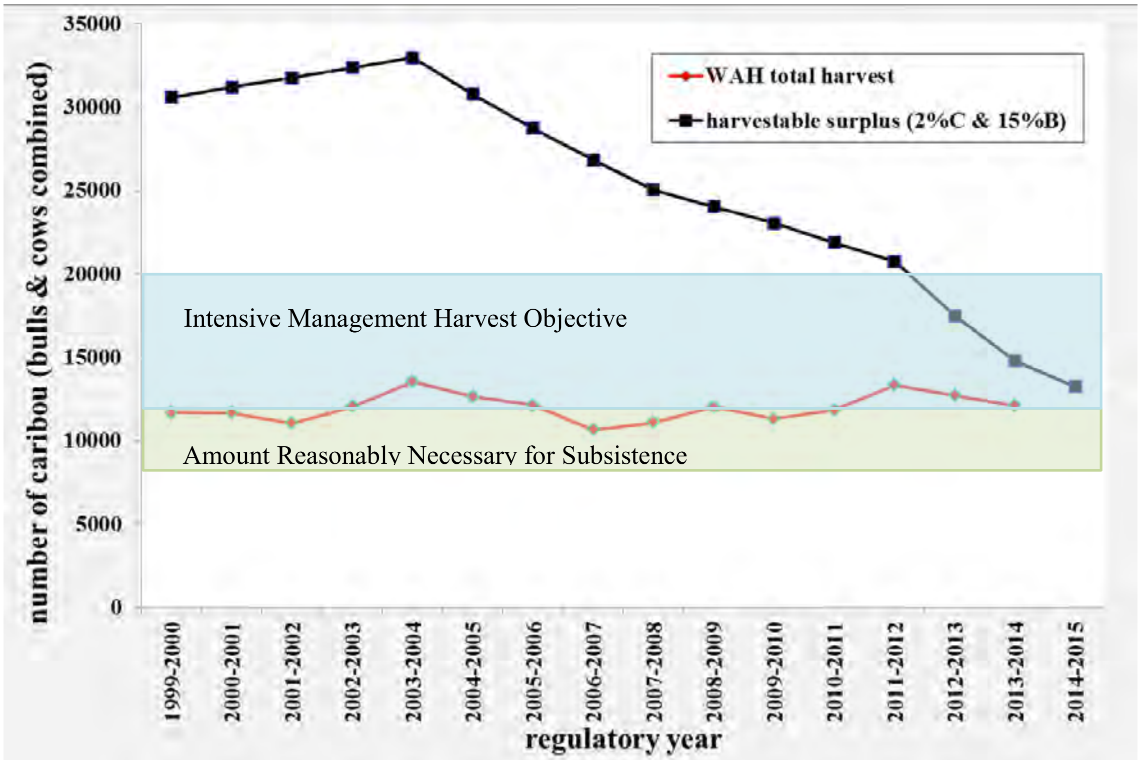

Figure 38. Harvestable surplus (bulls & cows combined) relative to harvest levels, Intensive Management Harvest Objective (12,000–20,000 caribou; blue box), and the Amount Reasonably Necessary for Subsistence range (8,000–12,000 caribou; green box), Western Arctic caribou herd, RY99–RY14.

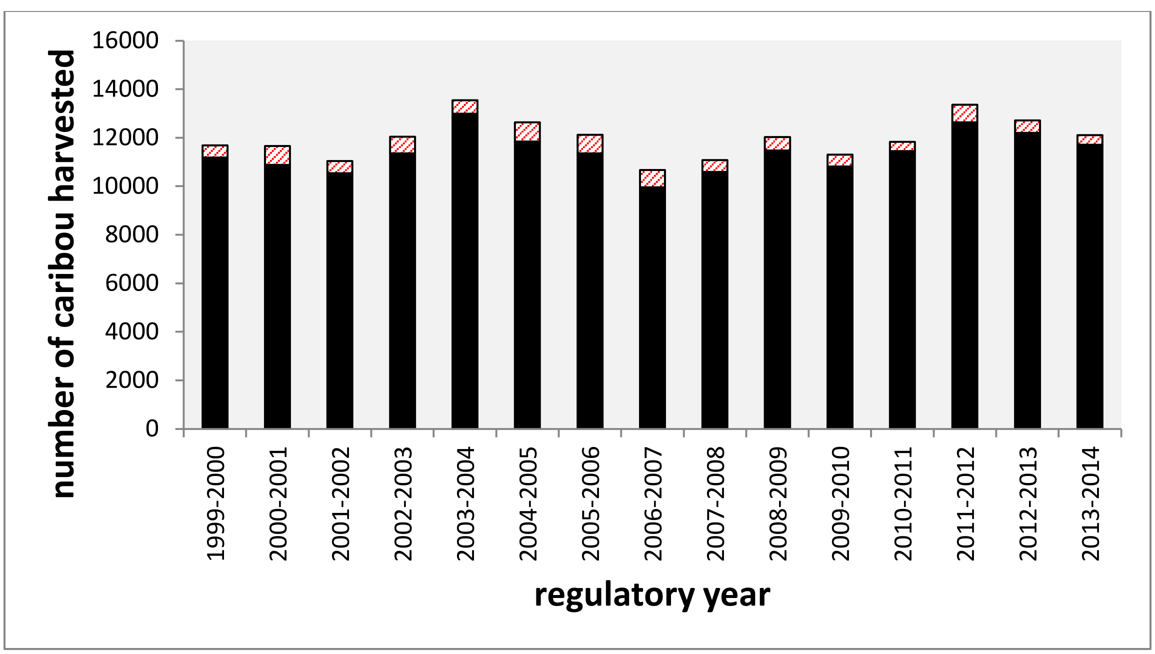

Figure 39. Total harvest by local (black bars) and nonlocal (red patterned bars) hunters, Western Arctic caribou herd, RY99–RY13.

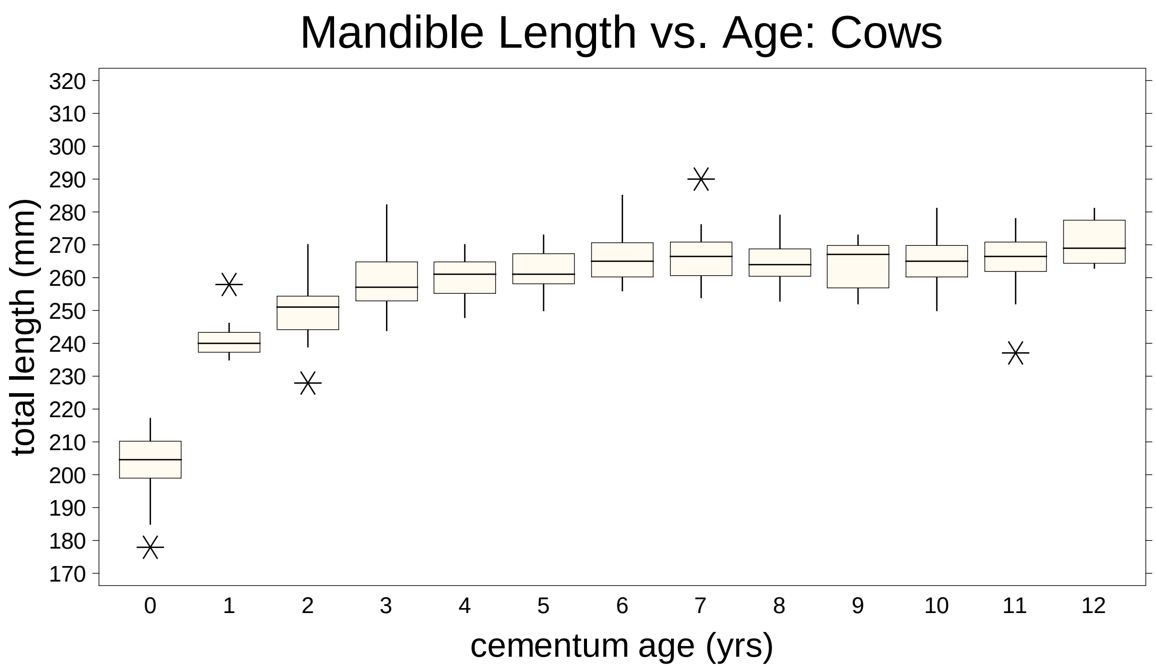

Figure 40. Box and whisker plot of cow mandible length as a function of tooth cementum age, Western Arctic caribou herd, 1997–2015 (n_i=245 cows; all years combined; asterisks=possible outliers).

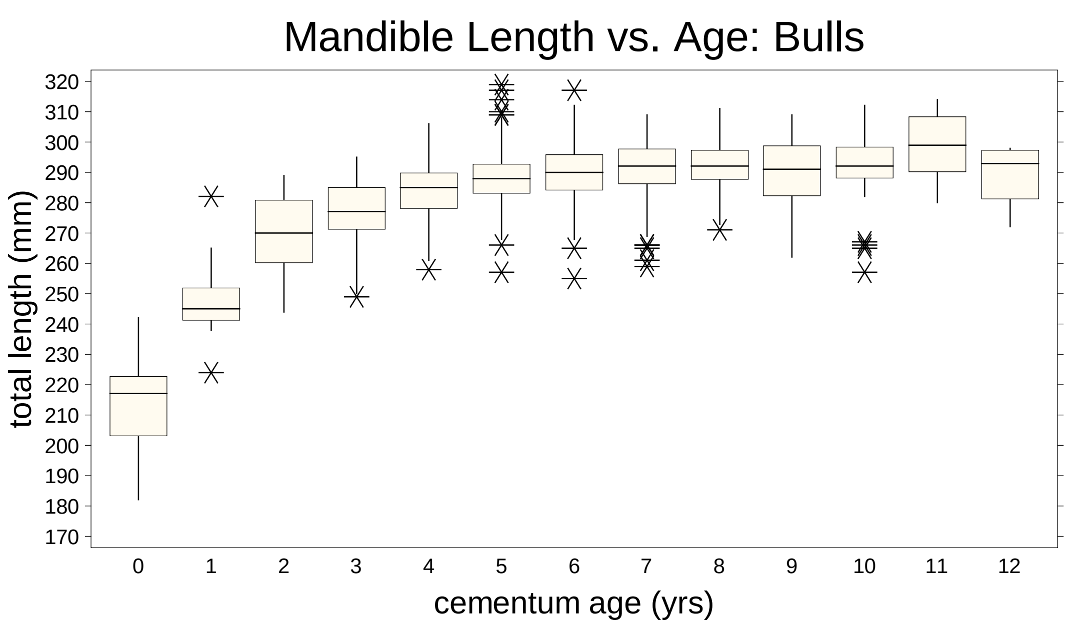

Figure 41. Box and whisker plot of bull mandible length as a function of tooth cementum age, Western Arctic caribou herd, 1997–2015 (n_i=695 bulls; all years combined; asterisks=possible outliers).

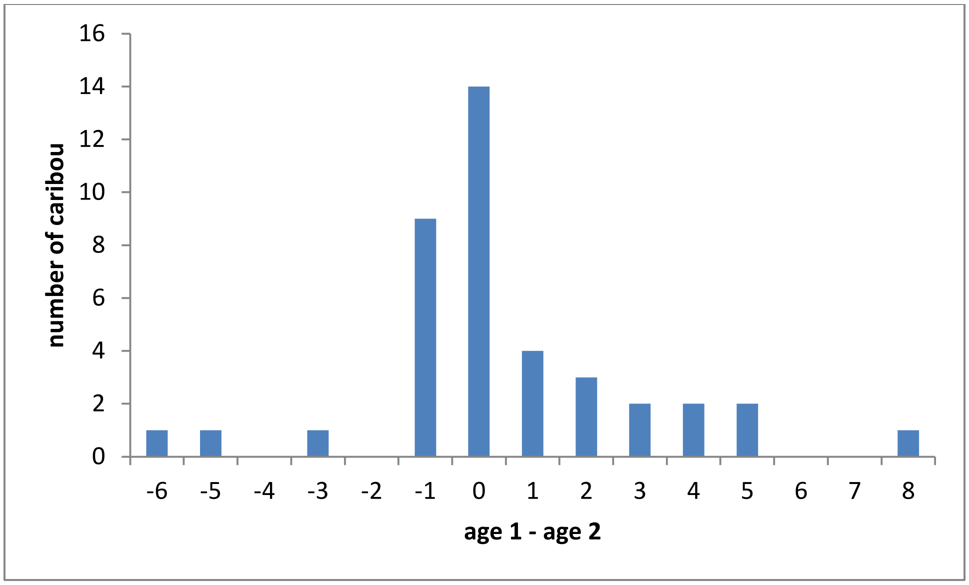

Figure 42. Difference between 2 blind samples in caribou tooth cementum ages, Western Arctic caribou herd (n_i = 40 caribou).

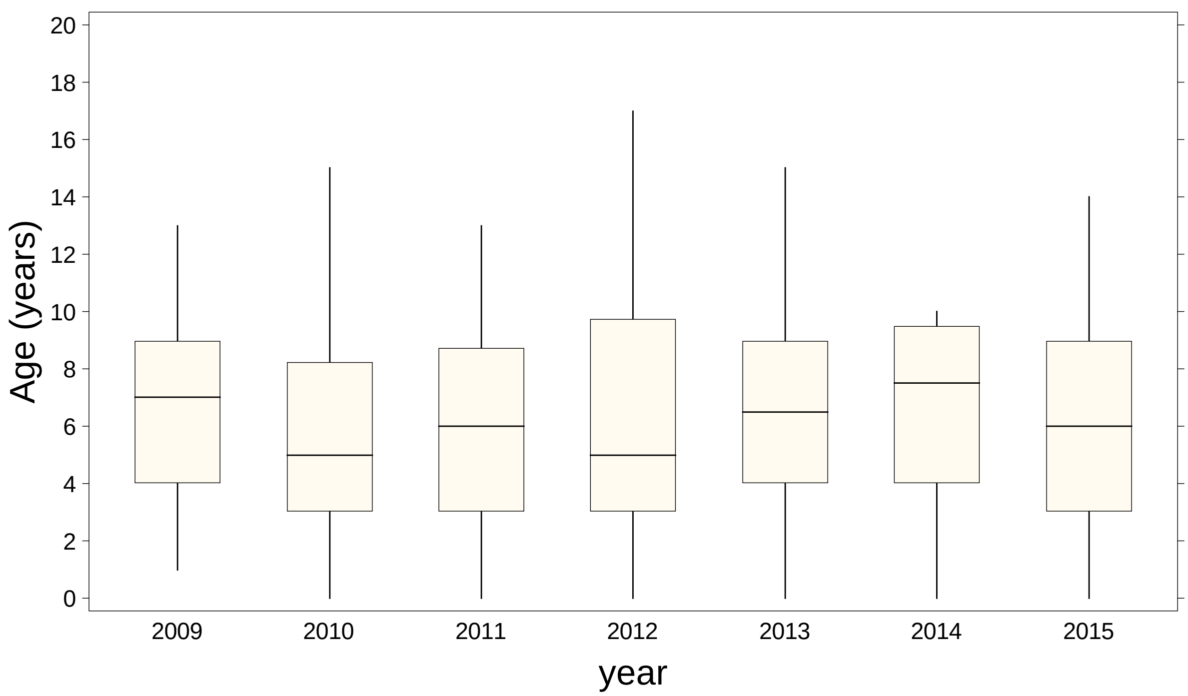

Figure 43. Box and whisker plot of cow tooth cementum age, Western Arctic caribou herd, 2009–2015 (n_i = 316 cows with no outliers; NOTE: n_i = 8 individuals in 2014).

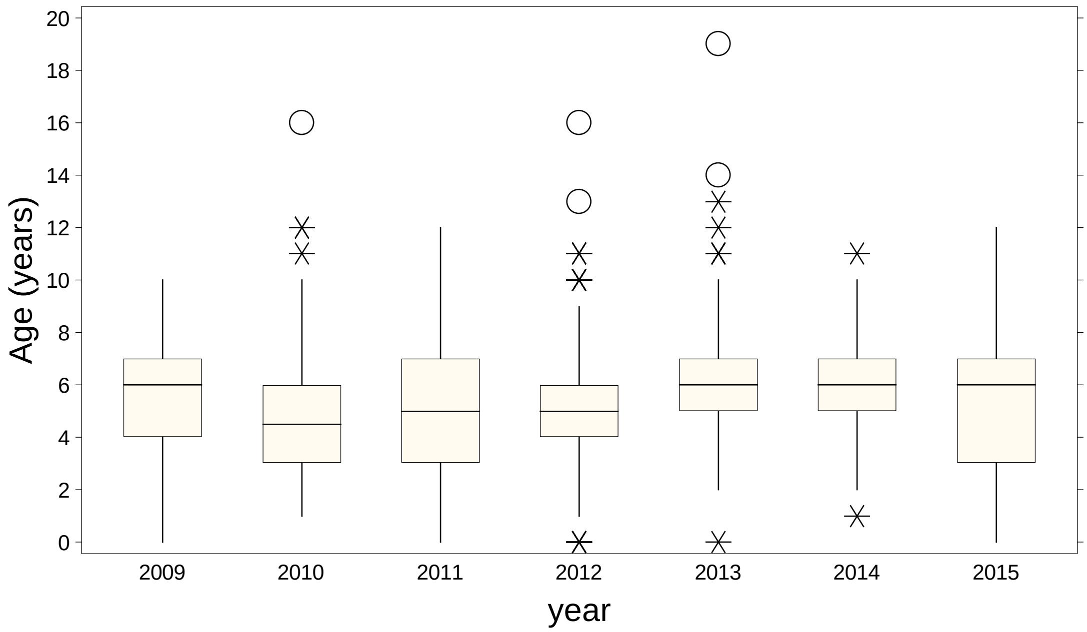

Figure 44. Box and whisker plot of bull tooth cementum age, Western Arctic caribou herd, 2009–2015 (n_i=843 bulls; asterisks=possible outliers; open dots=probable outliers).

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 and binomial confidence intervals for cows of the Western Arctic caribou herd collared with conventional or lightweight satellite radio collars[a] for collar years[b] 1987 through 2014.

				Binomial Confidence Intervals		
Collar year	Sample size[a]	No. died	Mortality rate[c] (%)	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	86	17	20	14–26	13–28	12–30
CY13	93	14	15	10–21	9–23	8–24
CY14	104	18	17	13–23	12–25	11–26

[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. CY87 = 1 Oct 1987–30 Sep 1988).
[c] Mortality rate=(Number caribou died/Sample size)100.

Table 3. Short yearling[a] survey results of the Western Arctic caribou herd, 1984–2015.

	Number of caribou			Number			3-yr moving
Year	Adults	SY[a]	Total	Groups	Radio-collared cows	SY[a]:100 adults	average SY[a]:100 adults
1984	1,646	503	2,149			31	28
1985	2,776	600	3,376			22	25
1986	5,372	1,227	6,599			23	23
1987	4,272	1,003	5,275			23	23
1988	6,047	1,312	7,359	31	45	22	26
1989	5,321	1,718	7,039	29	37	32	26
1990	5,231	1,278	6,509	25	36	24	25
1991	7,111	1,371	8,482	47	48	19	22
1992	7,660	1,678	9,338	49	52	22	20
1993	4,396	814	5,210	19	33	19	20
1994	8,369	1,587	9,956	44	53	19	18
1995	13,283	2,196	15,479	53	86	17	19
1996	4,876	1,073	5,949	32	36	22	22
1997	9,298	2,438	11,736	40	56	26	23
1998	7,409	1,585	8,994	34	46	21	21
1999	6,354	975	7,329	34	36	15	18
2000	8,398	1,513	9,911	41	47	18	17
2001	6,814	1,294	8,108	32	33	19	17
2002	8,268	1,258	9,526	38	42	15	18
2003	8,518	1,602	10,120	42	49	19	19
2004	7,078	1,599	8,677	33	42	23	18
2005	8,376	1,026	9,402	35	40	12	18
2006	7,528	1,479	9,007	36	41	20	19
2007	10,570	2,603	13,173	44	57	25	19
2008	9,550	1,084	10,634	43	54	11	17
2009	13,873	1,963	15,836	59	71	14	13
2010	9,890	1,479	11,369	47	53	15	13
2011	11,316	1,058	12,374	52	58	9	12
2012	8,015	1,012	9,027	40	41	13	13
2013	9,584	1,601	11,185	36	53	17	14
2014	10,423	1,425	11,848	27	57	14	14
2015	12,659	1,661	14,320	33	66	13	14

[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, 1992–2015.

Year	Median June survey date	With Calf	No Calf ≥1 hard antler	No Calf soft antlers	No Calf no antlers	Total	Maternal	Non-Maternal	Calves: 100 Cows
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
2014	11	45	2	19	2	68	47	21	69
2015	7	46	7	13	2	68	53	15	78

Table 5. Fall population composition of the Western Arctic caribou herd, 1961–2014.

Year	Bulls	Cows	Calves	Total	Calves: 100 Cows	Calves: 100 Adults	Bulls: 100 Cows
1961	276	501	187	964	37	24	55
1970	1,748	2,732	1,198	5,678	44	27	64
1975	720	2,330	1,116	4,166	48	37	31
1976	273	431	222	926	52	32	63
1980	715	1,354	711	2,780	53	34	53
1982	1,896	3,285	1,923	7,104	59	37	58
1992	1,600	2,498	1,299	5,397	52	32	64
1995	1,176	2,029	1,057	4,262	52	33	58
1996	2,621	5,119	2,525	10,265	49	33	51
1997	2,588	5,229	2,255	10,072	43	29	49
1998	2,298	4,231	1,909	8,438	45	29	54
1999	2,059	4,191	1,960	8,210	47	31	49
2001[a]	1,117	2,943	1,095	5,155	37	27	38
2004	2,916	6,087	2,154	11,157	35	24	48
2006	1,900	4,501	1,811	8,212	40	28	42
2008	2,981	6,618	3,156	12,755	48	33	45
2010	2,419	4,973	1,735	9,127	35	23	49
2012	2,119	5,082	1,919	9,120	38	27	42
2014	2,384	6,082	2,553	11,019	42	30	39

[a] Sample from Mulgrave Hills only and based on 25 radiocollared caribou in the area. Survey was conducted on 14 Nov 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 Red Dog mine operations during 15 August through 20 November).

Sex	Season	Julian dates	Calendar dates
Cows			
	Spring	126–159	6 May–8 Jun
	Calving	160–164	9 Jun–13 Jun
	Post-calving	165–186	14 Jun–5 Jul
	Summer	187–211	6 Jul–30 Jul
	Late summer	212–260	31 Jul–17 Sep
	Fall	261–311	18 Sep–7 Nov
	(Rut)	(295–299)	(22 Oct–26 Oct)
	Winter	312–125	8 Nov–5 May
Bulls			
	Spring	136–185	16 May–4 Jul
	Summer	186–214	5 Jul–2 Aug
	Late summer	215–249	3 Aug–6 Sep
	Fall	250–308	7 Sep–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, 1991–1992 through 2014–2015 (winter=1 Nov–31 Mar; bottom row (n_i) is number of radiocollared caribou found during each winter; subareas are shown in Figure 29).

	Year																							
Area	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	13 14	14 15
1	5	9	0	1	10	4	6	9	0	5	5	4	2	0	1	0	0	0	5	1	1	1	2	3
2	1	0	0	1	0	0	0	0	9	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
3	1	2	4	0	5	0	5	1	1	5	0	4	0	0	2	1	8	0	1	0	0	1	0	4
4	52	6	1	26	33	12	5	11	42	12	22	23	12	16	48	33	38	31	26	17	8	38	10	8
5	9	6	8	3	26	4	25	31	5	6	9	16	31	5	10	8	28	6	3	20	24	0	8	4
6	6	19	4	1	2	2	0	2	12	0	3	8	20	0	13	0	10	2	19	33	16	0	2	0
7	4	4	7	6	9	59	29	24	17	42	31	38	14	19	5	16	13	43	13	6	25	42	73	77
8	20	54	75	54	16	20	29	20	5	29	5	0	20	53	18	42	2	15	25	23	20	4	5	2
9	2	0	0	9	1	0	1	1	9	2	25	7	1	6	2	0	1	3	9	0	6	15	0	1
n_i[c]	61	70	90	78	63	81	88	67	72	63	58	69	86	78	70	69	90	78	68	81	83	67	65	69

[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; 17,322 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; 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
[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, 1991–1992 through 2014–2015 (winter=1 Nov–31 Mar; subareas are shown in Figure 22).

Area[a]	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	13 14	14 15
1	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	0.2	0.3
2	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	0.0	0.1
3	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	0.0	0.3
4	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	5.5	1.2	0.9
5	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	1.2	0.6
6	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	0.3	0.0
7	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	7.5	11.1	10.6
8	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	0.8	0.8	0.0
9	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	0.0	0.2
N[b]	*437*	*457*	**479**	*473*	*468*	**463**	*458*	*453*	*445*	*455*	*466*	*478*	**490**	*460*	*432*	*406*	**382**	*368*	**355**	*340*	**325**	*276*	**235**	*212*

[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] Estimated Western Arctic caribou herd population size in thousands from Table 1. Numbers in **bold** are census results; numbers in *italics* are estimated using average annual rate of population change.

Table 9. Number of radiocollared caribou mortalities (morts) by source and year, Western Arctic caribou herd, collar years 1979–2014. (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 morts
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	10
CY11	122	47	43	5	12	5	11	4	4	2
CY12	100	23	23	4	4	3	7	0	1	4
CY13	103	19	18	7	6	2	1	0	0	2
CY14	113	23	22	6	2	3	5	0	1	5

Table 10. Annual WAH-TCH caribou harvest levels by sex and hunter residence, RY99 through RY14.

Regulatory year (RY)	WAH-TCH harvest by local hunters[a]	WAH harvest by local hunters[b]	WAH harvest by nonlocal hunters[c]	Total WAH harvest[d]	Approximate WAH-TCH cow harvest[e]	Approximate WAH-TCH bull harvest[f]
RY99	13,525	11,175	509	11,684	4,514	9,520
RY00	13,232	10,882	775	11,657	4,444	9,563
RY01	12,879	10,529	505	11,034	4,300	9,083
RY02	13,699	11,349	689	12,038	4,590	9,799
RY03	15,338	12,988	549	13,537	5,116	10,771
RY04	14,186	11,836	799	12,635	4,761	10,224
RY05	13,703	11,353	762	12,115	4,598	9,867
RY06	12,302	9,952	714	10,666	4,131	8,885
RY07	12,943	10,593	488	11,081	4,320	9,111
RY08	13,818	11,468	563	12,031	4,616	9,764
RY10	13,155	10,805	491	11,296	4,390	9,256
RY11	13,797	11,447	374	11,821	4,590	9,581
RY12	14,986	12,636	716	13,352	5,017	10,685
RY13	14,543	12,193	520	12,713	4,851	10,212
RY14	14,058	11,708	397	12,105	4,679	9,776

[a] Community harvest data (ADF&G 2000).
[b] This subtracts a constant 2,350 caribou (the estimated total TCH harvest) from the combined WAH–TCH annual harvest estimate.
[c] Statewide caribou harvest report data: this assumes that 95% of the caribou harvest by nonlocal hunters in Unit 26A were from the WAH.
[d] Total WAH harvest = (WAH harvest by local hunters)+(WAH harvest by nonlocal hunters).
[e] WAH–TCH cow harvest = (0.33*WAH-TCH harvest by local hunters)+(0.10*WAH harvest by nonlocal hunters).
[f] WAH–TCH bull harvest = (0.67*WAH-TCH harvest by local hunters)+(0.90*WAH harvest by nonlocal hunters).

Table 11. Number of hunters, success rates and caribou harvest[a] by sex for hunters residing outside the range of the Western Arctic caribou herd (WAH) per regulatory year and unit, RY09 through RY13.

Reg.		Number of hunters			Success	Caribou harvest			
Year	Unit	Successful	Unsuccessful	Total	rate (%)	Bulls	Cows	Unk	Total
RY09	21	0	1	1	0	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
RY10	21	1	1	2	50	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
RY11	21	0	1	1	0	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
RY12	21	0	0	0		0	0	0	0
	22	23	20	43	53	38	3	1	42
	23	259	189	448	58	323	63	5	391
	24	4	43	47	9	4	1	0	5
	26A	70	30	100	70	78	12	0	90
	Total	356	282	638	56	443	79	6	528
RY13	21	0	0	0		0	0	0	0
	22	16	24	40	40	23	2	0	25
	23	186	187	373	50	180	36	46	262
	24	9	38	47	19	14	3	0	17
	26A	85	41	126	67	97	6	14	117
	Total	296	290	586	51	314	47	60	421

[a] This table likely overestimates the number of WAH caribou taken by hunters residing outside the range of the WAH because it includes a small number of Teshekpuk caribou herd taken in Unit 26A.

Table 12. Numbers and percent of nonlocal hunters by transport methods and year for the Western Arctic caribou herd, RY99–RY13 (all Units combined; annual % in parentheses).

Reg. Year (RY)	Plane	Horse-Dog team	Boat	4-wheeler	Snow machine	Off road vehicle	Highway vehicle	Airboat	No transp.	Total
RY99	414 (72)	3 (1)	83 (14)	20 (3)	14 (2)	4 (1)	32 (6)	3 (1)	0 (0)	573
RY00	426 (65)	0 (0)	139 (21)	23 (3)	19 (3)	1 (0)	51 (8)	0 (0)	0 (0)	659
RY01	410 (69)	3 (1)	88 (15)	19 (3)	12 (2)	3 (1)	59 (10)	2 (0)	0 (0)	596
RY02	460 (67)	1 (0)	122 (18)	31 (5)	14 (2)	2 (0)	50 (7)	3 (0)	0 (0)	683
RY03	377 (67)	0 (0)	99 (17)	28 (5)	9 (2)	5 (1)	48 (8)	0 (0)	0 (0)	566
RY04	470 (73)	3 (0)	90 (14)	17 (3)	18 (3)	2 (0)	47 (7)	0 (0)	0 (0)	647
RY05	510 (74)	1 (0)	112 (16)	11 (2)	12 (2)	6 (1)	33 (5)	1 (0)	0 (0)	686
RY06	522 (76)	4 (1)	102 (15)	20 (3)	4 (1)	7 (1)	26 (4)	0 (0)	1 (0)	686
RY07	370 (76)	2 (1)	57 (12)	18 (4)	4 (1)	3 (1)	16 (5)	1 (0)	0 (0)	471
RY08	396 (79)	2 (0)	60 (12)	25 (5)	5 (1)	3 (1)	13 (3)	0 (0)	0 (0)	504
RY09	400 (65)	5 (1)	90 (15)	29 (5)	8 (2)	8 (1)	71 (12)	0 (0)	4 (1)	615
RY10	431 (74)	5 (1)	55 (9)	32 (6)	11 (2)	13 (2)	35 (6)	0 (0)	0 (0)	582
RY11	442 (69)	3 (1)	71 (11)	31 (5)	31 (5)	11 (2)	49 (8)	3 (0)	1 (0)	642
RY12	476 (76)	1 (0)	54 (9)	18 (3)	27 (4)	10 (2)	39 (6)	2 (0)	1 (0)	628
RY13	427 (76)	0 (0)	43 (8)	12 (2)	13 (2)	10 (2)	57 (10)	1 (0)	2 (0)	565

Table 13. Comparative and differential incisor (I-1) cementum ages (years) for 13 known-age reindeer or caribou.

Known age (yrs)	Cementum age 1	Sample quality 1	Difference 1	Cementum age 2	Sample quality 2	Difference 2
4	6	A	-2	6	A	-2
3	4	B	-1	3	A	0
13	12	A	1	13.5	A	-0.5
14	10	B	4	11	B	3
19	14	A	5			
1	1	A	0			
10	10	A	0	10	A	0
2	2	B	0			
3	2	A	1			
2	1	A	1	1	A	1
8	8	A	0	8	A	0
4	4	A	0	4	A	0
10	7	B	3			

Table 14. Median fall calf weights (lb) by year and sex (weights corrected for water saturation), Western Arctic caribou herd, 2008–2015.

	Number of calves			Median Weight, lb		
Year	Male	Female	Total	Male	Female	All Calves
2008	9	13	22	83	82	82
2009	20	16	36	90	89	90
2010	22	7	29	94	90	93
2011	9	14	23	86	90	90
2012	4	10	14	97	85	88
2013	4	9	13	94	93	93
2014	12	11	23	94	86	89
2015	13	12	25	110	100	101

Table 15. Median fall calf weights (lb) by sex and body condition of mother (sample size in parentheses), Western Arctic caribou herd, 2008–2015.

	Median calf weight (lb)					
Year	Female calf, mother <avg condition	Female calf, mother =avg condition	Female calf: mother >avg condition	Male calf, mother <avg condition	Male calf, mother =avg condition	Male calf, mother >avg condition
2008	77 (2)	84 (8)	90 (3)	96 (1)	80 (6)	89 (2)
2009		85 (8)	92 (8)	92 (2)	91 (14)	89 (4)
2010	96 (1)	93 (3)	88 (3)	80 (3)	96 (14)	95 (4)
2011	90 (1)	91 (8)	90 (5)	86 (1)	100 (3)	83 (4)
2012	89 (1)	86 (6)	84 (3)		97 (3)	97 (1)
2013	99 (1)	78 (1)	93 (5)	95 (1)		94 (2)
2014		83 (4)	86 (7)	68 (1)	81 (4)	95 (7)
2015		89 (5)	101 (16)		102 (4)	111 (9)

Table 16. Numbers (and percentages) of satellite-collared caribou that grossly changed their speed and/or direction of travel within 30 mi of the Red Dog road during August-December, Western Arctic caribou herd, 1994–2015.

Year	Total no. of satellite collars in herd, n_i	No. of collared caribou within 30 mi of Red Dog road, *n* (% total collars)	No. of collared caribou that changed speed or direction of travel, *n* (% total collars)	Estimated no. of caribou that changed speed or direction of travel[a]	Percent of collared caribou within 30 mi of Red Dog road that changed speed or direction of travel	No. of collared caribou that did not cross Red Dog road to south or southeast, *n* (% total collars)
1994	8	2 (25)	1 (12)		50	0
1995	5	2 (40)	1 (20)		50	1 (20)
1996	3	3 (100)	1 (33)		33	0
1997	6	1 (17)	1 (17)		100	1 (17)
1998	3	0 (0)	-		-	-
1999	11	2 (18)	2 (18)		100	2 (18)
2000	20	0 (0)	-	0	-	-
2001	18	5 (28)	2 (11)	51,000	40	1 (6)
2002	22	2 (9)	1 (5)	24,000	50	0
2003	28	4 (14)	1 (4)	20,000	25	1 (4)
2004	22	7 (32)	3 (14)	64,000	43	0
2005	15	4 (27)	2 (13)	56,000	50	0
2006	26	1 (4)	0	0	0	0
2007	22	1 (5)	0	0	0	0
2008	35	5 (14)	1 (3)	11,000	20	0
2009	41	1 (2)	1 (2)	7,000	100	1 (2)
2010	62	0 (0)	-	0	-	-
2011	74	21 (28)	18 (24)	78,000	86	4 (5)
2012	69	7 (10)	4 (6)	17,000	57	1 (1)
2013	73	6 (8)	4 (5)	12,000	66	0
2014	75	5 (7)	2 (3)	6,000	40	0
2015	81	12 (15)	8 (10)	22,000	83	2 (2)

[a] Estimated number of caribou that changed speed/direction = (WAH herd size) X (% of WAH that changed speed/direction).

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CHAPTER 15: CARIBOU MANAGEMENT REPORT

From: 1 July 2012
To: 30 June 2014[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 the 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, 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. 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, an ad hoc committee operating under IPCB with representatives of the various management and research agencies with responsibilities for 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; Canadian Wildlife Service; Parks Canada; and U.S. Geological Survey, Biological Resources Division. The

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

Porcupine Caribou Technical Committee meets regularly to coordinate research and management activities and sets priorities for future work.

A variety of factors affect PCH management, including IPCB and Porcupine Caribou Technical Committee recommendations, biological studies, subsistence harvest, and congressional actions regarding the potential opening of the Arctic National Wildlife Refuge (ANWR) to petroleum exploration and development.

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. 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. In 2013 a photocensus survey resulted in a population estimate of 197,000 caribou representing an average annual growth rate of 5% from 2010 through 2013.

MANAGEMENT DIRECTION

The following goals, proposed by 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 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 PCH.

- Enable users of PCH to participate in international efforts to conserve PCH and its habitat.

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

MANAGEMENT OBJECTIVE AND MANAGEMENT ACTIVITIES

- Maintain a minimum population of 135,000 caribou.

  - Conduct photocensuses 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 annually 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. Caribou were captured using a handheld netgun shot from an R-44 helicopter, manually restrained with hobbles and hood, and fitted with a VHF, GPS, or PTT collar. Annually in March, 10–20 10-month-old calves (short yearlings) were captured and radiocollared, and adult female caribou were recaptured and fitted with new collars approximately 4–6 years after radio collars were originally deployed. In addition, 10–15 bulls (ages unknown) were radiocollared annually. Bulls are not recaptured because they typically die prior to the life expectancy of the collar.

POPULATION STATUS AND TREND

Population Size

ADF&G, with assistance from ANWR and YDE staff, 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 photocensus 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 DeHavilland 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 likely 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 et al. 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 1995a). 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 collared 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 group 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), YDE funded and conducted composition counts from a helicopter during March on PCH's 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 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 (RY) 2006, which begins 1 July and ends 30 June (e.g., 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 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 during RY93–RY05 to 400–700 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. The total estimated annual harvest range of 400–700 caribou for the above communities, combined, represents the harvest range expected for years when caribou are relatively scarce.

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 14 July 2013 we completed a photocensus of the PCH, resulting in a population estimate of 197,228 (SE = 13,772; 95% CI = 168,667–225,789) caribou (Table 1). The photocensus included 70 of the 89 active radio collars deployed on PCH caribou (bulls and cows) and 1 radiocollared Central Arctic herd cow that had been with the PCH since spring 2013. Radio collar distribution resulted in a total of 23 groups of which 14 groups were in Alaska, and 9 groups were in Canada. In addition, 13 groups that did not contain collared caribou were located and photographed, 6 in Alaska and 7 in Canada. In total, 36 groups were identified and photographed. Enumeration of all caribou on photographs resulted in 141,978 caribou (Table 2).

Using Rivest et al.'s (1998) method, including the homogeneity model in phase 2 calculations to expand the estimate for missing radio collars, the 2013 PCH photocensus data set consisted of 23 groups that totaled 133,295 caribou and accounted for 71 of 90 PCH radio collars (includes 1 caribou originally collared as Central Arctic herd; Table 2). Abundance was estimated at 197,228 (SE = 13,772; 95% CI = 168,667–225,789) caribou (Table 1). Our assumption of a random distribution of radio collars in the survey was supported ($P = 0.865$; Table 1).

The 2013 photocensus resulted in the highest herd size estimate in the history of monitoring the PCH (Table 3). However, the 95% CI in 2013 overlapped with the estimate obtained in 2010 (168,948, SE = 7,384, 95% CI = 153,493–184,403) and the minimum count obtained in 1989 (178,000; Table 3).

Parturition and Early Calf Survival

Parturition rate of radiocollared females ≥4-years old was 86% ($n = 42$) in 2013 and did not differ significantly (95% binomial CI) from the long-term mean (1987–2012; $\bar{x} = 81\%$; Table 4). Parturition rate was not estimated in 2014 due to poor weather that prevented adequate radiotracking flights.

Parturition rate for 3-year-olds was 67% ($n = 3$) in 2013 and was unknown in 2014 due to poor weather that prevented adequate radiotracking flights. Mean parturition for all 3-year-olds during 2005–2013 was 68% ($n = 38$). 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 rates fell below 40% and were stable or positive when this parturition rate was ≥60% (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 not estimated in 2013 because caribou were aggregated in shrubby vegetation which made identification of individual radiocollared caribou and their unmarked calves difficult or impossible. Postcalving survival of calves was not estimated in 2014 due to poor weather that prevented adequate radiotracking flights.

The late June calf:cow ratio of radiocollared females ≥4-years old in 2013 was not estimated due to previously mentioned issues with sightability. The late June calf:cow ratio in 2014 was 49:100 (n = 39) compared to the long-term mean (years 1987–2011) of 58 calves:100 cows (Table 4).

Population Composition

In October 2012 we located 59 radiocollared caribou in Alaska and Yukon and sampled 40 caribou groups containing 1–4 radio collars per group. Most caribou groups (n = 28) contained 1 radiocollared caribou and 12 caribou groups contained 2, 3, or 4 radio collars. Twenty-eight groups contained radiocollared cows, 9 groups contained radiocollared bulls, and 3 groups included both radiocollared bulls and cows. The number of individuals classified per group ranged from 4 to 936 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 from 4 to 296 caribou and averaged 221 caribou. Of 11,614 caribou classified, 9,518 were adults and 2,096 were calves. We estimated ratios of 47 bulls:100 cows and 32 calves:100 cows (Table 4).

Previous caribou composition surveys (PCH 2009, Central Arctic 2009, Teshekpuk 2009) identified sources of bias associated with estimating compositions of large caribou herds (Caikoski 2013). 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 PCH in 2009 when the herd was split between Alaska and Yukon. Although we attempted to minimize sources of bias in the 2012 composition survey by sampling across the full spatial distribution of the herd and by using cow and bull radio collars, the extent and magnitude of any bias in the 2012 survey is unknown.

March composition surveys to estimate the calf:cow ratios were not conducted in RY12 or RY13. The long-term mean calf:cow ratio in March is 34 calves:100 cows (range = 20–56 calves:100 cows; Table 4).

Distribution and Movements

Calving Distribution. In early June 2013 most radiocollared cows were on the coastal plain or adjacent foothills between the Babbage and Kongakut rivers. Estimates of calving distribution and the concentrated calving area were not calculated in 2012 due to a small sample size. Only 10 of 39 radicollared cows that were judged parturient were observed with a calf at heel during the parturition survey in 2013.

In 2014, calving distribution and the concentrated calving area could not be estimated due to adverse weather conditions. However, based on the locations of cows fitted with GPS collars, most caribou likely calved on the coastal plain between the Hulahula and Kongakut rivers in Alaska. Additional calving may have occurred on the coastal plain in Yukon between the Babbage River and the Alaska-Yukon border.

In the 1980s and 1990s most of 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, PCH has primarily calved in Ivvavik National Park, Canada. In 7 of 11 years during 2004–2014, calving occurred on the coastal plain, primarily in Yukon between the Alaska-Canada border and the Babbage River. In the other 4 years, calving occurred in both Alaska and Canada, and some calving occurred in the 1002 area during 3 of those years.

<u>Summer Distribution</u>. 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.

Following calving in summer 2013, PCH was segregated into 3 distinct regions. About 20% of the radio collars remained on the coastal plain and moved west to the Canning River and mixed with Central Arctic caribou. About 65% of the radio collars moved to the south side of the Brooks Range to the upper Sheenjek and Coleen river drainages. The remaining radio collars, composed entirely of bulls, were in the Richardson Mountains on the border of Yukon and Northwest Territories.

Following calving in summer 2014, most of PCH were on the coastal plain from the Alaska border to the Canning River during late June and early July. By late July and early August the herd dispersed over a large geographic area from the Hulahula River to the Yukon-Northwest Territories border north of the Continental Divide and from the East Fork Chandalar River to the Old Crow Flats south of the Continental Divide.

<u>Fall Distribution</u>. In August 2012 about 80% of the PCH satellite- and GPS-collared caribou were in the Richardson Mountains or Old Crow Flats in northern Yukon, and the remaining caribou were in Alaska, mostly in the Sheenjek and East Fork Chandalar river drainages. During September most of PCH that were in Yukon moved west into Alaska and, by late September, over 90% of PCH was in Alaska distributed between the East Fork Chandalar River and the Coleen River.

In August and September 2013 the PCH was distributed over a large geographic area extending from the Aichilik River to the Yukon-Northwest Territories border north of the Continental Divide and from the Coleen River to the Richardson Mountains south of the Continental Divide. In late September through early October about 75% of the herd moved west to the East Fork Chandalar river drainage in Alaska, and remaining caribou moved south to the Ogilvie Mountains in Yukon.

<u>Winter Distribution</u>. During 2012–2013 the PCH wintered in 3 discrete regions. Based on the locations using satellite and GPS collars (n = 14), about 50% of PCH wintered in the Old Crow Flats in Yukon and in the upper Coleen river drainage in Alaska. About 35% of PCH wintered in the Ogilvie Mountains in Yukon, and 15% of PCH wintered in the North Fork Chandalar river

drainage in Alaska. Caribou that wintered in the North Fork Chandalar river drainage were mixed with Central Arctic herd caribou.

During 2013–2014, based on the locations of satellite and GPS collars (n = 20), about 50% of PCH wintered in the Ogilvie Mountains in Yukon, and 50% of PCH wintered in the upper Chandalar River or Hodzana Hills in Alaska. Caribou that wintered in Yukon were mixed with the Hart River, Fortymile, and potentionally Nelchina caribou. PCH that wintered in Alaska were mixed with Central Arctic, Hodzana, and Teshekpuk caribou.

Historical information on movements and distribution of PCH are summarized by Garner and Reynolds (1986), Whitten (1987, 1993b, 1995b), 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's hunting season for resident hunters during RY12–RY13 was 1 July–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 RY12–RY13 was 1 August–30 September, and the bag limit was 2 bulls.

Alaska Board of Game Actions and Emergency Orders. The Alaska Board of Game made no changes to the seasons or bag limits for PCH caribou in RY12–RY13, and no emergency orders were issued.

Alaska Harvest. Nonlocal Alaska resident and nonresident hunters harvested 138 PCH caribou in Alaska during RY12 and 136 caribou in RY13 (Table 5). 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, PCH has never been subjected to substantial harvest by nonlocal and nonresident hunters in Alaska.

Total annual harvest of PCH in RY12 and RY13 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 PCH winters in or near the upper Chandalar River. This harvest likely ranges 200–350 caribou in years when caribou are accessible. In RY12 and RY13 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 RY12 was estimated at 1,283 caribou (Table 5) (Cooley and Branigan 2014). Most harvest occurred in August followed by September and July, and 86% of the harvest consisted of bulls (Cooley and Branigan 2014). Harvest in Canada during RY13 was estimated at 2,920. Eighty-three percent of the RY13 harvest was bulls, and harvest chronology was unknown (Table 5).

Harvest Rate. In RY12 the total harvest was estimated at 1,821–2,121 caribou (Table 5), which is 1.1% of the 2013 population estimate. Total harvest in RY13 was estimated at 3,456–3,756 caribou (Table 5), which is 1.8% of the 2013 population estimate.

Hunter Success. Success rates for nonlocal Alaska residents and nonresidents combined were 57% in RY12 and RY13, similar to previous years (Table 6). 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's range.

Local hunter success depended on spatial and temporal distribution of PCH relative to village locations. Success rates by Kaktovik residents were likely low or moderate in RY12 and RY13 because 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 RY12 and RY13 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 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's 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 PCH in Alaska occurs.

Natural Mortality

A study on the causes of natural mortality on 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).

Annual survival rates of radiocollared adult cows are not available for RY12 and RY13. Survival rates for those years are currently being analyzed by the U.S. Fish and Wildlife Service and will be available for the next report period (Eric Wald, U.S. Fish and Wildlife Service, personal communication, Fairbanks, 2015).

Wertz (2008) 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 PCH during 1989–2001. During 2006–2011 estimated survival rates improved (range 83–88%; $\bar{x}$ = 88%) and were consistent with population growth observed in PCH during that time period (Eric Wald, personal communication).

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 PCH. Over time the entire extent of the calving grounds may be important for caribou.

In recent years 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

Population size of PCH was the largest ever estimated in 2013 at 197,000, representing an average annual growth rate of 5% since 2010 when the herd was estimated at 169,000 caribou. During 2001–2010 the herd likely grew at an average rate of 2–3% annually since 2001, although rates may have varied substantially during that period. The current increase in population size observed in PCH is consistent with an improvement in estimated annual survival rates of radiocollared cows from 2003 to 2011.

Current and historic harvest rates of 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 PCH since the 1970s. Therefore, ADF&G and the Board of Game have maintained liberal hunting seasons and bag limits for residents and nonresidents.

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 2014). In 2012–2013 and 2013–2014, Canadian harvest was estimated at 1,283 and 2,920 caribou, respectively. Prior to 2010–2011, 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 PCH relative to communities and more importantly, the Dempster Highway. Future harvest estimates will provide additional insight into the range of PCH harvest in Canada.

We met our goal to conserve PCH and its habitat through international cooperation and coordination with ANWR and Canadian government agencies (YDE, Northwest Territories Department of Environment and Natural Resources, Canadian Wildlife Service, 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.

We met our goal to ensure opportunities for customary and traditional uses of PCH by providing liberal seasons and bag limits. The goals to enable users of Porcupine caribou to participate in international efforts to conserve the herd and to encourage cooperation and communication among users and governments were met because IPCB, which includes members from Alaska and Canada, met during RY12–RY13. 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 197,000 caribou obtained in July 2013, we met our management objective of 135,000 caribou during RY12–RY13. No regulatory changes are recommended at this time.

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Table 1. Porcupine caribou herd photocensus abundance estimate statistics, 2013.

Statistic	Value
Located and photographed radio collars[a]	71
"Missing" radio collars[b]	19
Caribou enumerated from located radio collars	133,295
Abundance estimate	197,228
95% confidence interval	168,667–225,789
Standard error	13,772
t-value	2.07
Test of randomness (*P*-value >0.05 fails to reject randomness)	0.865

[a] Includes one caribou collared as a Central Arctic herd cow.
[b] "Missing" radio collars refers to radio collars that were not in groups photographed. General locations of all missing radio collars were known (see text above).

Table 2. Number of caribou counted and radio collars present by group during summer 2013 Porcupine caribou herd (PCH) photocensus.

Group	No. of caribou	Total PCH radio(s)	PCH cow radio(s)	PCH bull radio(s)	CAH[a] radio(s)	Comments
AK 1/1	5,203	3	2	1		
AK 2	404					Excluded from model input
AK 3	253					Excluded from model input
AK 4/2	3,501	3	3			
AK 5	348					Excluded from model input
AK 6/3	7,035	4	3	1		
AK 7-12/4	31,515	16	14	1	1[b]	
AK 13/5	11,220	6	6			
AK 14/6	9,017	5	5			
AK 15	677					Excluded from model input
AK 16	1830	2	2			
AK 17/8	8613	3	3			
AK 18/9	11,446	3	3			
AK 19/10	931	1	1			
AK 20/12	1,375	1	1			
AK 21	161					Excluded from model input
AK 22/13	3,305	2	2			
AK 23/14	21,297	7	7			
AK 24/15	1,930	1	1			
AK 25	2,321					Excluded from model input
CA 1	2,665	1		1		
CA 2	2,038	2		2		
CA 3	1,232					Excluded from model input
CA 4	1,946	3		3		
CA 5	384					Excluded from model input
CA 6	1,793	1		1		
CA 7	524	1		1		
CA 8	111					Excluded from model input
CA 9	65					Excluded from model input
CA 10	1,020	2		2		
CA 11	2,040					Excluded from model input
CA 12	2,349	2		2		
CA 13	598	1		1		
CA 14	2,144	1		1		
CA 15	610					Excluded from model input
CA 16	77					Excluded from model input
Total	141,978	71	53	17	1	

[a] CAH = Central Arctic herd.
[b] CAH cow.

Table 3. Porcupine caribou herd population estimates, 1961–2013.

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 ± 15,500	APDCE[d]
2013	197,000 ± 28,500	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 = 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 95% confidence intervals.

Table 4. Porcupine caribou demographic data, 1987–2014[a].

Year	Cows observed[b]	Parturition rate	June calf survival[c]	Postcalving survival[d]	Late June calf:cow[e]	October calf:cow	October bull:cow	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	0.23	0.44		
2010	41	0.85	0.76	0.87	0.65	0.34	0.57	0.20	169,000[i]
2011	59	0.86	0.48	0.59	0.41				
2012	–[g]	–[g]	–[g]	–[g]	–[g]	0.32	0.47		
2013	42	0.86	–[j]	–[j]	–[j]				197,000[i]
2014	39	–[g]	–[g]	–[g]	0.49				
Mean[k]		0.81	0.72	0.85	0.58			0.34	

[a] Data from Fancy et al. 1994, Alaska Department of Fish and Game, and Yukon Department 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] Modeling developed by Rivest et al. (1998) applied to data collected from APDCE method to estimate herd size and apply confidence intervals.
[j] No data due to dense caribou groups making identification of cow:calf pairs not possible.
[k] Mean is for years 1987–2011.

Table 5. Porcupine caribou herd harvest[a], regulatory years[b] 1985–2013.

Regulatory	Reported[c]				Estimated		
year	M	F	Unk	Total	Alaska	Canada	Total[d]
1985	52	12	1	65	500–700	4,000	4,500–4,700
1986	70	14	0	84	1,000–2000	500–1,000	1,500–3,000
1987	106	22	1	129	<500	2,000–4,000	2,500–4,500
1988	82	7	0	89	<500	2,000–4,000	2,500–4,500
1989	104	8	0	112	500–700	2,000	2,500–2,700
1990	19	1	0	20	100–150	1,680	1,780–1,830
1991	101	3	0	104	100–150	2,774	2,874–2,924
1992	78	1	0	79	658	1,657	2,315
1993	77	5	0	82	250	2,934	3,184
1994	72	3	0	75	200	2,040	2,240
1995	61	7	0	68	200	2,069	2,269
1996	76	2	0	78	200	2,159	2,359
1997	58	4	1	63	300	1,308	1,608
1998	83	11	1	95	300	–[e]	
1999	84	4	0	88	400	–[e]	
2000	62	10	0	72	300	–[e]	
2001	105	9	0	114	400	–[e]	
2002	72	3	1	76	300	–[e]	
2003	120	8	0	128	500	–[e]	
2004	60	7	0	67	200	–[e]	
2005	32	10	0	42	500	–[e]	
2006	57	1	1	59	400–700	–[e]	
2007	113	13	0	126	400–700	–[e]	
2008	78	15	0	93	400–700	–[e]	
2009	108	18	2	128	400–700	–[e]	
2010	89	15	3	107	400–700	1,720	2,227–2,527
2011	127	27	1	155	400–700	1,850	2,405–2,705
2012	116	18	4	138	400–700	1,283	1,821–2,121
2013	118	15	3	136	400–700	2,920	3,456–3,756

[a] A small proportion (<10%) of the reported harvest may be Central Arctic herd caribou from Unit 25A.
[b] Regulatory year begins 1 July and ends 30 June (e.g., regulatory year 1985 = 1 July 1985–30 June 1986).
[c] Data from Alaska general harvest tickets.
[d] Includes reported and estimated harvest beginning in regulatory year 2010.
[e] Canadian data not collected.

Table 6. Porcupine caribou herd[a] nonlocal[b] and nonresident hunter success, regulatory years[c] 1995–2013.

Regulatory year/	Unit				Total for
Hunters	25A	25B	25D	26C	Units 25 and 26C
1995					
Total hunters	57	9	1	21	88
Successful	32	2	0	10	44
% Successful	56	22	0	48	50
1996					
Total hunters	47	20	0	9	76
Successful	29	16	0	2	47
% Successful	62	80	0	22	62
1997					
Total hunters	56	10	3	17	86
Successful	34	5	0	6	45
% Successful	61	50	0	35	52
1998					
Total hunters	85	12	3	17	117
Successful	63	3	2	9	77
% Successful	74	25	67	53	66
1999					
Total hunters	80	23	16	6	125
Successful	55	14	5	3	77
% Successful	69	61	31	50	62
2000					
Total hunters	91	13	12	6	122
Successful	56	0	2	2	60
% Successful	62	0	17	33	49
2001					
Total hunters	121	27	14	14	176
Successful	85	5	2	9	101
% Successful	70	19	14	64	57
2002					
Total hunters	98	21	23	12	154
Successful	65	5	2	4	76
% Successful	66	24	9	33	49
2003					
Total hunters	127	29	12	13	181
Successful	95	19	0	9	123
% Successful	75	66	0	69	68
2004					
Total hunters	85	11	16	20	132
Successful	54	0	3	8	65
% Successful	64	0	19	40	49

Regulatory year/ Hunters	Unit				Total for Units 25 and 26C
	25A	25B	25D	26C	
2005					
Total hunters	80	11	12	30	133
Successful	24	0	0	18	42
% Successful	30	0	0	60	32
2006					
Total hunters	88	12	33	23	156
Successful	45	1	1	12	59
% Successful	51	8	3	52	38
2007					
Total hunters	142	10	16	55	223
Successful	82	1	3	40	126
% Successful	58	10	19	73	57
2008					
Total hunters	140	10	18	52	220
Successful	74	1	1	32	108
% Successful	53	10	6	62	49
2009					
Total hunters	195	14	16	39	264
Successful	108	2	4	18	132
% Successful	55	14	25	46	50
2010					
Total hunters	152	16	16	42	226
Successful	79	1	5	22	107
% Successful	52	6	31	52	47
2011					
Total hunters	169	10	15	56	250
Successful	116	0	9	30	155
% Successful	69	0	60	54	62
2012					
Total hunters	167	17	14	38	236
Successful	106	4	2	23	135
% Successful	63	24	14	61	57
2013					
Total hunters	136	42	3	51	232
Successful	70	30	0	33	133
% Successful	51	71	0	65	57

[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.

[c] Regulatory year begins 1 July and ends 30 June (e.g., regulatory year 1995 = 1 July 1995–30 June 1996).

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CHAPTER 16: CARIBOU MANAGEMENT REPORT

From: 1 July 2012
To: 30 June 2014[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 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 photocensus 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 WMCH's 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. WMCH also provided a low-density comparison population for the long-term Delta caribou herd research project.

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

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 289 permits were issued for the first 3 seasons (89, 100, and 100, respectively), participation and success were low (6 caribou harvested). The number of permits available was increased to 250 (125 per hunt) during regulatory years (RY; regulatory year begins 1 July and ends 30 June, e.g., RY93 = 1 July 1993–30 June 1994) 1993 and 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 Alaska Board of Game (board) 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 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 changed the fall caribou bag limit back to 1 bull because cow harvests in 2000 and 2001 approached sustainable limits. In RY12 WMCH was made part (Zone 4) of the Fortymile registration hunts RC860 and RC867.

MANAGEMENT DIRECTION

MANAGEMENT GOALS

- Ensure that increased recreational use and mining development do not adversely affect the White Mountains caribou 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

Due to unfavorable weather and because the herd did not aggregate, we were unable to photocensus WMCH in 2012 and 2013.

Population Composition

We conducted composition surveys on 26 September 2012 and 10 October 2013 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 attempted to classify all caribou that were in groups with radiocollared animals and also classify caribou found in a search of the surrounding area. We searched areas containing the majority of the radiocollared caribou and also classified caribou encountered while in transit between search areas. We assumed bulls and cows were thoroughly mixed since surveys were conducted during the month of the rut. Classification categories consisted of cows; calves; and large, medium, and small bulls. Observers identified bulls by the absence of vulva and classified bulls by antler characteristics (Eagan 1993). We tallied the composition of each group on a 5-position counter and recorded the tallies on a data sheet.

Distribution and Movements

We strived to maintain at least 20 radiocollared caribou in WMCH and relocate them a minimum of once per month (excluding December and January) to monitor distribution and movements.

MORTALITY

Harvest

We estimated harvest by using data from returned harvest ticket and registration permit report cards. For RY12 and RY13, caribou harvested in the Beaver Creek drainage and west of Preacher and American Creeks in Unit 25C (Fortymile caribou hunt Zone 4) were considered WMCH animals; caribou harvested in the Chatanika river drainage in Unit 20B, Birch Creek drainage, and south and east of Preacher and American creeks 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 fall composition surveys in 2012 and 2013 we classified 336 and 328 caribou, respectively (Table 1). We met our bull:cow ratio objective during 2012 but fell slightly below the objective during 2013.

Fall bull:cow ratios in 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 WMCH. 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.

Low productivity (i.e., calf:cow ratios of 15–20, 2012 and 2013) suggests this herd is in decline.

Distribution and Movements

Calving in 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; the Beaver and Preacher Creek drainages during RY10–RY11; and the Beaver, Preacher, and Upper Birch creek drainages during RY12–RY13.

Fortymile herd caribou crossed to the north side of the Steese Highway in autumn 2008. On 9 October 2008, some mixing with WMCH was documented during a composition survey. When 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 FCH at least through April and had returned to WMCH by 16 June 2009 when we radiotracked the herd. Again, during winters 2012–2013 and 2013–2014, several radiocollared White Mountains caribou were located with Fortymile caribou in the upper Salcha and Goodpaster river drainages.

MORTALITY

Harvest

Season and Bag Limit (RY12–RY13).

Season/Hunt conditions	General hunt	Registration hunt
Fall season	10 Aug–20 Sep[a,b]	Hunt RC860 10 Aug–30 Sep[a] 10 Aug–20 Sep[b]
Hunt area	Units 20B and 20F west of the Elliott and Dalton Highways.	Units 20B and 20F east of the Elliott and Dalton Highways, and Unit 25C.
Bag limit	1 bull	1 bull
Winter season	None	Hunt RC867 1 Dec–31 Mar[a] Closed[b]
Hunt area		Units 20B and 20F east of the Elliott and Dalton Highways, and Unit 25C.
Bag limit		1 caribou

[a] Residents.
[b] Nonresidents.

Alaska Board of Game Actions and Emergency Orders. 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 During Fall. Harvest during fall general season hunts was low from RY87 to RY99 ($\bar{x}$ = 16.46; 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 FCH had 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. The fall hunt was converted to a registration permit hunt (RC860, Zone 4) in RY12, and harvest of bulls was unchanged ($\bar{x}$ = 11.3, RY02–RY11; $\bar{x}$ = 12.0, RY12–RY13).

Harvest During Winter. 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. In RY12 the winter hunt was included in the Fortymile registration permit hunt (RC867, Zone 4), and harvest remained extremely low (0–3 caribou).

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). Based on an estimated population of 500–600 animals, harvest rates have averaged 3.09% (17/550) during the last 5-year period (RY09–RY13).

Hunter Residency and Success. During RY12 and RY13 all 27 White Mountains caribou were harvested by resident hunters residing outside of Unit 25C (Table 4). Success rates for all hunters were relatively low ($\bar{x}$ = 12.9%) during this same period. The low success rates were probably due to the relative inaccessibility of caribou during both fall and winter hunts seasons.

Harvest Chronology. From RY90 (when winter seasons opened) through RY11, 86% (440/509) of the harvest occurred during the fall season (10 August–20 September). During RY12–RY13, 89% (24/27) of the harvest occurred during the fall season.

Transport Methods. The most common method of transportation used by successful hunters during the fall seasons of RY12 and RY13 was 3- or 4-wheelers ($\bar{x}$ = 64%; 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 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 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

Fall bull:cow ratios during RY10–RY11 were at or slightly below our management objective of ≥30 bulls:100 cows. Because we were not able to conduct censuses of the herds in 2013 and 2014, we are uncertain if we met our objective to maintain a stable or increasing population. Successful completion of population censuses has been problematic due to unfavorable weather 3 of the last 4 years.

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 herds seasons under one registration permit during the fall and winter hunts and adding Zone 4 to the hunt addresses allocation issues, at least temporarily. In addition, herd mixing has made it difficult to capture and radiocollar caribou belonging to WMCH, which makes it difficult to maintain an adequate sample size to estimate abundance, productivity, and survival. If FCH begins to use the White Mountains for calving, as they 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 WMCH whereby management of the 2 herds as distinct populations will be moot.

When the FCH harvest was liberalized in RY00, hunting pressure on WMCH seemed to decrease. However, with BLM's improved access in this area, increased hunter effort and harvest during fall may occur in the future, particularly if opportunities to hunt other Interior caribou herds decline. To date, no measurable increases have been observed.

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, Alaska, 1989–2014.

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	
10/3/13	27	10	20	13	68	32	30	38	18	328	
2014[e]											

[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.
[e] No census or composition survey.

Table 2. White Mountains caribou harvest during fall season[a], Alaska, regulatory years[b] 2000–2013.

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[c]	0	22
2011	7	1[c]	0	8
2012[d]	19	0	0	19
2013[d]	5	0	0	5

[a] General season (excludes winter permit hunt harvest).
[b] Regulatory year begins 1 July and ends 30 June (e.g., regulatory year 2000 = 1 July 2000–30 June 2001).
[c] Illegal take.
[d] White Mountains caribou harvest made part of Fortymile registration hunt RC860 (Zone 4).

Table 3. White Mountains caribou herd harvest during winter season, Alaska, regulatory years[a] 2000–2013.

Hunt	Regulatory year	Permits issued	Did not hunt (%[b])	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
RC867[c]	2012	Unk	Unk	Unk	3 (50)	1	2	0	3
	2013[d]								

[a] Regulatory year begins 1 July and ends 30 June (e.g., regulatory year 2000 = 1 July 2000–30 June 2001).
[b] Includes those who did not report.
[c] The White Mountains caribou herd hunt was absorbed into the Fortymile caribou hunt (Zone 4). Permits were not segregated by zone, therefore the number of permits issued, number that did not hunt, and number that were unsuccessful cannot be determined.
[d] Winter hunt canceled.

Table 4. White Mountains caribou herd hunter residency and success, Alaska, regulatory years[a] 2008–2013.

Regulatory year	Successful				Unsuccessful				Total hunters
	Unit[b] resident	Non-Unit resident	Nonresident	Total (%)	Unit[b] resident	Non-Unit resident	Nonresident	Total (%)	
2008[c]	13	3	3	19 (17)	59	31	6	96 (83)	115
2009[c]	6	2	3	11 (10)	62	28	5	95 (90)	106
2010[c]	15	4	3	22 (17)	65	32	7	104 (83)	126
2011[c]	5	2	1	8 (8)	55	30	6	91 (92)	99
2012[d]	0	22	0	22 (19)	0	81	10	91 (81)	113
2013[d]	0	5	0	5 (5)	0	75	16	91 (95)	96

[a] Regulatory year (RY) begins 1 July and ends 30 June (e.g., RY08 = 1 July 2008–30 June 2009).
[b] Residents of Units 20 and 25C, RY08–RY11; residents of Unit 25C, RY12–RY13.
[c] Includes only fall general season hunts.
[d] Includes both fall (RC860, Zone 4) and winter (RC867, Zone 4) registration permit hunts.

Table 5. White Mountains caribou herd percent harvest by transport method, Alaska, regulatory years[a] 2008–2013.

Regulatory year	Percent harvest by transport method								*n*
	Airplane	Horse	Boat	3- or 4-Wheeler	Snowmachine	ORV[b]	Highway vehicle	Other/Unk	
2008[c]	26	0	0	42	11	16	5	0	19
2009[c]	18	0	0	73	9	0	0	0	11
2010[c]	14	0	5	73	5	0	5	0	22
2011[c]	0	0	0	63	0	0	25	13	8
2012[d]	5	0	0	68	14	0	0	9	22
2013[d]	20	0	20	60	0	0	0	0	8

[a] Regulatory year begins 1 July and ends 30 June (e.g., regulatory year 2008 = 1 July 2008–30 June 2009).
[b] Other off-road vehicles.
[c] Includes only fall general season hunts.
[d] Includes both fall (RC860, Zone 4) and winter (RC867, Zone 4) registration permit hunts.

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CHAPTER 17: CARIBOU MANAGEMENT REPORT

From: 1 July 2012
To: 30 June 2014[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 communities 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 until at least 2008, when the TCH was estimated at more than 68,000 individuals (Parrett 2011). The exponential growth rate was 7.0% between 1984 and 2008, based on minimum count estimates (Table 1). The next abundance estimate in 2011 showed a 19% decline in abundance to approximately 55,000 (Parrett 2013).

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

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

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 multiple publications (Philo et al. 1993, Prichard et al. 2001, Person et al. 2007, Yokel et al. 2009, Wilson et al. 2012, Parrett 2013, Prichard et al. 2014).

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. Starting in 2011, and used retroactively where data were available, we used 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 incapable 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 now has two-way utility, as the number of added caribou from another herd can be explicitly estimated (Brian Taras, ADF&G biometrician, personal communication).

A photo census was completed on 16 July 2013. A Cessna 182 aircraft with telemetry equipment was used to search for radiocollared caribou while TCH caribou were in insect relief aggregations. A DeHavilland 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 analyst/programmer, Fairbanks, Alaska) 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 181 black and white 9x9-inch photographs developed and printed by HAS Images (Dayton, Ohio) and subsequently used in photo layout. Photo layout and drawing of overlap lines occurred in August 2013 and photographs were counted in October 2013 by a group of 5 staff, with 21% of the photos being recounted by a different individual.

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, 6–12 June 2013, and 6–10 June 2014. 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 2 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 helicopter surveys were completed 20–21 October 2012 and 19–20 October 2013, while spring fixed-wing surveys were completed 13–14 April 2013 and 7–9 April 2014. 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, an observation supported in recent analyses from other herds (Rasiulis et al. 2014). Beginning in 2000, major reductions in the transmitter weight of PTTs appeared to eliminate the differential mortality rates; since then, we have used data from VHF, GPS, and PTT collars for mortality estimates.

The survival of a sample of 121 caribou with known ages was evaluated with a staggered-entry Kaplan–Meier survival curve. These caribou were captured as yearlings from 1990 through 2014. In addition to estimating annual survival rates, we investigated age-specific survival rates of these animals. This was achieved by comparing the sample proportion of living animals within a given year to another sample proportion of living animals within a different given year.

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 2013, we hand-captured neonatal calves as part of a cooperative calf mortality study with BLM. An additional sample of calves was weighed in June 2014. Calves were weighed during capture, and we compared weights from those 2 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, www.argos-system.org/) in Landover, Maryland. Current locations from PTT and GPS collars were plotted periodically throughout the year 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 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.

We did not update fall and spring migration using Brownian Bridge Movement Models (Horne et al. 2007, Sawyer et al. 2009). Previous estimates and detailed methods are included in the previous management report (Parrett 2013).

Winter distribution in 2013 and 2014 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 of 37 and 34 caribou of both sexes, from 2013 and 2014, respectively. We estimated 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.

2014), and spring migration does not start until 4 May for most individuals (median date of spring migration initiation, unpublished ADF&G data).

HARVEST

Harvest data are summarized by regulatory year (RY), which begins 1 July and ends 30 June (e.g., RY12 = 1 July 2012–30 June 2013). Harvests during RY12 and RY13 were monitored through sealing and permit reporting processes, as well as through community harvest surveys conducted by ADF&G's Division of Subsistence.

Previous analyses have shown that the hunter registration and reporting system was not effective in estimating caribou harvest in communities within the range of the TCH (e.g., Georgette 1994). For at least the past 10 years, few hunters have registered with the department, and as a result no inquiries regarding harvest have been conducted using the registration system. Consequently, community harvest surveys have been used as an alternate method to quantify harvest; however, during this reporting period, no community harvest surveys were completed within the range of the TCH. Lacking recent estimates, we used average per-capita harvests from communities located in the core TCH range. 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 Alaska Department of Commerce, Community, and Economic Development to the per capita harvest rate for each village to estimate the total caribou harvest for RY12 and RY13. Because some communities have access to caribou from more than one herd on an annual basis, we used previously estimated proportional herd harvest from specific communities based on harvest in relation to caribou distribution where spatially referenced harvest data and satellite telemetry caribou location data were concurrent (Parrett 2013)

Additionally, harvest by nonlocal hunters was determined through harvest ticket reporting, with proportional herd harvest 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

From census photographs taken on 16 July 2013, we counted 32,629 caribou, distributed in 10 groups between Barrow and Harrison Bay. Of 77 collared adult caribou that were believed to be active, we located 59 during the 2013 photo census. Of the active caribou not located during the photocensus, 2 were known to be with the CAH at the time of the photo census, 8 were with the WAH, and an additional 8 were missing at the time of the photo census. Only 3 of the missing caribou were later found alive, but 5 others were heard in the month prior to the photocensus. During radiotracking in the hours following photography, we did not hear any WAH frequencies among TCH photocensus groups, however we did hear 2 CAH collars.

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 statistical necessity, we used and tested data sets that excluded recent collar deployments (adults and neonates since 2012) due to anticipated unequal mixing and nonrandom distribution of collars in the herd. Despite attempts to satisfy this precaution by limiting data to collars deployed prior to 2013, the hypothesis of randomness was rejected ($P = 0.002$).

Rivest et al. (1998) provided 3 different models that varied in the assumptions associated with missing collars. The results of choosing different models vary substantially only 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 39,172 (±12%); however, this number includes an unknown number of CAH caribou, includes a large number of caribou associated with the WAH at the time of the photo census, and importantly, fails the assumption of randomness.

Only estimates used for management purposes have been reported here; however, multiple ways of analyzing the herd mixture and the variety of newly deployed collars were considered independently. The results from these supplemental analyses corroborate the Rivest analysis (above), indicating that the herd likely numbered 32,000–45,000 at the time of the photo census in 2013. The herd experienced an exponential growth rate (Johnson 1994) of 7% from 1984 to 2011, and an exponential rate of decline of 5.0% between 2008 and 2011 and 27% from 2011 to 2013 (Table 1).

Productivity, Recruitment, and Mortality Estimates

Parturition Surveys. In 2013, we monitored 36 adult cows in early June. The parturition rate was 61%, and calving success was 44%. In 2014, we monitored 32 adult cows during the calving period. The parturition rate was 28%, and calving success was 16%. Both parturition and calving success rates were lower in 2013 and 2014 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 71% ($n = 7$) in 2013 and 25% ($n = 4$) in 2014. Boertje et al. (2012) suggested that a prolonged rate (5-year running average) of 3-year-old parturition less than 55% was indicative of low nutritional status.

Fall composition counts. During surveys on 20–21 October 2012 we located 31 collared caribou, and classified 5,010 caribou in the vicinity of the collared animals. The proportion of bulls in the adult sample was 28% (26–31% 95% CI; bull:cow ratio 39:100; Table 3).

During surveys on 19–20 October 2013, we located 30 collared caribou, and classified 2,449 caribou in the vicinity of the collared animals. The proportion of bulls in the adult sample was 28% (22–34% 95% CI; bull:cow ratio 39:100; Table 3).

Short-yearling counts. On 13–14 April 2013, we located 25 collared caribou during spring recruitment surveys. We classified 3,566 caribou in the areas surrounding the collared animals and observed 12% short yearlings (10–13%, 95% CI) or 13 short yearlings:100 adults (Table 2).

On 7–10 April 2014, we located 28 collared caribou during spring recruitment surveys. We classified 2,614 caribou in the areas surrounding the collared animals and observed 13% short yearlings (9–17%, 95% CI) or 15 short yearlings:100 adults 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 2012 (CY12; the 12-month collar year period beginning 1 July 2012) started with 65 collared females, the mortality rate was 32% (21–35%, 95% CI). CY13 started with 67 collared females and the mortality rate was 28% (18–41%, 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% (1990–2011; 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 3 years is likely to provide a solid comparison for mortality rates exceeding the long-term average by more 10%.

The Kaplan-Meier curve indicated that survival declined steadily from 1 year of age through 10 years of age. The estimated probability of surviving up to 6 years of age was approximately 50% (Fig. 2, initial $n = 121$). Yearlings may survive at a lower rate than 2-year-olds, but the difference was not statistically significant (79% survival for yearlings, 95% CL 71–86%, $n = 121$; 90% survival for 2-year-olds, 95% CL 82–95%, $n = 82$).

Capture, Body Condition, and Calf Weights

Captures. During 26–28 June 2013 we captured 32 female caribou. Twenty-one were new captures, and 11 were recaptures. Eighteen VHF and 13 GPS collars were deployed on females. We captured 6 male caribou which were collared with PTT collars, and recaptured 2 yearling males to remove their calf collars.

During 25–28 June 2014 we captured 27 female caribou and 13 male caribou. Twenty-one were recaptures, and 19 were recaptures. Fifteen VHF, 7 PTT, and 11 GPS collars were deployed.

There was 1 capture mortality in 2013, and 0 in 2014.

Body Condition. A likelihood ratio test comparing models with and without year as a fixed effect indicated no support for the additional parameter ($\chi^2 = 0.15$, $p = 0.7$), indicating no long-term trend in yearling weights, with an average weight of 50.5 kg (SE = 1.3). 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 5.5 kg ($n = 31$) and 5.8 kg ($n = 25$) in 2013 and 2014, respectively. These weights are lighter than previous average female weights from the TCH from 2006 through 2009 ($\bar{x} = 6.0$ kg, $n = 77$), and from the adjacent CAH from 2001 through 2005 (Arthur and Del Vecchio 2009; $\bar{x} = 6.6$ kg, $n = 266$). The mean weights from 2011 through 2014 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, Parrett 2013). 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 are 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. 3). 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 3 movement types are the most common (Parrett 2013). Of 314 total collar years (i.e., some individuals were repeated in multiple collar years), 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 directional movement, 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).

In previous years, there had been 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. In the winters of 2012–2013 and 2013–2014, caribou were primarily concentrated near Atqasuk and Wainwright and to the east of Anaktuvuk Pass (Fig. 4).

Spring migration routes are variable, similar to those seen in fall, as would be expected for the return migration to the calving ground (Parrett 2013). 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.

HARVEST

Season and Bag Limit. The hunting seasons and bag limits were the same for both regulatory years of the reporting period.

RY12 and RY13 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 previous analyses 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 (Parrett 2013). Harvest in Atqasuk had a smaller proportion of unknown-herd harvest (14%), and was similarly dominated by TCH harvest; in contrast, Nuiqsut harvest did include an estimated 11% directly attributable to the CAH (Parrett 2013).

Using per capita harvest rates and recent population levels for villages within the primary range of the TCH, we estimate that approximately 3,387 TCH caribou were harvested in each of RY12 and RY13 (Tables 5 and 6). The harvest rate from the TCH based on these per capita estimates was approximately 6% of the 2011 population estimate, but 10% of the 2013 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 (Parrett 2013).

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. Since the vast majority of nonlocal harvest is actually from the WAH (Parrett 2013), we did not report sub-unit specific harvest, success rates, or residency. In the past, the total number of caribou harvested by nonlocal hunters has averaged around 100 caribou per year, with nonlocal hunters typically been split evenly between nonlocal resident and nonresident hunters (Parrett 2013).

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 more than 95% of their caribou in August and September in both RY12 and RY13.

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 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.

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 in 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 additional area opened to leasing and exploration in 2008 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 2013 population estimate of 32,000 caribou continues the decline first documented in 2011. Based on recruitment indices, adult mortality rates, and calf production, continued decline seems likely, particularly if vital rates are similar to the past 5 years. Much like the adjacent WAH in previous years, adult female mortality in the TCH over the past 2 years was a strong contributor to the recent decline, which increased from a 5% annual decline to a 27% annual decline.

While the lack of trend in 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. 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. For many 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 from the WAH and CAH into the TCH as well. 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. Documenting the rates of herd switching, both temporary and permanent, will increasingly become a management priority.

The current estimated harvest rate is approximately 10% of the current population. A 10% harvest rate was also estimated for 2002–2005, a period of high growth. The poor quality of harvest data makes it difficult to conclude that the herd actually sustained those high harvest levels; spatially explicit data are also needed, because the estimated harvest rate depends a great deal upon the ratio of WAH to TCH in the harvest. Nevertheless, the conservative estimate of 10% 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, regulatory change may need to be initiated. Decreasing productivity and recruitment has likely resulted in an age structure dominated by older adults that exacerbated the effect of difficult winters, resulting in the observed population decline from 2008 to 2011. Future declines may be quite rapid if adult mortality rates remain high. 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. The need for accurate harvest data is greater than ever.

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.

- 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.
- Improve harvest reporting; proactively attempt to improve hunter registration and reporting. If changes in harvestable surplus result in Tier I or Tier II allocation and reporting systems, preparing hunters for a change is extremely important.

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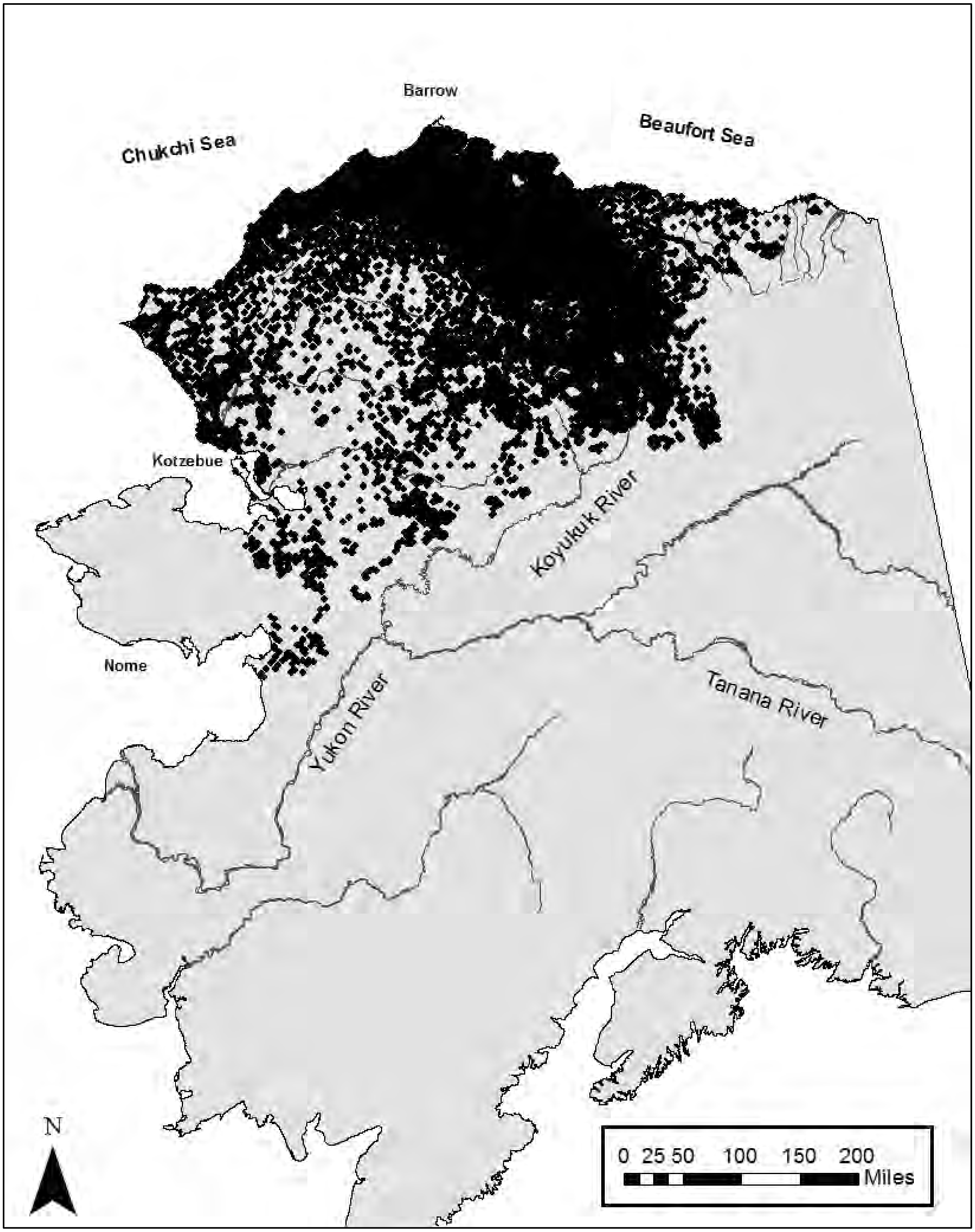

Figure 1. Locations of satellite-collared Teshekpuk caribou herd caribou (GPS and PTT), Alaska, 1990–2012. Locations were filtered for accuracy and the data set was reduced to no more than one location per-day per-caribou. These data come from collars purchased and deployed as part of a cooperative effort between ADF&G, BLM, North Slope Borough, and Conoco Phillips.

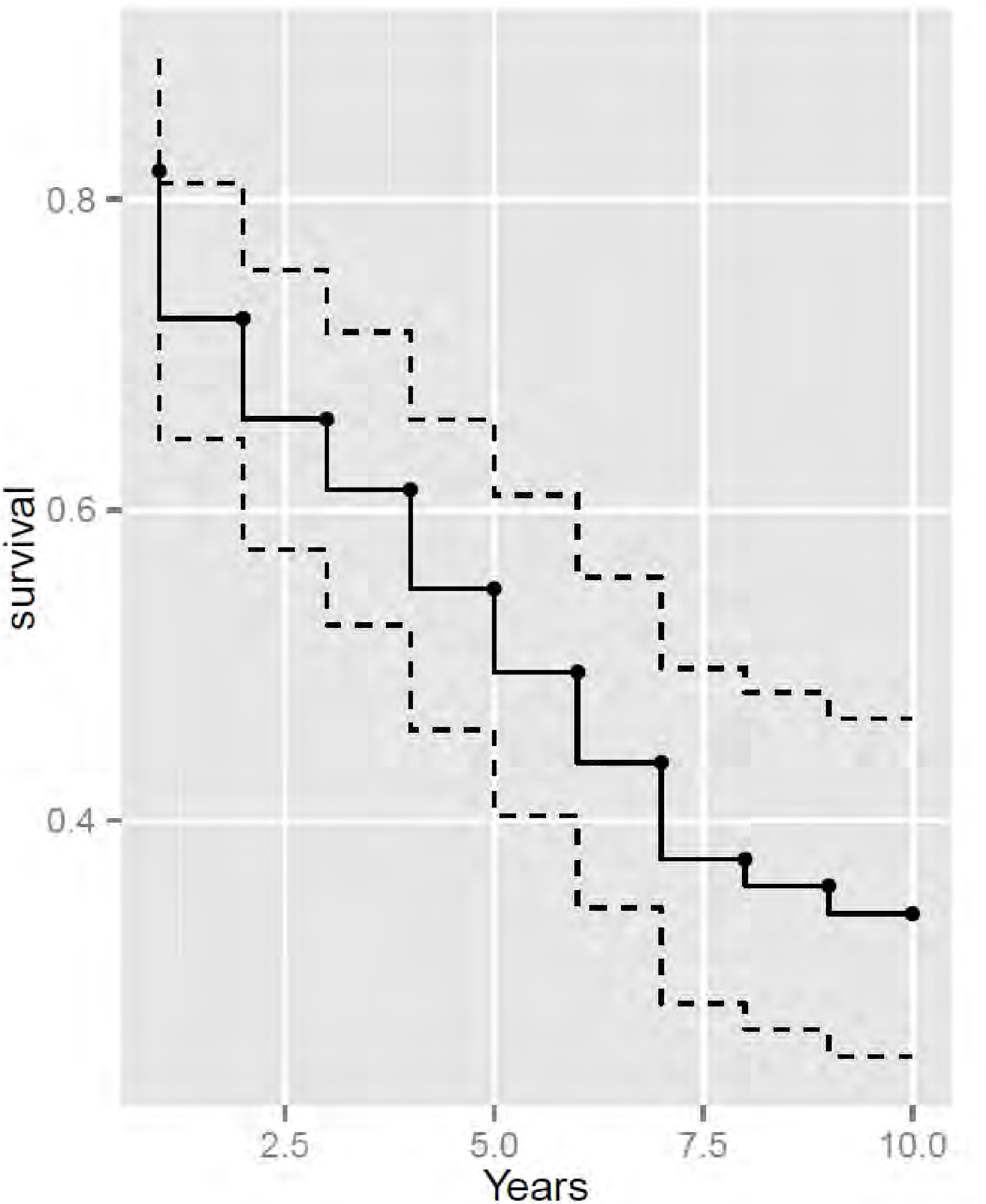

Figure 2. Kaplan-Meier Survival curve for Teshekpuk caribou herd female caribou, Alaska, initially captured as yearlings (13 month of age), and followed through 10 years of age.

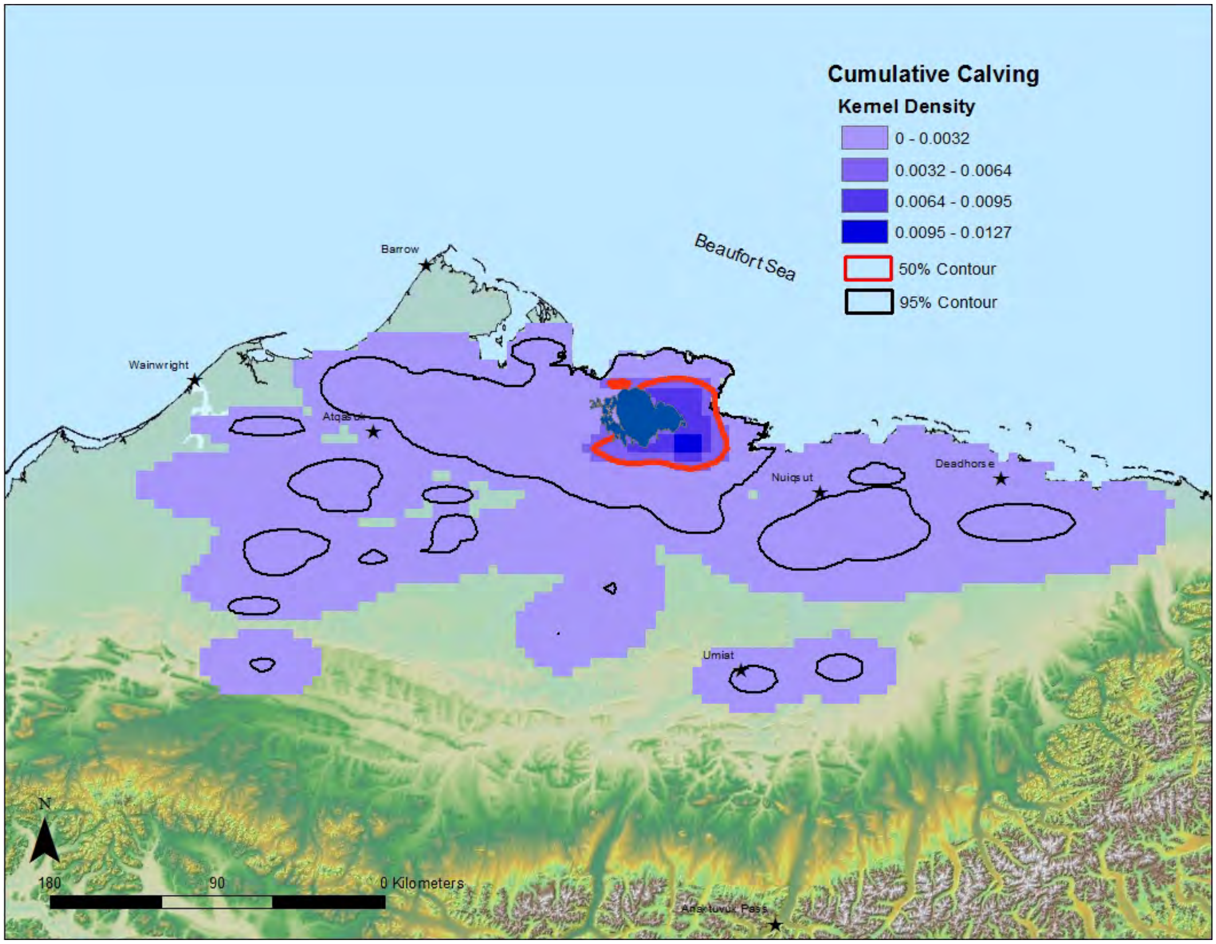

Figure 3. Cumulative calving distribution of the Teshekpuk caribou herd (TCH), Alaska, 1994–2012. Annual kernel density estimates were averaged using a static 5-km grid as the basis for comparison, using locations of parturient collared caribou to generate the utilization distribution. This estimate is unbiased with respect to annual sample size. Occasional use of Central Arctic herd and WAH calving grounds is depicted by the farthest east and southwest extent of calving. Historically, the highest density of calving TCH caribou has been within 30 km of Teshekpuk Lake.

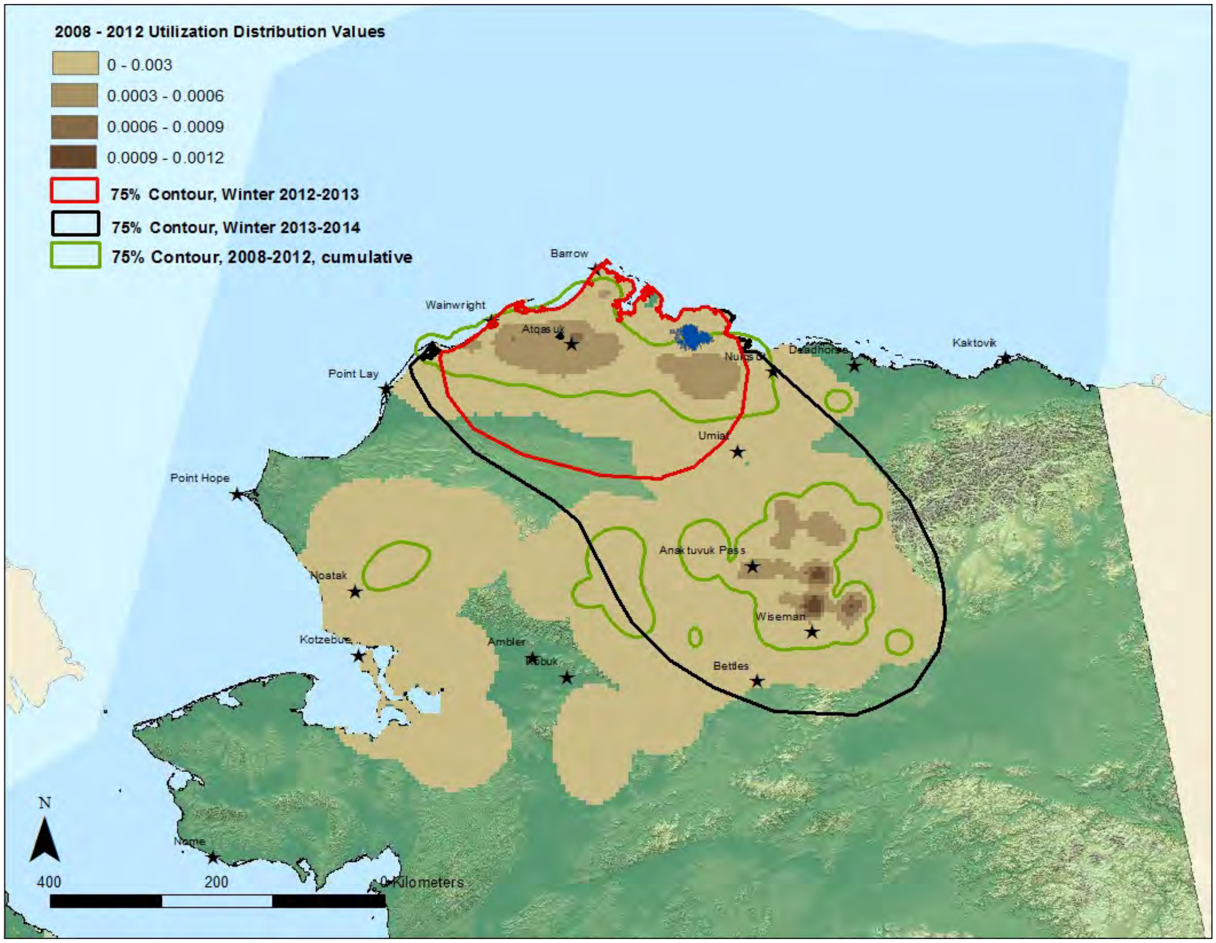

Figure 4. Cumulative Teshekpuk caribou herd winter range, Alaska, 2008–2012, with utilization distribution values depicted in shades of brown, and 75% kernel contour from the 2008–2012 winter in green. The 75% kernel contours from the 2 individual winters from this reporting period (2012–2013 and 2013–2014) are depicted by red and black outlines.

Table 1. Population estimates and exponential growth rates of the Teshekpuk caribou herd, Alaska, 1978–2013.

Year	Minimum population estimate	Population estimate (% SE)[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 (33%)	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 (11%)	15.2[e]
2008	64,106[d]	68,932 (10%)	5.8%
2011	52,673[f]	55,704 (5%)[g]	-5.0%
2013	32,629[f]	39,172 (15%)	-27%

[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 Central Arctic herd (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. SE 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. Note that the 2013 estimate was not corrected in a similar fashion, despite the inclusion of CAH collared caribou in the photo census.

Table 2. Teshekpuk caribou herd, Alaska, calving and short-yearling survey results, 1999–2014[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				
2013	36	61	44	3,566	13	12	10–13%
2014	32	28	16	2,614	15	13	9–17%
AVERAGE	39	68	55	2,658	18	15	

[a] Data from 1990-1998 included in previous reports; see Parrett (2013).
[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, Alaska, fall composition counts, 2009–2013[a].

	Helicopter surveys				
Year	Bulls:100 Cows	% Bulls[b] (95% CI)	Calves:100 Cows	% Calves (95% CI)	*N*
2009	46	36 (26–37)	18	11 (10–12)	6,576
2010	46	32 (29–35)	29	17 (15–19)	1,208
2011	–	–	–	–	–
2012	39	28 (26–31)	35	21 (18–25)	5,010
2013	39	28 (22–34)	34	20 (17–23)	2,449

[a] From 2009 onward, the helicopter survey took place in October, during rut; previous results of fixed-wing composition and July-timed surveys are reported elsewhere (Parrett 2013).
[b] Percent bulls is the percentage of total adults, not the total of all caribou observed.

Table 4. Annual mortality of adult female radiocollared Teshekpuk caribou, Alaska, 2000–2014[a].

Collar year[b]	Sample Size[c]	Mortalities[d]	Mortality rate[e] (%)	95% Binomial confidence, %
2000–2001[f]	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%
2012–2013	65	21	32	21–45%
2013–2014	67	19	28	18–41%
Average			16.8	

[a] Data for years prior to 2000–2001 can be found in Parrett (2013).
[b] Collar year defined as 1 July–30 June.
[c] Sample size = the total number of active radio collars at the beginning of the collar year.
[d] Number of radiocollared caribou that died during the collar year.
[e] Mortality rate = Known Mortalities/ Number of Active Female Collars.
[f] 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.

Table 5. Summary of community-based harvest assessments for communities within the range of the Teshekpuk caribou herd, Alaska, 1985–2007.

Community	Survey year	Human population	Average No. 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 6. Estimated annual harvest of Teshekpuk herd caribou, Alaska, by residents living within Unit 26A during regulatory years[a] (RY) RY12 and RY13.

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 5.

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CHAPTER 18: CARIBOU MANAGEMENT REPORT

From: 1 July 2012
To: 30 June 2014[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 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 2010, the herd was estimated at 70,034 caribou (Table 1). The increase was due to low adult mortality, high parturition rates (≥85%), and good fall calf recruitment to October (≥50 calves:100 cows) during 1998–2010 (Lenart 2013).

Reported harvest on CAH changed over time as a result of regulatory modifications and changes in hunting pressure. Beginning in regulatory year (RY) 1991, which begins 1 July and ends 30 June (e.g., RY91 = 1 July 1991–30 June 1992), harvest and hunting pressure increased on CAH, likely because hunting was severely restricted on several Interior Alaska caribou herds (e.g., Delta, Macomb, Fortymile). These restrictions displaced hunters to hunt CAH, and CAH had become accessible by road because the Dalton Highway was officially opened to public traffic in 1991. During RY00–RY12, the total number of hunters and reported harvest increased, although harvest rates remained less than 3% of the herd.

The Central Arctic caribou range encompasses the eastern north slope coastal plain from just west of the Colville River to the Canadian border, the north side of the Brooks Range from the Itkillik River to the Canadian border, the south side of the Brooks Range from approximately the North Fork Koyukuk River to the East Fork Chandalar River, and as far south as the Chandalar River valley (Fig. 1). 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

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

what was originally a major calving area (Lawhead and Johnson 2000, Wolfe 2000). No directional shift in distribution of caribou that calved east of the Sagavanirktok River was noted (Wolfe 2000). CAH summer range extends from Fish Creek, just west of the Colville River, eastward along the coast (and inland approximately 30 miles) to the Canadian border. 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 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 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, 1985a,b; Whitten and Cameron 1983, 1985; Curatolo and Murphy 1986). In the mid-1990s, research on CAH was reduced substantially, and efforts were focused on monitoring population parameters and their relationship to management objectives. During the mid-1990s, some of 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 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 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.

MANAGEMENT DIRECTION

During 2000–2010, CAH grew substantially. Current management goals and objectives reflect this increase in population size, as well as intensive management population and harvest objectives that the Alaska Board of Game (board) established for CAH. An intensive management 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 intensive management population objective for 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: Provide the opportunity for a subsistence harvest of CAH caribou.

Goal 3: 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. (Goal 2)

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. (Goals 2 and 3)

MANAGEMENT ACTIVITIES

- Conduct a photocensus every 2–3 years. (Objective 1)
- Conduct annual fall composition surveys. (Objectives 3 and 4)
- Radiocollar 10–20 yearling females annually. (Objectives 1 and 2)
- Radiocollar 10–20 adult females and males annually to maintain 25–30 radio collars on adult females and 10–20 radio collars on adult males. (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)
- Estimate peak of calving. (Objective 2)
- 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, 2008, 2010, and 2013 using the modified aerial photo-direct count technique (Davis et al. 1979), commonly referred to as "photocensus." A photocensus represents the caribou that were located and present during the photocensus; we do not locate all caribou in the herd, and caribou from other herds may be present. However, we conduct photocensuses 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.

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 deHavilland Beaver aircraft, or caribou were counted directly from the Beaver or radiotracking airplane. As we were photographing, we used a custom-made computer program, "PHOTOMAN (version 3.0.12)," which was developed within ADF&G to assist in overlap lines for transects and photo layouts when caribou were counted from photographs. Caribou were radiotracked via Cessna 182 and Super Cub aircraft to locate groups of caribou.

Caribou were counted directly from photographs, and caribou observed from airplanes were added to this count and referred to as "minimum count" of caribou in the photocensus. During 1997–2013 we also used a method described by Rivest et al. (1998) to estimate herd size and provide a measure of uncertainty. This method used the distribution of radiocollared caribou among groups of known size to estimate the number of caribou in groups without radiocollared caribou. The estimator assumes a 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.

In 2013 we also took steps to account for (i.e., remove) the 10 PCH caribou captured in the photocensus. We made 2 adjustments to the Rivest estimate to account for PCH caribou: 1) we removed PCH caribou estimated to be represented by the 10 PCH radio collars, and 2) we removed PCH caribou from the caribou that the Rivest's method added to the count by multiplying these additional caribou by the proportion of PCH caribou in the total caribou counted. Each radiocollared PCH caribou represents 2,191 caribou based on the 2013 PCH photocensus estimate of 197,228 and 90 radio collars (J. R. Caikoski, Wildlife Biologist, ADF&G memorandum [2013 Surveys of the Porcupine caribou herd–parturition, postcalving, and photocensus], 5 February 2014, Fairbanks). We accounted for the uncertainty associated with these adjustments. We also took steps to account for 2 PCH caribou in the 2008 photocensus and 2 PCH and 2 TCH in the 2010 photocensus (A. L. Crawford, Biometrician, ADF&G memorandum [Estimating Central Arctic caribou herd abundance under herd mixing conditions: Analysis summary], 6 October 2015, Fairbanks). Analyses of these methods are still being investigated, and adjustments to the method may be made in the future.

We used the adjusted Rivest estimates and their associated variances to estimate trend with a multiplicative mixed effects model using Bayesian methods and the software OpenBUGS (Lunn et al. 2009). The multiplicative model was preferred because a proportional change in slope is assessed as opposed to a linear model which evaluates an additive change in slope (J. Merickel ADF&G Biometrician, Fairbanks, personal communication). In addition, lambda is estimated directly in the multiplicative model. Trend was estimated separately for 2 time periods (1997–2008 and 2008–2013), because the data indicated the population peaked between 2008 and 2012. Modeling the entire data set was not feasible due to variation in the data. Posterior means were used as point estimates for lambda, and 90% and 95% credible intervals were calculated. Note that a 95% credible interval is interpreted slightly different than a confidence interval: there is a 95% probability that the interval contains the true value of lambda.

No population estimates were conducted during 2003–2007 due to lack of suitable weather, poor aggregation quality, or both.

Radiocollaring

Caribou were captured using a handheld netgun from an R-44 helicopter and manually restrained with hobbles and blindfold-hood while we collected measurements and fitted the radio collars. Eleven-month-old calves captured in April were weighed. We assessed general body condition on all caribou as very poor, poor, average, good, or very good. We recorded sex (male or female) and age as 11-month-old calf (short yearling) or adult. We recorded latitude, longitude, and general location of capture.

We maintained 60–100 radio collars (including VHF [very high frequency transmitters], GPS [Global Positioning System] transmitters, and PTT [Platform Terminal Transmitters]) in CAH. We attempted to maintain approximately 20 radio collars on female yearlings, 12 on adult bulls, and the remaining collars on females ≥2-years old. 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. We received satellite-location data from the Service Argos Data Collection and Location System (ARGOS) in Landover, Maryland for the Telonics satellite collars and from Iridium Communications, Inc. in McLean, Virginia for the Lotek radio collars.

During 21–23 April 2013 we deployed a total of 35 radio collars on CAH, including 12 Telonics-Argos GPS satellite radio collars deployed on adult females ≥2-years old (4 recaptures and 8 random), 3 Telonics VHF radio collars were deployed on males ≥2-years old, and 20 Telonics VHF radio collars were deployed on 11-month-old females. Radio collars were deployed on the south side of the Brooks Range between the Dalton Highway and the East Fork Chandalar River, north of the North Fork Chandalar valley. On 29 June 2013, 3 Telonics VHF radio collars were deployed on adult females ≥2-years old near Badami.

During 17–19 April 2014 we deployed a total of 51 radio collars on CAH including 13 Telonics-Argos GPS satellite radio collars deployed on adult females ≥2-years old (7 recaptures and 6 random), and Telonics VHF radio collars were deployed on 2 males ≥2-years old, 2 female yearlings (almost 2-years old), 21 11-month-old females (short yearlings), 1 recaptured adult female, and 12 random adult females. Radio collars were deployed on the south side of the Brooks Range between the Dalton Highway and the East Fork Chandalar River, north of the North Fork Chandalar valley. On 28 June 2014 we deployed 1 GPS Telonics-Argos with VHF radio collar and 9 GPS Lotek with VHF radio collars on random adult females ≥2-years old with 9 radio collars south of Badami-Bullen Point and 1 on the Kadleroshilik pingo.

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 radiocollared 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). During 1997–2002, caribou were located once, with a target date of 3–9 June. During this period when caribou were only located once, 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 2009–2014, 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. The proportion of calves:100 cows was determined during 20–25 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.

Parturition rates and the proportion of calves:100 cows were calculated for 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. A 90% binomial confidence interval was calculated for parturition rates and the late June calf:cow ratio using a normal approximation method: sqrt (parturition rate * (1−parturition rate)/(n−1).

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 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 2007–2014 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 and 2014, 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. No fall composition survey was conducted in 2013 because CAH was mixed with PCH.

Peak rut was estimated as the date 228 days (gestation period) prior to the estimated peak calving date of CAH (19 October). Caribou groups were located by radiotracking radiocollared caribou ≥1-year old 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. In addition, some groups without radio collars were sampled. 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.

Mortality

Annual adult female mortality rate for females ≥1-year old was estimated per regulatory year by determining the number of known mortalities in a regulatory year and dividing that number by the number of active radio collars beginning 1 July of that regulatory year.

Distribution and Movements

Distribution of 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 using the Argos and Iridium satellite service systems.

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. Pedersen, 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

2013 Photocensus. We conducted a photocensus on the Central Arctic caribou herd 4–5 July 2013. A complete description of survey and analyses methods were described in E. A. Lenart, ADF&G memorandum (2013 Central Arctic caribou photocensus results), 8 August 2014, Fairbanks.

We considered conditions for the photocensus to be good. On 4 July temperature was 58°F, mostly cloudy with broken clouds, ceilings at 5,000 feet, and an estimated 12–18 mph wind from the northeast when caribou west of Prudhoe Bay were photographed during late afternoon. Caribou were loosely aggregated. We photographed caribou east of Prudhoe Bay on 5 July during late morning. Temperature was 58°F, sunny and clear, with an estimated 12–18 mph wind from the northeast switching to southwest. Caribou were tightly aggregated.

We located and photographed all 54 of 54 active radio collars deployed on Central Arctic caribou (≥1-year old, 9 males and 45 females), including 2 caribou originally collared as TCH but are now identified as CAH caribou. We also located 10 Porcupine Caribou radio collars in 4 groups mixed in with the 7 groups that were photographed east of Prudhoe Bay. Caribou were distributed in 12 groups from the Colville River delta to east of the Canning River on the Sadlerochit River. Caribou were distributed in 4 groups west of Prudhoe Bay between the Colville River delta and Beechey Point, 7 groups east of Prudhoe Bay between the Canning and Sadlerochit rivers either along the coast or up to 15 miles inland, and 1 group of 2 bull caribou with a radio collar on the mouth of Sagavanirktok River. All other radiocollared bulls were located with radiocollared females. A total of 10 groups were photographed, and 2 groups were either estimated or counted from the Beaver. Ten of the 12 groups of caribou had 1 or more radio collars.

Minimum Count: In 2013 we counted 70,364 caribou from photographs and caribou not included in photographs in 12 groups of caribou and considered this a "minimum count" of caribou in the photocensus which also included some PCH caribou (Table 1).

Rivest's Population Estimate. We estimated CAH population at 50,753 (SE = 4,345, 95% CI = 40,924–60,582 caribou), using the Rivest et al. (1998) estimator and made adjustments for PCH caribou in the count (Table 1; E. A. Lenart, Wildlife Biologist, ADF&G memorandum [2013 Central Arctic Caribou Photocensus Results], 8 August 2014, Fairbanks).

Historical Population Size and Summary. Population size was not estimated during 2003–2007; however, CAH increased substantially during 1995–2008 (Table 1). Using the adjusted Rivest estimates for years 1997–2008, there is significant evidence at the 95% credible interval that the population was increasing at an annual rate between 1.10 and 1.13 with a point estimate (posterior mean) of 1.12 (Table 2, Fig. 2). High parturition rates, good calf survival, and low adult mortality since 1997 contributed to the increase in population size. We determined that immigration from PCH and TCH likely played a minor role in contributing to the increase during those years. High annual rates of increase similar to those reported here have been reported for other Arctic caribou herds (1.12), although minimum count estimates were used as well as a different method to calculate the annual rate of increase (Carroll 2007, Dau 2007).

Using the adjusted Rivest estimate for years 2008–2013, lambda was estimated to be between 0.86 and 1.01 at the 95% credible interval with a point estimate (posterior mean) of 0.95 (Table 2, Fig. 2). The 95% credible interval encompasses 1, indicating the growth rate is not significantly less than 1, however a 90% credible interval for lambda is (0.90, 0.99) which does indicate a lambda less than 1 (growth rate <1 indicates the herd is declining). These results show that during 2008–2013, the CAH population stopped increasing and may be slightly decreasing. Note that results from 2008 to 2013 should be viewed with caution because there were only 3 data points with high variability as represented by the large credible interval (Fig. 2). Although results of the model are somewhat inconclusive because there are only 3 data points, a very late spring occurred in 2013 resulting in high mortality of adult and yearling females during the month of May. We suspect that these high mortality rates were reflected in the 2013 photocensus estimate resulting in a lower population number. In conclusion, it is likely CAH population peaked between 2008 and 2012 (note that the 2 estimates between 2008 and 2010 are not significantly different from each other) and was either stable, or slightly decreased during 2008–2013. Two additional population estimates should help us determine the trend more conclusively since 2008 (Fig. 2).

Parturition and Early Calf Survival

Parturition Rates. Parturition rates of radiocollared females ≥4-years old throughout Unit 26B were 80% (*n* = 25) in 2013 and 76% (*n* = 34) in 2014 (Table 3; Fig. 3). In 2013, parturition rates were higher in Unit 26B West (100%, *n* = 9) compared to Unit 26B East (69%; *n* = 16); but note low sample sizes in Unit 26B West. Spring in 2013 persisted approximately 1 month longer, and caribou calved further south compared to previous years (Fig. 3). Parturition rates were similar between Units 26B West and Unit 26B East in 2014 (Table 3). Parturition rates for 3-year-olds were 75% (*n* = 4) in 2013, and no 3-year-olds were located in 2014 (Table 4).

We determined the 5-year moving weighted average for 3-year-olds for years 2009–2013 to be 63.8%±18.8% (annual sample size ranged 4–7, CI = 95%) using methods described in Boertje et al. 2012 and estimating a binomial standard error for the 95% CI (Table 4). The point estimate was lower the previous 4 years (2010–2013) compared to 2003–2009; however the error bars overlap considerably which likely reflects the annual low sample sizes. Boertje et al. 2012 considered 5-year moving weighted averages of 55–80% to be moderate parturition rates, although the utility of this measure for Arctic caribou remains unknown (Valkenburg et al. 2000, Boertje et al. 2012). 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.

During the previous 15 years (since 2000), parturition rates were very high for females ≥4-years old (≥91%) for 11 of the 15 years (Table 3). Parturition rates were still considered good (≥75%) in years they were lower than 91% (2005, 2009, 2013, 2014; Table 3). We observed no significant differences in parturition rates between Unit 26B West and Unit 26B East during 1994–2014, except in 2013, although sample sizes were small (Table 3).

Peak of Calving. In 2013, 32% (7 of 22) of the radiocollared females ≥3-years old that were considered pregnant had a calf by 6 June. Therefore, the estimated date range for peak of calving in 2013 was 7−8 June, and the point estimate was 7.5 (Table 5). In 2014, 12% (3 of 26) of the radiocollared females ≥3-years old that were considered pregnant had a calf by 3 June. The estimated date for peak of calving in 2014 was 4–6 June and the point estimate was 5.0 (Table 4). During 1997–2014 the mean estimated date was 5 June (mean point estimate ± SE = 5.5 ± 0.52; Table 5; Arthur and Del Vecchio 2009; Lenart 2013; ADF&G unpublished data, Fairbanks; R. D. Cameron, Wildlife Biologist, ADF&G [retired], personal communication, 2012).

Early Summer Calf Survival. The late June calf:cow ratio of radiocollared females ≥4-years old throughout Unit 26B was 56:100 (n = 25) in 2013 and 65:100 (n = 34) in 2014 (Table 6). During 1997–2012, the late June calf:cow ratio was relatively high (≥71:100; Table 6) in all years except 2009 and 2012, when they were slightly lower (52:100 and 69:100). These high calf:cow ratios indicated consistently high productivity and early calf survival, which contributed to the increase in population size observed during 2000–2010. Late June calf:cow ratios were similar between Unit 26B West and Unit 26B East (Table 6).

The late June calf:cow ratio for radiocollared 3-year-olds was 50:100 (n = 4) in 2013, and only 1 3-year-old was located in 2014, and it did not have a calf. 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 4).

Population Composition

No sex and age composition survey was conducted in 2013 because CAH was mixed with PCH. In 2014 a fall composition survey was conducted on the south side of the Brooks Range between the Dalton Highway and the East Fork Chandalar River. A total of 3,903 caribou were classified in 31 groups with 32 radio collars. However, we determined, post-survey, that some CAH caribou may have been mixed with some PCH caribou based on PCH satellite radio collar locations (E. A. Lenart, ADF&G memorandum [Fall 2014 CAH composition], 1 September 2015, Fairbanks). Therefore, only groups sampled west of the Middle Fork Chandalar River were included in the 2014 composition analyses (15 groups with 18 radio collars). This resulted in 2,004 caribou with an observed bull:cow ratio of 41:100 and calf:cow ratio of 42:100 (Table 7). The bull:cow ratio was considerably lower compared to previous years, but this number should be viewed with caution because of the smaller sample size and potential mixing. The calf:cow ratio was also lower but still considered good. We expected a lower calf:cow ratio because parturition rates and late-June calf:cow ratios were lower in 2014 compared to 2010−2012. This ratio should also be viewed with caution.

During 2009–2012, we observed high bull:cow ratios ranging from 50:100 to 69:100. Similarly, calf:cow ratios were high ranging from 33:100 to 61:100 (Table 7). Bull:cow ratios were high since 1976 (≥50:100), indicating harvest had little effect on sex ratios (Lenart 2013). Calf:cow ratios also were high, implying summer calf survival rates were relatively high and contributed to the growth of the herd (Lenart 2013).

Distribution and Movements

Calving Distribution. Distribution of calving in 2013 was different compared to previous years because spring persisted approximately 1 month longer in the eastern Brooks Range and on the eastern coastal plain. It appeared that some CAH calved along the way to the calving grounds, from the north side of the Brooks Range to the calving grounds (Fig. 3). Peak of calving was estimated 2.5 days later compared to the overall mean for the previous 16 years (Table 5). Calving distribution in 2014 was similar to where CAH calved during 2009–2012, such that the greatest concentration in Unit 26B West was in the headwaters of the Kachemach River and the Itkillik Hills, and in Unit 26B East, along the Kadlersohilik River, just east of Franklin Bluffs with calving occurring as far east as the Katakturuk River (Fig. 3; Lenart 2013).

Summer and Early Fall Distribution. In 2012 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.

In 2013 approximately 80% of CAH was east of the Sagavanirktok during postcalving, going as far east as the Canadian border in July and returning to west of the Canning River in early August. During late August and early September, CAH was mostly east of the road on the coastal plain between the Sagavanirktok and Canning Rivers. By the end of September, caribou were in the foothills of the Brooks Range near Accomplishment Creek and Ribdon River.

In 2014 caribou were distributed on the coastal plain between the Colville and Sadlerochit rivers with some caribou going into the foothills-mountains between the Sadlerochit and Kongakut rivers. By the middle of August, caribou were on the coastal plain, and by the end of August, caribou had moved back west and were distributed between the Colville and Canning rivers. Most of the herd east of the Dalton Highway had moved into the foothills by early September. Approximately 30% of the herd was on the west side of the Dalton Highway in early September and remained on the coastal plain until early October and migrated with Teshekpuk caribou south to the mountains, remaining west of the Dalton Highway. In most years CAH summer range extends from the Colville River to just east of the Katakturuk River and from the coast inland to the foothills. Postcalving 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 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, 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 early to mid-October.

Fall Distribution. During the rut in 2012, most of the caribou were on the north side of the Brooks Range in the upper Sagavanirktok and Lupine drainages. During the rut in 2013, most CAH were distributed between Bob Johnson and Ackerman Lakes and in the upper North Fork and upper Middle Fork Chandalar rivers. In 2014 most caribou were distributed between the upper North Fork Chandalar River, Your Creek, Middle Fork Chandalar, and Wind rivers. The proportion of CAH that migrated with the Teshekpuk caribou remained with TCH during rut and winter.

In general, during the rut in mid-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. During RY08–RY10 most of CAH were on the south side of the Brooks Range by mid-October, and in 2011 and 2012, most of CAH were on the north side of the Brooks Range during rut.

Winter Distribution. In RY12 most CAH were distributed between Twin Lakes and the upper North Fork and Middle Fork Chandalar rivers with some caribou as far east as the East Fork Chandalar River between the Wind and Junjik rivers. In RY13 most CAH caribou were distributed between Bob Johnson and Ackerman Lakes and further south into the northern part of the Hodzana Hills.

Since RY01 most of CAH (54–100%) wintered on the south side of the Brooks Range between the Dalton Highway and the East Fork Chandalar River, north of Hodzana Hills. However in RY07 only 2% of the herd wintered on the south side (Table 8; Lenart 2013). 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.

Mixing with Other Herds.

Teshekpuk Caribou Herd — In 2012 a small proportion of mixing occurred during summer, early fall, and rut. During winter RY12, 1–2 satellite radiocollared caribou wintered with CAH. During summer and fall 2013, no mixing with TCH occurred. However, a small proportion of TCH mixed with CAH during winter in RY13. During postcalving and summer 2014, 1–3 satellite radiocollared TCH remained within CAH summer range. In late summer-early fall 2014 a proportion of CAH remained on the coastal plain and migrated with TCH during rut and remained with TCH during winter for RY14.

Mixing with Teshekpuk caribou frequently occurs in both summer and winter because herd ranges overlap along the Colville River in summer and early fall in particular. Annually since 2004, 1–5 radiocollared TCH cows have calved with CAH. These animals frequently switch back and forth between the Teshekpuk and Central Arctic herds from year to year. In addition, near the Colville river drainage, some cow caribou calve between the Teshekpuk and Central Arctic core calving grounds or on the boundary of the summer ranges and may spend the summer with either herd.

Porcupine Caribou Herd — In summer 2012 a small amount of mixing occurred near the Canadian border. Mixing did not occur during rut because most of CAH was still north of the Brooks Range during rut in 2012. Mixing did not occur during winter 2012–2013 because most of PCH was in Canada.

In 2013 approximately 11% of PCH mixed with CAH during postcalving-early summer on the coastal plain between the Canning River and the Hulahula River. Substantial mixing occurred again during rut and early winter west of the East Fork Chandalar River. In 2014, substantial mixing occurred late winter-early spring west of the East Fork Chandalar River and again during postcalving-early summer on the eastern coastal plain near the Canning River. Some mixing occurred during rut. During winter RY14, substantial mixing occurred near the East Fork Chandalar River.

Mixing with PCH during fall and winter occurred frequently during RY01–RY11, except in RY09 (Lenart 2013). Mixing with PCH during summer (postcalving aggregations) in 2010 and 2011 occurred along the coastal plain between the Canning River and Kaktovik (Lenart 2013). Mixing during summer occurred less frequently during 2002–2009 (Lenart 2013).

Western Arctic Caribou Herd — No mixing occurred with WAH in 2013 or 2014. Mixing with WAH occurs occasionally during winter, most recently during RY11 when portions of the WAH, TCH, and PCH wintered with CAH on the south side of the Brooks Range, east of the Dalton Highway (Lenart 2013). 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 TCH and WAH occasionally mixed with CAH in fall and winter, and some of these animals may have been harvested and recorded as harvest from CAH.

<u>Season and Bag Limit (5AAC 85.025)</u>.

RY11–RY13 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 Unit 25D.	1 Jul–30 Apr; 10 caribou	1 Aug–30 Sep; 1 bull

Unit and location	Resident open season and bag limit	Nonresident open season and bag limit
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 Sep; 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. No regulatory changes were made to caribou seasons and bag limits within CAH range during RY11−RY13.

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 1 July–15 May. 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 1 July–15 May. This was a change for resident hunters from a bag limit of 2 caribou, and cow caribou could only be taken during 1 October–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 CAH.

Regulations in Unit 25A were also changed to increase harvest opportunity on the winter range of 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 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 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. Most of the harvest of CAH caribou occurs in Unit 26B, and all summaries related to harvest hereafter (unless otherwise noted) refers to harvest in Unit 26B.

In RY12, 1,430 hunters reported hunting and 722 hunters reported harvesting 1,007 caribou (50% success rate; Tables 9 and 10). In RY12, 522 hunters harvested 1 caribou, 143 hunters harvested 2 caribou each, 37 hunters harvested 3 caribou each, 12 hunters harvested 4 caribou each, and 8 hunters harvested 5 caribou each (Table 11).

In RY13, 1,423 hunters reported hunting, 616 hunters reported harvesting 854 caribou (43% success rate; Tables 9 and 10). In RY13, 433 hunters harvested 1 caribou, 143 hunters harvested 2 caribou each, 29 hunters harvested 3 caribou each, 7 hunters harvested 4 caribou each, and 4 hunters harvested 5 caribou each (Table 11). Reported harvest steadily increased beginning in RY04 (Table 9), but was <2% of the estimated CAH population level. Success rates in RY12 and RY13 were similar to previous years, and success by hunters who hunt 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 RY12, 1,126 Alaska residents reported hunting, and 533 resident hunters reported harvesting 771 caribou (47% success rate; Table 10). A total of 295 nonresidents reported hunting, and 188 of these reported harvesting 235 caribou (64% success rate). In RY13, 983 residents reported hunting, and 354 resident hunters reported harvesting 516 caribou (36% success rate; Table 10). A total of 424 nonresidents reported hunting, and 255 nonresident hunters reported harvesting 328 caribou (60% success rate). A small proportion of hunters were nonresidents (21% in RY12 and 30% in RY13; Table 10). Nonresidents took 23% and 38% of the harvest in RY12 and RY13 respectively.

Bowhunters accounted for 28% and 22% of the harvest in RY12 and RY13, respectively (Table 9). They accounted for an average of 26% of the harvest during the previous 5 years (RY09–RY13; Table 9). The success of bowhunters using the DHCMA is related to caribou distribution.

Reported harvest of cows during RY12 and RY13 was 275 and 131, respectively. Harvest of cows was higher beginning RY10 compared to previous years because the cow season was lengthened in RY10 (Table 9). Cow harvest is <1% of the herd and currently has no impact on herd growth.

During RY09–RY13, a range of 8–27 caribou were reported harvested in Unit 25A west of the East Fork Chandalar River during October through early May. CAH winters in this region and frequently mixes with PCH. All harvest in Unit 25A is reported in the PCH management report as harvest from PCH; however, some or all of the 8–27 caribou may have been CAH.

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 CAH, based on the timing and location of harvest and distribution of caribou (Braem et al. 2011). Additional local harvest of 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 RY12 (58%) and RY13 (54%), similar to previous years (Table 12). The remaining harvest occurred primarily in September (25% and 28%). In RY11 the number of caribou harvested in April was substantially higher (159) compared to 7–67 during RY00–RY10, RY12, and RY13. Some of this increase was likely due to a change in bag limit from 3 to 5 beginning in RY10 and was likely related to availability of caribou in Unit 26B in April. 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 and is made up of both Teshekpuk and Central Arctic caribou.

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 RY12 and RY13 the proportion of successful hunters who used highway vehicles to access caribou was 43% and 33%, respectively (Table 13). The proportion of successful hunters who used airplanes in RY12 was 32% and in RY13 was 40%. The proportion of successful hunters using airplanes increased beginning in RY07 (Table 13). The use of boats (including airboats), particularly in the Ivishak and Echooka drainages, to access caribou is also common, and the proportion of successful hunters who used boats and airboats combined averaged approximately 22% during RY09–RY13. Few hunters used horses, dogs, snowmachines, or all-terrain vehicles as a transport method (Table 13), except in RY11, when a higher proportion of caribou were harvested using dogs (6%) 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 CAH. During RY97–RY13, we determined minimum mortality rates of 4–33% among radiocollared cow caribou ≥1-year old (Table 14).

In RY12 we determined that 49 CAH females ≥1-year old were alive beginning 1 July 2012. During the regulatory year, we determined that 16 CAH female caribou ≥1-year old died. This resulted in a mortality rate of 33% for CAH females ≥1-year old for RY12. Additional mortalities included 3 adult females; 11 of 20 short yearlings (11-month-old calves) that were radiocollared in April 2013 died by 30 June 2013; and 5 adult males. Two yearling caribou that were collared in April 2012 were found dead with the Teshekpuk caribou and were assigned as Teshekpuk caribou. The spring of 2013 persisted approximately 1 month later than usual, and CAH experienced high mortality in adult females and 11-month-old calves immediately following the spring.

In RY13 we determined that 44 radiocollared CAH females ≥1-year old were alive beginning 1 July 2013. During the regulatory year, we determined that 10 radiocollared CAH female caribou ≥1-year old died. This resulted in a mortality rate of 23% for CAH females ≥1-year old for RY13. Additional mortalities included 1 adult female during recaptures; 2 of 22 short yearlings (11-month-old calves) that were radiocollared in April 2014; and 4 adult males (2 with TCH). Two 2-year-old caribou that were collared in April 2012 were found dead with the Teshekpuk caribou in October 2013 and were assigned as Teshekpuk caribou. One yearling caribou that had not been heard since captures in April 2013 was found dead with the Porcupine caribou and was assigned as Porcupine caribou. Similarly, a caribou radiocollared in 2008 and subsequently found with the Porcupine caribou was found dead this year with PCH and was assigned to PCH.

In RY14 we determined that 60 radiocollared CAH females ≥1-year old were alive beginning 1 July 2014. During the regulatory year, we determined that 12 radiocollared CAH female caribou ≥1-year old died. This resulted in a mortality rate of 20% for CAH females ≥1-year old for RY14. Additional mortalities included 4 males (2 were with the TCH), 4 females assigned to

PCH, 2 adult females captured in April 2015 that were dead in May 2015, and 1 11-month-old calf that was captured in April 2014 and dead by the end of June.

CONCLUSIONS AND RECOMMENDATIONS

High parturition rates, high early summer calf survival, and low adult mortality during 1998–2008 contributed to a population increase of approximately 12% annually in 10 years (Tables 1–4, 6, and 14). During 2008–2013 the population ceased increasing and may be slightly decreasing. The lower population size observed in 2013 was likely related to the late spring in 2013 when high mortality rates for adult and yearling females were observed. Distribution during calving and postcalving during 2002–2012 and 2014 was similar among years. In 2013 caribou calved further south likely because spring lasted approximately 1 month longer. During summers CAH was distributed mostly east of Prudhoe Bay, particularly near the Canning River, and further east in some years. 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 PCH occurs on the wintering grounds.

Reported harvest increased beginning in RY00 but remained <2% of the herd (Table 9). 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 29.5% of the overall harvest during RY00–RY13. 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. 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 56 and 41 bulls:100 cows during the most recent fall composition surveys in 2012 and 2014.

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 2013 the population was 50,753±9,829 caribou. This population size could provide for a harvest >1,400 caribou. 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 2012 the bull:cow ratio was 56 bulls:100 cows, and in

October 2014, the bull:cow ratio was 41 bulls:100 cows; noting that the 2014 data should be viewed with caution because of small sample size (n = 2,004) and potential mixing with PCH. 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 RY12–RY13.

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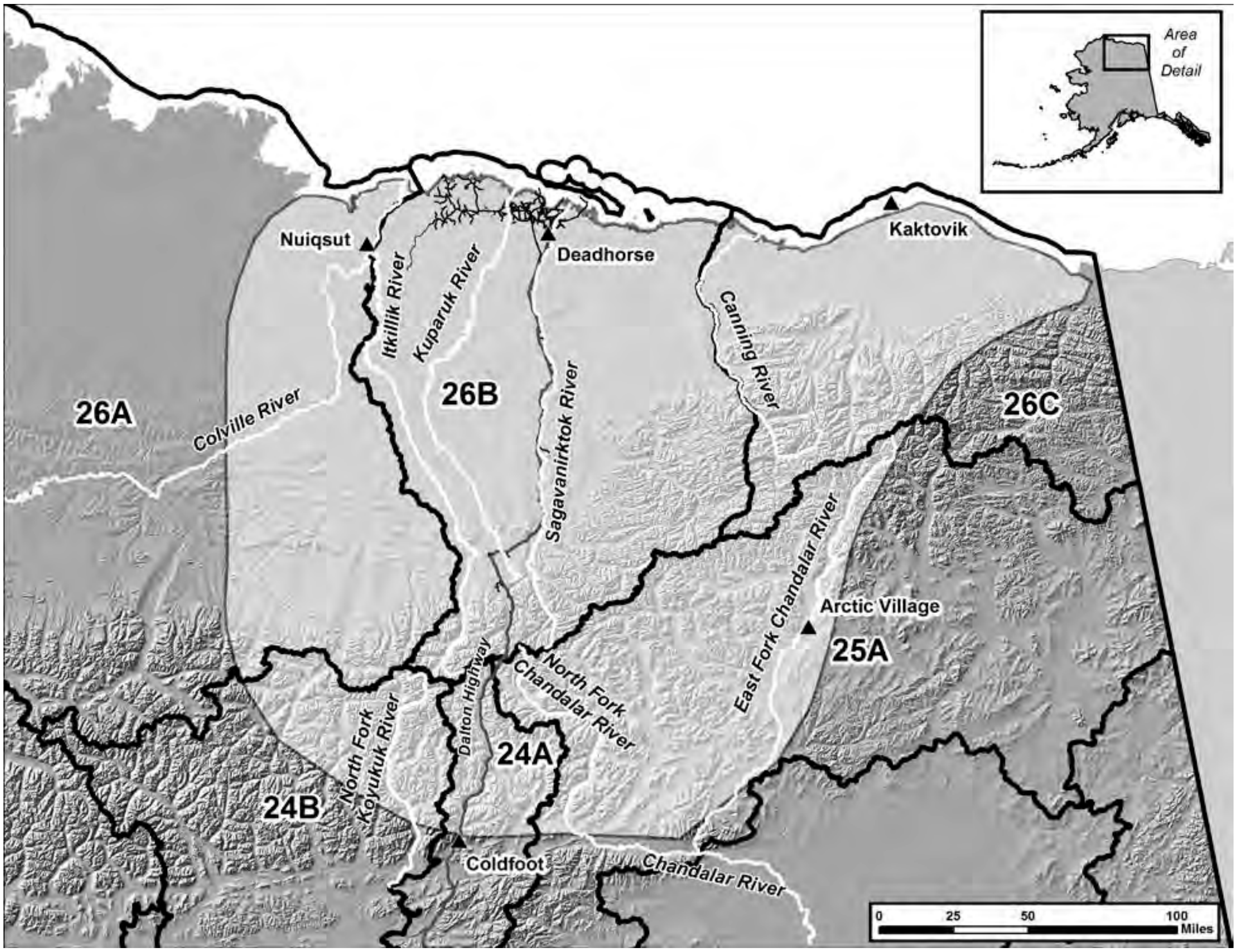


Figure 1. Range of the Central Arctic caribou herd, Alaska, 2006–2014.

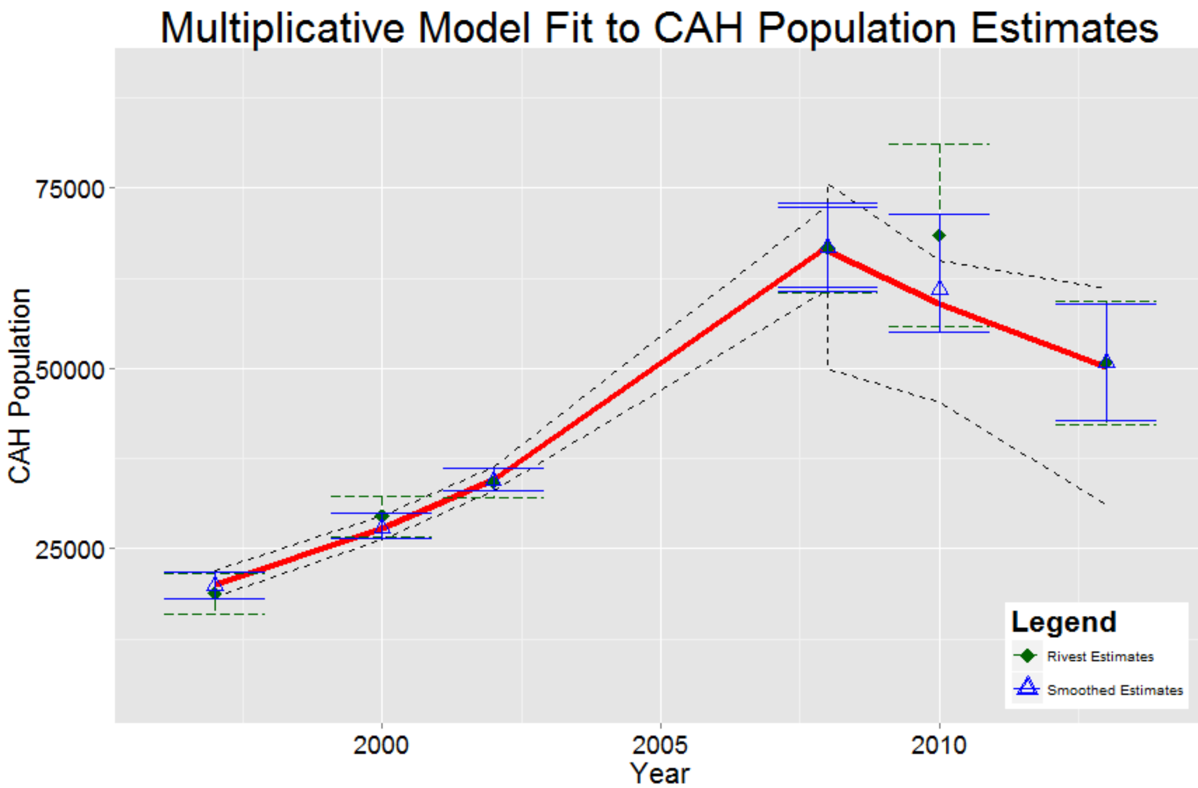
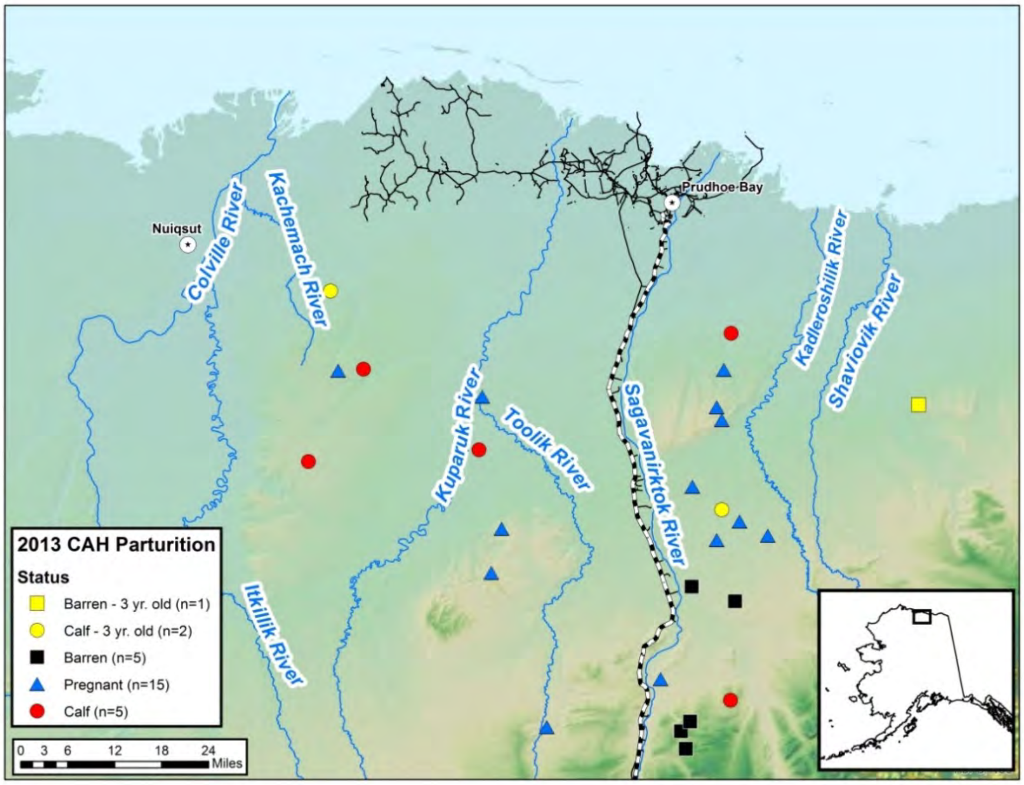


Figure 2. Central Arctic caribou (Alaska) population trend estimation derived from adjusted Rivest estimates and associated variances. A multiplicative mixed effects model fit using Bayesian methods was applied to estimate lambda during 1997–2008 and 2008–2013. Lambda is depicted by the trend line (solid thick line). The dashed error bar along the trend line represents a 95% credible interval. During 1997–2008 the 95% credible interval for lambda was 1.10–1.13 (point estimate = 1.12). During 2010–2013 the 95% credible interval was 0.85–1.01 (point estimate = 0.95). The solid error bars around the smoothed (triangle) estimates represents a 95% credible interval. The dashed error bars around the Rivest estimates (diamond) represents a 95% credible interval.



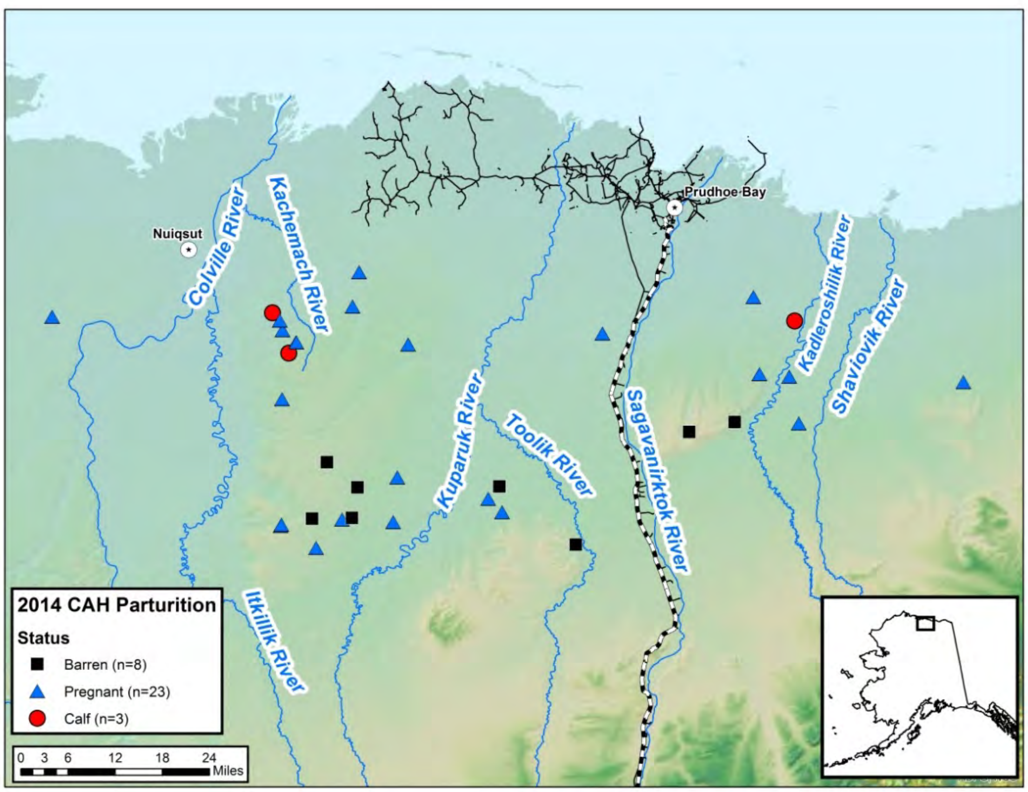


Figure 3. Locations of radiocollared Central Arctic caribou females ≥3-years old during calving 2–6 June 2013 (top) and 2–3 June 2014 (bottom), Alaska.

Table 1. Central Arctic herd estimated population size, Alaska, 1978–2013.

Year	Date	Method[a]	No. CAH[b] radio collars located (no. missing)	No. of groups photographed (located)[c]	No. of groups with radio collars	No. PCH[b] or TCH[b] radio collars (Est. no. caribou)	Minimum count[d]	Estimated population size (SE)[e]	Confidence interval (population range)
1978	Jul	STS	–[f]	unk	unk	unk	5,000		
1981	Jul	AC	–[f]	unk	unk	unk	8,537		
1983	21 Jul	APDCE	–[f]	unk	unk	unk	12,905		
1991	18–20 Jun	RSQS	unk	unk	unk	unk	n/a	19,046 (n/a)	90% (14,667–23,414)
1992	8–9 Jul	APDCE	unk	9 (10)	unk	unk	23,444		
1995	13 Jul	APDCE	unk	12 (42)	unk	unk	18,100		
1997	19–20 Jul	APDCE	41 (3)	22 (22)	12	0	19,730	18,824 (1,431)	95% (15,674–21,974)
2000	21 Jul	APDCE	81 (4)	22 (24)	22	0	27,128	29,519 (1,449)	95% (26,504–32,533)
2002	16 Jul	APDCE	76 (4)	9 (9)	9	0	31,857	34,211 (1,050)	95% (31,790–36,361)
2008	2–3 Jul	APDCE	62 (0)	14 (18)	12	2 PCH (3,379)	66,772	66,666 (3,206)	95% (59,609–73,722)
2010	9 Jul	APDCE	57 (2)	16 (18)	14	2 PCH (3,379), 2 TCH (1,916)	70,034	68,442 (6,420)	95% (54,571–82,312)
2013	4–5 Jul	APDCE	54 (0)	10 (12)	10	10 PCH (21,914)	70,364	50,753 (4,345)	95% (40,924–60,582)

[a] STS = systematic transect surveys; AC = aerial count; APDCE = aerial photo direct count extrapolation (Davis et al. 1979); RSQS = random stratified quadrat survey (Valkenburg 1993).

[b] CAH = Central Arctic herd; PCH = Porcupine caribou herd; TCH = Teshekpuk caribou herd.

[c] Groups located include single caribou.

[d] Minimum number of caribou observed during survey; may include caribou from other herds.

[e] In 1991, analysis used was Gasaway et al. 1986. During 1997–2013, analysis used was Rivest et al. 1998. In years that PCH or TCH caribou radio collars were present, we adjusted the "Rivest" estimate to account for PCH or TCH radio collars (E. A. Lenart, Wildlife Biologist, ADF&G memorandum [2013 Central Arctic caribou photocensus results], 8 Aug 2014, Fairbanks).

[f] No radio collars were deployed.

Table 2. Central Arctic caribou, Alaska, estimate of lambda at the 90% and 95% credible intervals derived from a multiplicative mixed effects model using Bayesian methods on adjusted Rivest estimates and their associated variances for years 1997–2008 and 2008–2013.

Time period (yr)	Point estimate of λ	LCI[a] 90%	UCI[b] 90%	LCI 95%	UCI 95%
1997–2008	1.116	1.103	1.128	1.100	1.131
2008–2013	0.9453	0.9004	0.9864	0.8561	1.011

[a] LCI = lower credible interval.
[b] UCI = upper credible interval.

Table 3. Central Arctic herd caribou percent parturition of radiocollared females, Alaska, 1997–2014.

		Percent parturition by unit for females ≥4-years old[a]			
		Unit		Unit 26B combined	Total
Year	Date(s)	26B West (*n*)	26B East (*n*)	±90% CI	(*n*)
1997	6 Jun	77 (13)	46 (13)	61 ±16.0	(26)
1998	3–4 Jun	93 (14)	83 (12)	88 ±10.5	(26)
1999	5, 9 Jun	94 (16)	92 (12)	93 ±8.2	(28)
2000	6–7 Jun	89 (9)	100 (16)	96 ±6.6	(25)
2001	3–9 Jun	90 (20)	93 (15)	91 ±7.9	(35)
2002	4–7 Jun	89 (27)	96 (23)	92 ±6.4	(50)
2003	30 May–8 Jun	93 (29)	100 (25)	96 ±4.3	(54)
2004	31 May–11 Jun	88 (40)	96 (28)	91 ±5.7	(68)
2005	31 May–9 Jun	86 (35)	80 (25)	83 ±8.0	(60)
2006	29 May–8 Jun	94 (32)	100 (22)	96 ±4.3	(54)
2007	2–6 Jun	88 (32)	100 (24)	93 ±5.7	(56)
2008	2–4 Jun	100 (26)	96 (20)	98 ±3.6	(46)
2009	1–3 Jun	74 (19)	76 (25)	75 ±10.9	(44)
2010	2–5 Jun	91 (11)	100 (26)	97 ±4.4	(37)
2011	2–4 Jun	83 (12)	96 (23)	91 ±7.9	(35)
2012	3, 7 Jun	83 (12)	100 (12)	92 ±13.4	(24)
2013	2–6 Jun	100 (9)	69 (16)	80 ±12.6	(25)
2014	2–3 Jun	77 (26)	75 (8)	76 ±8.2	(34)

[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 that were included in the ≥4-years old sample.

Table 4. Central Arctic caribou herd annual parturition rates and 5-year moving weighted average of proportion pregnant and late June calf:cow ratios for 3-year-olds, Alaska, 1999–2013.

	3-Year-old percent parturition				3-Year-old late June calf:cow ratios (calves:100 cows)	
Year	%	*n*	5-Year moving weighted average proportion pregnant ±95% CI	Total *n* in 5th year	Calves:100 cows ±90% CI	*n*
1999	100	7			33 ±34.6	6
2000	80	10			60 ±26.9	10
2001	77	13			38 ±23.0	13
2002	77	12			57 ±22.6	14
2003		0	82 ±12	42		0
2004	88	8	80 ±12	43		0
2005	86	7	81 ±12	40	40 ±40.3	5
2006	71	7	80 ±13	34	71 ±30.5	7
2007	100	4	85 ±14	26	75 ±41.1	4
2008		0	85 ±14	26		0
2009	60	5	78 ±17	23	60 ±40.3	5
2010	60	5	71 ±19	21	40 ±40.3	5
2011	50	4	67 ±22	18	50 ±47.5	4
2012	71	7	62 ±21	21	43 ±33.2	7
2013	75	4	64 ±19	25	50 ±47.5	4

Table 5. Estimated date of peak of calving[a] for Central Arctic caribou herd, Alaska, 1997–2014.

Year	Survey dates	Number of radiocollared parturient cows ≥3-years old	Estimated dates for peak of calving[b]	Point estimate for calving date[c]
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
2013	3–6 Jun	22	7–8 Jun	7.5
2014	2–3 Jun	26	4–6 Jun	5.0

[a] Peak of calving was defined as the date when 50% or more of the radiocollared parturient cows ≥3-years old gave birth.

[b] For years 2002–2006, radiocollared females were relocated daily or every 2–3 days until a calf was present (Arthur and Del Vecchio 2009). If observations of females determined parturient with no calf were followed by ones with a calf present, the range of days between observations was determined as the estimated date the females had calved. For years 1997–2000 and 2007–2014, 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 (Lenart 2013).

[c] The date of the point estimate was determined by deriving the midpoint between the estimated dates for peak of calving.

Table 6. Central Arctic herd caribou late June calf:cow ratios (calves:100 cows) of radiocollared females ≥4-years old, Alaska, 1997–2014.

		Late June calf:cow ratios (calves:100 cows) by unit for females ≥4-years old[a]			
		Unit		All Unit 26B	Total
Year	Date(s)	26B West[b] (*n*)	26B East (*n*)	±90% CI	(*n*)
1997	29–30 Jun	85 (13)	64 (11)	75 ±14.8	(24)
1998	29–30 Jun	79 (14)	80 (15)	79 ±12.6	(29)
1999	22–24 Jun	92 (13)	67 (12)	80 ±13.4	(25)
2000	17–19 Jun	79 (14)	72 (18)	75 ±12.8	(32)
2001	23–25 Jun	78 (18)	81 (16)	79 ±11.6	(34)
2002	23–25 Jun	78 (28)	83 (24)	81 ±9.1	(52)
2003	24–26 Jun	77 (26)	78 (27)	77 ±9.5	(53)
2004[c]	24 Jun	78 (27)	87 (17)	82 ±9.7	(44)
2005	24 Jun	77 (35)	61 (23)	71 ±9.7	(58)
2006	23–24 Jun	82 (22)	94 (33)	89 ±7.0	(55)
2007	22–23 Jun	87 (32)	71 (21)	81 ±8.9	(53)
2008	23–24 Jun	100 (3)	90 (42)	91 ±7.0	(45)
2009	23–24 Jun	56 (17)	48 (25)	52 ±12.8	(42)
2010	22–23 Jun	92 (12)	81 (27)	85 ±9.6	(39)
2011	20–21 Jun	80 (10)	75 (20)	77 ±12.9	(30)
2012	26–27 Jun	64 (11)	73 (15)	69 ±15.1	(26)
2013	26–27 Jun	60 (5)	55 (20)	56 ±16.7	(25)
2014	24–25 Jun	75 (24)	40 (10)	65 ±13.7	(34)

[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 7. Central Arctic caribou herd fall composition surveys, Alaska, 2009–2014.

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)
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)
13–14 Oct 2014[a]	41	42	23 (462)	55 (1,097)	22 (445)	2,004	15	18 (0)

[a] View data with caution. Originally 3,903 caribou were classified but we determined caribou may have been mixed with Porcupine herd caribou based on Porcupine caribou herd satellite radio collar locations. Therefore, only groups sampled west of the Middle Fork Chandalar River were included; reducing overall sample size substantially.

Table 8. Winter distribution of radiocollared Central Arctic herd (CAH) caribou south of the Brooks Range, Alaska, regulatory years[a] 2001–2013.

Regulatory year	Date(s) of radiotracking	Percent of CAH on south side of Brooks Range	Number of radio collars located
2001	29–31 Mar 2002	69	103
2002	26 Feb 2003	68	89
2003	15 Mar 2004	87	100
2004	11, 17 Mar 2005	60	111
2005	9 Mar 2006	54	76
2006	Mar 2007	60	54
2007	27 Mar 2008	2	43
2008	10–11 Mar, 7 Apr 2009	95	58
2009	29, 30 Mar, 18 Apr 2010	91	53
2010	8–9 Mar, 13 Apr 2011	94	50
2011[b]	Feb 2012	80	10
2012	28 Mar 2013	100	39
2013[b]	25 Mar 2014	94	17

[a] Regulatory year begins 1 July and ends 30 June (e.g., regulatory year 2001 = 1 July 2001–30 June 2002).
[b] No radiotracking flights of VHF radio collars 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 in 2012 and end of March in 2014 to capture winter distribution.

Table 9. Reported Central Arctic caribou herd harvest by sex and method of take, Alaska, regulatory years[a] 2000–2013[b].

Regulatory year	Reported harvest Male	Female	Unk	Total (harvest by bow)[c]	Total hunters	Percent successful hunters[d]
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	757	45	13	815 (224)	1,317	49
2010	978	234	26	1,238 (296)	1,622	54
2011	814	346	12	1,172 (330)	1,401	57
2012	726	275	6	1,007 (285)	1,430	50
2013	719	131	4	854 (190)	1,423	43

[a] Regulatory year begins 1 July and ends 30 June (e.g., regulatory year 2000 = 1 July 2000–30 June 2001).
[b] Source: Harvest ticket reports from Unit 26B in caribou database via ADF&G's Wildlife Information Network (WinfoNet).
[c] Harvest by bow is also included in total harvest.
[d] Percent successful hunters calculated by dividing successful hunters by number of total hunters.

Table 10. Reported Central Arctic caribou herd hunter residency and success, Alaska, regulatory years[a] 2000–2013[b].

Regulatory year	Successful hunters: Alaska resident	Successful hunters: Nonresident	Successful hunters: Unk	Successful hunters: Total (%)	Unsuccessful hunters: Alaska resident	Unsuccessful hunters: Nonresident	Unsuccessful hunters: Unk	Unsuccessful hunters: Total (%)	Total hunters[c]
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	461	175	6	642 (49)	574	87	8	669 (51)	1,317
2010	633	234	4	871 (54)	600	142	4	746 (46)	1,622
2011	594	194	6	794 (57)	511	81	9	601 (43)	1,401
2012	533	188	1	722 (50)	593	107	5	705 (49)	1,430
2013	354	255	7	616 (43)	629	169	5	803 (56)	1,423

[a] Regulatory year begins 1 July and ends 30 June (e.g., regulatory year 2000 = 1 July 2000–30 June 2001).
[b] Source: Harvest ticket reports from Unit 26B in caribou database via ADF&G's Wildlife Information Network (WinfoNet).
[c] Total hunters includes hunters who were not determined successful or unsuccessful.

Table 11. Number of caribou bagged and total caribou harvested by hunter residency, Central Arctic herd, Alaska, regulatory years[a] 2010–2013.

No. caribou harvested/ Hunter residency	Regulatory year 2010	2011[b]	2012	2013
1 caribou				
Resident	426	373	378	242
Nonresident	191	161	143	186
Total[c]	620	537	522	433
Total caribou harvest	620	537	522	433
2 caribou				
Resident	130	146	100	74
Nonresident	42	32	43	68
Total[c]	173	181	143	143
Total caribou harvest	346	362	286	286
3 caribou				
Resident	49	43	35	26
Nonresident	1	1	2	2
Total[c]	50	44	37	29
Total caribou harvest	150	132	111	87
4 caribou				
Resident	18	20	12	7
Nonresident	0	0	0	0
Total[c]	18	20	12	7
Total caribou harvest	72	80	48	28
5 caribou				
Resident	10	11	8	4
Nonresident	0	0	0	0
Total[c]	10	11	8	4
Total caribou harvest	50	55	40	20

[a] Regulatory year begins 1 July and ends 30 June (e.g., regulatory year 2010 = 1 July 2010–30 June 2011).
[b] One hunter harvested 6 caribou illegally.
[c] Total includes unknown residency.

Table 12. Reported Central Arctic caribou herd harvest chronology, Alaska, regulatory years[a] 2000–2013[b].

Regulatory	Harvest chronology by month (%)												
year	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May/Jun	Unk[c]	Total
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)	457 (56)	246 (30)	18 (2)	1 (<1)	0 (0)	1 (<1)	0 (0)	7 (<1)	61 (7)	3 (<1)	4	815
2010	24 (2)	793 (64)	275 (22)	47 (4)	11 (<1)	0 (0)	0 (0)	0 (0)	5 (<1)	57 (4)	19 (1)	7	1,238
2011	20 (2)	681 (58)	214 (18)	40 (3)	36 (3)	3 (<1)	2 (<1)	1 (<1)	2 (<1)	159 (13)	8 (<1)	6	1,172
2012	19 (2)	584 (58)	252 (25)	63 (6)	6 (<1)	0 (0)	2 (<1)	0 (0)	0 (0)	33 (3)	43 (4)	5	1,007
2013	10 (1)	461 (54)	241 (28)	79 (9)	6 (<1)	0 (0)	0 (0)	1 (<1)	3 (<1)	35 (4)	16 (2)	2	854

[a] Regulatory year begins 1 July and ends 30 June (e.g., regulatory year 2000 = 1 July 2000–30 June 2001).

[b] Source: Harvest ticket reports from Unit 26B in caribou database via ADF&G's Wildlife Information Network (WinfoNet).

[c] Includes the occasional animal reported taken illegally in May and June prior to regulatory year 2009.

Table 13. Reported Central Arctic caribou harvest by transport methods, Alaska, regulatory years[a] 2000–2013[b].

Regulatory year	Harvest by transport methods (%)								Total
	Airplane	Horse/Dog	Boat	Airboat	Snowmachine	4-Wheeler/ Other ORV[c]	Highway vehicle	Unk	
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	216 (26)	33 (4)	144 (18)	45 (5)	0 (0)	1 (<1)	364 (45)	12 (1)	815
2010	356 (29)	27 (2)	194 (16)	111 (9)	0 (0)	3 (<1)	517 (42)	30 (2)	1,238
2011	330 (28)	73 (6)	178 (15)	61 (5)	0 (0)	3 (<1)	505 (43)	23 (2)	1,172
2012	324 (32)	26 (3)	136 (14)	56 (6)	0 (0)	6 (<1)	436 (43)	23 (2)	1,007
2013	341 (40)	26 (3)	122 (14)	72 (9)	0 (0)	5 (<1)	278 (33)	10 (1)	854

[a] Regulatory year begins 1 July and ends 30 June (e.g., regulatory year 2000 = 1 July 2000–30 June 2001).
[b] Source: Harvest ticket reports from Unit 26B in caribou database via ADF&G's Wildlife Information Network (WinfoNet).
[c] ORV = off-road vehicles.

Table 14. Mortality rates of radiocollared cow caribou ≥1-year old, Central Arctic herd, Alaska, regulatory years[a] 1997–2014.

Regulatory year	Number of mortalities	Number of radio collars[b]	% Mortality
1997	2	44	4
1998	2	53	4
1999	7	53	13
2000	12	66	18
2001	4	64	6
2002	11	78	14
2003	7	75	9
2004	19	96	20
2005	8	77	10
2006	5	69	7
2007	7	64	11
2008	9	74	12
2009	9	65	14
2010	5	58	9
2011	10	58	17
2012	16	49	33
2013	10	44	23
2014	12	60	20

[a] Regulatory year begins 1 July and ends 30 June (e.g., regulatory year 1997 = 1 July 1997–30 June 1998).
[b] Number of radiocollared cow caribou ≥1-year old known to be alive at the beginning of the regulatory year.