Species Management Report and Plan ADF&G/DWC/SMR&P–2024–12

Fortymile Caribou Management Report and Plan, Game Management Units 20B, 20D, 20E, 20F, and 25C:

Report Period 1 July 2012–30 June 2017, and

Plan Period 1 July 2017–30 June 2022

Jeff Gross

2024

Alaska Department of Fish and Game Division of Wildlife Conservation

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Hunters are important founders of the modern wildlife conservation movement. They, along with trappers and sport shooters, provided funding for this publication through payment of federal taxes on firearms, ammunition, and archery equipment, and pay state hunting license and tag fees. These taxes and fees fund the federal Wildlife Restoration Program and the State of Alaska's Fish and Game Fund, which provided funding for the work reported on in this publication.

Species management reports and plans provide information about species that are hunted or trapped and management actions, goals, recommendations for those species, and plans for data collection. Detailed information is prepared for each species every 5 years by the area management biologist for game management units in their areas, who also develops a plan for data collection and species management for the next 5 years. This type of report is not produced for species that are not managed for hunting or trapping or for areas where there is no current or anticipated activity. Unit reports are reviewed and approved for publication by regional management coordinators and are available to the public via the Alaska Department of Fish and Game's public website.

This species management report and plan was reviewed and approved for publication by Jason Caikoski, Management Coordinator for Region III for the Division of Wildlife Conservation.

Species management reports and plans are available via the Alaska Department of Fish and Game's public website (www.adfg.alaska.gov) or by contacting Alaska Department of Fish and Game's Division of Wildlife Conservation, PO Box 115526, Juneau, AK 99811-5526; phone: (907) 465-4190; email: dfg.dwc.publications@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 Services (www.arlis.org). To subscribe to email announcements regarding new technical publications from the Alaska Department of Fish and Game, Division of Wildlife Conservation please use the following link: http://list.state.ak.us/mailman/listinfo/adfgwildlifereport.

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Purpose of this Report

This report provides a record of survey and inventory management activities for caribou (*Rangifer tarandus*) in Game Management Units 20B, 20D, 20E, 20F, and 25C for the 5 regulatory years 2012–2016 and plans for survey and inventory management activities in the next 5 regulatory years, 2017–2021. A regulatory year (RY) begins 1 July and ends 30 June (e.g., RY14 = 1 July 2014–30 June 2015). This report is produced primarily to provide agency staff with data and analysis to help guide and record agency efforts but is also provided to the public to inform it of wildlife management activities. In 2016 the Alaska Department of Fish and Game's (ADF&G, the department) Division of Wildlife Conservation (DWC) launched this 5-year report to report more efficiently on trends and to describe potential changes in data collection activities over the next 5 years. It replaces the caribou management report of survey and inventory activities that was previously produced every 2 years.

I. RY12–RY16 Management Report

Management Area

The Fortymile caribou herd (FCH) range includes portions of the upper Fortymile, Tanana, and Yukon river drainages in both Alaska and Yukon, Canada. This area includes the Charley, Fortymile, Salcha, Goodpaster, Chena, and Ladue rivers; and Beaver, Birch, and Shaw Creek drainages primarily between the Tanana River and the south bank of the Yukon River, including Game Management Units (Units) 20B, 20D, 20E, 20F, and 25C. Since 2012, the Fortymile caribou herd has ranged over a 42,128 mi^2 from the White Mountains area north of Fairbanks, east to the Stewart and White River drainages southeast of the City of Dawson, Yukon Territory, Canada (Fig. 1).

Summary of Status, Trend, Management Activities, and History of Fortymile Caribou in Units 20B, 20D, 20E, 20F, and 25C

The Fortymile caribou herd (FCH) is important for consumptive and nonconsumptive uses in Interior Alaska and southern Yukon Territory, Canada. 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. During 1973–1976, the population was estimated at 5,740–8,610 animals (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).

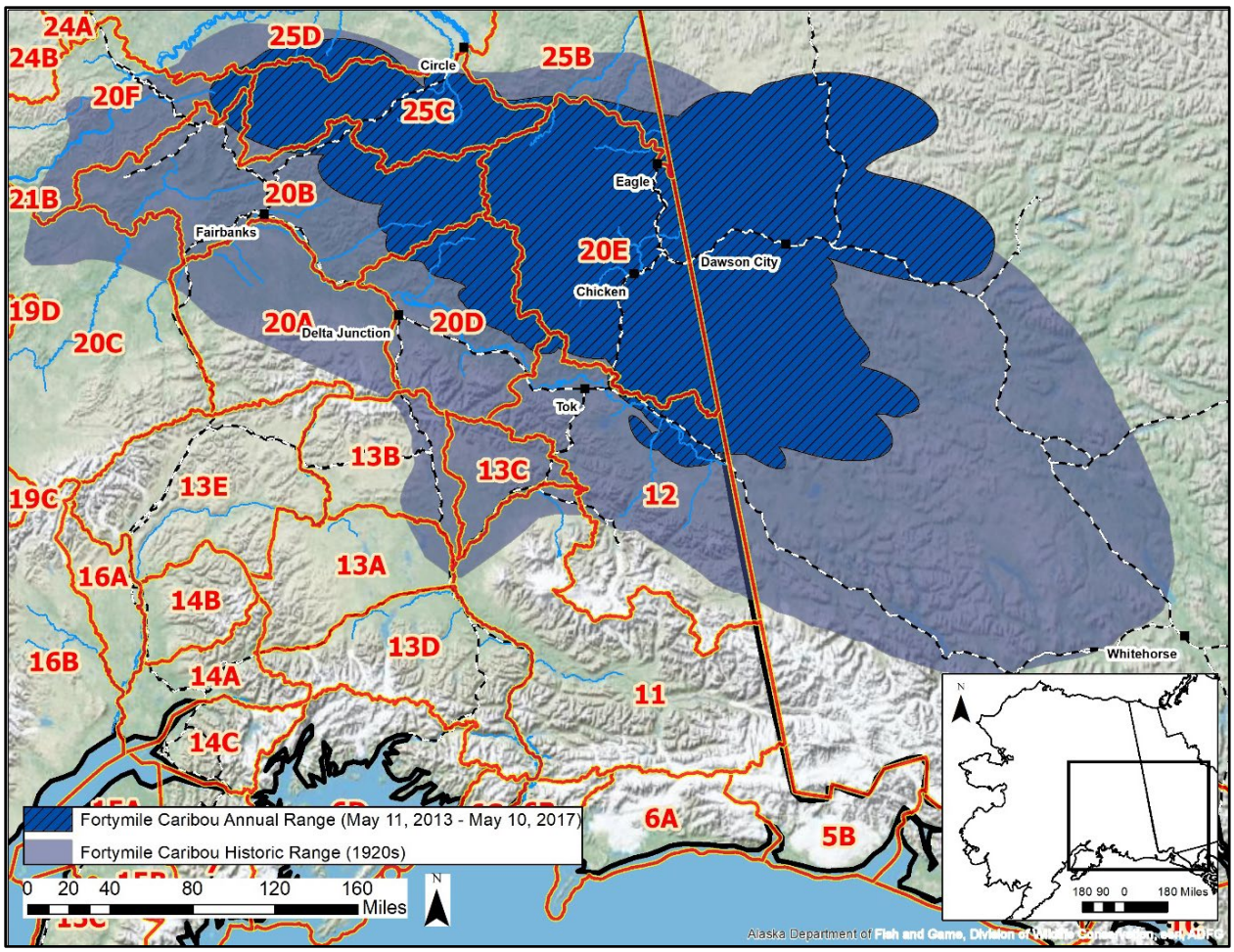


Figure 1. Annual range of the Fortymile caribou herd based on GPS locations from 2013–2017, in Game Management Units 12, 20B, 20D, 20E, 20F, 25B, 25C and 25D, Alaska.

During this decline, the herd's range size and seasonal migration patterns changed. 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 and stopped crossing north of the Yukon River.

Based on photocensus minimum counts, the population began a steady increase after 1976, likely in response to favorable weather conditions, reduced harvests, and a natural decline in wolf numbers (Fig. 2, Table 1). By 1990 the herd was estimated at 22,766 caribou. During 1990–1995, the herd remained relatively stable at about 22,000 caribou. During this time population growth stabilized, which could be due to high adult mortality, an unusually low pregnancy rate in 1993, and low-to-moderate calf survival (Boertje and Gardner 2000). To benefit FCH, ADF&G conducted nonlethal wolf control during RY97–RY00, and lethal wolf control during RY06–RY16; both efforts were in combination with public wolf trapping. In July of 2017, a successful photocensus survey was completed which resulted in a modeled population estimate of 83,659 (±2713.6 standard error [SE], 95% confidence interval [CI] = 78,138–89,180) based on a photocensus minimum count adjusted for missing caribou using a technique developed by Rivest et al. 1998 (Fig. 2). FCH experienced an average 6% annual rate of increase during 2009–2017

(Fig. 3). This is the highest population estimate ever recorded for the herd, based on results of an aerial photo census survey.

Table 1. Fortymile caribou herd Rivest (1998) abundance estimates with 95% confidence intervals and minimum counts, 1973–2017, Alaska.

		95% Confidence interval		
Year	Rivest estimate	Lower limit	Upper limit	Minimum count
1973	–	–	–	6,000
1974	–	–	–	6,000
1975	–	–	–	6,000
1981	–	–	–	10,093
1983	–	–	–	12,350
1984	–	–	–	13,402
1986	–	–	–	15,303
1988	–	–	–	19,975
1990	–	–	–	22,766
1992	–	–	–	21,884
1994	–	–	–	22,104
1995	–	–	–	22,558
1996	–	–	–	23,458
1997	–	–	–	25,910
1998	–	–	–	31,029
1999	–	–	–	33,110
2000	–	–	–	34,640
2003	–	–	–	43,375
2009	49,941	44,373	55,511	46,510
2010	56,443	49,447	63,441	51,675
2011	–	–	–	–
2012	–	–	–	–
2013	–	–	–	–
2014	–	–	–	–
2015	–	–	–	–
2016	–	–	–	–
2017	83,659	78,138	89,180	73,009

Note: En dashes indicate data not available.

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, Canada. During the late 1970s and 1980s, Alaska's hunting regulations for Fortymile caribou were designed to benefit subsistence hunters and prevent harvest from limiting herd growth. Bag limits, harvest quotas, and season openings tailored to

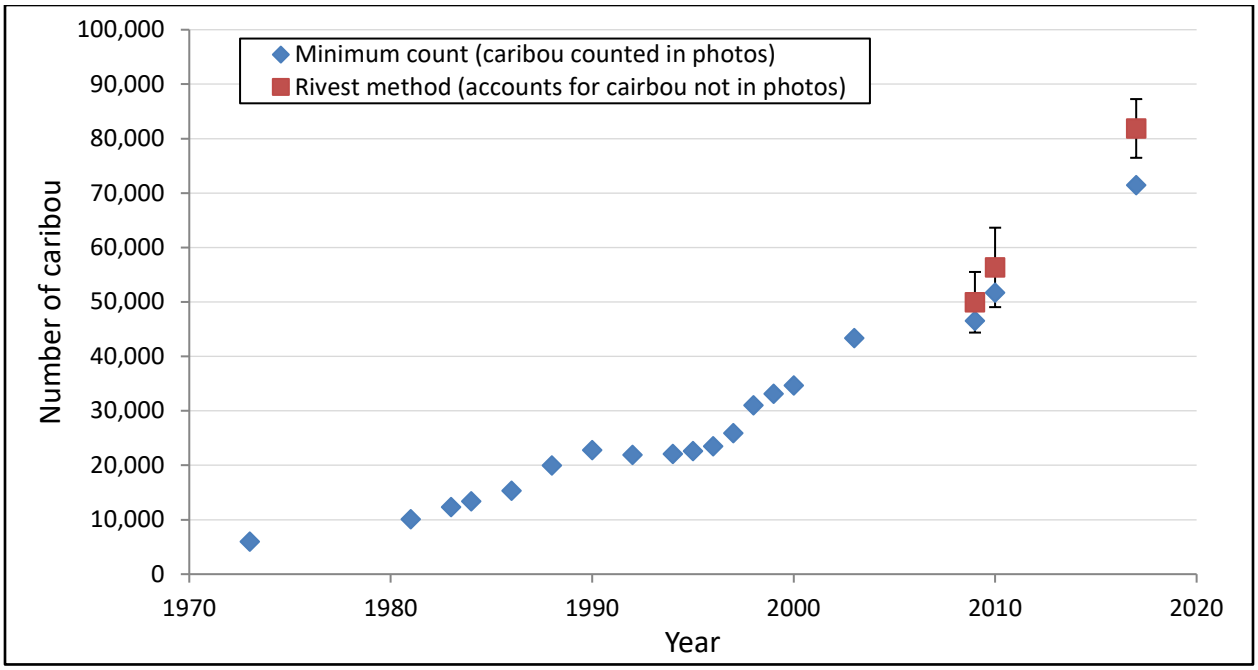


Figure 2. Population size of the Fortymile caribou herd from 1973 to 2017. Data from 1973 to 2017 include minimum counts for all years, and estimated abundance and associated 95% confidence intervals for 2009, 2010, 2017, and 2022, which was derived from photocensus minimum counts and modeling (Rivest et al. 1998).

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, U.S. federal agencies, and Yukon Department of Renewable Resources work with the public to develop a management plan for FCH.

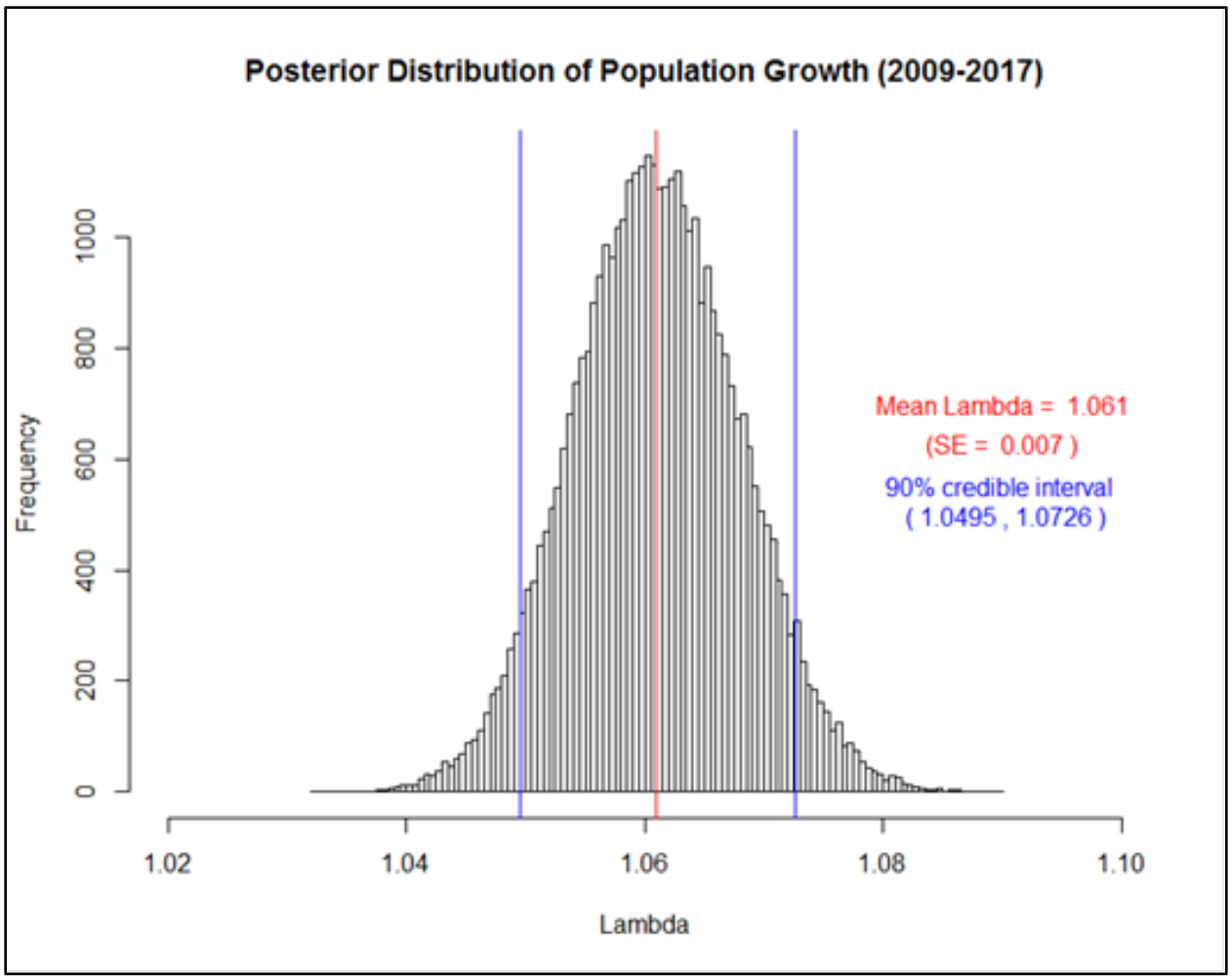


Figure 3. Histogram of the posterior distribution of Fortymile caribou herd growth from 2009–2017 using a simple exponential growth model fit to the 2009–2017 estimates, including their intra-survey uncertainty, using Bayesian methods to estimate annual growth rate (λ; lambda).

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 rivers) 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.

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.

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 guides regulatory development and implementation during RY12–RY18.

Historical information on FCH distribution, movements, biological monitoring, and harvest are reported in Gross (2005, 2007, 2009, 2011, 2013, 2015), Gardner (2001, 2003).

Management Direction

Existing Wildlife Management Plans

The plan section of this document outlines the current plan for FCH in Units 20B, 20D, 20E, 20F, and 25C. In addition, the Fortymile Caribou Herd Harvest Plan 2012–2018 outlines the recommendations developed by the public Harvest Management Coalition that is currently used to help guide harvest of the herd (Harvest Management Coalition 2012). Previous management

direction has been documented in the Fortymile caribou herd management reports of survey and inventory activities and can be found in Gross (2011, 2013, 2015).

GOALS

G1. 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.

CODIFIED OBJECTIVES

Amounts Reasonably Necessary for Subsistence Uses

Customary and traditional use and amounts reasonably necessary for subsistence uses (5 AAC 99.025) include the following for FCH:

C1. The Fortymile caribou herd has a positive finding for customary and traditional use of caribou in Units 12, 20D, 20E, 25C and an amount reasonably necessary for subsistence uses of 350–400 caribou.

Intensive Management

Fortymile caribou are identified as important for providing high levels of harvest for human consumptive use. Population and harvest objectives (5 AAC 92.108) were established by the Alaska Board of Game in 2000 and are as follows:

C2. Population Objective: 50,000–100,000 caribou.

C3. Harvest Objective: 1,000–15,000 caribou.

MANAGEMENT OBJECTIVES

M1. 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.

M2. Manage for a herd size of 50,000–100,000 unless nutrition indices indicate a lower sustainable limit.

M3. Manage the herd to sustain an annual harvest of 1,000–15,000 caribou.

M4. Maintain an October bull-to-cow ratio of at least 35:100.

MANAGEMENT ACTIVITIES

1. Population Status and Trend

ACTIVITY 1.1. Conduct caribou captures annually (objectives C1–C3, M1–M4).

Data Needs

Collars deployed on female and male caribou are critical for management of the Fortymile caribou herd. Having an adequate collared sample enables DWC biologists to conduct photocensuses and fall composition surveys. Survey data is then used to estimate population abundance; annual survival, parturition rates, and calving rates; and monitor hunting and seasonal distribution. In addition, calves are weighed during captures and fall weights of female calves-of-the-year are one of the indices used to evaluate nutritional status of the herd (Boertje et al. 2012).

Methods

Collars are deployed annually on FCH via chemical immobilization capture in October, March, and April. Captures were conducted using methods described in the ADF&G Division of Wildlife Conservation 2015 Caribou Capture Protocol located on ADF&G's internal DWC SharePoint site. A total of 35 female calves-of-the-year are collared annually (20 in fall and 15 in spring) to collect biological information and deploy radio collars to maintain an adequate sample size of known-age female caribou for each cohort in the herd. Short yearlings and adult females are recollared throughout their life every 3–5 years to maintain a known-age sample of 110 radiocollared females including a minimum of 20 satellite Global Positioning System (GPS) and 90 very-high frequency (VHF) collars. This allows an approximation of the age structure of the herd and ensures that all female cohorts are represented in the collared sample. Specific capture methodologies used during the report period were approved by the DWC Institutional Animal Care and Use Committee and are described in IACUC Protocol numbers 2012-034, 2013-13, 2015-03, 2016-10 and 2017-02.

Captures were conducted annually during the first 3 weeks of October and again in late March or early April to deploy collars. During October, between 4- and 5-month-old female calves are captured to deploy collars and collect weights to help assess nutritional condition of the herd.

Results and Discussion

In an effort to maintain desired sample sizes during the report period, 105 (all GPS), 181 (all VHF), and 41 (7 VHF, 34 GPS) collars were deployed on adult females, short yearling females, and adult males, respectively. Since RY12, there has been an emphasis to convert most of the VHF collars on adult caribou to GPS collars. The primary benefits of GPS collars compared to VHF collars include fewer radiotracking flights needed to locate individuals, known date and location of mortalities, and access to frequent location data. GPS location data provide movement data in real-time which informs hunt management and also enables a more robust analyses of distribution, movements, and vital rates.

Fall calf weights have been collected annually on the Fortymile caribou herd since 1990 (Table 2). During October 2012–2016 average annual calf weights ranged from 49.1–56.2 kg (109.1–

124.8 lbs; Table 2). Boertje et al. (2012) reported that declining nutritional status in the Fortymile herd was evidenced by the significant decline in calf weights from 1990–2010 (*P-value [P-val]* = 0.02, R^2 = 0.24). The declining trend in fall calf weights continued through fall of 2016 (0.12 kg per year (0.26 lbs per year), *P-val* = 0.08, 1990–2016; Fig. 4) further suggesting nutritional stress in the herd. However, the relationship between changes in fall calf weight and nutritional condition, productivity, survival, or herd trajectory is not well established in the literature. These investigations are ongoing

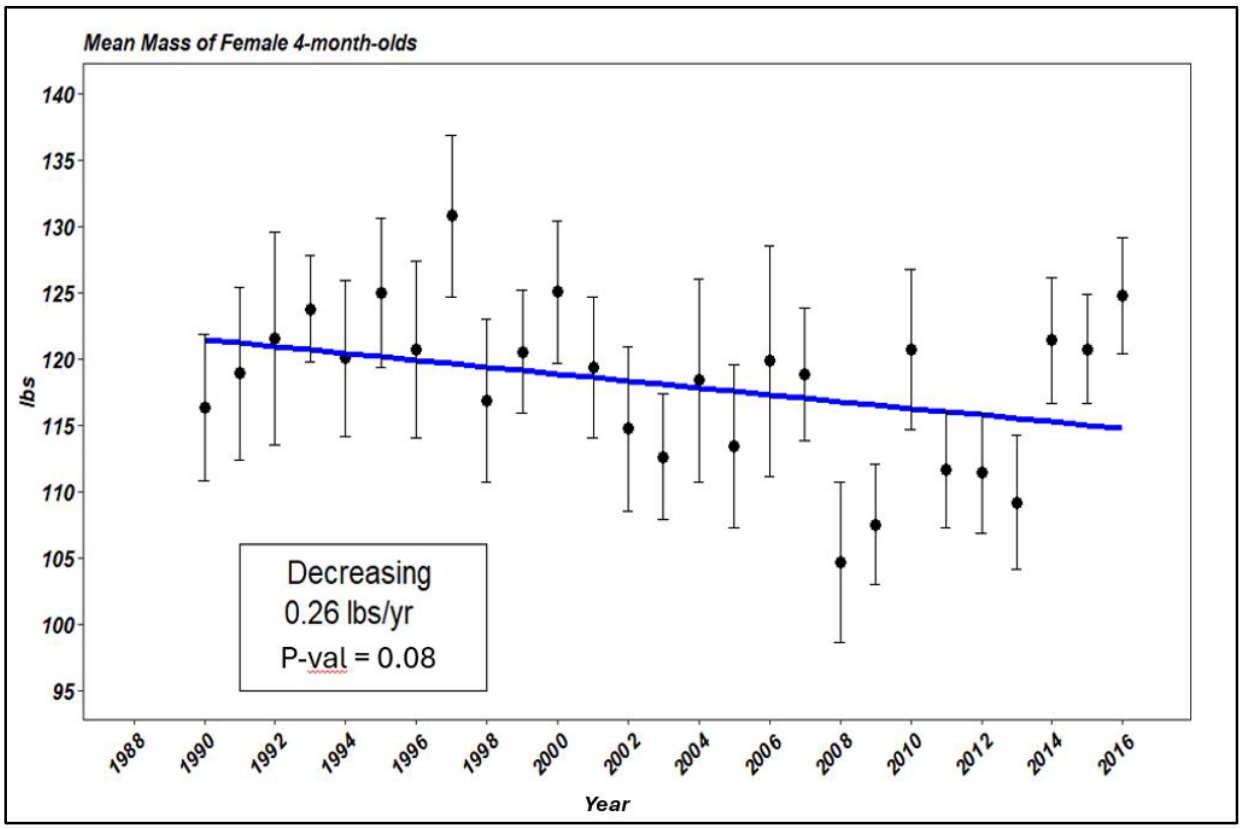


Figure 4. Trend analysis of female calf weights (lbs) at 4 months of age with 95% confidence intervals, Fortymile caribou herd, 1990–2016, Alaska. *Note*: Annual sample sizes ranged from 14 to 26 (mean *n* = 17.3). The linear mixed effects model indicated a significant linear decrease of 0.26 lb per year (±0.14 SE, *t*(25) = −1.823, *P-val* = 0.08).

Recommendations for Activity 1.1

Continue collaring efforts with an emphasis on increasing the proportion of GPS collars in the herd, including maintaining a sample of GPS collars on bulls. This will allow managers to monitor herd movements and mortality rates and ensure that enough collars are deployed on each cohort of female calves. Having an adequate sample size of collared, 3-year-old cows during annual parturition surveys during their first year of reproduction allows managers to meet the data needs for activities 1.2–1.5. Continue collecting fall weights of female calves as an index to assess herd nutrition.

Table 2. Four-month-old fall calf weights in pounds collected from Fortymile caribou during 1990–2016, Alaska.

	No. of calves		95% Confidence interval	
Year	(*n*)	Mean (lbs)	Lower limit	Upper limit
1990	14	116.3	110.8	121.8
1991	14	118.9	112.4	125.4
1992	14	121.5	113.5	129.5
1993	15	123.8	119.7	127.8
1994	14	120.0	114.2	125.9
1995	15	125.0	119.4	130.6
1996	14	120.7	114.0	127.4
1997	15	130.7	124.7	136.8
1998	17	116.9	110.7	123.0
1999	15	120.5	115.9	125.2
2000	15	125.0	119.7	130.4
2001	17	119.3	114.1	124.6
2002	15	114.7	108.5	120.9
2003	18	112.6	107.9	117.3
2004	16	118.4	110.7	126.0
2005	16	113.4	107.2	119.6
2006	14	119.8	111.1	128.5
2007	15	118.8	113.8	123.8
2008	15	104.6	98.6	110.6
2009	18	107.5	103.0	112.0
2010	18	120.7	114.6	126.7
2011	26	111.6	107.3	116.0
2012	25	111.4	106.9	115.9
2013	18	109.2	104.1	114.2
2014	25	121.4	116.7	126.2
2015	25	120.7	116.6	124.9
2016	24	124.8	120.4	129.2

ACTIVITY 1.2. Photocensus and abundance estimates (objectives C1–C3 and M1–M3).

Data Needs

Estimates of abundance, via the photocensus technique, are the primary metric for monitoring herd status. These data are needed to determine annual harvest quotas and evaluate population size and harvest in relation to objectives. Regular measures of population size also provide regulatory boards and Advisory Committees with biological data used in making informed decisions and recommendations.

Methods

Photocensus surveys of FCH were conducted using the modified aerial photo-direct count extrapolation (APDCE) technique (Davis et al. 1979, Valkenburg et al. 1985). This technique required monitoring postcalving aggregations by radiotracking collared caribou from mid-June

through mid-July. Aggregations of sufficient quality to conduct a photocensus typically occurred when temperatures were >55°F at 5,000 feet, and wind speed was <8 mph, presumably in response to insect harassment (Davis et al. 1979, Valkenburg et al. 1985).

In 2017, groups of caribou were photographed from a DeHavilland DHC-2 Beaver aircraft with a customized, digital-aerial-camera system. Small groups of caribou were photographed with handheld cameras or visually estimated by pilot observer teams in Piper PA-18 or similar aircraft. The digital-camera system in the Beaver was composed of 3, medium-format 100-megapixel cameras with 2 of the cameras oriented obliquely and 1 at nadir. Target altitude for photography is 1,500 feet above ground level (AGL). All cameras are contained within a rigid insert which is attached to a gyrostabilized mount. The system is instrumented with a differential GPS and inertial measurement unit (IMU) to record position and attitude (pitch, roll, and yaw). Customized flight management software running on a laptop computer controls the cameras and navigation system and allows the pilot and camera operator to see footprints of the imagery in real time as well as inspect thumbnails of each image as they are captured.

Flight data from the GPS and IMU are post processed using differential correction or precise point positioning (PPP) depending on the proximity to continually operating reference stations (CORS). Images are individually inspected and adjusted for exposure before being exported from raw format. Exterior orientation information (position, elevation, and attitude) and imagery are then processed through photogrammetry software using automated tie-point extraction and bundle adjustment to produce digital terrain models which are then used to orthorectify individual images. Once orthorectification is completed, the oblique and nadir orthophotos are mosaicked separately.

Enumeration of caribou from image mosaics occurs within geographic information system (GIS) software and uses a customized tool which allows users to count and classify caribou by placing colored points on each animal. Point data are stored in file geodatabases and archived. Minimum population size was the summation of the total number of caribou enumerated from digital photographs, and caribou that were visually estimated.

In 2017, an estimate of abundance and a measure of uncertainty was conducted using a method described by Rivest et al. (1998). The estimator is based on a 2-phase sampling design. Phase 1 uses the distribution of collared caribou among groups of known size to estimate the number of caribou in groups without collared caribou. Phase 2 uses a Horvitz–Thompson estimator and the proportion of active collars detected to expand the herd size from phase 1 to account for caribou represented by collars not located during the survey. Rivest et al. (1998) describes 3 detection models for use in phase 2. Of these models, the homogeneity method has been most frequently applied (Couturier 1996, Patterson et al. 2004) and is best suited for our data. This model assumes that all active collars are identified in observed groups and that unobserved groups with collared caribou are missed because they are outside of the surveyed area. It is important to note that phase 2 calculations are not necessary if all collars are located and associated groups are counted. Also, the consequences of not meeting the assumptions of phase 2 are greatly mitigated when a high proportion of the active collars are detected and associated groups counted. Finally, this estimator assumes a random distribution of collars among caribou and, therefore, that the number of collars in each group is Poisson distributed. A score test for overdispersion described in Rivest et al. (1998) was used to evaluate this assumption.

Annual growth rate from 2009–2017 was estimated using a simple exponential growth model fit to the 2009–2017 abundance estimates, including their associated intra-survey uncertainty, using Bayesian methods.

Results and Discussion

Photocensus surveys were attempted each year during the RY12–RY16 report period but were unsuccessful in all years. Inadequate weather conditions resulting in poor herd aggregations and insufficient light and visibility for taking adequate quality photographs of aggregations to count individual caribou resulted in these failed attempts. However, a successful photocensus was completed 6-days after the end of this report period, in RY17.

On 6 July 2017, we completed a photocensus of FCH. The photocensus included 190 of the 202 active collars deployed on FCH caribou. The remaining 12 collars were not located on the day of the census but were assumed to be active and outside the survey area. Collar distribution resulted in a total of 34 groups that contained active radio collars, 3 groups that did not contain collared caribou and 12 single collared caribou that were not associated with a group. In total, 37 groups were identified and photographed, or hand counted. Enumeration of all caribou on photographs and those hand counted, resulted in a minimum count of 73,009 caribou. All photos were counted twice to minimize human error (i.e., ensure counters were correctly identifying caribou in the photos) and improve precision.

Using Rivest et al.'s (1998) method, including the homogeneity model in phase 2 calculations to expand the estimate for nonphotographed collars, the abundance was estimated to be 83,659 (±2,713 SE; 95% CI = 78,138–89,180) caribou. Our assumption of a random distribution of collars in the survey was supported (*P-val* = 0.43; Table 3).

From 2009 to 2017 lambda averaged 1.061 (±0.007 SE) and was significantly different from 1 at the 90% credible interval (90% CrI = 1.0495–1.0726; Figs. 3 and 5). This estimated growth rate is similar to the long-term average annual growth rate reported by Boertje et al. (2012) during 1973–2010 of 6% ($\lambda = 1.062$; $R^2 = 0.9656$).

Recommendations for Activity 1.2

Continue with the use of digital photography. Utilize memoranda to archive details of future surveys.

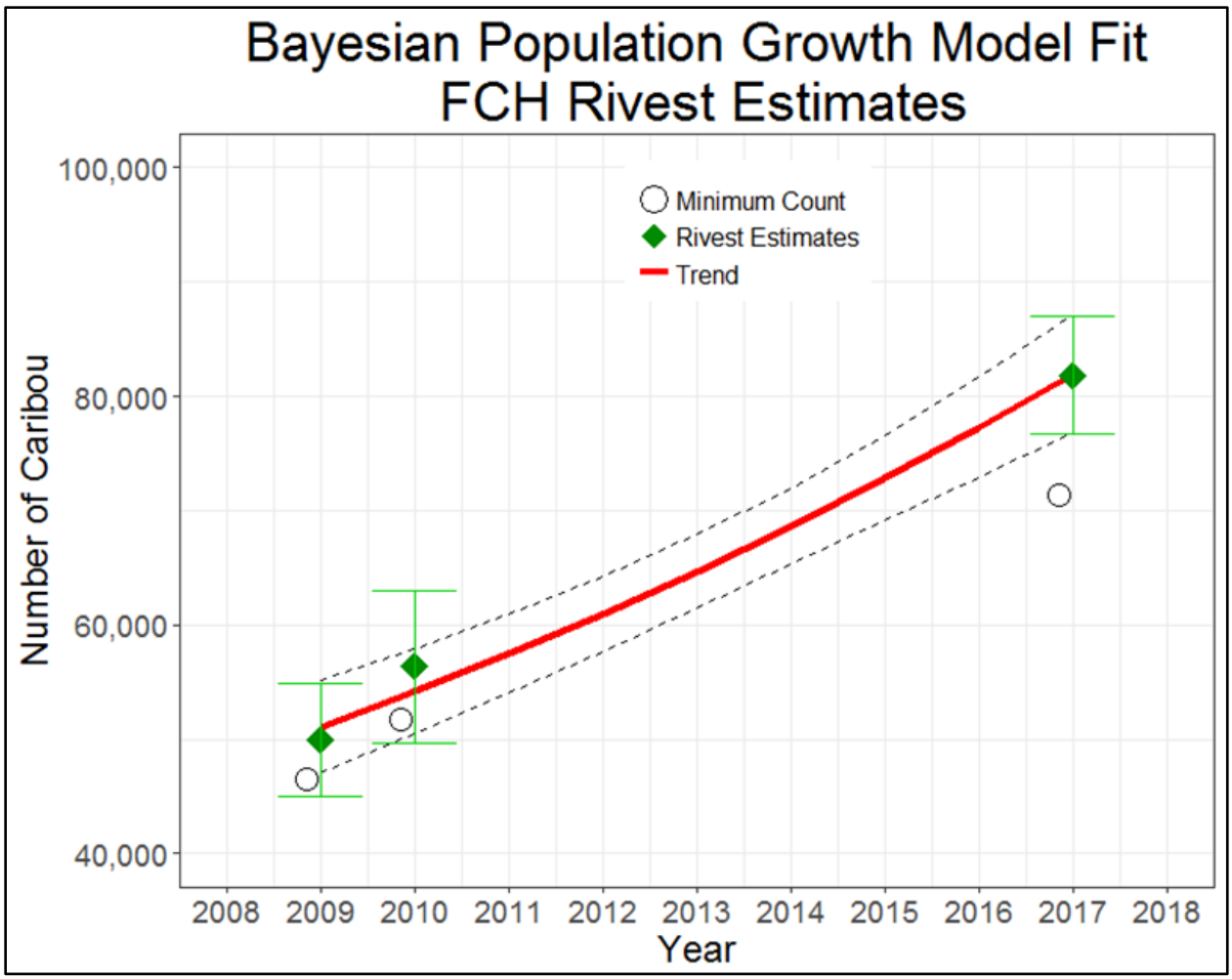


Figure 5. Population size of the Fortymile caribou herd (FCH) from 2009 to 2017, Alaska. Estimated abundance and associated 95% confidence intervals in 2010, 2010, and 2017 were derived from photocensus minimum counts and modeling (Rivest et al. 1998).

Table 3. Abundance estimate statistics from the 2009, 2010 and 2017 photocensus surveys of the Fortymile caribou herd, Interior Alaska.

Year	Statistic	Value
2009	Located and photographed collars	69
	Nonphotographed collars	3
	Minimum count from all groups	46,510
	Count from groups with located collars	43,230
	Rivest abundance estimate	49,941
	Standard error	2,530
	95% Confidence Interval	44,373–55,510
	Test of randomness P-value (P-value >0.05 fails to reject randomness)	0.518
2010	Located and photographed collars	78
	Nonphotographed collars	4
	Minimum count from all groups	51,675
	Count from groups with located collars	47,473
	Rivest abundance estimate	56,342
	Standard error	3,376
	95% Confidence Interval	49,047–63,636
	Test of randomness P-value (P-value >0.05 fails to reject randomness)	0.058
2017	Located and photographed collars	190
	Non-photographed collars	12
	Minimum count from all groups	73,009
	Count from groups with located collars	71,437
	Rivest abundance estimate	83,659
	Standard error	2,713
	95% Confidence Interval	78,138–89,180
	Test of randomness P-value (P-value >0.05 fails to reject randomness)	0.43

ACTIVITY 1.3. Monitor collared caribou throughout the year to determine seasonal distribution, mortality rates, and proximity to highways during hunting seasons (objectives C1–C3, M1–M4).

Data Needs

Seasonal distribution and proximity to highways during hunting seasons

Monitoring seasonal herd distribution allows managers to evaluate animal density and timing of use on seasonal ranges. These data enable managers to evaluate the potential impacts on their range when there are high densities of caribou, and whether range quality is limiting herd size through reduced caribou nutrition (Boertje et al. 2012).

Proximity of FCH to highways plays a significant role in harvest management. High harvest can occur for short periods of time when the herd approaches or crosses highways in the FCH hunt area during hunting seasons. An adequate number of VHF and GPS collars on the herd is needed to allow managers to monitor herd movements in relation to highways and associated trail systems throughout the hunting season. These location data are used by managers to implement inseason management actions in a timely manner to ensure harvest objectives are not exceeded.

Mortality rates

Annual survival rates are sensitive biological parameters for assessing population growth or decline and nutritional status of the herd. Estimates of annual survival provide an important demographic parameter to model population trajectory and abundance in years when herd size is not estimated via photocensus.

Methods

Seasonal distribution and proximity to highways during hunting seasons

We obtained seasonal herd distribution, movements, and estimates of annual mortality by monitoring approximately 100–160 cows fitted with VHF and satellite (GPS) 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, November, 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.

Mortality Rates

Annual survival is estimated from collared caribou using known-fate models. Annual survival for adult females, adult males, yearling females, and calves are conducted separately and are reported with 95% confidence intervals. Simple annual survival is calculated from 15 May through 14 May in a given year for yearling and adult caribou. Collared animals are not included until the following May-May interval, given that they survive until May 15.

Results and Discussion

Seasonal Distribution and Proximity to Highways During Hunting Seasons

Beginning in 2001, the herd expanded its range, 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 and winter of 2013, FCH underwent a major expansion of its range north and east into Yukon. At that time, large portions of the herd reached areas along the Dempster Highway in the Ogilvie Mountains northeast of Dawson. These areas had previously never been documented within the herd's current or historic range. During this RY12–RY16 period, the area used also expanded southeast across the White River northeast of Beaver Creek. Additionally, the herd has continued expanding to the west in the White Mountains in Alaska since 2013.

Calving and Post-calving

During RY12–RY16, the FCH calving and postcalving range included portions of the Mosquito Fork, Middle Fork, and North Fork of the Fortymile river drainage; the upper Charley, upper Seventymile, upper Salcha, upper Middle Fork Chena, upper Goodpaster, upper Healy, upper Sand Creek, and upper Billy Creek drainages; and portions of the South Fork and mainstem of the Birch Creek drainage.

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 (Fig. 6). 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 (Fig. 7).

In May 2014, FCH primarily calved along the western and southern edges of the Yukon-Charley Rivers National Preserve, in the Middle Fork Fortymile River upstream from and including the Joseph Creek drainage, and in the headwaters of the Salcha and Goodpaster river drainages (Fig. 6). The majority of the herd spent June in the same general area where it calved (Fig. 7).

In May 2015, FCH primarily calved along the western, southern, and eastern edges of the Yukon-Charley Rivers National Preserve, in the Joseph Creek drainage of the Middle Fork Fortymile River, in the upper North Fork Fortymile River, and in the headwaters of the Salcha and Goodpaster river drainages (Fig. 6). The majority of the herd spent June in the same general area where it calved (Fig. 7).

In May 2016, 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, Goodpaster and West Fork Chena river drainages (Fig. 6). The majority of the herd spent June in the same general area where it calved (Fig. 7).

In May 2017, 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, Goodpaster, and West Fork Chena river drainages (Fig. 6). The

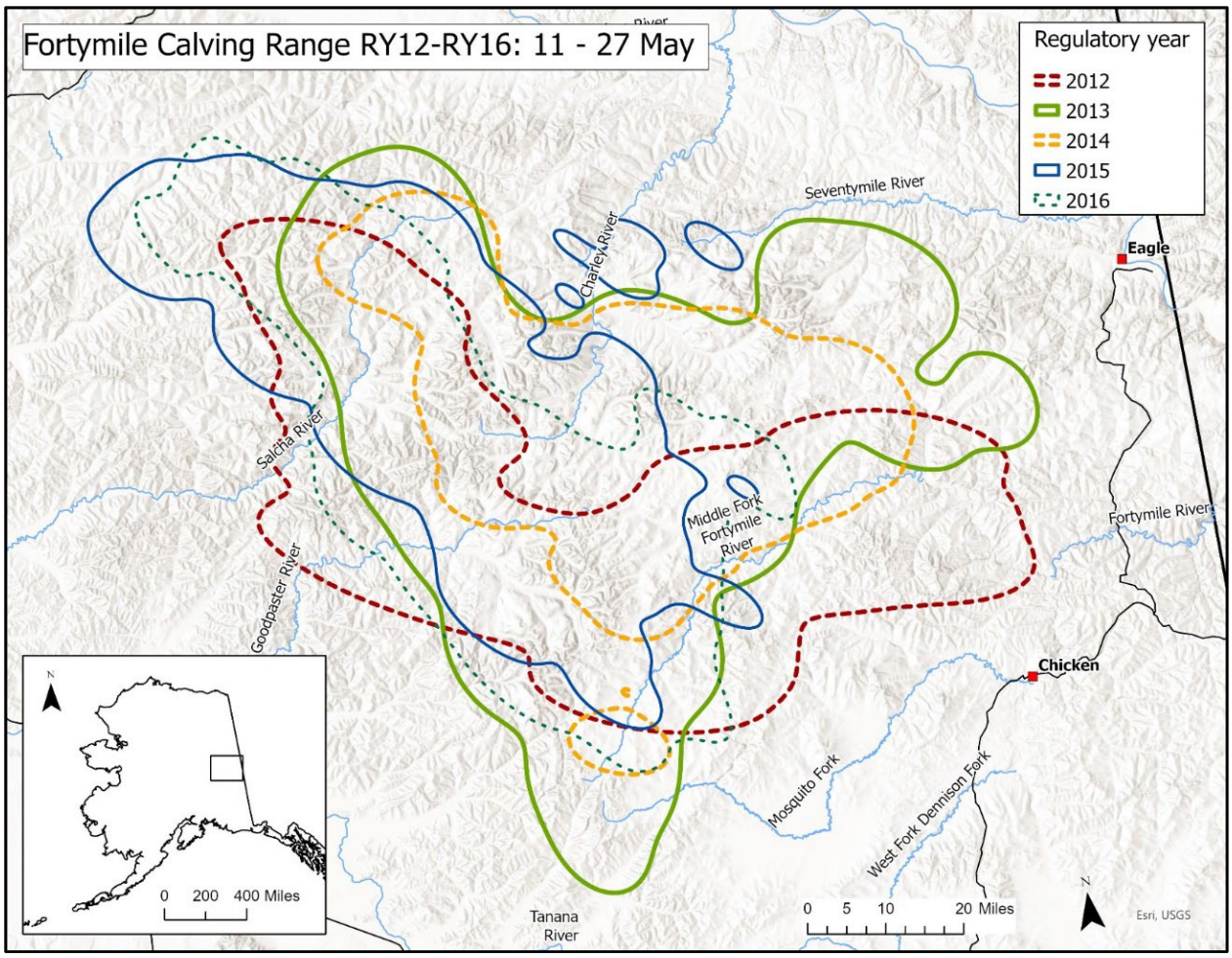


Figure 6. Fortymile caribou herd calving range during RY12–RY16, Alaska.

herd spent most of June in the same general area where it calved, but also spent a portion of June near the Taylor Highway from Chicken north to Little Champion Creek (Fig. 7).

During prerut and rut, in late September to mid-October 2012, FCH was concentrated in the upper Seventymile, Charley, upper Salcha, and upper West Fork Chena river drainages, and South Fork and mainstream Birch Creek 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 drainages of the upper Middle Fork Fortymile River, in the areas surrounding Chicken and Boundary, and in the Sixtymile river drainage in Yukon.

In late September through mid-October 2015, FCH was concentrated along the Chicken Ridge trail system, Mount Fairplay, and in the drainages of the Mainstem and East Fork of the

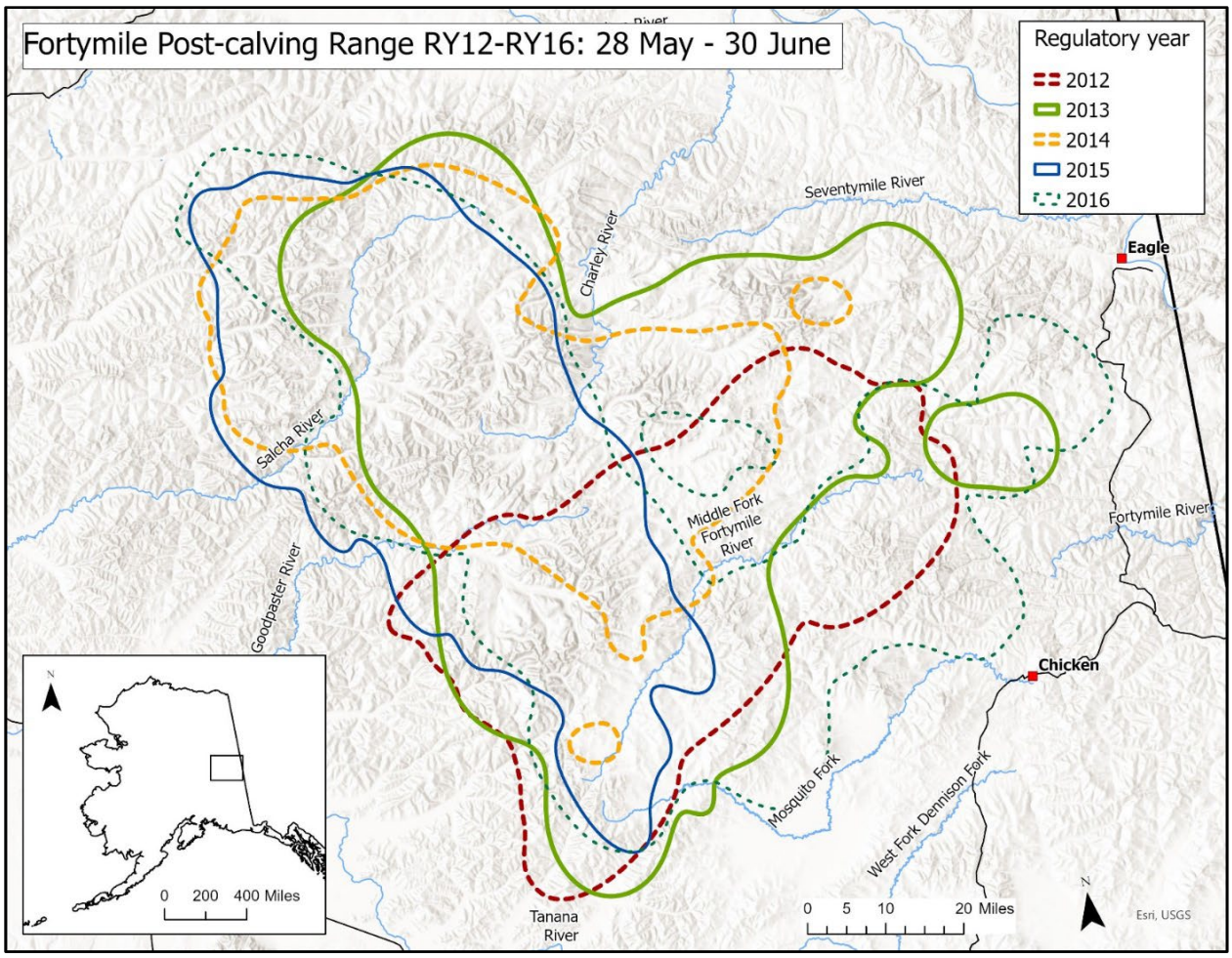


Figure 7. Fortymile caribou herd post-calving range during RY12–RY16, Alaska.

Dennison River, Liberty Creek, and in the North Fork of the Ladue River and Sixtymile River drainages in Alaska and Yukon.

In late September through mid-October 2016, FCH was concentrated in the drainages of Big Windy/Upper Sara Creek, Bear Creek, Anvil Creek, Dexter Creek, Ohio Creek, Upper North Fork Salcha River, Cottonwood Creek, Boulder Creek, Dan Creek, Ricks Creek, Porcupine Creek, and Stone Boy Creek.

In winter of December 2012–March 2013, the majority of the herd was concentrated in the White Mountains and Birch Creek areas near the Steese Highway (Fig. 8). 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.

During December 2013–March 2014, the majority of the herd concentrated within 40–60 miles of the Alaska-Yukon border, in both Alaska and Yukon (Fig. 8). The herd ranged from the upper Ladue River drainage to the south to the Tatonduk and Ogilvie river drainages to the north.

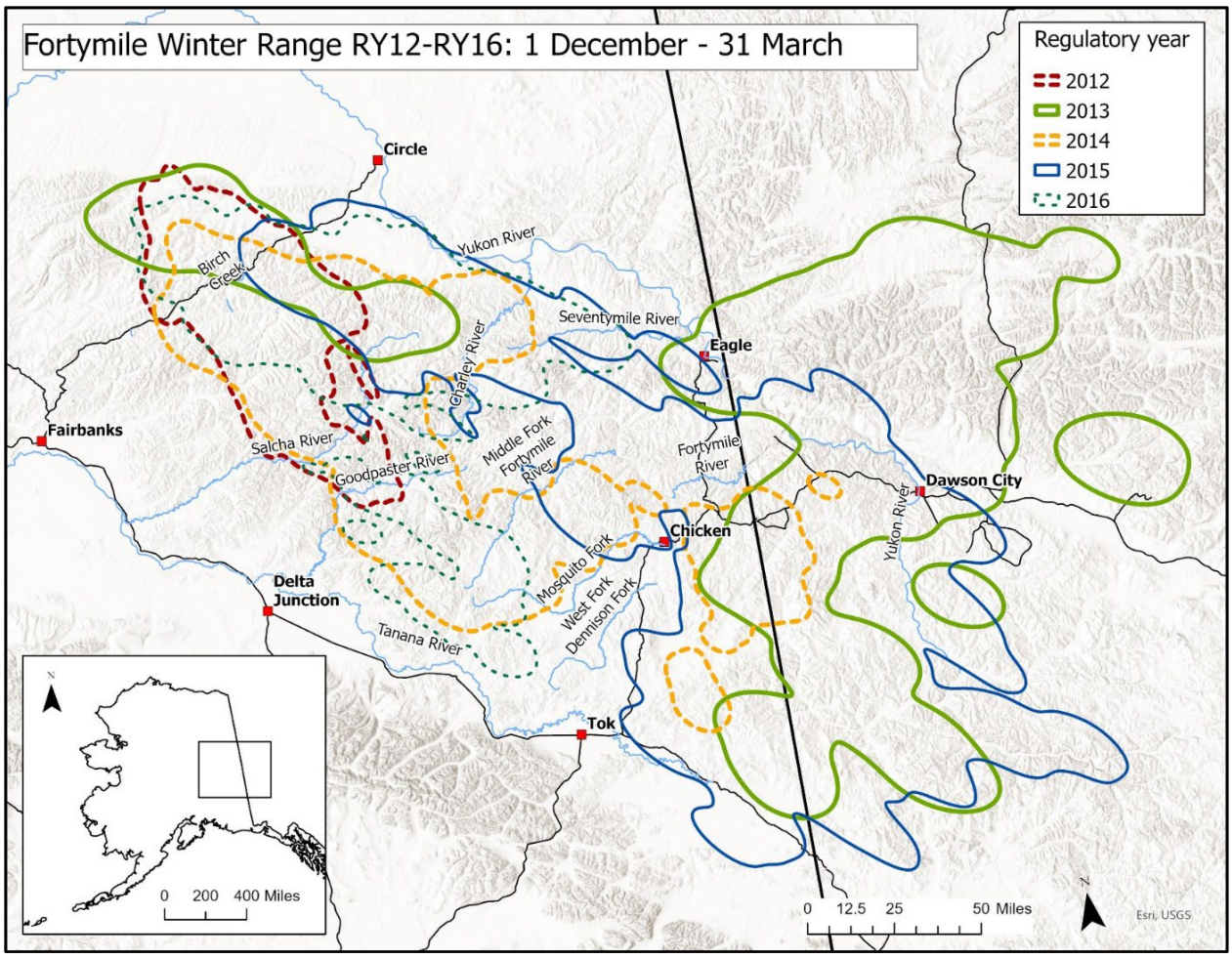


Figure 8. Fortymile caribou herd winter range during RY12–RY16, Alaska.

During December 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 (Fig. 8). 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.

During December 2015–March 2016, the majority of the herd was concentrated in the Birch Creek drainage near the Steese Highway, the northwest portion of the Yukon-Charley Rivers National Preserve south of the Yukon River and in the eastern portion of its winter range, near the Top of the World Highway between Boundary, Alaska and Dawson, Yukon Territory, and in the drainages of the Yukon River from Dawson, Yukon Territory upstream to the mouth of the White River in Yukon Territory (Fig. 8). A smaller portion of the herd was also distributed between these concentrations through the middle of its range.

During December 2016–March 2017, the majority of the herd was concentrated in the White Mountains and Birch Creek and middle fork of the Chena river drainages near the Steese Highway and Chena Hot Springs Road and in the northwest portion of the Yukon-Charley Rivers

National Preserve south of the Yukon River (Fig. 8). A smaller portion of the herd was also distributed in the upper Goodpaster and upper middle fork of the Fortymile River drainages.

Mortality Rates

From 2012–2016, annual survival of adult females ranged from 85% (95% CI = 78–90%) to 97% (95% CI = 92–98%), and the long-term average from 1991–2016 was 90.6% (95% CI = 89.0–92.0%) across all years (Table 4, Fig. 9). Yearling female survival during 2012–2016, ranged from 70% (95% CI = 49–84%) to 96% (95% CI = 79–99%) and the long-term average from May 15, 1991–May 14, 2017, was 84.6% (95% CI = 80.5–87.9%) across all years (Table 5, Fig. 10). Annual survival of adult males (n = 23) from May 2016 and 2017 was 87% (95% CI = 67–96%).

Recommendations for Activity 1.3

Continue this activity. Utilize memoranda to archive details of future surveys.

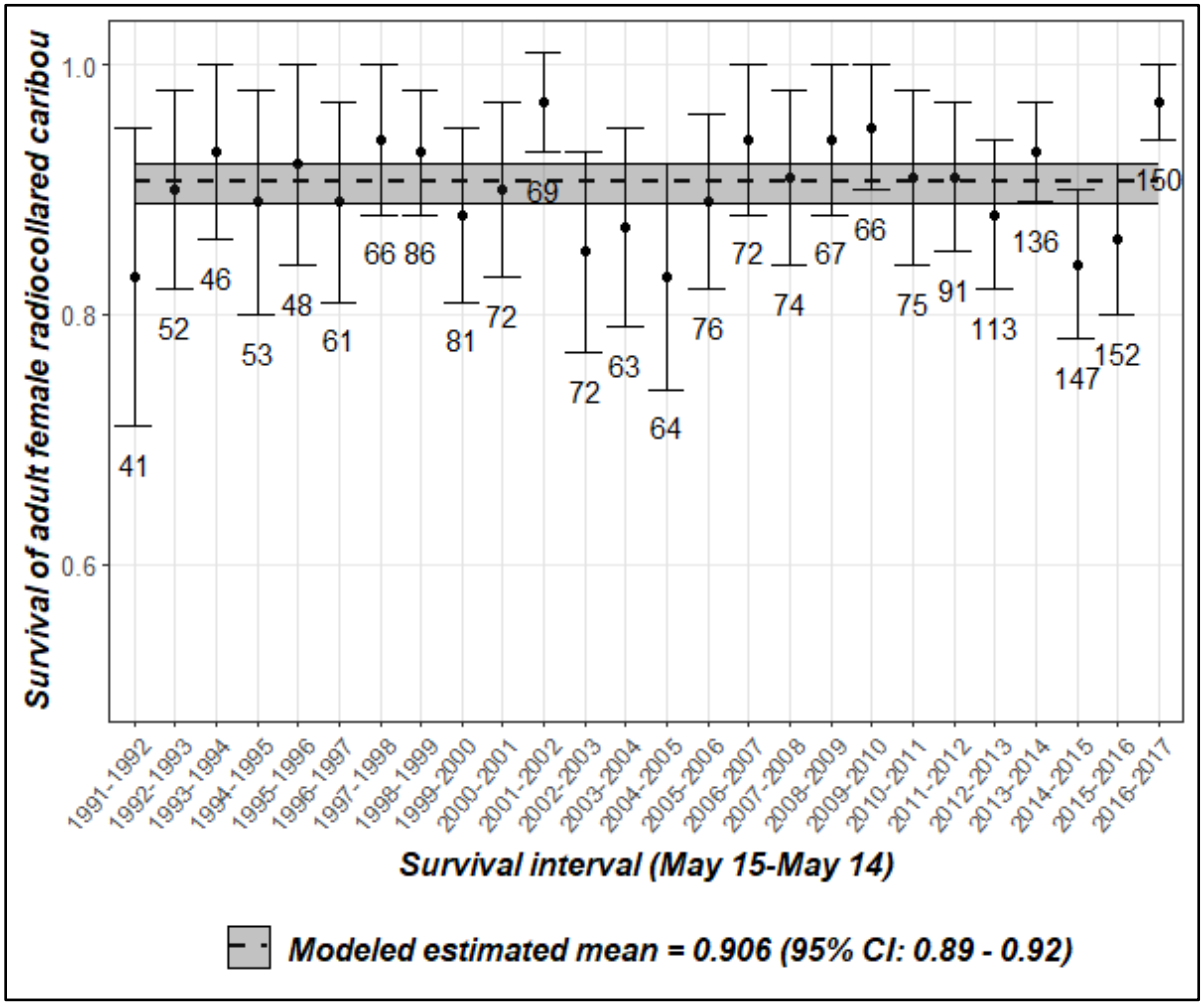


Figure 9. Survival rates and 95% binomial confidence intervals among adult female radiocollared caribou in the Fortymile herd, May 15, 1991–May 14, 2017. Data labels indicate sample size (*n*).

Table 4. Year specific annual survival rates for adult female Fortymile caribou 1991–2016, Alaska.

Year	No. adult females (*n*)	Annual survival	95% Confidence interval	
			Lower limit	Upper limit
1991	41	0.77	0.50	0.92
1992	53	0.90	0.79	0.96
1993	57	0.93	0.82	0.98
1994	53	0.89	0.77	0.95
1995	54	0.92	0.80	0.97
1996	55	0.90	0.79	0.96
1997	71	0.94	0.85	0.98
1998	76	0.93	0.84	0.97
1999	92	0.88	0.79	0.93
2000	82	0.90	0.81	0.95
2001	75	0.97	0.90	0.99
2002	77	0.85	0.75	0.91
2003	71	0.86	0.75	0.92
2004	68	0.83	0.71	0.90
2005	61	0.89	0.79	0.95
2006	78	0.94	0.87	0.98
2007	79	0.91	0.82	0.95
2008	76	0.94	0.86	0.98
2009	71	0.96	0.88	0.98
2010	79	0.91	0.82	0.95
2011	97	0.91	0.84	0.95
2012	116	0.89	0.82	0.94
2013	131	0.94	0.88	0.97
2014	155	0.85	0.78	0.90
2015	153	0.88	0.81	0.92
2016	156	0.97	0.92	0.98

Note: In this table, a year is defined as 15 May–14 May (e.g., year 2012 = 15 May 2012–14 May 2013).

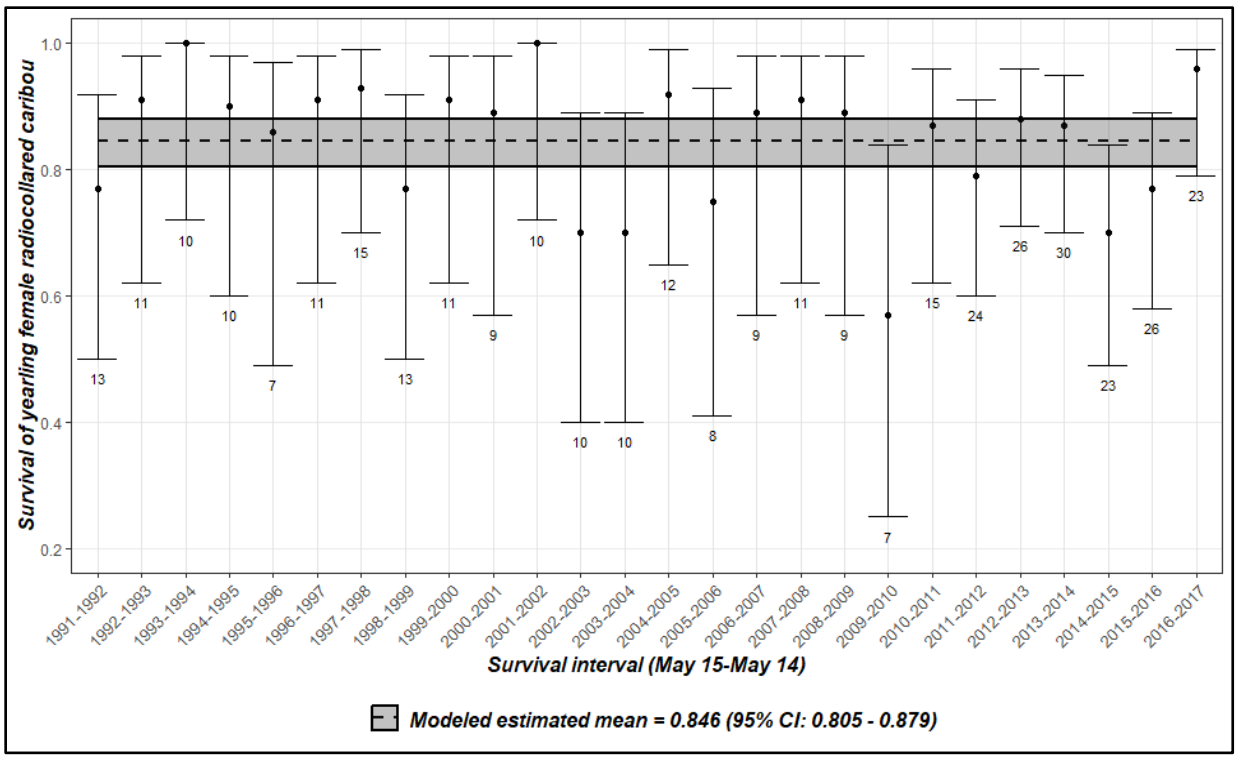


Figure 10. Survival rates and 95% binomial confidence intervals (CI) among radiocollared yearling female caribou in the Fortymile herd, 1992–2017. The line is the model estimated overall mean with an approximate 95% confidence interval.

Table 5. Year specific annual survival rate for yearling female Fortymile caribou (1992–2016), Alaska.

Year	No. female yearlings (*n*)	Annual survival	95 % Confidence interval	
			Lower limit	Upper limit
1992	12	0.91	0.62	0.98
1993	10	1.00	0.72	1.00
1994	10	0.90	0.60	0.98
1995	7	0.86	0.49	0.97
1996	11	0.91	0.62	0.98
1997	16	0.93	0.70	0.99
1998	14	0.77	0.50	0.92
1999	12	0.91	0.62	0.98
2000	11	0.89	0.57	0.98
2001	10	1.00	0.72	1.00
2002	10	0.70	0.40	0.89
2003	10	0.70	0.40	0.89
2004	13	0.92	0.65	0.99
2005	8	0.75	0.41	0.93
2006	10	0.89	0.57	0.98
2007	11	0.91	0.62	0.98
2008	9	0.89	0.57	0.98
2009	7	0.57	0.25	0.84
2010	15	0.87	0.62	0.96
2011	28	0.79	0.60	0.91
2012	30	0.88	0.71	0.96
2013	30	0.87	0.70	0.95
2014	24	0.70	0.49	0.84
2015	27	0.77	0.58	0.89
2016	25	0.96	0.79	0.99

Note: In this table, a year is defined as 15 May–14 May (e.g., year 2012 = 15 May 2012–14 May 2013).

ACTIVITY 1.4. Conduct annual parturition surveys in May to determine parturition rates of radiocollared females ≥3-years of age (objectives C1–C2 and M1–M3).

Data Needs

Estimates of parturition rate (also referred to as natality rate) provide a direct measure of productivity and indexes of adult female body condition and herd nutrition (Boertje et al. 2012, Valkenburg et al. 2000). Parturition rates of 3-year-old cows during different phases of herd growth (increasing population phase, stable or 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).

Methods

Parturition rate was estimated by observing collared females ≥3 years of age from fixed-wing aircraft during mid to late May. Repeated observations of the same individuals during the calving period were attempted until a newborn calf was observed or antlers were lost. Caribou observed with either a calf, hard antlers, or distended udders were classified as parturient (Whitten 1995). Parturition rate was calculated as the number of adult females classified as parturient divided by the total number of adult females observed.

Results and Discussion

Parturition rates of known-age ≥3-year old females have been monitored in the Fortymile herd since 1993 (Table 6). The parturition rate of 3-year-old cows declined significantly between 1993–2017 (Fig. 11), likely due to declining herd nutrition.

Table 6. Fortymile caribou parturition rates of known-age, radiocollared females, 1993–2017, Alaska.

	3-year-old cows		≥4-year-old cows		All cows ≥3-years old	
Year	No. parturient/ total[a]	Parturition rate (%)	No. parturient/ total[a]	Parturition rate (%)	No. parturient/ total[a]	Parturition rate (%)
1993	4/9	(44)	28/38	(74)	32/47	(68)
1994	5/6	(83)	32/39	(82)	37/45	(82)
1995	5/7	(71)	30/34	(88)	35/41	(85)
1996	9/9	(100)	29/30	(97)	38/39	(97)
1997	6/6	(100)	33/40	(83)	39/46	(85)
1998	9/9	(100)	38/39	(97)	47/48	(98)
1999	10/12	(83)	49/56	(88)	59/68	(87)
2000	8/9	(89)	47/52	(91)	55/61	(90)
2001	7/10	(70)	43/47	(91)	50/57	(88)
2002	6/7	(86)	44/46	(96)	50/53	(94)
2003	9/11	(82)	27/42	(64)	36/53	(68)
2004	4/7	(57)	37/40	(93)	41/47	(87)
2005	2/6	(33)	28/33	(85)	30/39	(77)
2006	9/11	(82)	40/50	(80)	49/61	(80)
2007	5/6	(83)	50/55	(91)	55/61	(90)
2008	7/8	(88)	46/51	(90)	53/59	(90)
2009	3/9	(30)	36/47	(77)	39/56	(70)
2010	2/7	(29)	41/53	(77)	43/60	(72)
2011	2/3	(67)	47/55	(85)	49/58	(86)
2012	8/13	(62)	42/47	(89)	50/60	(82)
2013	15/18	(83)	50/57	(88)	65/75	(88)
2014	7/19	(37)	57/83	(69)	64/102	(63)
2015	12/20	(60)	70/76	(92)	82/96	(85)
2016	3/12	(25)	75/93	(81)	78/105	(74)
2017	17/19	(89)	72/79	(91)	89/98	(91)

[a] Number of radiocollared cows with calf, plus radiocollared cows with no calf, but with hard antlers or udder, divided by the total number of radiocollared cows of the same age class observed.

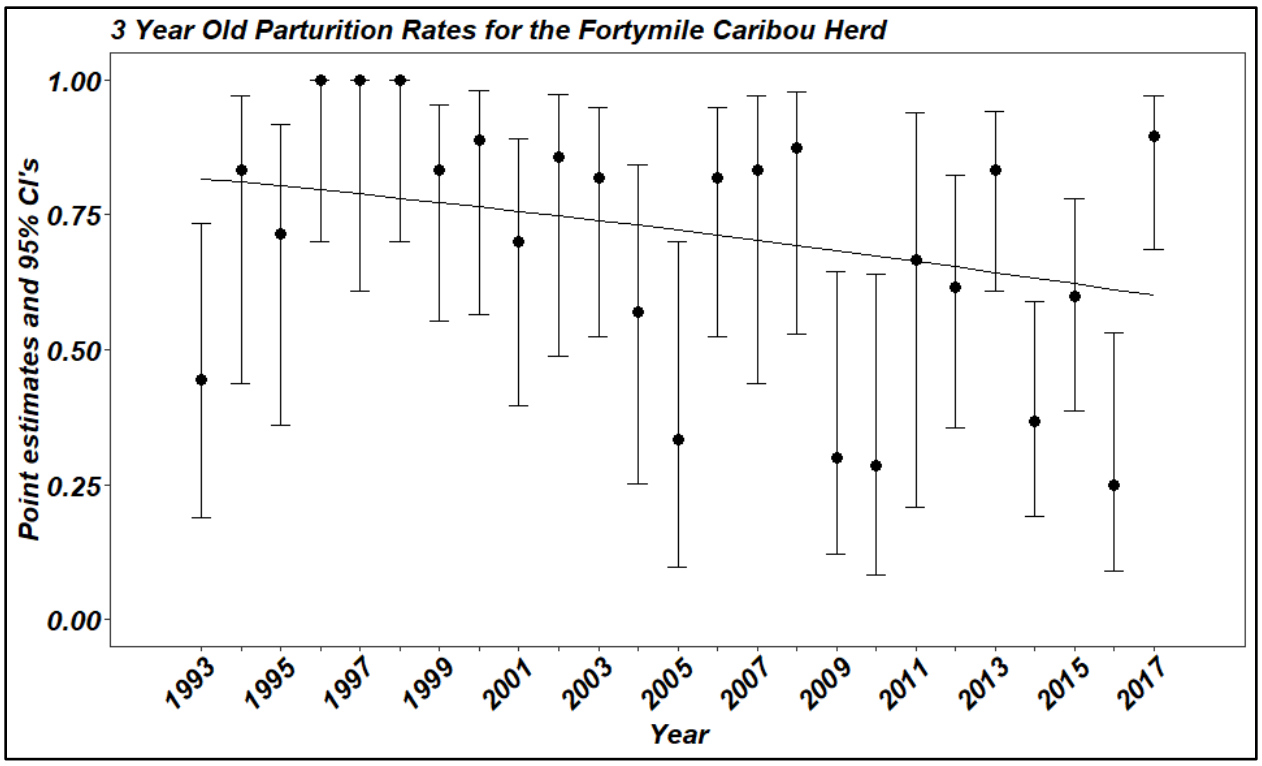


Figure 11. Parturition rates and 95% CIs among radiocollared 36-month-old female caribou in the Fortymile herd, 1993–2017. A significant decline in trend of 36-month-old parturition occurred during these years using annual data and logistic regression (generalized linear model) in Program R (slope on the logit scale = −0.045 [SE = 0.03], P = 0.147). Annual sample sizes ranged from 3 to 20 ($\bar{x}$ = 10.12).

Analysis of parturition rates of known-age cows in Alaska caribou herds resulted in a 5-year moving average of 3-year-old parturition rates >60%. This likely indicates nutritional status is sufficient for the current population level. Note that an average of 55–60% should be viewed as a cautionary signal and nutritional indicators should be closely monitored, and an average of <55% is a signal that the nutritional status of the herd may be notably reduced (Boertje et al. 2012).

In 2012, the 5-year moving average fell below 55% for the first time since 1993, when FCH parturition data collection began (Table 7, Fig. 12). Boertje et al. (2012) recommended considering management actions to stabilize or reduce the herd if the 5-year moving average falls below a 55% threshold and overgrazing, not adverse weather, is the most likely cause for low nutrition. Although the 5-year moving average of 3-year-old parturition rate increased above the threshold in 2013, it continued to hover near the 55–60% level through 2017 (Fig. 12). Additional information about the nutritional status of the FCH can be found in Boertje et al. (2012).

Recommendations for Activity 1.4

Continue this activity. Utilize memoranda to archive details of future surveys.

Table 7. Five-year moving average of parturition rates in the Fortymile caribou herd, 1997–2017, Interior Alaska.

Year	*n*	3-year old parturition rate (%) (5-year moving average)
1997	37	78.4
1998	37	91.9
1999	43	90.7
2000	45	93.3
2001	46	87.0
2002	47	85.1
2003	49	81.6
2004	44	77.3
2005	41	68.3
2006	42	71.4
2007	41	70.7
2008	38	71.0
2009	40	64.2
2010	41	62.7
2011	33	56.7
2012	40	54.2
2013	50	59.4
2014	60	56.6
2015	73	60.2
2016	82	54.9
2017	88	61.3

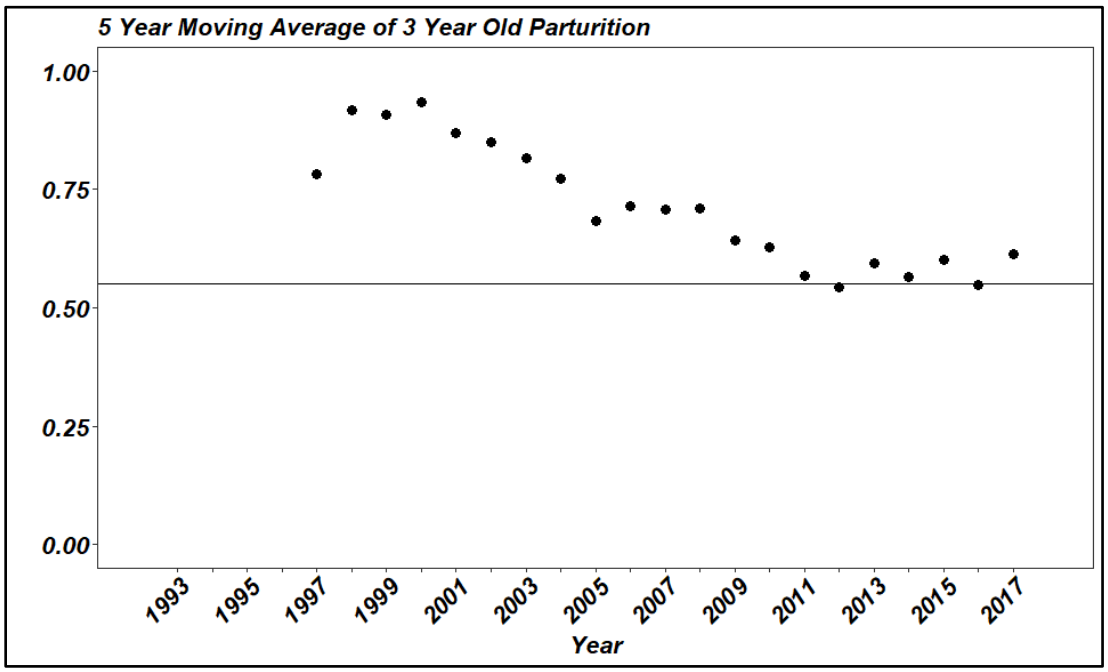


Figure 12. Five-year moving average of parturition rates in the Fortymile caribou herd, 1997–2017. The horizontal line is at the cautionary threshold of 55%.

ACTIVITY 1.5. Conduct annual fall composition surveys to estimate fall calf-to-cow and bull-to-cow ratios (objectives C1–C2 and M1–M4).

Data Needs

Estimates of fall calf-to-cow ratios are an index of early calf survival. This ratio may serve as an index for the quality of summer conditions when compared to calf-to-cow ratios of the same period. Estimates of fall bull-to-cow ratios provide a measure to evaluate if there are adequate numbers of bulls for breeding, satisfactory numbers for hunter preferences, and enough bulls surviving annually. Furthermore, bull-to-cow ratios may inform appropriate harvest rates when abundance is low and harvestable surplus is near management or codified objectives. These metrics are less important when abundance estimates are regularly obtained but may help evaluate herd status and trends in periods when a photocensus could not be conducted. For example, a decline in the bull-to-cow ratio has been documented in other Alaska caribou herds (Mulchatna and Western Arctic) during periods of population decline (Barten 2015 and Dau 2015).

Methods

Surveys occur near peak of rut to take advantage of the increased mixing of bulls, cows, and calf caribou. Peak of rut is estimated as 228 days (gestation period) prior to the median FCH calving date.

Prior to the composition survey a sample of 75–130 (mean = 96) collars deployed on FCH caribou were randomly selected from the collars known to be active immediately prior to the day of survey. This was done to manage the total number of collars the radiotracking planes would need to search for on the day of the survey to improve efficiency, without compromising the survey results.

During composition surveys we located radio collars 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. Group location and the number of collars in each group was determined by fixed-wing aircraft and relayed to a helicopter immediately prior to the arrival of the helicopter to each caribou group. We defined a group as caribou that were lumped together and spatially separated or distinguishable from neighboring caribou or caribou groups. We attempted to locate as many collars as possible and sample across the full spatial expanse of the herd.

We attempted to spread survey effort evenly throughout the herd by classifying an equal number of caribou in the vicinity of each radio collar, so the sum total would equal the desired overall sample size (approximately 10–15% of the herd). For example, if the herd size was 50,000, and 10% of the herd was to be classified, the total composition sample would consist of 5,000 individual caribou; and if we planned to locate 100 collars during the survey, we would classify 50 caribou in the vicinity of each collar.

To adjust for variable group size and number of radiocollared caribou per group, we multiplied the number of cows, calves, 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.

On the day of the survey, we tallied the composition of each group using a 5-position counter or digital voice recorder. The voice recordings were reviewed at a later date and tallied on a 5-position counter. 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).

Results and Discussion

Composition surveys were conducted in RY12–RY16. During these years calf-to-cow ratios averaged 28 calves per 100 cows, close to the average of 31 calves per 100 cows observed during the most recent growth phase (1976–2011) and bull-to-cow ratios averaged 43 bulls per 100 cows, which was the same as the average (43 bulls per 100 cows) observed during 1976–2011 (Table 8).

In October 2012, we located 59 collared caribou in Alaska and Yukon and sampled 40 caribou groups for age and sex composition. A total of 4.8324 caribou were classified. The calf-to-cow ratio was 22 calves per 100 cows and the bull-to-cow ratio was 40 bulls per 100 cows (Table 8).

In October 2013, we located 114 collared caribou in Alaska and Yukon and sampled 4 caribou groups for age and sex composition. A total of 3,921 caribou were classified. The calf-to-cow ratio was 28 calves per 100 cows and the bull-to-cow ratio was 38 bulls per 100 cows (Table 8).

In October 2014, we located 72 collared caribou in Alaska and Yukon and sampled 3 caribou groups for age and sex composition. A total of 4,794 caribou were classified. The calf-to-cow ratio was 25 calves per 100 cows and the bull-to-cow ratio was 34 bulls per 100 cows (Table 8).

In October 2015, we located 79 collared caribou in Alaska and Yukon and sampled 40 caribou groups for age and sex composition. A total of 5,662 caribou were classified. The calf-to-cow ratio was 35 calves per 100 cows and the bull-to-cow ratio was 53 bulls per 100 cows (Table 8).

In October 2016, we located 99 collared caribou in Alaska and Yukon and sampled 5 caribou groups for age and sex composition. A total of 3,288 caribou were classified. The calf-to-cow ratio was 32 calves per 100 cows and the bull-to-cow ratio was 48 bulls per 100 cows (Table 8).

Recommendations for Activity 1.5

Continue this activity. Utilize memoranda to archive details of future surveys.

Table 8. Fortymile caribou fall composition counts and population size, Alaska, regulatory years 1985–2016.

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	49,941[g] (44,373–55,511)
2009	10/7/09	59	34	17	52	26	33	42	30	4,503	51,675	56,443[g] (49,447–63,441)
2010	10/2/10	43	32	18	58	27	31	41	24	7,169	–	–[h]
2011	10/5/11	42	25	15	60	21	42	37	25	3,949	–	–[h]

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
2012	10/9/12	40	22	13	62	19	40	41	25	4,832		–[h]
2013	10/6–10/13	38	28	17	60	28	32	40	23	3,921		–[h]
2014	10/9/14	34	25	16	63	34	36	31	21	4,794		–[h]
2015	10/14/15	53	35	19	57	39	35	24	26	5,662		–[h]
2016	10/7/16	48	32	18	56	40	36	26	25	3,288		83,659[g] (78,138–89,180)

[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-to-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 survival of calves collared in October (56% [n = 16]) during winter 2004–2005.

[f] Average interpolations of herd size because herd size was not estimated.

[g] Abundance estimate developed using Rivest et al. (1998) method, with 95% CI.

[h] Modeled population estimates not yet developed.

2. Mortality-Harvest Monitoring and Regulations

ACTIVITY 2.1. Monitor reported and estimated harvest in Alaska and Canada (objectives C1–C3 and M3).

Data Needs

Estimates of annual harvest are needed to evaluate IM objectives and ensure that harvest is within sustainable limits.

Methods

We monitored harvest using both registration and youth draw permit hunt reports. Hunters were required to report within 3 days of harvest by phone, in person, or online. They reported harvest date and location, days hunted, transportation mode, commercial services used, and method of take. Harvest under the registration hunts is tracked closely through the open hunting seasons to avoid overharvest. If harvest approaches the quota or harvest objective, an emergency order is issued to stop further harvest.

Estimates of harvest in Canada are obtained from Yukon Department of Environment staff in Dawson, Yukon (Mike Suitor, Yukon Department of Environment (YDE), personal communication, 2017).

Season and Bag Limit

Seasons and bag limits for the Fortymile caribou herd Units 20E and 25C and portions of Units 20B, 20D, and 20F were established in 5AAC 85.025 editions 2012–2013, 2014–2015, 2015–2016, and 2016–2017.

Regulations during RY12–RY16 are found in the Alaska hunting regulations booklets numbers 53–57. Current caribou season dates and bag limits are available online at: http://www.adfg.alaska.gov/index.cfm?adfg=wildliferegulations.hunting.

Results and Discussion

Harvest by Hunters-Trappers

We issued between 3,904–6,493 registration permits annually during RY12–RY16 (Table 9). Numbers of hunters and caribou reported harvested annually ranged between 2,637–4,137 and 974–1,297 respectively during RY12–RY16 (Table 9). Total human-caused mortality of Fortymile caribou, including harvest reported on registration permits and general harvest tickets, accidental death, and illegal and unreported harvest ranged between 1,008–1,331 caribou annually during RY12–RY16 (Table 10). To assist herd growth during RY12–RY16, 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.

Table 9. Reported Fortymile caribou harvest by joint state–federal registration permit, Alaska, regulatory years 2004–2016.

Regulatory year	Permits issued[bc]	Did not hunt (%)[b]	Did not report (%)[b]	Total hunted[b]	Successful hunters (%)[b]	Unsuccessful hunters (%)[b]	Harvest[b]			Total reported harvest[b]	Harvest quota	
							Bulls	Cows	Unk		Cows	Total
2004	4,217	1,540 (37)	180 (4)	2,497 (59)	846[d] (34)	1,651 (66)	592	243	11	846	210	850
2005	4,438	1,786 (40)	169 (4)	2,483 (56)	741[e] (30)	1,742 (70)	557	182	2	741	210	850
2006	3,975	1,295 (33)	75 (2)	2,605 (66)	852[f] (33)	1,753 (67)	601	247	4	852	210	850
2007	4,576	1,361 (30)	33 (1)	3,182 (70)	1,012[g] (32)	2,170 (68)	746	262	4	1,012	210	850
2008	3,582[i]	1,078 (30)	9 (1)	2,471 (69)	913[h] (37)	1,558 (63)	681	217	15	913	210	850
2009	2,765[i]	736 (27)	7 (<1)	2,018 (73)	1,083[i] (54)	935 (46)	881	192	10	1,083	210	850
2010	5,113	1,930 (38)	64 (<1)	3,119 (61)	725[j] (23)	2,394 (77)	630	89	6	725	200	795
2011	3,771	1,495 (40)	56 (1)	2,220 (59)	1,066[k] (48)	1,154 (52)	935	125	6	1,066	250	1,000
2012	4,701	1,748 (37)	131 (3)	2,822 (60)	1,297[l] (46)	1,525 (54)	1,081	190	26	1,297	250	1,000
2013	3,904	1,229 (31)	38 (1)	2,637 (68)	1,186[m] (45)	1,451 (55)	1,152	14	20	1,186	250	1,000
2014	5,852[k]	1,736 (30)	653 (11)	3,460 (59)	974[n] (28)	2,486 (72)	684	278	12	974	250	1,000
2015	6,493	2,237 (35)	105 (2)	4,141 (64)	1,117[qo] (27)	3,024 (73)	816	291	10	1,117	250	1,000
2016	6,210	2,228 (36)	97 (2)	3,872 (62)	976 (25)	2,896 (75)	634	334	8	976	250	1,000

[b] Data from RC860 and RC867 harvest reports.
[c] 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.
[d] An additional 12 hunters reported harvesting Fortymile caribou on general harvest reports.
[e] An additional 4 hunters reported harvesting Fortymile caribou on general harvest reports.
[f] An additional 12 hunters reported harvesting Fortymile caribou on general harvest reports.
[g] An additional 20 hunters reported harvesting Fortymile caribou on general harvest reports.
[h] An additional 9 hunters reported harvesting Fortymile caribou on general harvest reports.
[i] An additional 11 hunters reported harvesting Fortymile caribou on general harvest reports.
[j] An additional 4 hunters reported harvesting Fortymile caribou on general harvest reports.
[k] An additional 18 hunters reported harvesting Fortymile caribou on general harvest reports.
[l] An additional 9 hunters reported harvesting Fortymile caribou on general harvest reports.
[m] An additional 58 hunters reported harvesting Fortymile caribou on general harvest reports.
[n] An additional 30 hunters reported harvesting Fortymile caribou on general harvest reports, and 20 hunters reported harvesting Fortymile caribou on DC851 reports.
[o] An additional 2 hunters reported harvesting Fortymile caribou on general harvest reports.

Table 10. Fortymile caribou harvest, Alaska, regulatory years 2004–2016.

Regulatory year[a]	Reported on registration permit[b]				Youth draw permit	General harvest report[c]	Estimated		
	Male	Female	Unk	Total			Other[d]	Yukon harvest	Total
2004	592	243	11	846	–	12	10	0	868
2005	557	182	2	741	–	4	10	0	755
2006	601	247	4	852	–	12	10	0	874
2007	746	262	4	1,012	–	20	10	0	1,042
2008	681	217	0	898	–	9	10	0	917
2009	881	192	10	1,083	–	11	10	0	1,104
2010	630	89	6	725	–	4	10	15	754
2011	935	125	6	1,066	–	18	10	15	1,109
2012	1,081	190	26	1,297	–	9	10	15	1,331
2013	1,152	14	20	1,186	–	58[d,e]	10	15	1,269
2014	684	278	12	974	20	30	10	15	1,049
2015	816	291	10	1,117	14	2	10	30	1,173
2016	634	334	8	976	17	0	10	5	1,008

[a] A regulatory year is 1 July through 30 June (e.g., regulatory year 2004 = 1 July 2004 through 30 June 2005).
[b] Data from RC860 and RC867 harvest reports for the Fortymile caribou herd.
[c] Harvest reported under general harvest ticket.
[d] Includes estimated unreported and/or illegal harvest.
[e] Includes 49 general harvest reports from Fortymile herd caribou harvested in Unit 25B.

Hunter Residency and Success

Nonresidents made up 8–13% of hunters during RY12–RY16 and accounted for 11–17% of the total harvest (Table 11). The success rate for residents (local and nonlocal combined) was 24–43%, whereas success rate for nonresidents was 31–58% (Table 11).

Table 11. Fortymile caribou hunter residency and success of hunters who reported residency, regulatory years 2004–2016, Alaska.

	Successful[a]						Unsuccessful[a]							
Regulatory year	Local[b] resident	Nonlocal resident	Nonresident	Unknown residency	Total	(%)	Local[c] resident	Nonlocal resident	Nonresident	Unknown residency	Total	(%)	Unknown success[a]	Total hunters[a]
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
2015	147	838	131	1	1,117	(27)	243	2,521	259	1	3,024	(73)	0	4,141
2016	21	820	135	0	976	(25)	183	2,410	302	1	2,896	(75)	0	3,872

[a] Data from RC860 and RC867 harvest reports and general season harvest reports for the Fortymile caribou herd.
[b] Residents of Unit 12 north of Wrangell–St Elias, Unit 20E, Unit 20D, and residents of Circle and Central in Unit 25C.

Harvest Chronology

During the fall hunt (RC860) in RY12–RY14 and RY16, most harvest (68–90%) occurred during the last week in August and first week in September (Table 12). This coincides with the hunt zones 1 and 3 season openings on 29 August in RY12–RY13 and RY16, and 3 September opening in RY14. In RY15, harvest was fairly evenly spread out during the last week in August through the third week in September, primarily due to fewer caribou available close to the road system over the opening 2 weeks, which allowed for a more even harvest over a longer period of time than in other years (Table 12).

During the winter hunting season (RC867) in RY12 and RY14–RY15, harvest was more evenly spread throughout the season than during the fall hunt (Table 13). However, in RY13, the winter season was cancelled due to the quota being taken during the fall hunt (RC860). In RY16 large numbers of caribou were available near the Steese Highway in early December, resulting in nearly all harvest occurring in the first week in December over the first few days of the state season (Table 13).

Table 12. Fortymile caribou autumn harvest by month/day, Alaska, regulatory years 2004–2016.

Regulatory year[a]	Number harvested by week (%)[b]															
	10–16 Aug		17–23 Aug		24–30 Aug		31 Aug–6 Sep		7–13 Sep		14–20 Sep		21–27 Sep		28–30 Sep		*n*
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]
2015	37	(5)	37	(5)	138	(19)	150	(21)	186	26)	154	(22)	4	(1)	3	(<1)	709[f]
2016	33	(9)	40	(11)	173	(47)	76	(21)	30	(8)	14	(4)	1	(<1)	0	(0)	367[g]

[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 harvest reports for the Fortymile caribou herd that indicated a harvest date.
[c] Includes 7 unknown.
[d] Includes 10 unknown.
[e] Includes 7 unknown.
[f] Includes 3 unknown.
[g] Includes 7 unknown.

Table 13. Fortymile caribou winter harvest by month/day, Alaska, regulatory years 2004–2016.

Regulatory year	Reported harvest (%)[b]								
	1–16 Nov	17–30 Nov	1–15 Dec	16–31 Dec	1–15 Jan	16–31 Jan	1–15 Feb	16–28 Feb	Total
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]	– (–)	– (–)	– (–)	– (–)	– (–)	– (–)	– (–)	– (–)	–
2014	33 (8)	12 (3)	199 (46)	31 (7)	44 (10)	43 (10)	30 (7)	43 (10)	435
2015	0 (0)	0 (0)	107 (26)	165 (41)	59 (15)	21 (5)	22 (5)	19 (5)	405[g]
2016	5 (1)	1 (<1)	579 (96)	7 (1)	0 (0)	1 (<1)	4 (1)	1 (<1)	602[h]

[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 and only on federal land 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.

[g] An additional 12 caribou (3% of total winter harvest) were harvested in March.

[h] An additional 4 caribou (1% of total winter harvest) were harvested in March.

Transport Methods

RC860 FALL HUNTS — In RY12–RY16, 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. The majority of successful hunters used ATV's during these years (Table 14). 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 14). Successful hunters primarily accessed FCH using snowmachines and highway vehicles along the Steese and Taylor highways (zones 1 and 3).

During the report period, we issued 14 emergency orders to delay, close, and reopen hunting seasons in various hunt zones in order to meet harvest quotas. All Emergency Orders issued during the report period are available online at:
https://webintra.dfg.alaska.local/index.cfm?adfg=staffinformation.hunting_eo_archive

Table 14. Fortymile caribou harvest by transport method, Alaska, regulatory years 2004–2016.

Regulatory year	Harvest by transport method (%)																Total
	Airplane		Horse		Boat/airboat		3- or 4-Wheeler		Snowmachine		Off-road vehicle		Highway vehicle		Walking		Unknown		
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	(2)	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
2015	120	(11)	2	(<1)	19	(2)	229	(21)	269	(24)	37	(3)	388	(35)	11	(<1)	42	(4)	1,117
2016	158	(16)	1	(<1)	19	(2)	213	(22)	258	(26)	26	(3)	257	(26)	21	(2)	23	(23)	976

Note: Data in this table includes RC860 and RC867 harvest reports for the Fortymile caribou herd.

Recommendations for Activity 2.1

Continue. Estimates of annual harvest are important to evaluate intensive management objectives and ensure that harvest is within sustainable limits compared to population size and trend.

3. Habitat Assessment-Enhancement

The most recent review of abundance, nutrition, and range expansion of the FCH (Boertje et al. 2012) examined nutritional status of the FCH in relation to habitat and other factors. Declines in fall calf weights and 36-month-old parturition rates (Figs. 4 and 11) suggest that nutritional status of the herd has declined since about the early 2000s. Boertje et al. (2012) provided evidence suggesting that overgrazing of the herd's summer range was a likely causative factor for the decline in these indices. In addition, large-scale fires in the 2000s may have reduced lichen biomass on portions of the herd's winter range. However, Boertje et al. (2012) did not identify winter range as a likely cause for the decline in herd nutrition. Techniques to enhance habitat on a scale that would improve the nutritional status of the FCH are not well understood, and there are presently no habitat enhancement projects proposed in this plan.

NONREGULATORY MANAGEMENT PROBLEMS OR NEEDS

Data Recording and Archiving

Harvest data was stored on an internal database housed on a server (https://winfonet.alaska.gov/). Electronic copies of data, reports, and memorandums will be stored in the WinfoNet – Data Archive. Tok area office caribou management program. Project ID: Tok caribou. Primary Region: Region III.

Agreements

The 2012–2018 Fortymile Caribou Harvest Plan was developed by the Harvest Management Coalition and provided recommendations for harvest management of the Fortymile caribou herd during this report period.

In March 2016, a data sharing agreement was put in place for sharing data between the ADF&G, BLM and YDE (Interagency agreement for sharing of Fortymile caribou herd VHF and satellite location data for research and management purposes 2016, on file in Tok ADF&G office).

Permitting

IACUC Protocol numbers 2012-034, 2013-13, 2015-03, 2016-10 and 2017-02.

Conclusions and Management Recommendations

The amounts reasonably necessary for subsistence uses objective of 350–400 Fortymile caribou in Units 12, 20D, 20E, and 25C (C1) was met because more than 400 caribou were harvested annually by Alaska resident hunters during RY12–RY16 (range 974–1,297). The IM harvest objective of 1,000–15,000 caribou (C3) was met in all but 1 year during RY12–RY16.

Management objective M3, to sustain an annual harvest of 1,000–15,000 caribou, was also met in all but 2 years of the reporting period.

The most recent abundance estimate (2017) of 83,659 (SE ± 2,713) caribou which met both population goals of 1) managing for a herd size of 50,000–100,000 unless nutrition indices indicated a lower sustainable limit (M2); and 2) Intensive management (IM) objective C2 which includes a population objective of 50,000–100,000 caribou.

The Fortymile herd had an average annual growth rate of 5% during RY12–RY16 which met the goal of providing conditions for the 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 (M1). Objective M4, to maintain an October bull-to-cow ratio of at least 35:100, was met in all but 1 year during RY12–RY16.

II. Project Review and RY17–RY21 Plan

Review of Management Direction

MANAGEMENT DIRECTION

The primary management direction for the FCH, as described by the herd goal, in Units 20B, 20D, 20E, 20F, and 25C will remain unchanged during the upcoming new plan period.

GOALS

The FCH goal will remain unchanged from the previous report period.

G1. 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.

CODIFIED OBJECTIVES

Amounts Reasonably Necessary for Subsistence Uses

Customary and traditional use and amounts reasonably necessary for subsistence uses (5 AAC 99.025)

C1. The Fortymile caribou herd has a positive finding for customary and traditional use of caribou in Units 12, 20D, 20E, 25C and an amount reasonably necessary for subsistence uses of 350–400 caribou.

Intensive Management

C1. Population Objective: 50,000–100,000 caribou

C2. Harvest Objective: 1,000–15,000 caribou

MANAGEMENT OBJECTIVES

M1. 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.

M2. Manage for a herd size of 50,000–100,000 unless nutrition indices indicate a lower sustainable limit.

M3. Manage the herd to sustain an annual harvest of 1,000–15,000 caribou.

M4. Maintain an October bull-to-cow ratio of at least 35:100.

REVIEW OF MANAGEMENT ACTIVITIES

1. Population Status and Trend

ACTIVITY 1.1. Conduct caribou captures annually (objectives C1–C3, M1–M4).

Data Needs

Collars deployed on female and male caribou are required for all management activities associated with monitoring of the FCH. These activities include photocensus and abundance estimates, estimates of annual survival rates, estimates of parturition, calving and seasonal distribution, composition surveys, and hunt monitoring.

Fall weights of female calves of the year are one of the indices used to evaluate nutritional status of the herd (Boertje et al. 2012).

Methods

Capture 35 female calves-of-the-year annually to collect biological information and deploy radio collars to maintain an adequate sample size of known-age, female caribou for each cohort in the herd. A minimum sample size of 110 radiocollared females in the herd, including a minimum of 40 satellite GPS and 70 VHF collars

Collars are deployed annually on FCH caribou via chemical immobilization capture in October, March, and April. Short yearlings and adult females are recollared throughout their life every 3–5 years to maintain a known-age sample that approximates the age structure of the herd. The annual collaring of 35 female calves of the year (20 in fall and 15 in spring) ensures that all female cohorts are represented in the collared sample.

Captures were conducted annually during the first 3 weeks of October and again in late April to deploy collars. During October, 4- to 5-month-old, female calves are captured to deploy collars and collect weights and other biological measurements to help assess nutritional condition of the herd.

ACTIVITY 1.2. Photocensus and abundance estimates (objectives C1–C3 and M1–M3).

Data Needs

Estimates of abundance (via conducting photocensus) are the primary metric for monitoring herd status and are important for setting annual harvest quotas and evaluating population size and harvest in relation to intensive management (IM) and amount reasonably necessary for subsistence (ANS) objectives. Regular measures of population size provide regulatory boards and advisory committees with biological information to make informed decisions or recommendations regarding regulatory actions.

Methods

A photocensus is conducted using the modified aerial photo-direct count technique (Davis et al. 1979, Valkenburg et al. 1985) and digital photography. This technique required monitoring postcalving aggregations by radiotracking collared caribou from mid-June through mid-July. Aggregations of sufficient quality to conduct a photocensus typically occurred when temperatures were >55°F at 5,000 feet and wind speed was <8 mph, presumably in response to insect harassment (Davis et al. 1979, Valkenburg et al. 1985).

Groups of caribou are photographed from a DeHavilland DHC-2 Beaver aircraft with a customized, digital-aerial-camera system. Small groups of caribou are photographed with handheld cameras or visually estimated by pilot observer teams in Piper PA-18 or similar aircraft. The digital-camera system in the Beaver is composed of 3, medium-format 100-megapixel cameras, with 2 of the cameras oriented obliquely and 1 at nadir. Target altitude for photography is 1,500 feet above ground level (AGL). All cameras are contained within a rigid insert which is attached to a gyrostabilized mount. The system is instrumented with a differential GPS and inertial measurement unit (IMU) to record position and attitude (pitch, roll, and yaw). Customized flight management software running on a laptop computer controls the cameras and navigation system and allows the pilot and camera operator to see footprints of the imagery in real time as well as inspect thumbnails of each image as they are captured. Flight data from the GPS and IMU are post processed using differential correction or precise point positioning (PPP) depending on the proximity to continually operating reference stations (CORS). Images are individually inspected and adjusted for exposure before being exported from raw format. Exterior orientation information (position, elevation, and attitude) and imagery are then processed through photogrammetry software using automated tie-point extraction and bundle adjustment to produce digital terrain models which are then used to orthorectify individual images. Once orthorectification is completed, the oblique and nadir orthophotos are mosaicked separately.

Enumeration of caribou from image mosaics occurs within geographic information system (GIS) software and uses a customized tool which allows users to count and classify caribou by placing colored points on each animal. Point data are stored in file geodatabases and archived. Minimum population size was the summation of the total number of caribou enumerated from digital photographs, and caribou that were visually estimated.

An estimate of abundance and a measure of uncertainty is conducted using a method described by Rivest et al. (1998). The estimator is based on a 2-phase sampling design. Phase 1 uses the

distribution of collared caribou among groups of known size to estimate the number of caribou in groups without collared caribou. Phase 2 uses a Horvitz-Thompson estimator and the proportion of active collars detected to expand the herd size from phase 1 to account for caribou represented by collars not located during the survey. Rivest et al. (1998) describes 3 detection models for use in phase 2. Of these models, the homogeneity method has been most frequently applied (Couturier 1996; Patterson et al. 2004) and is best suited for our data. This model assumes that all active collars are identified in observed groups and that unobserved groups with collared caribou are missed because they are outside of the surveyed area. It is important to note that phase 2 calculations are not necessary if all collars are located and associated groups are counted. Also, the consequences of not meeting the assumptions of phase 2 are greatly mitigated when a high proportion of the active collars are detected and associated groups counted. Finally, this estimator assumes a random distribution of collars among caribou; and therefore, the number of collars in each group is approximately Poisson distributed. A score test to evaluate overdispersion in a Poisson model is provided to assess this assumption (Dean and Lawless 1989).

ACTIVITY 1.3. Monitor collared caribou throughout the year to determine seasonal distribution, mortality rates, and proximity to highways during hunting seasons.

Data Needs

Seasonal Distribution and Proximity to Highways During Hunting Seasons

Monitoring seasonal herd distribution allows managers to evaluate animal density and timing of use on seasonal ranges to evaluate potential impacts to range and to help evaluate how close the herd may be to maximum carrying capacity in relation to its seasonal ranges (Boertje et al. 2012).

Proximity of FCH to highways plays a significant role in harvest management of this herd. High harvest can occur in short periods of time when the herd approaches or crosses highways in the FCH hunt area during hunting seasons. An adequate number of VHF and GPS collars on the herd is needed to allow managers to monitor herd movements in relation to highways, and associated trail systems, throughout the hunting season. This location data is used by managers to implement in season management actions in a timely manner to ensure harvest objectives are not exceeded.

Mortality Rates

Annual survival rates of adult males and females, and yearling females and female calves are sensitive biological parameters, particularly for adult females (≥2 years of age), to population growth or decline and nutritional status of the herd. Estimates of annual survival provide an important demographic parameter to evaluate population trajectory in years when abundance is not estimated and also corroborates modeled estimates of trends in abundance.

Methods

Seasonal Distribution and Proximity to Highways During Hunting Seasons

We obtain seasonal herd distribution, movements, and estimates of annual mortality by monitoring cows fitted with VHF and satellite radio collars throughout the year. On an annual basis, a portion of the radiocollared caribou are located approximately weekly during hunting seasons in August, September, November, 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.

Mortality Rates

Annual survival is estimated from collared caribou using known-fate models. Annual survival for adult females, adult males, yearling females, and calves are conducted separately and are reported with 95% confidence intervals. Simple annual survival is calculated from 15 May through 14 May in a given year for yearling and adult caribou. Newly collared animals are not included until the following May-to-May interval, given that they survive to the first 15 May after they were collared.

ACTIVITY 1.4. Conduct annual parturition surveys in May to determine parturition rates of radiocollared females ≥3-years of age (objectives C1–C2 and M1–M3).

Data Needs

Estimates of natality rate (also referred to as parturition rate) provide a direct measure of productivity and is a useful index to adult female body condition and to assess herd nutrition (Boertje et al. 2012, Valkenburg et al. 2000). Parturition rates of 3-year-old cows during different phases of herd growth (increasing population phase, stable or 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).

Methods

Parturition rate is estimated by observing collared females ≥3 years of age from fixed-wing aircraft during mid to late May. Repeated observations of the same individuals are attempted until a newborn calf is observed. Caribou observed with either calves, or hard antlers, or distended udders are classified as parturient (Whitten 1995). Parturition rate is calculated as the number of adult females classified as parturient divided by the total number of adult females observed.

ACTIVITY 1.5. Conduct annual fall composition surveys to estimate fall calf-to-cow and bull-to-cow ratios (objectives C1–C2 and M1–M4).

Data Needs

Estimates of fall calf-to-cow ratios are an index of early calf survival. This ratio may serve as an index for the quality of summer conditions when compared to calf-to-cow ratios of the same period. Estimates of fall bull-to-cow ratios provide a measure to evaluate if there are adequate numbers of bulls for breeding, satisfactory numbers for hunter preferences, and enough bulls surviving annually. Furthermore, bull-to-cow ratios may inform appropriate harvest rates when abundance is low and harvestable surplus is near management or codified objectives. These metrics are less important when abundance estimates are regularly obtained but may help evaluate herd status and trends in periods when a photocensus could not be conducted. For example, a decline in the bull-to-cow ratio has been documented in other Alaska caribou herds (Mulchatna and Western Arctic) during periods of population decline (Barten 2015 and Dau 2015).

Methods

Surveys occur near peak of rut to take advantage of increased mixing of bulls, cows, and calf caribou. Peak of rut is estimated as the date 228 days (gestation period) prior to the median calving date of FCH.

Prior to the composition survey, a sample of at least 75 collars deployed on FCH caribou are randomly selected from the collars known to be active immediately prior to the day of survey. This is done to minimize the total number of collars the radiotracking planes would need to search for on the day of the survey to improve efficiency, without compromising the survey results.

During composition surveys we locate radio collars using a fixed-wing aircraft (Piper PA-18 or Bellanca Scout) and use an observer in a Robinson R-44 helicopter to visually classify 10–15% of the herd. Group location and the number of collars in each group is determined by fixed-wing aircraft and relayed to a helicopter immediately prior to the arrival of the helicopter to each caribou group. We define a group as caribou that are lumped together and spatially separated or distinguishable from neighboring caribou or caribou groups. We attempt to locate as many collars as possible and sample across the full spatial expanse of the herd.

We attempt to spread survey effort evenly throughout the herd by classifying an equal number of caribou in the vicinity of each radio collar, so the sum total will equal the desired overall sample size (approximately 10–15% of the herd). For example, if the herd size is 50,000, and 10% of the herd is to be classified, the total composition sample would consist of 5,000 individual caribou; and if we plan to locate 100 collars during the survey, we would classify 50 caribou in the vicinity of each collar.

To adjust for variable group size and number of radiocollared caribou per group, we multiply the number of cows, calves, and bulls in each group by the proportion of radiocollared caribou that are in the group to derive weighted totals and ratios for each group. Weighted totals and ratios of all groups are added to derive herd composition.

On the day of the survey, we tally the composition of each group using a 5-position counter or digital voice recorder. Voice recordings are reviewed at a later date and tallied on a 5-position counter. Totals are recorded on a data sheet. We classify each caribou as a cow, calf, or bull. Bulls were further classified as small, medium, or large, based on antler size (Eagan 1993).

2. Mortality-Harvest Monitoring

ACTIVITY 2.1. Monitor reported and estimated harvest in Alaska and Canada (objectives C1–C3 and M3).

Data Needs

Estimates of annual harvest are important to evaluate IM objectives and ensure that harvest is within sustainable limits compared to population size and trend.

Methods

We monitor harvest using both registration and youth draw permit hunt reports. Hunters are required to report within 3 days of harvest by phone, in person, or online. They report harvest date and location, days hunted, transportation mode, commercial services used, and method of take. Harvest under the registration hunts is tracked closely through the open hunting seasons to avoid overharvest. If harvest approaches the quota or harvest objective an emergency order is issued to stop further harvest.

Estimates of harvest in Canada will be obtained from Yukon Department of Environment (YDE) staff in Dawson, Yukon.

3. Habitat Assessment-Enhancement

Techniques to enhance habitat on a scale that would improve the nutritional status of the FCH are not well understood, and there are presently no habitat enhancement projects proposed in this plan.

NONREGULATORY MANAGEMENT PROBLEMS OR NEEDS

Data Recording and Archiving

Harvest data was stored on an internal database housed on a server (http:/winfonet.alaska.gov/index.cfm). Electronic copies of data, reports, and memorandums will be stored in the WinfoNet – Data Archive. Tok area office caribou management program. Project ID: Tok caribou. Primary Region: Region III.

Agreements

The 2012–2018 Fortymile Caribou Harvest Plan was developed by the Harvest Management Coalition and will continue to provided recommendations for harvest management of the Fortymile caribou herd during the plan period, unless a revised plan is developed (Harvest Management Coalition 2012).

In March 2016, a data sharing agreement was put in place for sharing data between the ADF&G, BLM and YDE.

Permitting

None.

References Cited

Advisory Committee Coalition. 2000. Fortymile caribou herd harvest plan 2001–2006. Alaska Department of Fish and Game, Division of Wildlife Conservation, Fairbanks. http://www.adfg.alaska.gov/static/research/plans/pdfs/fortymile_harvest_plan_2001_2006.pdf (Accessed 24 February 2023).

Advisory Committee Coalition. 2006. Fortymile caribou herd harvest plan 2006–2012. Alaska Department of Fish and Game, Division of Wildlife Conservation, Fairbanks. http://www.adfg.alaska.gov/static/research/plans/pdfs/fortymile_harvest_plan_2001_2006.pdf (Accessed 24 February 2023).

Barten, N. L. 2015. Mulchatna herd caribou, Units 9B, 17, 18 south, 19A, and 19B. Chapter 3, Pages 3-1 through 3-22 [*In*] P. Harper and L. A. McCarthy, editors. Caribou management report of survey-inventory activities 1 July 2012–30 June 2014. Alaska Department of Fish and Game, Species Management Report ADF&G/DWC/SMR-2015-4, Juneau.

Bergerud, A. T., S. N. Luttich, and L. Camps. 2008. The return of caribou to Ungava. McGill Queen's University Press. Montreal, Canada.

Boertje, R. D., and C. L. Gardner. 2000. Reducing mortality on the Fortymile caribou herd. Alaska Department of Fish and Game, Division of Wildlife Conservation, Federal Aid Research Performance Report 1 July 1999–30 June 2000, Federal Aid in Wildlife Restoration Study 3.43, Juneau.

Boertje, R. D., C. L. Gardner, K. A. Kellie, and B. D. Taras. 2012. Fortymile caribou herd: Increasing numbers, declining nutrition, and expanding range. Alaska Department of Fish and Game, Wildlife Technical Bulletin 14, ADF&G/DWC/WTB-2012-14, Juneau.

Couturier, S. 1996. Calving photocensus of the Riviere George caribou herd and comparison with an independent census. Rangifer Special Issue 9:283–296.

Dau, J. 2015. Units 21D, 22A, 22B, 22C, 22D, 22E, 23, 24, and 26A. Chapter 14, pages 14-1 through 14-89 [*In*] P. Harper and L. A. McCarthy, editors. Caribou management report of survey and inventory activities 1 July 2012–30 June 2014. Alaska Department of Fish and Game, Species Management Report ADF&G/DWC/SMR-2015-4, Juneau.

Davis, J. L., R. T. Shideler, and R. E. LeResche. 1978. Fortymile caribou herd studies. Alaska Department of Fish and Game, Division of Game, Research Final Report 1 July 1973–30 June 1975, Federal Aid in Wildlife Restoration Studies 3.13R, 3.15R, and 3.16R, Juneau.

Davis, J. L., P. Valkenburg, and S. J. Harbo Jr. 1979. Refinement of the aerial photo-direct count extrapolation caribou census technique. Alaska Department of Fish and Game, Division of Game, Research Progress Report 1 July 1978–30 June 1979, Federal Aid in Wildlife Restoration Job 3.25R, Juneau.

Dean, C., and J. F. Lawless. 1989. Testing for overdispersion in Poisson and binomial regression models. Journal of the American Statistical Association 87:451–457.

Eagan, R. M. 1993. Delta caribou herd. Pages 122–147 [*In*] S. M. Abbott, editor. Caribou management report of survey and inventory activities 1 July 1990–30 June 1992. Alaska Department of Fish and Game, Division of Wildlife Conservation, Federal Aid in Wildlife Restoration Study 3.0, Juneau.

Fortymile Caribou Herd Management Planning Team. 1995. Fortymile caribou herd management plan. Alaska Department of Fish and Game, Division of Wildlife Conservation, Tok. http://www.adfg.alaska.gov/static/research/plans/pdfs/fortymile_harvest_plan_1995.pdf (Accessed 24 February 2023).

Gardner, C. L. 2001. Fortymile caribou herd. Pages 139–167 [*In*] C. A. Healy, editor. Caribou management report of survey-inventory activities 1 July 1998–30 June 2000. Alaska Department of Fish and Game, Division of Wildlife Conservation, Federal Aid in Wildlife Restoration, Study 3.0, Juneau.

Gardner, C. L. 2003. Fortymile caribou herd. Pages 139–167 [*In*] C. A. Healy, editor. Caribou management report of survey and inventory activities 1 July 2000–30 June 2002. Alaska Department of Fish and Game, Division of Wildlife Conservation, Federal Aid in Wildlife Restoration Study 3.0, Juneau.

Gross J. A. 2005. Units 20B, 20C, 20D, 20E, and 25C caribou management report. Pages 140–160 in C. Brown, editor. Caribou management report of survey and inventory activities 1 July 2002–30 June 2004. Alaska Department of Fish and Game. Project 3.0. Juneau, Alaska.

Gross, J. A. 2007. Units 20B, 20C, 20D, 20E, and 25C caribou. Pages 135–157 [*In*] P. Harper, editor. Caribou management report of survey and inventory activities 1 July 2004–30 June 2006. Alaska Department of Fish and Game, Division of Wildlife Conservation, Federal Aid in Wildlife Restoration Project 3.0, Juneau.

Gross, J. A. 2009. Units 20B, 20C, 20D, 20E, and 25C caribou. Pages 136–158 in P. Harper, editor. Caribou management report of survey and inventory activities 1 July 2006–30 June 2008. Alaska Department of Fish and Game. Project 3.0. Juneau.

Gross, J. A. 2011. Units 20B, 20C, 20D, 20E, and 25C caribou. Pages 143–170 [*In*] P. Harper, editor. Caribou management report of survey and inventory activities 1 July 2008–30 June 2010. Alaska Department of Fish and Game. Project 3.0. Juneau.

Gross, J. A. 2013. Units 20B, 20C, 20D, 20E, and 25C caribou. Pages 156–186 [*In*] P. Harper, editor. Caribou management report of survey and inventory activities 1 July 2010–30 June 2012. Alaska Department of Fish and Game, Species Management Report ADF&G/DWC/SMR-2014-3, Juneau.

Gross, J. A. 2015. Units 20B, 20C, 20D, 20E, and 25C caribou. Chapter 12, 12-1 through 12-34 [*In*] P. Harper and L. A. McCarthy, editors. Caribou management report of survey and inventory activities 1 July 2012–30 June 2014. Alaska Department of Fish and Game, Species Management Report ADF&G/DWC/SMR-2015-4, Juneau.

Harvest Management Coalition. 2012. Fortymile caribou herd harvest plan 2012–2018. Alaska Department of Fish and Game, Division of Wildlife Conservation, Fairbanks.

Murie, O. J. 1935. Alaska-Yukon caribou. U.S. Department of Agriculture, Bureau of Biological Survey, North American Fauna Series 54, Washington, D.C.

Patterson, B. R., B. T. Olsen, and D. O. Joly. 2004. Population estimate for the Bluenose–East Caribou Herd using post-calving photography. Arctic 57:47–58.

Rivest, L-P., S. Couturier, and H. Crepeau. 1998. Statistical methods for estimating caribou abundance using postcalving aggregations detected by radio telemetry. Biometrics 54:865–876.

Skoog, R. O. 1956. Range, movements, population, and food habits of the Steese–Fortymile caribou herd. Thesis, University of Alaska Fairbanks.

Valkenburg, P., D. A. Anderson, J. L. Davis, and D. J. Reed. 1985. Evaluation of an aerial census technique for caribou based on radiotelemetry. Pages 287–299 [*In*] T. C. Meredith and A. M. Martell, editors. Proceedings second North American caribou workshop. McGill Subarctic Research Paper 40.

Valkenburg, P., and J. L. Davis. 1989. Status, movements, range use patterns, and limiting factors of the Fortymile caribou herd. Alaska Department of Fish and Game, Division of Wildlife Conservation, Research Final Report 1 July 1984–30 June 1988, Federal Aid in Wildlife Restoration Study 3.32, Juneau.

Valkenburg, P., D. G. Kelleyhouse, J. L. Davis, and J. M. Ver Hoef. 1994. Case history of the Fortymile caribou herd, 1920–1990. Rangifer 14(1):11–22.

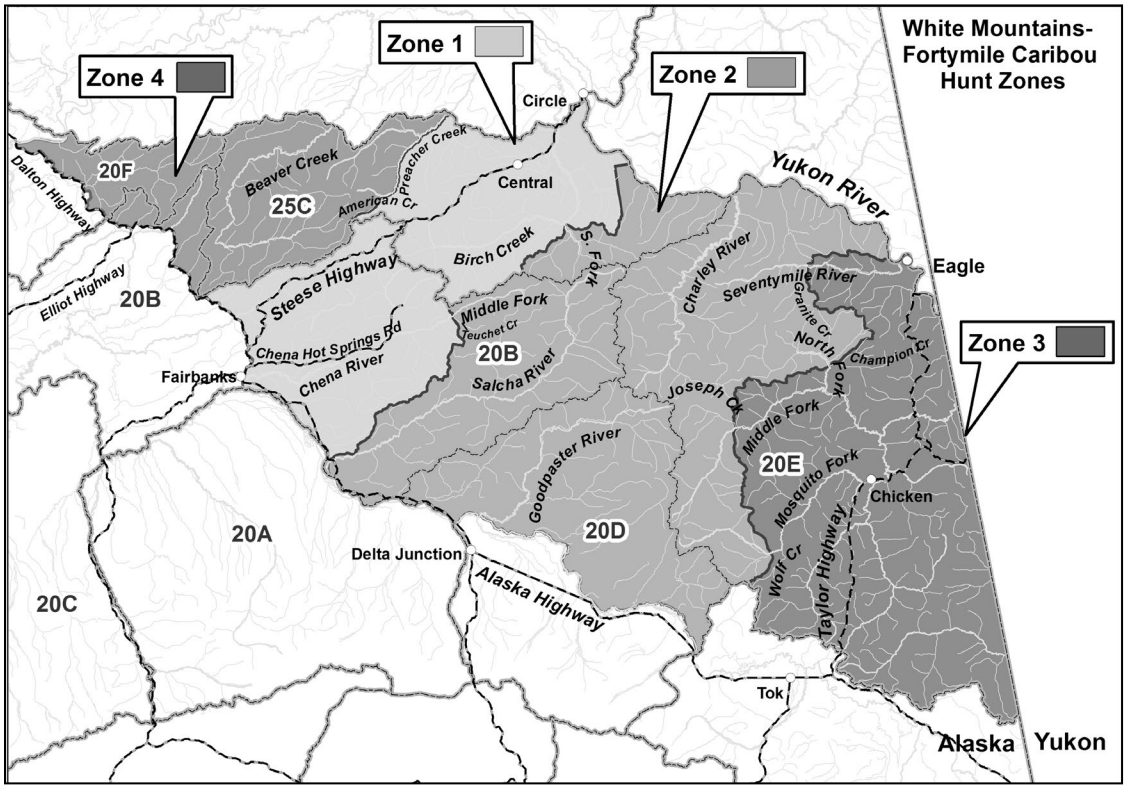
Valkenburg, P., T. H. Spraker, M. T. Hinkes, L. H. Van Daele, R. W. Tobey, and R. A. Sellers. 2000. Increases in body weight and nutritional status of transplanted Alaskan caribou. Pages 133–138 [*In*] R. E. Haugerud, editor. Proceedings of 8th North American Caribou Workshop, 20–24 April 1998, Whitehorse, Yukon, Canada. Rangifer, Special Issue 12.

Valkenburg, P., R. W. Tobey, B. W. Dale, B. D. Scotton, and J. M. Ver Hoef. 2003. Body size of female calves and natality rates of known-aged females in two adjacent Alaskan caribou herds, and implications for management. Pages 203–209 [*In*] R. E. Haugerud, editor. Proceedings of 9th North American Caribou Workshop, 23–27 April 2001, Kuujjuaq, Quebec, Canada. Rangifer, Special Issue 14.

Whitten, K. R. 1995. Antler loss and udder distension in relation to parturition in caribou. Journal of Wildlife Management 59(2):273–277.

Appendix. 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[1]) and *Fortymile Caribou Herd Harvest Plan 2012–2018* (Harvest Management Coalition 2012[2]) 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.

[1] Advisory Committee Coalition. 2006. Fortymile caribou herd harvest plan 2006–2012. Alaska Department of Fish and Game, Division of Wildlife Conservation, Fairbanks.

[2] Harvest Management Coalition. 2012. Fortymile caribou herd harvest plan 2012–2018. Alaska Department of Fish and Game, Division of Wildlife Conservation, Fairbanks.

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.


ALASKA
DEPARTMENT OF FISH AND GAME