OPERATIONAL PLAN FOR INTENSIVE MANAGEMENT OF THE FORTYMILE CARIBOU HERD IN GAME MANAGEMENT UNITS 12, 20B, 20D, 20E AND 25C DURING REGULATORY YEARS 2014–2019

Prepared by:

DIVISION OF WILDLIFE CONSERVATION

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This operational plan has been prepared by the Alaska Department of Fish and Game (ADF&G) to provide supporting information on the intensive management (IM) plan for the Fortymile Caribou Herd (FCH) during regulatory years (RY) 2014–2015 through 2019–2020 (RY = July 1–June 30, e.g., RY14 = July 1, 2014–June 30, 2015). The IM plan for the FCH is found in Title 5, Alaska Administrative Code, Section 92, Part 113 (abbreviated as 5 AAC 92.113). Based on the biological and management information for this area (Appendix A), this operational plan describes rationale for evidence of limiting factors; choice of indices for evaluating treatment response; and decision frameworks on implementation, suspension, or termination for predation control, habitat enhancement, and prey harvest strategies. *Intensive Management Protocol* (ADF&G 2011) describes the administrative procedures and the factors and strategies in adaptive management of predator-prey-habitat systems to produce and sustain elevated harvests of caribou, deer, or moose in selected areas of Alaska. The IM plan for the FCH has been developed based on the recommendation of the Upper Tanana Fortymile and Eagle Fish and Game Advisory Committees and at the request of the Alaska Board of Game (BOG).

BACKGROUND

Residents of the upper Yukon/Tanana drainages expressed concern, since the early 1980s, about chronically low numbers of the Fortymile Caribou Herd (FCH) and moose in Units 12 and 20E. They believed that the low numbers of caribou primarily resulted from wolf predation and low numbers of moose resulted from a combination of wolf and brown bear predation. During Board of Game (BOG) meetings in March 2004 and 2006, the Upper Tanana/Fortymile Fish and Game Advisory Committee and the public provided testimony explaining the problem and requested corrective action.

The BOG first adopted the Upper Yukon/Tanana Predation Control Implementation Plan (plan) in November 2004 to increase the moose population. The plan authorized control of wolves and brown bears in the Upper Yukon–Tanana Predation Control Area (UYTPCA) in all of Units 12 and 20E, excluding the Yukon-Charley Rivers National Preserve (YUCH). The plan was authorized for January 1, 2005–December 31, 2009. The BOG authorized the commissioner to issue public aerial or public land and shoot permits to control wolves pursuant to AS 16.05.783. Baiting of brown bears under a control permit was allowed as a method of brown bear removal beginning in spring of 2005. Using ADF&G discretionary permit authority, the geographic area where public permittees were allowed to take wolves was limited to southern Unit 20E and to Unit 12 north of the Alaska Highway, and the area they were allowed to take bears was limited to southcentral Unit 20E. During January–May 2006 at multiple meetings, the BOG modified the plan to:

- Add the FCH and expand the UYTPCA to encompass an 18,750 mi^2 portion of the FCH range (all of Unit 20E and portions of Units 12, 20B, 20D and 25C) (Fig. 1)
- Expand wolf control to the entire UYTPCA
- Limit brown bear control to southcentral Unit 20E
- Clarify and update key components of the plan that included wildlife population and human use information, predator and prey population levels and objectives, plan justifications, methods and means, and time frame for updates and evaluations.

After these BOG changes, ADF&G did not use discretionary permit authority to limit the geographic area were control was conducted.

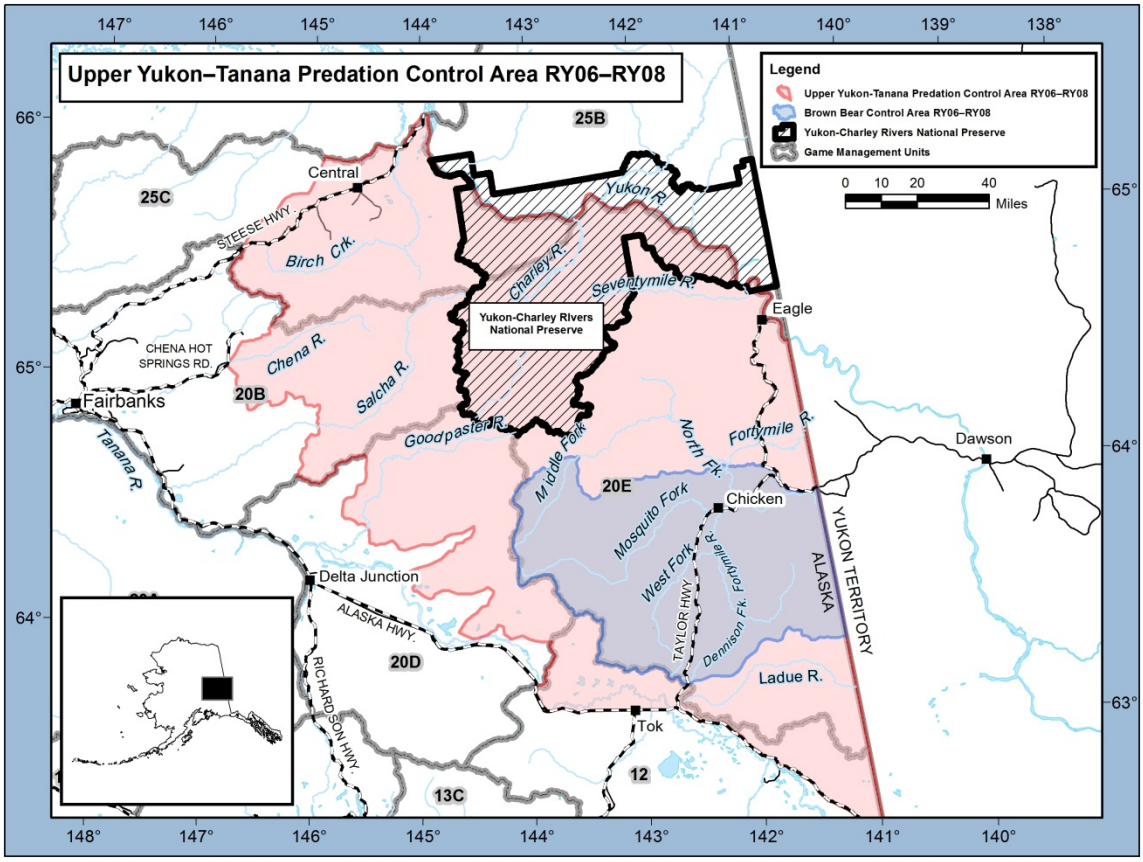

Figure 1. Upper Yukon–Tanana Predation Control Area, regulatory years 2006–2007 through 2008–2009 (18,750 mi^2).

In March 2009, the BOG reauthorized the plan for January 1, 2009–December 31, 2014. The reauthorized plan suspended bear control on July 1, 2009 because it was determined to be ineffective due to a combination of ineffective methods and lack of permittee incentives. It retained the 18,750 mi^2 UYTPCA (Fig. 2), and reaffirmed public aerial shooting permits or public land and shoot permits for wolf control.

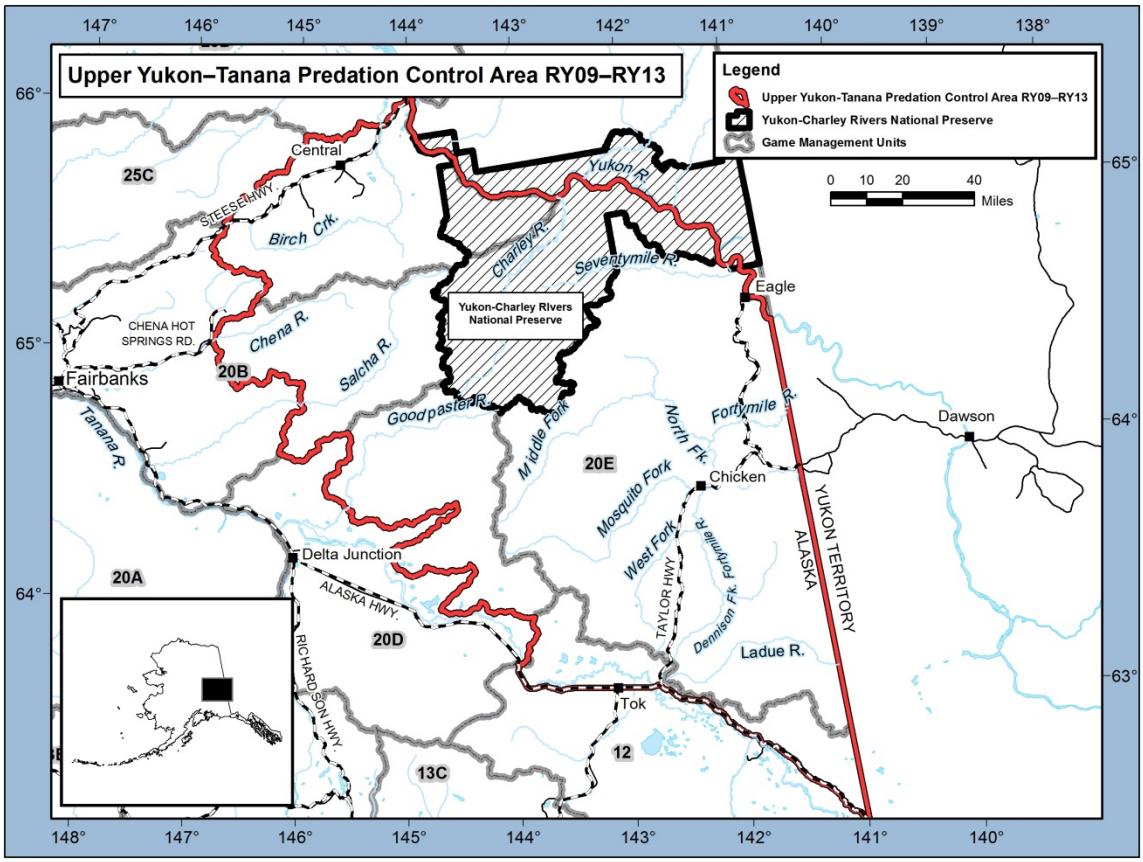

Figure 2. Upper Yukon–Tanana Predation Control Area, regulatory years 2009–2010 through 2013–2014 (18,750 mi^2 area).

In addition, department wolf removal using helicopters was implemented under the commissioner's authority to supplement public permittee efforts and help achieve removal objectives. The following IM prey and predator objectives were also specified.

- FCH population objective of 50,000–100,000 and harvest objective of 1,000–15,000.
- Moose population objective of 8,744–11,116 and harvest objective of 547–1,084 in Unit 12 north of the Alaska Highway and in Unit 20E
- Wolf control objective of maintaining no fewer than 88–103 wolves (mid-point = 96). A minimum population of 88 wolves is approximately a 75% reduction from the minimum pre-control population of 350 and assured that wolves persisted in the UYTPCA.

This IM Operational Plan retains the objectives of the 2009 version of the plan related to the FCH and wolves, but removes portions related to moose. It is assumed that moose will continue to benefit in northern Unit 12 and Unit 20E from continued wolf removal for the primary benefit of the FCH under this plan.

ADF&G is maintaining a minimum of 90 VHF collars and 20 satellite GPS collars to facilitate annual spring parturition surveys, summer photocensuses, and fall composition surveys; and to track seasonal movements, and document survival rates of individual females beginning at 4-months of age. In addition, the collared sample is used to monitor herd distribution to assist with harvest management.

Since being added to the plan in 2006, the FCH has increased from 43,000 in June 2006 to 51,675[1] in June 2010, based on photocensus results. Harvest of the herd is guided by the Fortymile Caribou Herd Harvest Plan, which includes a quota system designed to encourage herd growth by taking less than the harvestable surplus. During RY06–RY12 reported harvest was 729–1,306 annually (Table 1). During RY10–RY13, both the FCH population and harvest have remained at the lower end of the IM Objectives.

Table 1. Fortymile caribou reported harvest, regulatory years 2006–2007 through 2012–2013.

Regulatory year	Reported on registration permit[a]				Reported on general harvest report	Total
	M	F	Unk	Total		
2006–2007	601	247	4	852	12	864
2007–2008	746	262	4	1,012	20	1,032
2008–2009	681	217	0	898	9	907
2009–2010	881	192	10	1,083	11	1,094
2010–2011	630	89	6	725	4	729
2011–2012	935	125	6	1,066	18	1,084
2012–2013	1,081	190	26	1,297	9	1,306

[a] Data from RC860 and RC867 harvest reports.

ADAPTIVE MANAGEMENT FRAMEWORK

Adaptive management is a process in which programs are designed to maximize what can be learned from management actions for potential application elsewhere, not simply modifying management in light of experience (National Research Council 1997:122). Managers wishing to use the best available information for management decisions or recommendations often need to generate new information for specific field situations (National Research Council 1997:174). Any section of the following framework may be modified as new information comes to light in the study area or the scientific literature. Lack of an anticipated response may require evaluation

[1] The 2010 FCH population estimate is the most current herd population estimate available.

of additional criteria or a research project to understand which additional factors may be influencing the system and whether they are feasible to manage.

I. TREATMENTS

A. *Predation Control:*

Department FCH research projects (1994–2003) indicated wolf predation, primarily on calves, is the major limiting factor on population growth (Boertje and Gardner 1998, Boertje and Gardner 2000, Boertje et al. 2008). During this research, an average of 69% of calf mortality (calves born in 1994–1999), occurred during the calving/post-calving periods in May and June (Boertje and Gardner 2000).

The current UYTPCA encompasses the FCH calving/post-calving range (Fig. 3). For purposes of this IM Plan, that range is defined as the portion of the entire herd range used during May 11–June 30, in 16 out of 17 years, during 1992–2008 (Boerjte et al. 2012). This area encompasses the core uplands or core tundra as defined by Boertje et al. (2012) and excludes heavily treed areas to the west and southeast that have been rarely used (used in only 1 of 17 years during 1992–2008).

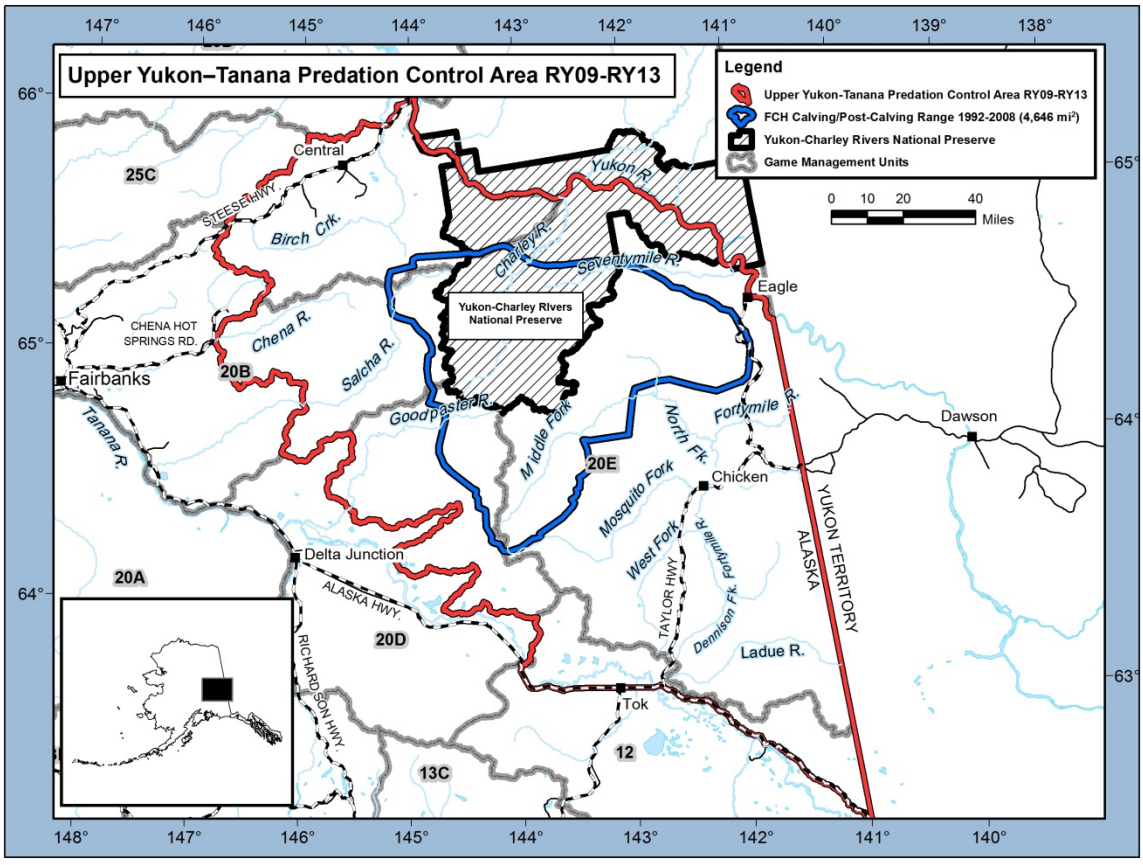

Figure 3. Upper Yukon–Tanana Predation Control Area in regulatory years 2009–2010 through 2013–2014 (18,750 mi^2 area), with the Fortymile Caribou Herd calving/post-calving range (4,646 mi^2). Includes the portion of the herd's range used during 11 May–30 June, in 16 out of 17 years, during 1992–2008 (Boerjte et al. 2012).

Public harvest of wolves and bears under current trapping and hunting regulations will continue to be encouraged. Public aerial shooting permits for removal of wolves in the UYTPCA, with the exception of YUCH, will continue to be available to interested parties as authorized in 5 AAC 92.110. Predator harvest incentive programs for hunters and trappers initiated and funded by non-government organizations will also be encouraged. Public participants will be encouraged, but not required, to concentrate wolf removal efforts on packs that occur within the FCH calving/post-calving range.

Aerial removal of wolves by department staff will be used to supplement public permittee efforts, and will be focused primarily within the FCH calving/post-calving range, excluding YUCH. We will attempt to temporarily reduce wolves in packs with territories that overlap the calving/post calving range to the lowest level possible.

The department will use airplanes and helicopters to locate and lethally remove wolves. Removal will occur either in early-winter (October-early December) or late-winter (mid-February–mid-April) to take advantage of longer daylight hours and warmer temperatures during these periods. When possible, 1 or 2 members of each pack may be radiocollared to aid in locating and removing non-radiocollared pack members.

Presently known alternatives to predator control for reducing the number of predators are ineffective, impractical, or uneconomical in the control area. Hunting and trapping conducted under authority of ordinary hunting and trapping seasons and bag limits alone is not an effective reduction technique in sparsely populated areas such as the UYTPCA. Numbers of hunters and trappers are relatively low and educational programs to stimulate interest and improve skills in taking wolves have been unsuccessful because of the inherent wariness of wolves, difficult access, and relatively poor wolf pelt prices. Application of the most common sterilization techniques (surgery, implants, or inoculation) are not practical reduction techniques because they require extensive and time-consuming veterinary care, which has proven impractical in remote areas. Also, relocation of wolves is impractical because it is expensive, and it is very difficult to find publicly acceptable places to relocate the animals.

B. *Habitat Enhancement:*

A 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 36-month parturition rate and fall calf weights (Fig.s 4 and 5) suggest that nutritional status of the herd has declined since about the early 2000s. Boertje et al. (2012) provided evidence that suggested overgrazing of the herds summer range was a likely causative factor for the decline in these indices. In addition, recent fires 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.

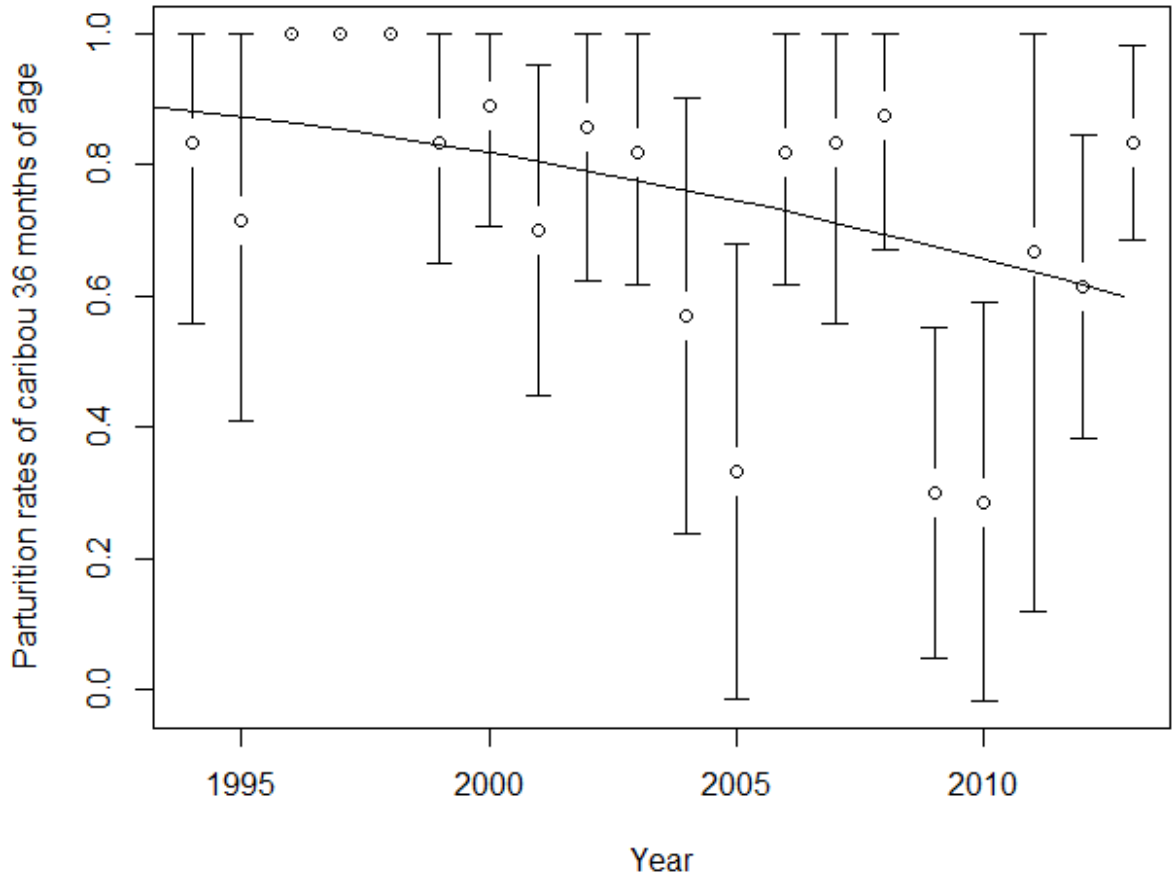

Figure 4. Parturition rates and 90% binomial CIs (truncated at 1.0 in 10 cases) among radiocollared 36-month-old caribou in the Fortymile herd, 1994–2013. The low parturition rates in 2004, 2005, 2009, and 2010 caused a significant decline in trend based on using annual data and logistic regression (generalized linear model) in Program R (slope on the logit scale = −0.09 [SE = 0.031], $P = 0.0006$, $R^2 = 0.20$). Annual sample sizes ranged from 3 to 18 ($\bar{x} = 8.75$).

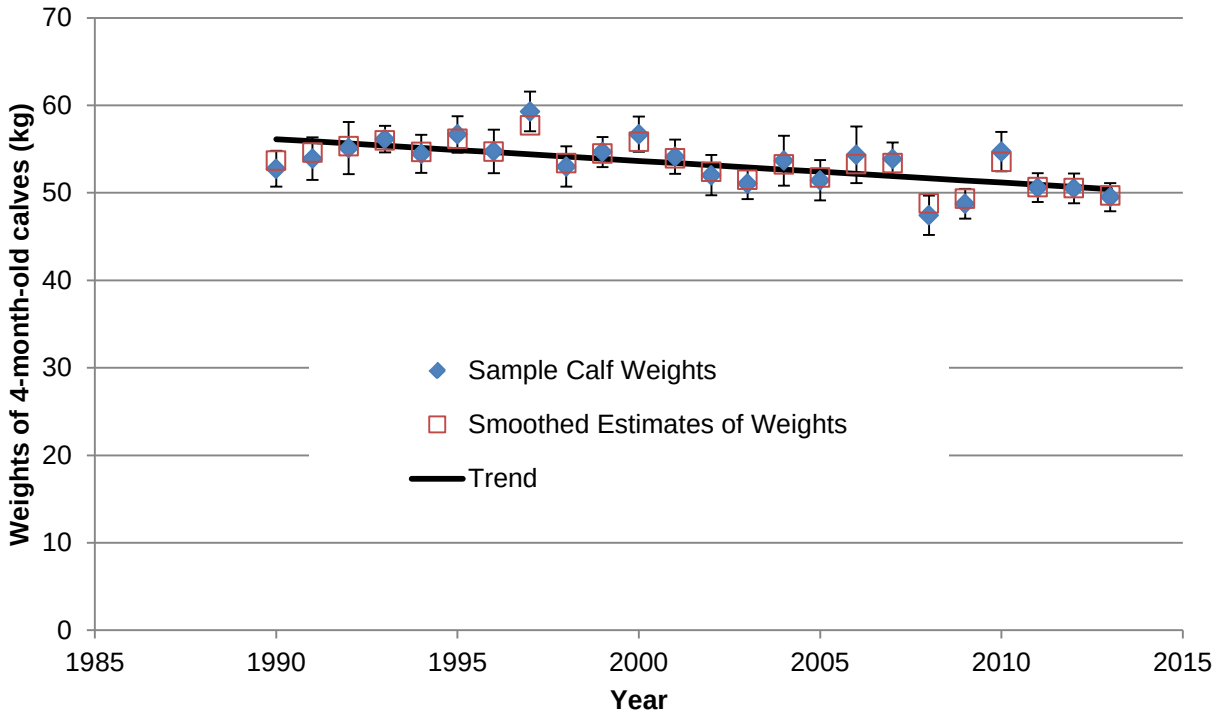

Figure 5. Trend analysis on female calf weights at 4 months of age in the Fortymile caribou herd, 1990–2013. Annual sample sizes ranged from 14 to 26. The linear mixed effects model indicated a significant linear decrease of 0.25 kg/yr (P = 0.001). We provided 90% CIs for sample estimates.

C. *Prey Harvest:*

Harvest of the FCH is guided by the Fortymile Caribou Herd Harvest Plan 2012–2018 (FCH harvest plan), which was developed by the Harvest Management Coalition consisting of members of the Anchorage, Central, Delta, Eagle, Fairbanks, Matanuska Valley, and Upper Tanana/Fortymile state fish and game advisory committees, the federal Eastern Interior Regional Subsistence Advisory Council, Yukon Fish and Wildlife Management Board, Yukon Department of Environment, and Yukon First Nations, in cooperation with Bureau of Land Management and the Alaska Department of Fish and Game (Harvest Management Coalition, 2012). Included in the FCH harvest plan are strategies for harvest of the FCH as it grows and expands its range and guidelines for increasing harvest to stabilize or reduce herd numbers if herd nutrition becomes compromised. Currently, harvest of the FCH is based on a proportion of the herd size that is intended to promote continued herd growth by taking less than the harvestable surplus.

II. ANTICIPATED RESPONSES TO TREATMENTS

By focusing much of the wolf removal efforts on the FCH calving and post calving range, we are targeting wolf predation on calves during May and June (Boertje and Gardner 1998, Boertje and Gardner 2000, Boertje et al. 2008), the major factor limiting FCH growth. In addition, removal of wolves in other parts of the FCH range in Alaska is likely to provide additional relief from wolf predation on both adults and calves, as observed in other caribou herds (Gasaway et al. 1983, Boertje et al. 1996, Hayes et al. 2003). Wolf control, combined with conservative harvest (guided by the FCH harvest plan) and favorable weather, should provide conditions for continued herd growth.

However, as previously mentioned, if nutritional indices indicate continued herd growth is no longer advisable, the control program will be continued to maximize hunter harvest as long as harvest is sufficient to prevent further herd growth. If further growth can be prevented, the result of this strategy will be allocation of the entire harvestable surplus to hunters.

A. *Predator Abundance:*

We estimated the pre-control UYTPCA wolf population during November 2004 was 350–410 in 50–70 packs or approximately 19–22 wolves/1000 mi^2. This estimate was based on department wolf surveys (Gross 2006), wolf research in interior Alaska and Yukon (Gasaway et al. 1983, Boertje et al. 1996, McNay and DeLong 1998, Hayes 2003), anecdotal observations, trapper and hunter interviews, and sealing records. The portion of this population in packs with territories that overlap the FCH calving/post-calving range (Fig. 3) was estimated at 150–210 (mid-point = 180 wolves) in 25–35 packs (Gross, unpublished data, ADF&G Tok).

Our most recent area-wide (18,750 mi^2) UYTPCA wolf population estimate (Nov. 2013) was 338–373 (mid-point = 356 wolves) in 45–47 packs. It was developed using 25 iterations of the PredPrey model (Version 1.5) (McNay and DeLong 1998). Model inputs included 2012–2013 population and harvest data for wolves, moose and caribou (Gross, unpublished data, ADF&G Tok; John Burch, NPS, personal communication, 2013). Mathematical equations in PredPrey, which define model functions, were taken from published predator-prey studies conducted across North America.

The department control permittees, hunters, and trappers removed an average of 124 wolves annually (range 60–226) across the entire 18,750 mi^2 control area during RY06-RY12 (Table 2). The November 2013 estimate of 338–373 (18–20 wolves/ 1,000 mi^2) was close to our November 2004 pre-control estimate of 350–410 (19–22 wolves/1000 mi^2). During RY06-RY12, relatively low area-wide annual removal rates (25–62%, average 45%, using mid-point estimates) (Table 3) have allowed the wolf population to rebound to near pre-control levels by the following fall in most years (ADF&G 2013).

Table 2. Annual wolf removal within UYTPCA since program was expanded to include the FCH in RY06.

Regulatory year	Harvest removal		Dept. control removal	Public control removal	Total removal	Spring abundance (range)[a]
	Trap	Hunt				
2006	73	7	N/A	23	103	259 (197–322)
2007	57	14	N/A	27	98	284 (268–300)
2008	82	11	84	49	226	146
2009	31	4	15	10	60	175
2010	26	11	0	25	62	212 (200–223)
2011	62	17	56	8	145	184 (170–197)
2012	41	12	40	78	171	215 (197–232)

[a] Fall estimate minus all know wolf kills.

Table 3. Percent reduction in wolf numbers (estimated or confirmed number remaining by 1 May each regulatory year) from pre-control (fall 2004) levels since program was expanded to include the FCH in RY06.

Regulatory Year	% reduction in UYTPCA (18,750 mi^2) Wolf Population	% reduction in wolves from packs overlapping FCH Calving/Post-Calving Range
2006–2007	32	-[a]
2007–2008	25	-[a]
2008–2009	62	69
2009–2010	54	71
2010–2011	44	-[a]
2011–2012	52	62
2012–2013	43	84

[a] Inadequate information available to estimate wolf numbers and % reduction.

While area-wide reductions in wolves have proven difficult to achieve since the UYTPCA was expanded in 2006, wolves from packs that overlap the 4,646mi^2 FCH calving/post-calving range (Fig. 3), were reduced by an average of 72% (range 62 – 84%) (Table 3) from pre-control levels in RY08-RY09 and RY11-RY12 (Gross, unpublished data, ADF&G Tok). This was due to the combined efforts of trappers, hunters, control permittees and department removal during these years.

B. *Predation Rate:*

By focusing much of the wolf removal efforts on the FCH calving/post calving range, we are targeting wolf predation on calves during May and June which is the major factor limiting FCH growth (Boertje and Gardner 1998, Boertje and Gardner 2000, Boertje et al. 2008). In addition, removal of wolves in other parts of the FCH range in Alaska is likely to provide additional relief from wolf predation on both adults and calves, as observed in other caribou herds (Gasaway et al. 1983, Boertje et al. 1996, Hayes et al. 2003). While we anticipate

reduction in wolf predation rates if desired wolf reductions are achieved, the magnitude of the reductions are uncertain.

Previous research on benefits of lethal wolf removal for caribou in Alaska and Yukon have generally involved the reductions of wolves throughout entire herd ranges (Gasaway et al. 1983, Boertje et al. 1996, Hayes et al. 2003), rather than a portion of them, such as the calving/post-calving range. Additional research is needed to further evaluate the benefit of removal methods used in this program. It should primarily focus on early calf-mortality (i.e. – first 5-6 weeks of life) following wolf removal from packs in the FCHs calving/post-calving range, with some level of effort to also estimate mortality of calves and adults until the following spring.

C. *Prey Abundance:*

The FCH experienced an average 6% annual rate of increase during 1996–2010, concurrent with wolf control programs (Boertje et al. 2012). Continued growth is expected during the life of this IM plan if similar conditions occur. Those conditions include: wolf reductions focused on calving/post calving range, quota based harvest tied to a fixed herd harvest rate under the FCH harvest plan, adequate herd nutritional condition, and favorable weather conditions. However, the herd could be stabilized or reduced by harvest if nutritional condition continues to decline, as suggested by lower 36 month old parturition rates and 4 month old female calf weights since the early 1990s.

D. *Prey Recruitment:*

Boertje and Gardner (1998, 2000), and Boertje et al. (2008) provided direct evidence that wolf predation, primarily on calves during May and June, was the dominant factor influencing FCH population trend during 1994–2003. If wolves are temporarily reduced by at least 60% of the pre-control level in the calving/post-calving areas, we anticipate that wolf predation, particularly on calves, will decline. Assuming bear predation on calves does not increase, this decline in wolf predation is anticipated to increase or maintain recruitment that could be allocated to herd growth (2012 objective of Harvest Management Coalition, allowing proportional harvest) or increased hunter harvest in lieu of herd growth.

Fall calf:cow ratios that are obtained during composition surveys are an estimate of calf survival to fall and an indicator of potential recruitment. Ratios averaged 31 calves:100 cows (range 22-37) during RY06–RY13 (Table 4). Wolf control to benefit the FCH was conducted during all of these years, with an average of 72% (range 62–84%) reduction in packs that overlap the calving/post-calving range during RY08-RY09 and RY11-RY12 (Table 3). This rate of removal had the potential to improved calf survival. However, the effect of wolf control is impossible to quantify using only fall calf:cow ratios.

Table 4. Fortymile Caribou Herd fall composition counts RY06 – RY13.

Regulatory year	Date of composition count	Calves: 100 Cows	Composition sample size
2006–2007	10/5/06	34	4,995
2007–2008	10/4/07	37	5,228
2008–2009	10/7–8/08	33	4,119
2009–2010	10/7/09	34	4,503
2010–2011	10/2/10	32	7,169
2011–2012	10/5/11	25	3,949
2012–2013	10/9/12	22	4,832
2013–2014	10/6-10/13	28	3,921

E. *Prey Productivity or Nutritional Condition:*

Parturition rates are determined annually by observing known-age radiocollared females from a Piper PA-18 during calving season in May. Caribou observed with calves, hard antlers, or distended udders are classified as parturient (Whitten 1995).

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

Analysis of parturition rates of known-age cows in Alaska caribou herds indicates that a 5-year moving average of 3-year-old parturition rates of <55% could indicate nutritional stress (Boertje et al. 2012). In 2012, it was 54% among FCH cows (n=13) (Table 5). This was interpreted as a cautionary signal that nutritional status of the herd was reduced. However, it increased to 59% after inclusion of the 2013 (n=18) data.

Table 5. Fortymile caribou parturition rates of known-age radiocollared females, 1993–2013.

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

[a]Number of radiocollared cows with calf + radiocollared cows with no calf, but with hard antler or udder divided by number of radiocollared cows observed.
[b]Near daily flights were flown during this period in conjunction with a calf mortality research project.
[c]Three to 4 flights were conducted during this period.

Although the 5-year moving average of 3-year-old parturition rate increased above the threshold in 2013, nutritional status of the herd will continue to be monitored annually. Additional information about the nutritional status of the FCH can be found in Boertje et al. (2012). As discussed in Section I. B. above, parturition rates among radiocollared 36-month-old caribou in the Fortymile herd declined during 1994–2010 (Fig. 4, Table 5).

In addition to natality rates, weights of 4-month old female calves have also been monitored as an index of herd nutrition. Autumn calf weights have been collected on the FCH since 1990, with a long-term (1990–2013) average of 117.5 lbs (53.3 kg). Boertje et al. (2012) found a declining trend in the FCH fall calf weights of 0.46 lbs/yr (0.22 kg/yr, $P = 0.02$) during 1990–2010. Although calf weights have declined indicating decline in general herd nutrition, the relationship between a given percentage decline and the nutritional status of a caribou herd has not been well documented in the literature. However, fall calf weights will continue to be collected annually in anticipation that those data, in addition to other research, eventually may be correlated with general herd nutritional status.

In 1998, for the first time in 3 decades, FCH density exceeded 1.3 caribou/mi^2 (0.5 caribou/km^2). Beginning in 2001, the herd expanded its range use, possibly as a result of increased herd size. The herd moved farther west near the Steese Highway in fall 2001 and used winter range in Yukon, Canada during winters 2000–2001 through 2012–2013. Even so, more than 75% of the historic Fortymile range had not been used since the 1960s and the far eastern portion of the range has not been used since at least the 1940s. In fall of 2013, the FCH further expanded its range. In Yukon, the herd reached areas along the Dempster Highway northeast of Dawson never before documented within the herd's historic range and to the southeast crossed the White River northeast of Beaver Creek. In addition, the herd continued expanding west in the White Mountains in Alaska during fall 2013. Much of the habitat in Yukon and in the White Mountains has abundant lichen and the potential to provide improved nutrition for the herd.

F. *Harvest:*

The primary management goal for the FCH, identified in both the current FCH Federal Aid Management Report (Gross, *In prep)* and FCH harvest plan, is to restore the herd 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. A secondary goal outlined in the harvest plan is to increase the allowable harvest of the FCH as the herd grows and as the herd can sustain harvest within the constraints of the primary goal. Initially, predation control in the UYTPCA will be conducted to promote growth of the FCH. However, as previously mentioned, if nutritional indices indicate continued herd growth is no longer advisable, the control program will be continued to maximize hunter harvest as long as harvest is sufficient to prevent further herd growth. If further growth can be prevented, the result of this strategy will be allocation of the entire harvestable surplus to hunters.

G. *Use of Nontreatment Comparisons:*

Other than general comparisons to adjacent herds, a similar nontreatment area is not available and no specific comparisons will be identified at this time. This constrains our ability to evaluate responses to treatments.

H. *Other Mortality Factors:*

Antibody screening of blood samples (n=159) collected during 1975–2001 indicate there were no significant infectious diseases affecting population dynamics of the herd (Zarnke 2001). Since 2001, the only additional blood samples taken for screening were collected in 2012. These samples have not been analyzed.

Frequency of severe weather events in the herd's range are low and weather has not been identified in past research as a major factor influencing FCH trend. However, Boertje et al. (2012) pointed out that "weather patterns in the vast, remote Fortymile herd range were inadequately measured" during 1990-2010.

III. Evaluation Criteria and Study Design to Document Treatment Response

Adaptive management with the intent to increase harvestable surplus of prey requires evaluating the biological response and achievable harvest after treatments are implemented (Walters 1986). Evaluation will be reported to BOG in February each year with an interim update of selected criteria in August each year.

A. *Predator Abundance and Potential for Return to Pre-treatment Abundance:*

We will estimate wolf abundance each November using methods listed in Section II A and will monitor removal yearlong. Wolf control and trapping and hunting harvest will be suspended at any time in any given year if <88 wolves are estimated to be remaining in the UYTPCA.

Wolf abundance over the entire UYTPCA (18,750 mi^2) is currently similar to pre-control (Section II A). Based on relatively low removal rates annually during 2004-12 (ADF&G 2013) over the entire UYTPCA, we expect wolves to remain at near pre-treatment levels.

B. *Habitat and Forage Condition:*

No criteria or thresholds of forage production or utilization exist for recommending change in management actions for this herd. However, research efforts to assess FCH habitat have been discussed with Alaska Federal Agency partners (BLM and NPS) and the Yukon Department of Environment. These efforts are anticipated to be costly and logistically difficult and are still in the initial stages of development.

C. *Prey Abundance, Age-sex Composition, and Nutritional Condition:*

The FCH IM population objective is 50,000–100,000.

In addition, the 2012–2018 FCH harvest plan details the following population goal and objectives, which if achieved will contribute to continued achievement of the IM objective.

Goal:

- Promote continued growth and restore the herd to its historic range in both Alaska and Yukon to the extent possible without compromising herd health.

Objectives:

- During the life of the plan, promote and support management actions to increase the population by approximately 2-3% annually.
- Over the long term, continue to promote and support management actions to achieve a population of 50,000–100,000.

Captures of known-age females will be conducted during late September–mid October to deploy VHF radio and satellite collars. Collars are needed to facilitate censuses, sex and age surveys, and parturition surveys needed to evaluate IM treatments.

A census will be attempted annually between late-June and mid-July to assess herd size relative to goals and objectives using the modified aerial photo direct count technique (Davis et al. 1979). However, a census may not be achievable every year due to various factors generally related to weather and insect abundance.

Parturition surveys will be done during May to assess nutritional condition of the herd. Known-age radiocollared females will be observed from a Piper PA-18 during calving season. Caribou observed with calves, hard antlers, or distended udders will be classified as parturient (Whitten 1995). Parturition rates of know age cows will be used as the primary index for monitoring nutritional condition of the FCH (see Section IV. C.2 below).

FCH population status and trend monitoring techniques currently used are described in more detail in the 2013 FCH Federal Aid Management Report (Gross *In prep*) In addition, assessment of herd nutrition is described in detail in Boertje et al. (2012) and Gross (*In prep*).

D. *Prey Harvest:*

The FCH IM harvest objective is 1,000–15,000.

In addition, the 2012–2018 FCH harvest plan details the following harvest goals and objectives, which if achieved will contribute to continued achievement of the IM objective.

Goals:

- Promote continued growth and restore the herd to its historic range in both Alaska and Yukon to the extent possible without compromising herd health.

- Increase the allowable harvest of the FCH as the herd grows and as the herd can sustain harvest without compromising herd health.
- Provide reasonable opportunity for Alaska subsistence uses.
- Manage Alaska hunts to allow opportunity for nonsubsistence hunters while staying within the constraints of all other goals and objectives.

Objectives:

- During the life of this plan, promote and support management actions to increase the harvest to 1,000-4,000 annually.
- Over the long term, continue to promote and support management actions to achieve a harvest of 1,000–15,000.
- Manage Alaska harvest to provide at least 14 days of hunting during each of the fall and winter seasons to ensure reasonable opportunity for state and federally-qualified subsistence hunters.
- Manage Alaska harvest to provide at least 7 days of hunting during the fall season for nonresident hunters.

FCH harvest will be monitored relative to the IM objective through registration and drawing permit harvest reports. Harvest rates specified in the harvest plan include an annual herd harvest rate of 3% if herd size is <70,000 and 4% if herd size is ≥70,000. However, the harvest plan recognizes that if nutritional condition of the herd indicates that further growth will compromise herd health, the harvest rate may need to exceed 4% to achieve herd stabilization or reduction.

E. Calf and adult mortality

A research plan for the FCH is currently being developed. As mentioned in Section II B., additional research is needed to evaluate the benefit of wolf removal methods used in this program.

IV. Decision Framework to Implement or Suspend a Treatment

A. *Predation Control:*

1. Prey Population Abundance.

Consistent with the FCH harvest management plan, wolf control will be suspended if the point estimate resulting from a photocensus is >100,000, and herd growth cannot be stabilized or reduced through harvest alone. However, there is uncertainty about how many caribou the range can support. Therefore, a population based threshold value alone triggering treatments are not sufficient. Instead, nutritional indices and harvest strategies discussed later in this section will provide guidelines and threshold values that will be used to trigger IM actions.

2. Prey Harvest Catch Per Unit Effort (CPUE).

CPUE will not be used to trigger management actions because many factors influence the number of days it takes for hunters to harvest a caribou. These include, but are not limited to weather, water levels, fuel cost, the day of the week the season opens, reporting habits, as well as moose numbers and their distribution.

B. *Habitat Enhancement:*

We do not have data on range condition and can only speculate on how fire may affect nutritional condition of caribou (see Section I B). Therefore, we will not recommend a habitat metric for management decisions at this time.

C. *Prey Harvest Strategy:*

1. Prey Harvest.

Wolf control will be suspended if reported harvest is >15,000

Consistent with the FCH harvest plan, annual harvest rates will be 3% if herd size is <70,000 and 4% if herd size is ≥70,000. Because annual harvest of the FCH is based on a fixed rate of the current herd size, as herd size increases or declines, harvest will follow. However, if nutritional condition of the herd indicates that further growth will compromise herd health the harvest rate may need to exceed 4%. If the herd is stabilized or reduced through harvest, or declines because of increased natural mortality, predator control will continue unless the upper end of the IM harvest objective is achieved.

2. Prey Nutritional Index.

Parturition rates of know age cows, will be used as the primary index for monitoring nutritional condition of the FCH (see Section II. E above). If the 5-year moving average of 3-year-old parturition rates is ≤55%, this will signal that nutritional status of the herd may be notably reduced (Boertje et al. 2012). If the 5-year moving average remains below this threshold for 2-3 years, herd stabilization or reduction through increased harvest will be considered with input from stakeholders and will be implemented if deemed prudent. If the herd is stabilized or reduced, predator control will continue with harvestable surplus reallocated from wolves to hunters. However, if herd nutrition becomes compromised and herd stabilization or reduction is unsuccessful through harvest alone, then wolf control will be suspended.

V. PUBLIC INVOLVEMENT

A. *Continued Outreach by Department:*

Primary engagement with the public will take place through the state fish and game and Federal regional advisory committee processes. In particular, state and federal committee members involved in the Harvest Management Coalition will be engaged by the department as herd management issues arise or when the FCH harvest plan is due for revision.

B. *Continued Engagement to Confirm Criteria Chosen for Evaluating Success:*

We will continue to engage the Harvest Management Coalition as we apply criteria chosen for evaluating success including achieving and evaluating FCH numbers and harvest.

C. *Participation in Prey and Predator Harvest or Predator Control:*

Public aerial wolf control has been an important component of removing wolves and is anticipated to continue.

Local hunters and trappers will also be encouraged to continue harvest of wolves to help regulate the numbers post-treatment to prolong the effectiveness of predator control. Predator harvest incentive programs initiated and funded by Non-Government Organizations will also be encouraged.

D. *Monitoring and Mitigation of Hunting Conflict:*

Hunting conflicts will be primarily monitored using hunter check stations, hunter contacts in the field and at AFG&G offices, and registration permit hunt reports. Harvest management, including addressing hunting conflicts as they arise, will continue to be guided by recommendations in the FCH harvest plan and through ongoing engagement with the Harvest Management Coalition.

VI. OTHER CONSIDERATIONS

Success of aerial wolf control by the public has been variable in recent years, largely depending on late-winter tracking conditions. Additional department effort will be necessary in years when public permittees have reduced success. Department conducted wolf control in RY08–RY12 required considerable operational funding and staff time. This will continue to be a major consideration in the future when department wolf control is conducted.

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APPENDIX A. Summary of supporting information.

Geographic Area and Land Status	
Management area(s)	Prey abundance assessment (FCH hunt area - 25,217 mi^2), prey harvest assessment (FCH hunt area - 25,217 mi^2) (Fig. 6) Predator abundance assessment (18,750 mi^2) (Fig. 2)
Land status	4,466 mi^2 (23.8%) federal land (NPS/BLM/US military/USFWS), 3,184 mi^2 (17.0%) Alaska Native corporation land, 11,093 mi^2 (59.2%) State of Alaska (Fig. 7)
Biological and Management Situation	
Prey population	FCH IM objectives: 50,000–100,000 and harvest objective of. FCH - Estimated in 2010 (most recent census): 51,675 caribou
Prey harvest (human use)	IM objectives (rate): 1,000–15,000 Reported in RY2012: 1,306 (3.0%) Amount necessary for subsistence: FCH 350 – 400. Determined in 1992.
Feasibility of access for harvest	Access is primarily along Taylor and Steese highways and the extensive trail systems accessed from these highways. Access is also available along numerous river systems and from small airstrips scattered throughout the UYTPCA and Fortymile hunt areas. Seasons dates allow for fall and winter access opportunities. Unleaded gasoline (average among communities): $4.00-$6.50/gal. unleaded, 100 octane low lead aviation fuel (average among communities): $5.50-7.00/gal.
Nutritional condition	5-year (2009–2013) moving average of 3-year-old parturition rates =59% in 2013.
Habitat status and enhancement potential	Wildfires and floods regularly reset succession to early seral stages. No enhancement is anticipated.
Predator(s) abundance	Estimated in fall (Nov. 1) 2013 (precision): 338-373 wolves (based on 25 model iterations using PredPrey (Version 1.5))
Predator(s)	Reported in RY2012: Within UYTPCA wolf control kill and hunter/trapper

harvest	harvest = 171(44% reduction from estimated midpoint of fall population of 386).
Evidence of predation effects	Department research projects on the FCH (1994–2003) indicated wolf predation, primarily on calves, is the major limiting factor on population growth in the FCH (Boertje and Gardner 1998, Boertje and Gardner 2000, Boertje et al. 2008). During this research project an average of 69% of calf mortality (calves born in 1994-1999), occurred during the calving and post calving periods in May and June (Boertje and Gardner 2000).
Feasibility of predation control	The FCH experienced an average annual rate of increase between 1996-2010 of 6%/year concurrent with wolf control programs during this period (Boertje et al. 2012). If similar conditions are achieved during the life of this plan, including ongoing wolf reductions associated with this IM Operational Plan, continuation of a quota based harvest tied to a fixed herd harvest rate under the FCH harvest plan and favorable weather conditions, similar growth rates observed during 1996-2010 (~6% annually) are anticipated.
Other mortality	Blood assessment of FCH caribou captured in 2012 has not been analyzed at this point. However, antibody screening of blood samples (n=159) analyzed between 1975–2001 indicate there were no significant infectious diseases affecting population dynamics of the FCH (Zarnke 2001). Boertje et al. (2012) points out that “weather patterns in the vast, remote Fortymile herd range were inadequately measured” during 1990-2010. However, frequency of severe weather events in the herds range are low and weather has not been identified in past research as a major factor influencing FCH trend.

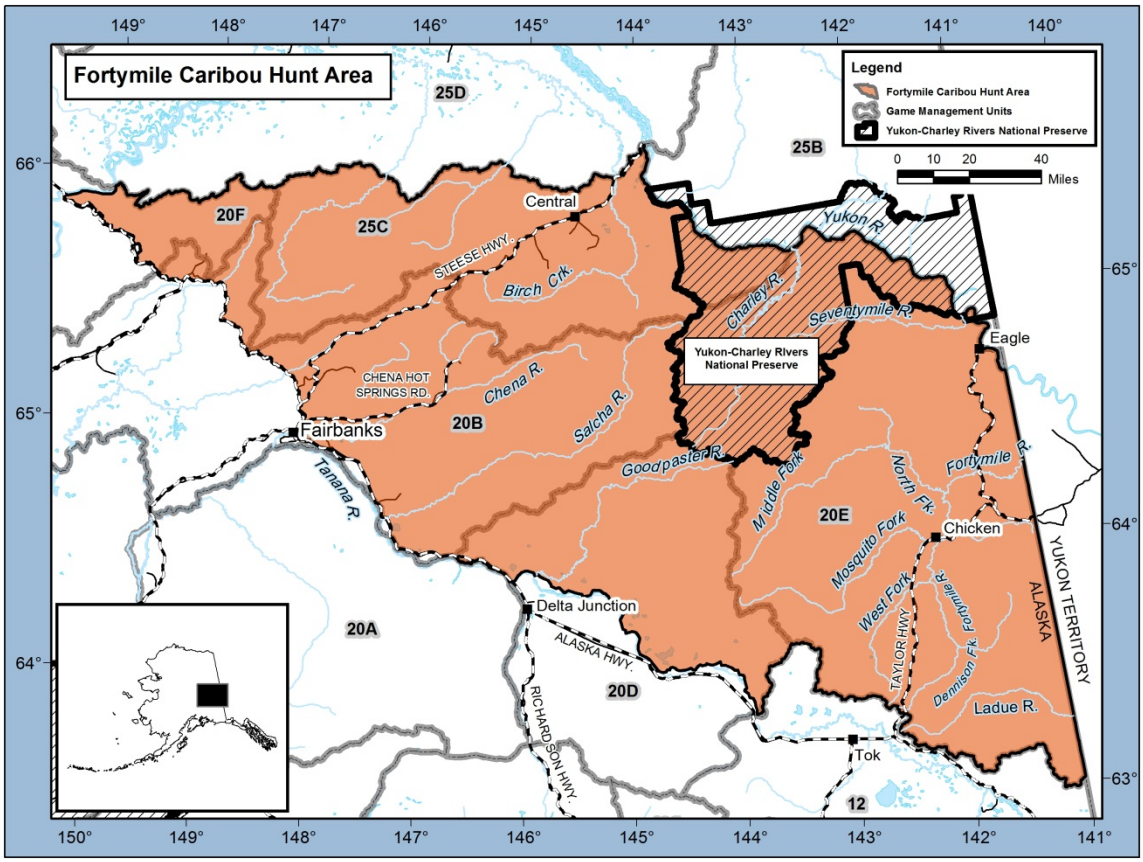

Figure 6. Fortymile Caribou Herd Hunt Area (25,217 mi^2).

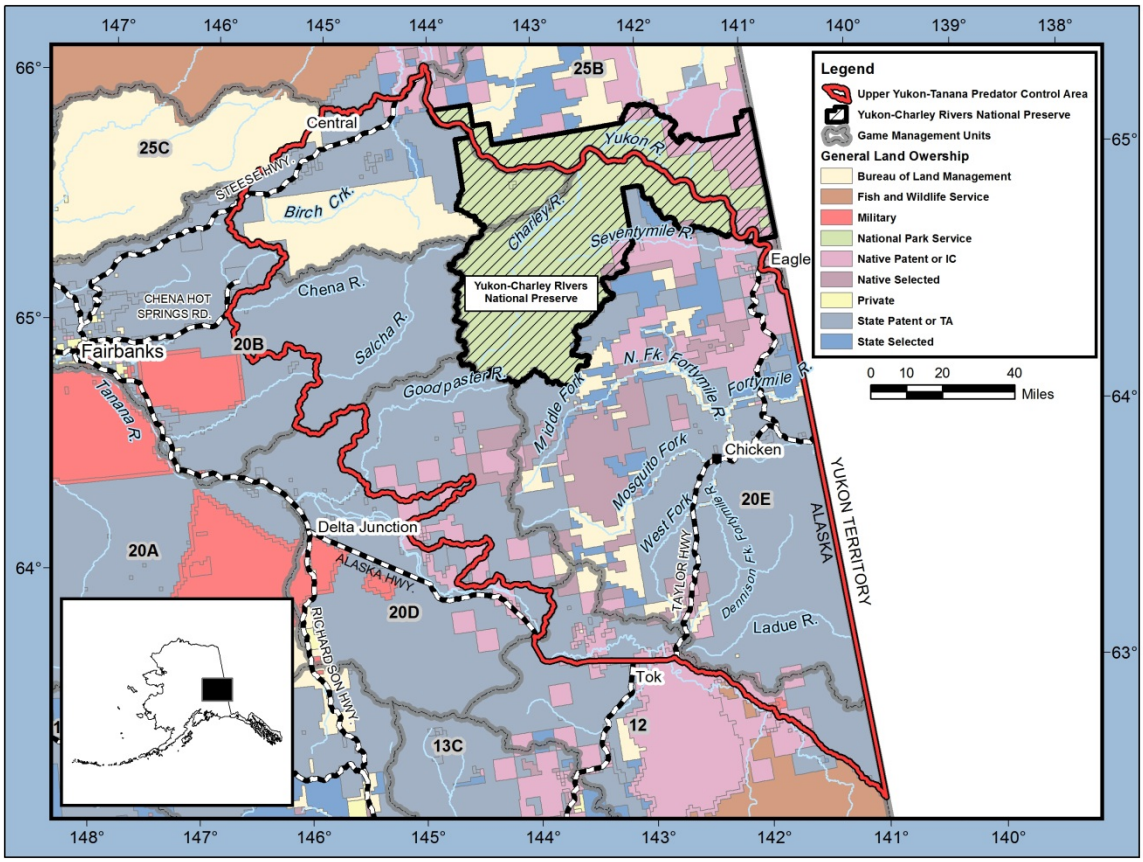

Figure 7. Land ownership within the Upper Yukon–Tanana Predator Control Area.