

**PORCUPINE CARIBOU
ANNUAL SUMMARY REPORT
2016**



Porcupine Caribou, Yukon Environment

Submitted to: Porcupine Caribou Management Board

Submitted by: Porcupine Caribou Technical Committee

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Indicator Table

Annual Summary Report - 2016

Indicator	Value	5 or 3 year average	Notes	Assessment and Year Represented
Population size and trend				
Population size	2016 = no data	--	Attempted, poor light conditions for photo. Last census in 2013 (197,000).	No assessment (2016)
Population trend	2016 = unknown	--	Declined by 55,000 caribou between 1989 and 2001. Recovered to 169,000 by 2010 and continued to increase to 197,000 in 2013.	No assessment (2016)
Adult cow survival	2016 = no new data	0.879	Small differences in the annual survival of adult cows is key in determining the population trend for the herd. The last estimated survival rate (2011-12) was relatively high and was indicative of a growing population at that time. No new data has been collected since this last estimate.	No assessment (2016)
Calf birth rate	2016 = 0.75	0.81	29-year average = 0.81	Below average (2016)
Late June calf:cow ratio	2016 = 0.46	0.48	27-year average = 0.57	Below average (2016)
March calf:cow ratio	2016 = no data	--	17-year average = 0.35. Last successful survey 2010 (2009 birth year). Surveys attempted from 1989-2012.	No assessment (2016)
Bull Ratio	2016 = no data	--	Next survey scheduled for 2017.	No assessment (2016)
Peak of calving	2016 = June 1	1 June	Surveys occurred on June 3-4th so peak was estimated from size and mobility of calves	Average (2016)

Body condition				
Average backfat	F: 0.3 cm; M: 3.4 cm	2.6 cm	Caribou were available to hunters in Old Crow from mid-August thru late September and again late October thru late winter. Caribou were available on the Dempster Highway from mid-October thru late winter. Roughly equal number of bulls and cows evaluated; though harvested at different time periods. As expected, caribou harvested in September were in much better shape than in October.	Higher than average (Fall 2015)
Hunter assessment	F: 1.8 M: 3.1	2.9	Roughly equal number of bulls and cows evaluated, harvested at different time periods; as expected, caribou harvested in September were in much better shape than in October	Higher than average (Fall 2015)
Condition of caribou	Generally good	N/A		Good (2015-16)
Habitat and other considerations				
Snow conditions winter (2015-16)	<u>Snow Depth</u> Eagle = 78.3 cm Ogilvie = 61.3 cm Old Crow = 79.0 cm North Slope = no data Richardson = no data <u>Snow Density</u> Eagle = 0.18 g/cm ³ Ogilvie = 0.21 g/cm ³ Old Crow = 0.18 g/cm ³ Richardson = no data North Slope = no data	<u>Depth</u> 77.4cm 66.6 cm 72.9 cm no data no data <u>Density</u> 0.20 g/cm ³ 0.20 g/cm ³ 0.19 g/cm ³ no data no data	Spring precipitation, temperature and snowmelt appeared normal in most areas. Averages presented are for the length of record for each Region and are not 5 year averages.	Above average snow depth in Eagle and Old Crow regions (2015-16) Slightly below average snow depth in Ogilvie (2015-16) Average snow density in all areas (2015-16)

Wildland fires	2016 = data not yet available 2015 = 566.5 km ²	252 km ²	2004 and 2005 largest burned area ever. Total of 15% of range affected by fires since 1960	Slightly above 5 year average area burned in 2015; 5 year average continues to decrease.
Linear disturbance and human development	2015-16 = No major increases	N/A	Seismic project completed in 2013-14 south of Eagle Plains created the following: 2124 km new seismic lines 228 km new access roads	No additional increases in 2015-16 although proposals have been forwarded to build all season roads, conduct extended flow testing, and drill up to 20 additional wells at present.
Traditional Knowledge (2015)				
Hunters' needs met?	79% of hunters met needs	65%	"Were your households' needs met for caribou this year?" ABECK data available from 2000 to 2015.	Higher than average (2015)
Calf abundance	Winter = same, 37% Summer = same, 46%	<u>Winter</u> Same 37% <u>Summer</u> Same 43%	"Based on your observation for each season, where there more, equal or fewer calves over the last year than usual? ABEKC data available from 2010 to 2015.	Equal calves in winter (average) Equal calves in summer (above average)
Adult female abundance	Winter = more, 15% Spring = less, 20% Summer = same, 16% Fall = more, 34%	Winter 14% Spring 18% Summer 17% Fall 23%	"Based on your observation for each season, where there more, equal or fewer adult female caribou over the last year than usual? ABEKC data available 2013 to 2015	More than usual in winter (average) Fewer than usual in spring (slightly higher than average) Similar in summer (slightly higher than average) More than usual in Fall (higher than average)
Unusual, extreme and rare weather events	<u>Fall</u> More snow = 20% More ice = 6% <u>Winter</u> More snow = 28% More ice = 13%	<u>Fall</u> Snow = 15% Ice = 14% <u>Winter</u> Snow = 24% Ice = 7%	"What month did you observe any of the following unusual, extreme or rare weather related events?" ABEKS data available from 2005 to 2015.	<u>Fall (2015)</u> Snow = above average Ice = below average <u>Winter (2015)</u> Snow = above average Ice = above average
Observed body condition by season	Good across all seasons	Good	"What was the overall condition of caribou you observed in each season over the past year?" Borderlands data available from 2000 to 2015.	Good but more animals in fair and poor condition in summer and fall may warrant further investigation (2015).

Scientific and Traditional Knowledge Comparison Table (2015)

Indicator	Scientific (2015)	Traditional Knowledge (2015)
Population trend	No data	No data
Adult cow survival	No data	More than usual in winter (average) Fewer than usual in spring (slightly higher than average) Similar in summer (slightly higher than average) More than usual in Fall (higher than average)
Late June calf:cow ratio	No data	Equal calves in summer (above average)
March calf:cow ratio	No data	Equal calves in winter (average)
Total harvest	No data at time of report	Hunters needs met for caribou
Snow conditions winter	Significantly deeper than average snow depth in Eagle and Old Crow regions, above average snow depth in Ogilvie No deviation from long term average No icing event data collected	Above average snow in fall and winter Below average icing events in fall and above average in winter
Condition of caribou	Higher than average backfat (Fall 2015) Higher than average hunter assessment (Fall 2015)	Most often good in across all seasons

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INTRODUCTION

This report

This report was prepared for the Porcupine Caribou Management Board (PCMB) to provide information to make an assessment on the status of the herd as part of the *Harvest Management Plan for the Porcupine Caribou Herd in Canada* (HMP). Information within this report was guided by the topics listed in the HMP. As noted in relevant sections, some information is not available or analyzed. Under the HMP, Parties are requested to comment on this report and provide additional information to the PCMB at the Annual Harvest Meeting.

Information for this summary report was provided by members of the Porcupine Caribou Technical Committee (PCTC) and the Arctic Borderlands Ecological Knowledge Co-op (ABEKC). ABEKC was formed to monitor and assess ecological change in the range of the Porcupine Caribou herd and adjacent Mackenzie Delta area in NWT, Yukon and Alaska using both science and local traditional knowledge. Community researchers conduct yearly interviews with local experts in each community on important indicators that can be used to track ecosystem change. Note that interviewees are selected by communities and the monitors with the intention of interviewing a select number of land users engaging with a suite of ecological indicators (i.e., this should not be considered a random sample of caribou harvesters and should not be extrapolated to sampled communities). ABEKC identifies their sampling seasons as follows: Winter (January - March), Spring (April - June), Summer (July – September and Fall (October - December). Information from yearly interviews are currently available from 1996-2015 on the new ABEKC data portal. Interviews for 2016 will be completed in February 2017.

Herd background

1. The Porcupine Caribou Herd's (PCH) core home range is approximately 250,000 km² and extends into Alaska, Yukon, and the Northwest Territories. Within this range there are currently 12 different areas where different agencies have jurisdiction over land and/or wildlife management. Management of the herd must take into consideration:
 - 2 federal governments
 - 3 state or territorial governments
 - 8 native land claim agreements
 - 5 national parks or preserves
 - 1 territorial park
 - 2 special management areas
 - 2 specific ordinances
 - Dempster Highway Area Development Ordinance, and
 - a federal Order-in-Council Withdrawal (Yukon North Slope)

The PCH was the first international caribou herd with its own formal co-management agreements and boards. There are five main management agencies which work on the herd: Canadian Wildlife Service, U.S. Fish and Wildlife Service, Government of Yukon, Government of the Northwest Territories, and the Alaska Department of Fish and Game. Management and research is coordinated by the PCTC which consists of biologists from numerous agencies, co-management boards as well as occasional faculty members or students from various universities.

All aboriginal organizations within the Canadian range of the herd have land claim agreements. These agreements solidify the aboriginal right to hunt for food and ensure local participation in wildlife management through co-management boards. The agreements also created lands that are privately

owned and managed by the First Nations or Inuvialuit. Self-governing agreements in Yukon also give the First Nation governments the ability to regulate their citizens and their land.

Management direction and goals

To help coordinate management, two Porcupine Caribou agreements were set up, each creating a co-management board. In 1985, three governments and three native organizations signed the *Porcupine Caribou Management Agreement* (PCMA), creating the within-Canada Porcupine Caribou Management Board. In 1987, Canada and the United States signed an International Conservation Agreement, creating the International Porcupine Caribou Board (IPCB).

Research and monitoring is guided largely by the *Porcupine Caribou Herd Strategic Framework 2015-16 to 2019-20* (Porcupine Caribou Management Board 2015) and the Plan for the International Conservation of Porcupine Caribou Herd (International Porcupine Caribou Board 1993). The PCTC drafts workplans to coordinate research and monitoring activities, optimize funds and staff time, and provide technical information to co-management boards and agencies. Harvest management is co-operative among the Parties to the PCMA and is guided by the HMP and the accompanying Implementation Plan.

Goals that pertain to the PCTC taken from the *Porcupine Caribou Herd Strategic Framework 2015-16 to 2019-20* are:

B. The Board shall review relevant scientific information [and traditional knowledge] on the conservation management of the herd and its habitat, and make recommendations to the Minister on policy, legislation and regulations regarding:

- Management strategies
- Further research where there appears to be a need, including recommendations on methods of data collection and presentation;
- A herd management plan; and
- A predator management plan.

D. The Board may identify sensitive [caribou] habitat areas requiring special protection and recommend measures to protect such areas.

The *Plan for the International Conservation of the Porcupine Caribou Herd* outline a number of objectives pertinent to the PCTC.

- To conserve the Porcupine caribou herd and its habitat through international cooperation and coordination so that the risk of irreversible damage or long-term adverse effects as a result of use of caribou or their habitat is minimized.
- To ensure opportunities for customary and traditional uses of the Porcupine caribou herd.
- To enable users of Porcupine caribou to participate in the international coordination of the conservation of the Porcupine caribou herd and its habitat.
- To encourage cooperation and communication among governments, users of Porcupine caribou, and others to achieve the objectives of the Agreement.

Alaska Department of Fish and Game (ADF&G) list the following as management objectives (Lenart 2007):

- Maintain a minimum population of 135,000 caribou.
 - Conduct censuses every 2-3 years.
 - Estimate parturition rates and late June calf:cow ratios of radio-collared females.
 - Monitor herd movements by periodically relocating radio-collared caribou.
 - Monitor the harvest through field observations, hunter reports and contact with residents.

SCIENTIFIC KNOWLEDGE

POPULATION

Population size – photocensus

Objective

To estimate the size of the herd every 2 to 3 years (last completed 2013).

Methods

A technique called an Aerial Photo Direct Count Extrapolation has been used to estimate the herd size since 1972 (Davis 1979, Valkenburg, et al. 1985, Rivest et al. 1998). Once the insects come out during the warm weather in late June or early July, the caribou gather into very large, tight groups sometimes consisting of tens of thousands of caribou. These large groups are photographed and caribou in the photos are counted. Any caribou that are found outside of the large groups are added and the estimate is rounded to the nearest thousand caribou. Radiocollared caribou are used to help locate the caribou aggregations and correct the estimate for any missing caribou. This technique is considered an accurate and reliable method to count large barren-ground caribou herds and can also provide a measure of uncertainty (confidence interval) around the population estimate. A confidence interval is a range of values that describes the uncertainty surrounding the population estimate. For example, the photocensus in 2013 found that the population estimate of the PCH was 197,228 (95% CI = 168,667 – 225,789). That means that we are 95% confident that the true population estimate is within the upper (225,789) and lower number (168,667).

Results

A radiotracking flight on July 1, 2016 indicated that caribou were aggregated enough to photograph. ADF&G attempted to photograph the herd on the 2nd and 3rd of July but were unsuccessful because of poor lighting conditions (too dark due to high overcast conditions). At the time of the photocensus attempt, the majority of the herd was in Alaska on the north side of the Brooks Range in the vicinity of Peter and Schrader Lakes. Additional caribou were on the south side of the Brooks and in the Richardson Mountains in Yukon (Figure 1; Caikoski 2016).

Discussion

When the herd was first counted with this technique in 1972, the herd was estimated at about 102,000 caribou. Herd size grew steadily at about 5% each year until it reached 178,000 caribou in 1989. The herd began to decline by 3 to 4% per year from 1989 to 1998, and by 1.5% per year from 1998 to 2001. The census in 2001 showed 123,000 caribou in the herd (Figure 2; Arthur 2001).

Working cooperatively, biologists from Canada and Alaska attempted to photo census the herd each year since 2003 but were unsuccessful. In 2007 photos were taken however they were not good quality. If the herd had continued to decline at the same rate, it was estimated that the herd could have numbered 100,000 or fewer caribou in 2010. In 2010, ADF&G switched from minimum counts (bias low) to Rivest estimates that provided confidence intervals around the population estimate (Rivest et al. 1998).

Finally in July 2010, conditions permitted photos to be taken. The ADF&G estimated 169,000 (95% CI = 153,493 – 184,403) caribou in the herd from that census, the second highest on record. The high number of caribou showed the herd had obviously recovered from the 12-year decline documented between 1989 and 2001. Another successful photocensus was completed by ADF&G

and Yukon Environment in 2013 that estimated the herd to be 197,228 (95% CI = 168,667 – 225,789) caribou (Figure 2). Researchers will attempt another photocensus in summer 2017.

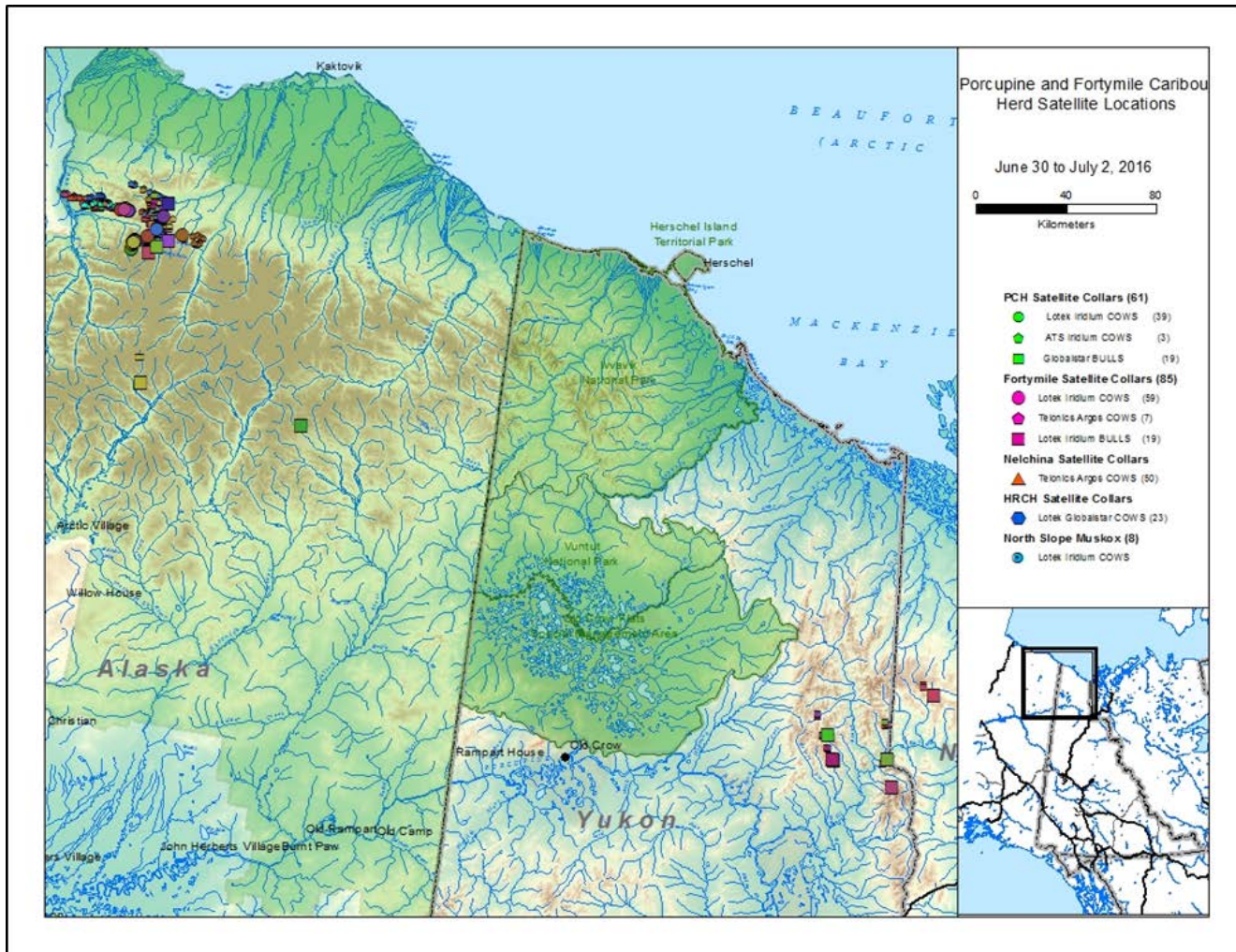


Figure 1. Locations of all GPS collared PCH caribou from 30 June – 2 July, 2016 just before the photocensus attempt on July 2nd and 3rd. Data and map from Yukon Environment.

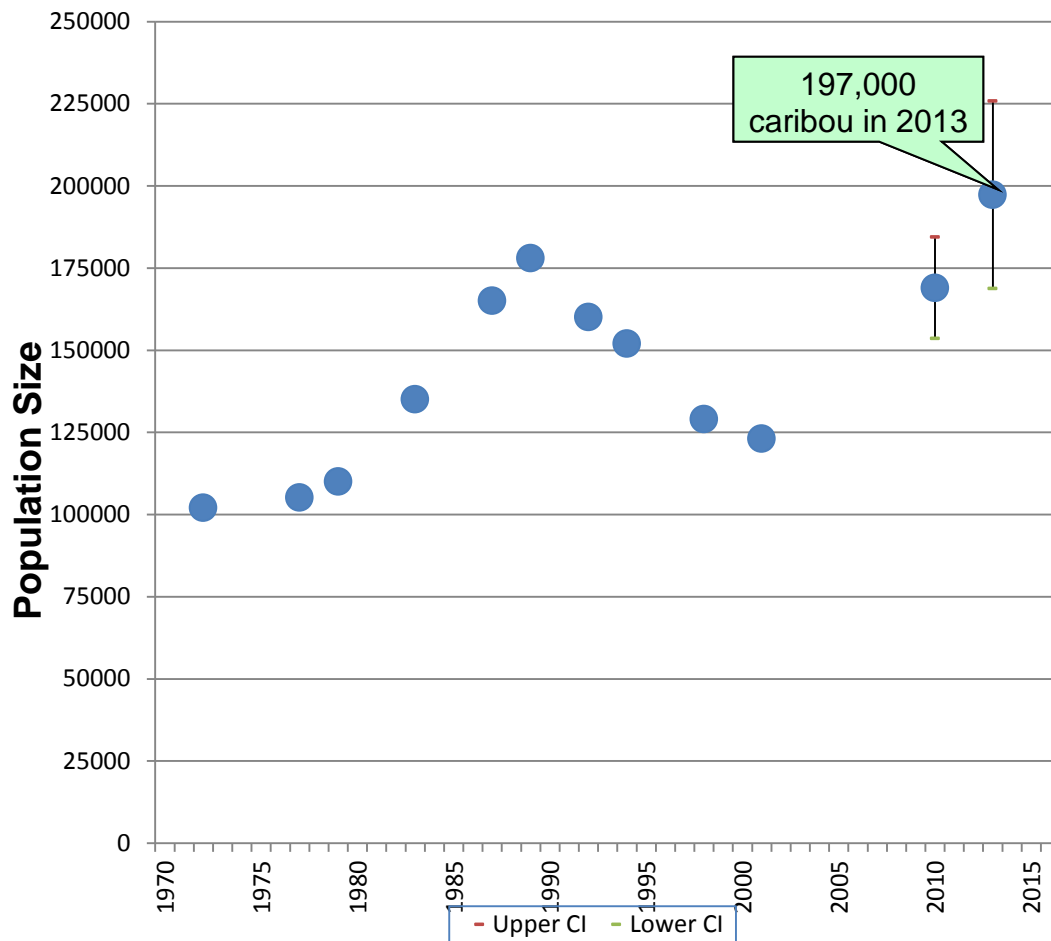


Figure 2. Estimated herd size of the Porcupine caribou herd size and 95% confidence intervals 1972 to 2013. Confidence intervals are only available for 2010 and 2013 photocensus attempts. Blue dots indicate successful survey attempts. There were no successful census attempts between 2014 - 2016.

Adult female survival

Objective

To obtain an annual estimate of survival for adult female Porcupine caribou.

Methods

In response to the continued population decline, researchers started a project in 2003 to get an updated estimate of adult female survival (Wertz et al 2007). As with many populations, the survival of breeding females is very important to the potential growth of the herd. Adult female survival has been estimated twice before; once when the herd was increasing and again when the herd began to decline (Fancy et al 1994, Walsh et al 1995). Information gathered from these earlier studies indicated that most cows died in winter, the harshest season of the year.

Researchers flew monthly over the winter to locate all the radio collared females and determine whether they were alive or not. Results showed that adult females survived at a similar rate as they did from 1989 to 1991 when the herd started to decline. Assuming that female survival was driving the decline, this suggested that the herd had continued its declining trend.

Results

There is no new data from 2016. However, an annual estimate of survival was calculated from June, 2003 to May 2012 (Figure 3). Survival varied between years with the point estimates for 2004-05 and 2005-06 the lowest (0.739 and 0.807 respectively), and conversely the highest rate was estimated for the caribou year 2010-11 at 0.905. The overall average survival rate during this time period was 0.852. Although variability within years ranged from 0.065 to 0.097 of the point estimates the annual rate indicated a general trend of increased survival during that time period.

Discussion

Estimates of survival are variable from year to year. It should be noted that these calculations have low statistical power due to small sample size of collared caribou. A sustained change of 2 or 3 percent in survival can make the difference between a herd increasing and decreasing. We would need approximately 300 collars deployed on caribou in order to statistically detect such a small change. Although this may be unfeasible, monitoring the trend and incorporating the variability of survival estimates into the Herd Estimator model will improve population estimates and help us understand the importance of survival data.

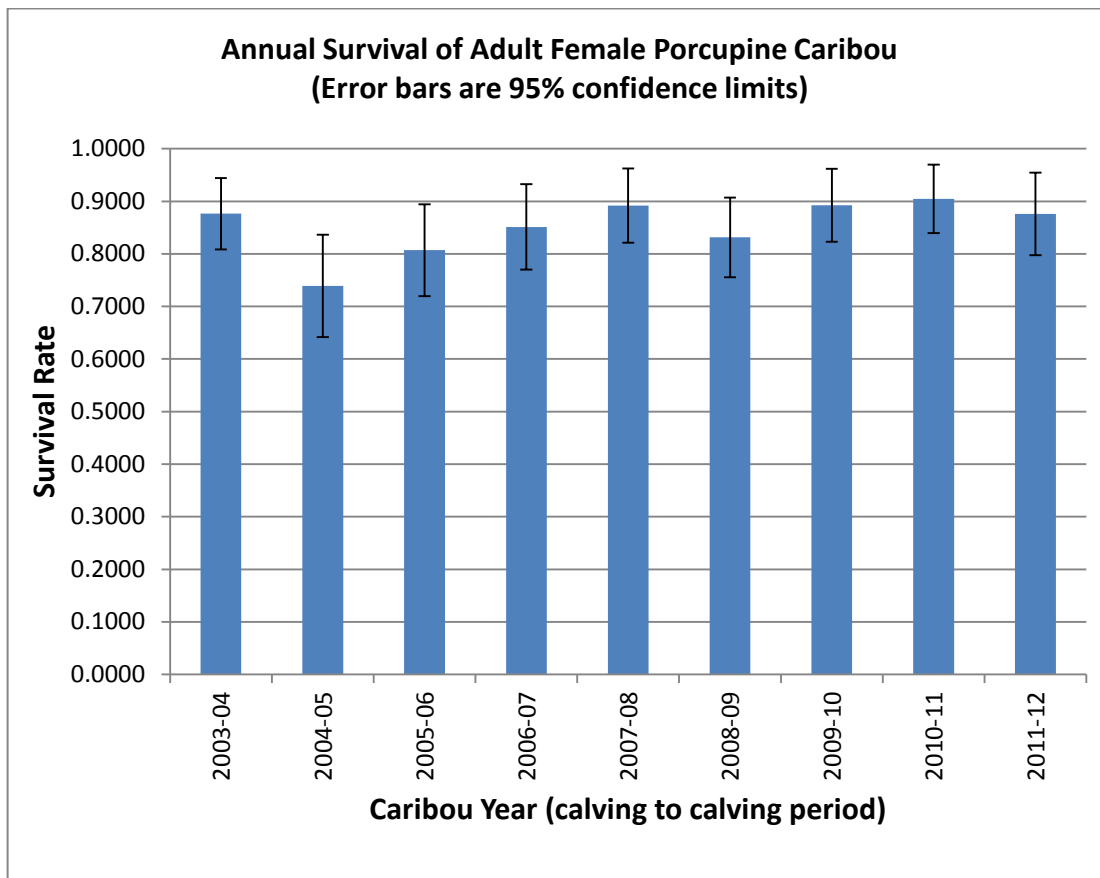


Figure 3. Annual survival estimates for adult female Porcupine Caribou, May 2003 – June 2012. Source: USFWS unpublished data. No new data was collected in 2016.

Calf birth rate and calf survival

Objective

To document the annual calf birth rate and survival rate.

Methods

Calving surveys are conducted each year to estimate the birth rate and early survival rate of calves. Collared females are located from a fixed-wing aircraft and are classified as barren, pregnant, or have given birth. Researchers can tell if female caribou are pregnant if cows are observed with calves, have hard antlers or distended udders (Whitten 1995). Female caribou are re-located after about one month to determine whether the calves have survived. Calving success is presented as the percent of cows that had calves. The July calf ratio is based on the proportion of collared females still with calves in late June or early July.

Because the majority of calves will have weaned by March, we do not use the ratio of collared females in late winter but instead estimate the number of calves for every 100 adult cows, called a calf:cow ratio. The March composition count has not been completed in recent years due to herd mixing in the winter range, adverse weather, budgetary constraints and changing research priorities.

Results

Parturition rate

Staff from ADF&G conducted a survey on June 3-4, 2016 to estimate how many females were pregnant (parturition rate). The parturition rate for adult cows ≥ 4 -years of age was 75% (Figure 4, $n=28$). This is slightly below the long term average of 81% (Caikoski 2016). Of the cows that were judged to be parturient, 17 of 28 were observed with a calf at heel indicating peak of calving occurred prior to the survey.

Post-calving survey

ADF&G staff conducted a post calving survey on June 22-24, 2016 to estimate cow:calf ratio and calf survival 3 weeks after peak of calving. Post calving survival, estimated from cows observed with calves in early June that were subsequently observed in late June (excludes mortality shortly before and after birth) was 100% for adults cows ≥ 4 -years of age ($n=11$). The late June calf:cow ratio was 46 calves per 100 cows ≥ 4 -years of age (Figure 4, $n=35$). The estimate of calf survival (100%) using calves observed in early June that were subsequently observed in late June was likely biased to calves that had already survived for several days after birth or was a result of random variation associated with a small sample size ($n=11$). The calf:cow ratio of 46 calves per 100 cows suggests an estimate of calf survival at 61%, calculated as the calf:cow ratio divided by parturition rate is more accurate.

March composition count

The last successful attempt was 2010 (2009 birth year). Subsequent years were not attempted due to herd mixing, logistics and adverse weather conditions (Figure 4). The long-term average (17 years) is 35 calves for every 100 cows (0.35). A composition count is planned for March 2016 depending on funding.

Discussion

Since 1985, birth rates and the proportion of cows with a live calf in late June were similar during the population decline as during the population increase (Figure 4). Therefore, there is no apparent pattern in the estimates. Population dynamics are most affected by survival of adult females over the medium and long term but can withstand fairly large annual fluctuations in calf birth rate or calf survival over the short term. If birth rates or calf survival rates are low for several years in a row,

population growth is more vulnerable therefore we should keep monitoring calves to ensure that if a large change in productivity does occur, we are able to document it.

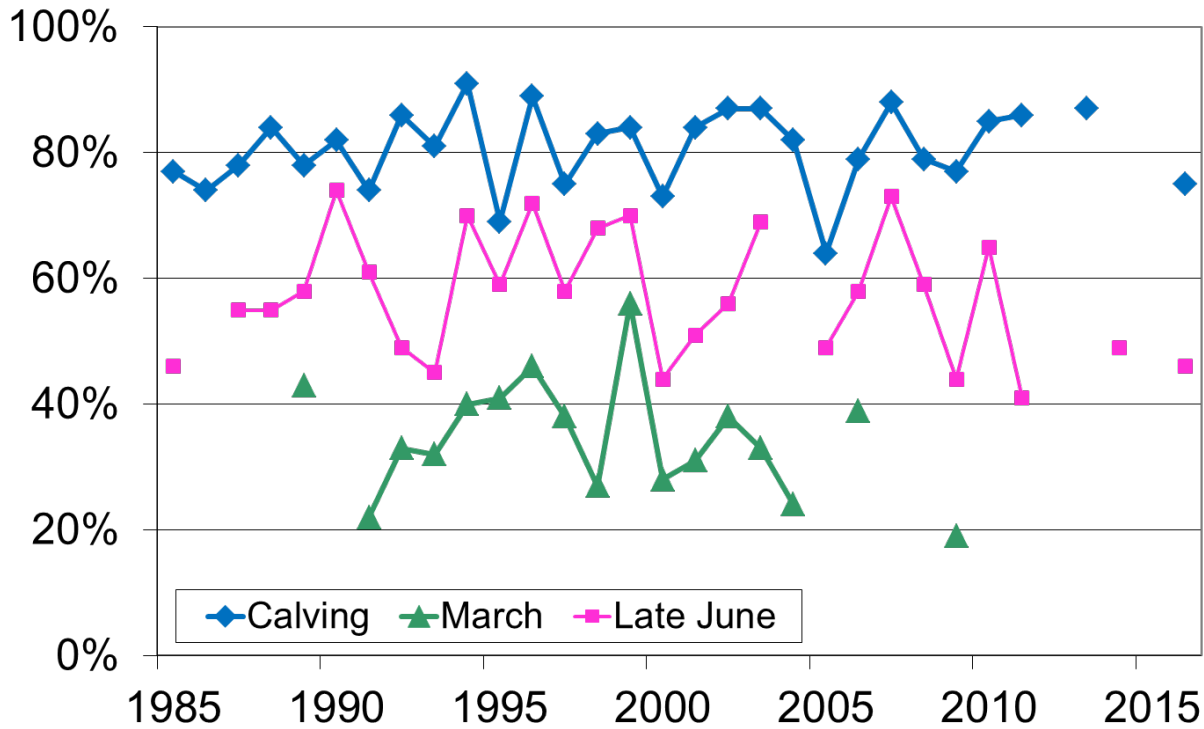


Figure 4. Estimated birth rate and calf survival indices for the Porcupine Caribou herd from 1985-2016.

Peak of calving

Objective

To estimate the date when half of the collared adult female caribou have given birth each spring.

Methods

During the calving surveys to document the birth rate (see previous), researchers record the date of their flights and how many of the collared cows have given birth. Only adult female caribou aged 3 years or older are used for this indicator. In some cases, the birth date is estimated based on the estimated age of the calf. The researchers then estimate the date when half of the collared adult female caribou have given birth. Peak of calving was approximated as the date at which greater than half of parturient cows were observed with a calf at heel.

Results

Based on the size and mobility of calves, peak of calving was likely around June 1st (Table 1, Caikoski 2016). Most calving occurred on the southern extent of the coastal plain in Alaska between the Yukon-Alaska border and the Sadlerochit River. Some calving likely occurred west of the Sadlerochit River and in Yukon, Canada based on locations of parturient cows that had not given birth at the time of the survey (Caikoski 2016).

Discussion

Caribou typically give birth *en masse* with many of the cows giving birth within days of each other. This is thought to be a strategy to reduce the risk of predation on any individual calf. This means that most of the cows would have been bred within a very short time period therefore peak of calving can be used as an indicator of how the rut went the previous fall. If the calving period is extended, it might mean that the rut was disrupted and cows were bred in a second estrus. This shows up as calves being born over an extended period of time. This is important because calves born late in the season are probably more likely to die from predators and they also may be too small to make the migration south for winter, reducing calf survival.

We would start to worry if births were a week or more out of sync. Since 1999, the peak date of calving varies by a few days each year, but there is no indication that large numbers of cows are giving birth 'out of sync' (Table 1).

Table 1. Peak dates of calving for the Porcupine Caribou herd.

Year	Peak of calving	Note
1999	3-Jun	1 to 5 June
2000	7-Jun	
2001	8-Jun	5 to 10 June
2002	5-Jun	
2003	1-Jun	
2004	3-Jun	3 or 4 June
2005	2-Jun	1 to 4 June
2006	2-Jun	
2007	30-May	
2008	30-May	29 or 30 May
2009	2-Jun	Before 2 Jun
2010	2-Jun	
2011	2-Jun	
2012	No data	
2013	4-Jun	3 rd or 4 th June
2014	No data	
2015	No data	
2016	1-Jun	
Average	1 June	

Bull ratio

Objective

To document the ratio of bulls to cows in the herd.

Methods

We fly by helicopter during mid-October and classify as many as 200 caribou around each radio-collared caribou (bulls, cows, short yearlings). Caribou are classified into cow, calf, or either small, medium, or large bull. Then the number of bulls relative to the number of cows is calculated by dividing the total number of bulls by the total number of cows.

Results

A rut count was not attempted in 2016; however, the ratio of bulls to cows was estimated first in 1980 (Porcupine Caribou Management Plan 1989). That study estimated that there were about 60 bulls for every 100 cows which indicated a healthy herd. Bull survival and the bull ratio were not regularly monitored in following years because as long as the pregnancy rate remained high, there was no reason to believe that there are too few bulls to breed the cows. Subsequent surveys occurred in 2009 and 2010. Results from the 2010 survey are the most reliable and indicated a ratio of 57:100. In 2013 due to the poor result achieved in 2012 and the successful completion of a photo count on the herd, a rut survey was planned. Unfortunately leading up to the survey a large proportion of the herd moved to the western edge of the herd's range, eventually mixing with members of the Central Arctic Herd. Monitoring during the rut showed most caribou remained mixed with the CAH which resulted in the cancellation of the rut count.

Discussion

In the Harvest Management Plan for the Porcupine Caribou Herd in Canada (HMP; Porcupine Caribou Management Board 2010), there is a provision for bull only harvest to be implemented for different user groups if the herd drops below a certain population size. In addition, the PCMB continues to promote harvesting of bulls, regardless of population size. Population modeling has shown that if the proportion of bulls in the harvest rose from 30% to 80%, we could see a sex ratio in the herd of about 40 bulls per 100 cows. We don't really know what might happen to the herd sex ratio when we take more bulls during harvesting activities; as a result we completed composition counts to get an updated bull ratio in 2009 and 2010 prior to the projected increase in harvested bulls resulting from the HMP.

The PCTC plans to conduct a rut count every year that a photo count is completed in order to input the sex ratio into the population model (Herd Estimator). Accurate harvest data from all Parties, including the sex ratio of the harvest, is important to assess the effect of a bull dominated harvest on the herd sex ratio. The PCTC still needs to determine how many collars are needed to provide the precision needed to assess the effect of harvest on the herd sex ratio, however we are aware that a sufficient number of collars are needed on bulls leading up to a rut count to provide confidence in those results as a standalone measure. The next rut count is planned for October 2017 if funding is approved.

CARIBOU BODY CONDITION

Hunter assessments and condition indicators

Objective

This long term project uses specific samples from hunter killed caribou to track the fatness of Porcupine Caribou.

Methods

Starting in 1987, Anne Allaye-Chan (a PhD student from University of Alaska Fairbanks) developed equations to estimate the body weight, body fat and body protein for adult cow Porcupine Caribou (Allaye-Chan 1991). Government of Yukon (YTG) did collections from 1989 to 1991 to test these equations and in 1991, started regular monitoring with hunters from Old Crow (Porcupine River in September), Ft. McPherson, Dawson and Mayo (Yukon portion of the Dempster Highway in November and March).

In 2001, we formally modified the program so that hunters could submit samples from any caribou they harvest. This program is also called the Caribou Sampling Initiative (CSI) in the HMP and is also similar to the Circum-Arctic Rangifer Monitoring and Assessment network Level 1 monitoring (Gunn and Nixon 2007). Hunters record a number of variables and rate the condition of their caribou.

Results

During the fall and winter of 2015 – 2016 caribou samples were submitted by hunters in Old Crow and NWT communities. Results are shown in Figure 5 and Figure 6. Of the samples collected, only those from caribou harvested between September 1 and April 30 were included. Twenty-one cows and 21 bulls received hunter rating scores where 1=poor, 2=fair, 3=good and 4=very good. Cows averaged a score of 1.8, whereas bulls averaged 3.1. Twenty-one cows and 16 bulls were also measured for backfat. Cows had an average of 0.3 cm while bulls an average of 3.4 cm.

Overall, body condition and backfat value for bulls was above the 5 year average in 2015-16, whereas cow body condition and backfat were below the 5 year average. Bulls harvested in September had the highest body condition and backfat values, while bulls and cows harvested in October and November were significantly lower.

Discussion

Overall, caribou condition seems to have improved in recent years although the data seem to be more variable after 2001 when hunters began rating their harvested caribou compared to when they were working with the biologists on the collection. This could also be a seasonal effect; caribou collections in the early 1990's were done three times (Sept, Nov and March) whereas the current system allows hunters to submit samples all winter long. This improving condition was also seen in the Arctic Borderlands Ecological Knowledge Co-op data (Russell et al 2013).

We should also keep in mind that hunters can be very selective when harvesting. This indicator gives an index of harvested caribou, not an index of the entire herd. Also, data are pooled over each winter but sample sizes remain small.

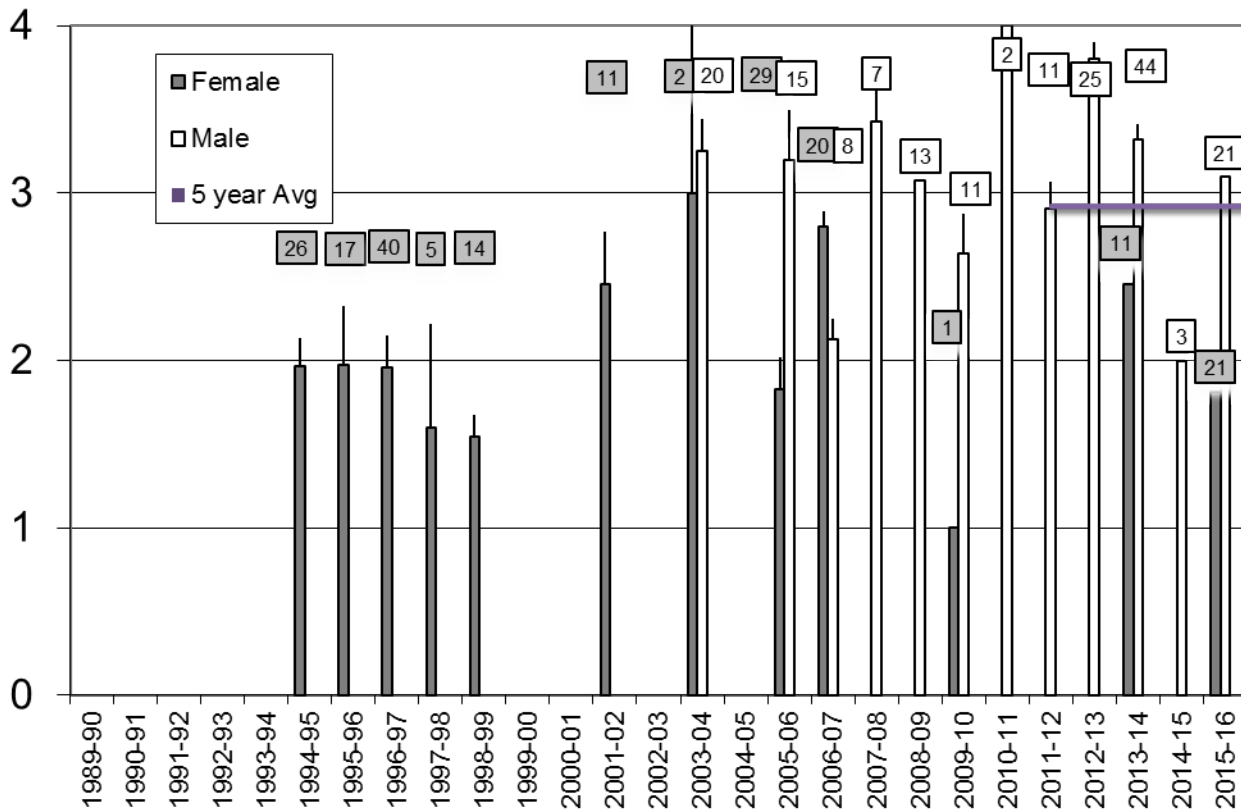


Figure 5. Average condition of harvested Porcupine caribou recorded by hunters. 1=poor 2=fair 3=good 4=very good. Error bars are standard errors. Labels indicate # of caribou sampled.

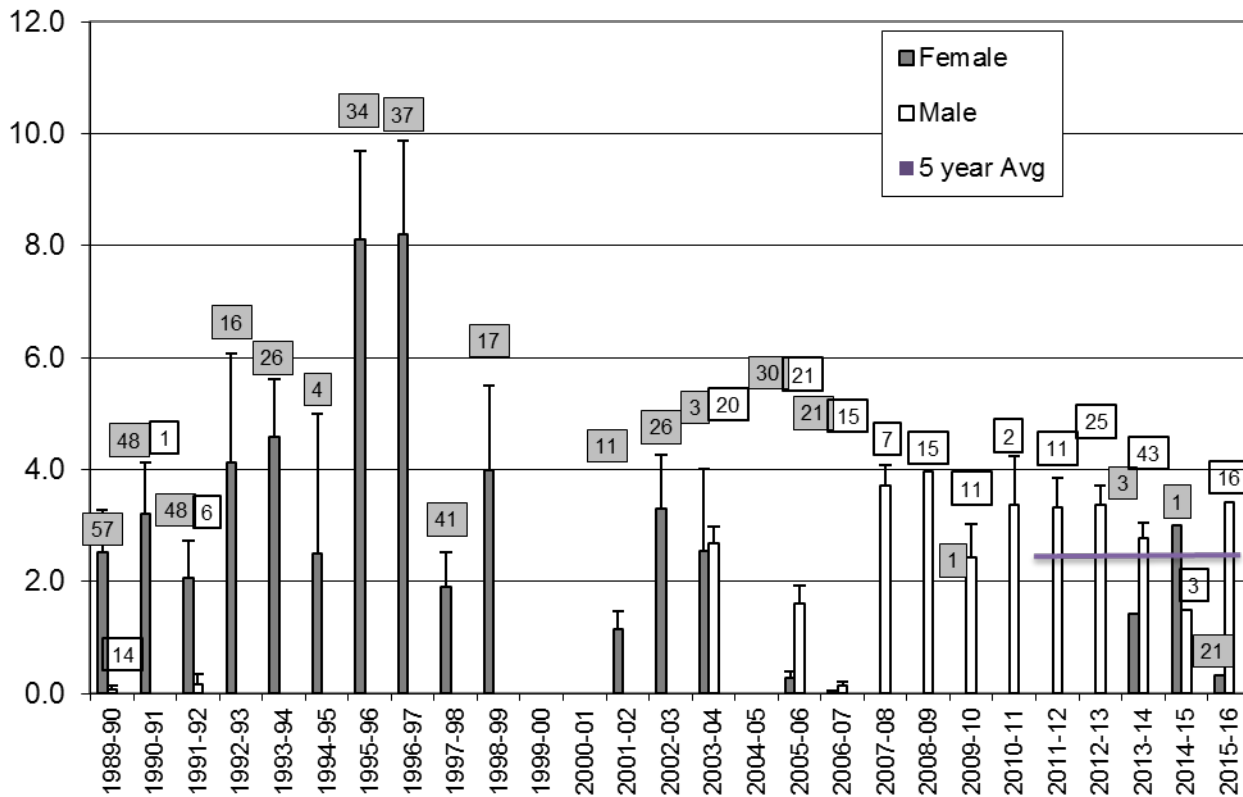


Figure 6. Average depth of backfat (cm) recorded in Body Condition Monitoring. Error bars are standard errors. Labels indicate # of caribou sampled.

HABITAT

Wildland fires

2016 season fire map data is not yet publicly available from Yukon or NWT. This section of the report contains information current to 2015 (identical to previous Status Reports).

Objective

To monitor the amount of Porcupine Caribou range burned as an index of range condition.

Methods

Historical fire perimeter data was downloaded from the respective agencies websites. Some judgments were made to delete what we thought were duplicate fires and merge incompletely mapped fires along the borders between jurisdictions. Fire polygons were clipped to the extent of PCH range and total area burned was summed for each year. The Alaskan fire perimeter data starts in 1945, Yukon in 1945 and NWT in 1965, therefore only fire information since 1960-2015 was summarized in this report.

Results

As of the 2015 season, the total area burned by fires since 1960 is 39,018 km² or roughly 15% of the herd's total annual range (Figure 7). Fires in 2015 burned a total of about 566.5 km², over twice the 5 year average area burned (252 km²) in the previous 5 years. This is still significantly less area than the largest fire years in the 2000's (e.g., area burned in 2004 was 10,213 km² and in 2005 was 5691 km²). In 2015 there were 6 fires in the Yukon, the largest of which was only about 67km², 12 fires in Alaska with the largest 205 km², and 4 fires within the NWT portion of the PCH range with the largest about 28 km². The years 2004 and 2007 show the largest number of large fires recorded in recent years (Figure 8). Fires in 2004 and 2005 resulted in record tracts of area burned (Figure 9).

Discussion

Fire perimeters are mapped by the fire management sections of the 3 jurisdictions. Although there are many similarities in methods, there are five cautionary notes when considering the data presented here. Firstly, the technology for remotely detecting wildland fires improved only in the 1960's therefore data prior to that should be viewed with caution. Secondly, past fires are continually being digitized from satellite or other remote sensing methods so the dataset will change as new data on old fires is added. Thirdly, maps show perimeters of fires only and do not reflect any unburned patches or varying fire severity within burned area. Fourthly, some fires are too small to map and are not included in the map files, and finally some fires burn areas that were previously burned.

There is much variability in how fires affect caribou; however, research completed on the Beverly Caribou Herd found that forests burned by wildfire produced enough lichen forage as early as 40 or 50 years after the fire. These areas once again become important to caribou (Thomas and Kiliaan 1998). Caribou also tended to avoid burns larger than 10,000 hectares (100 km²). The rate of re-growth of caribou forage can be quite variable and caribou use of burns is generally unknown, therefore wildland fire information presented here should be considered as an index of changes to winter habitat.

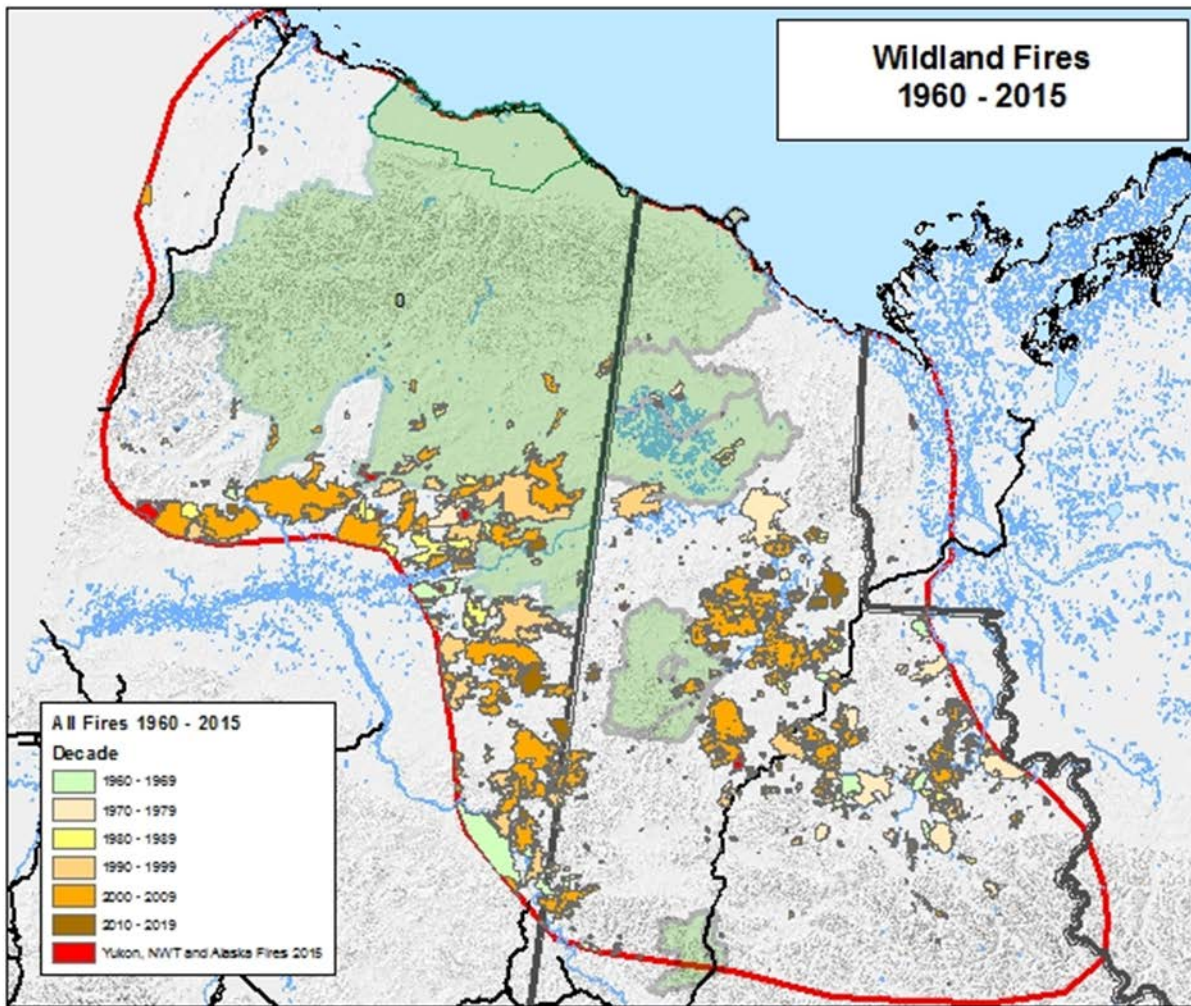


Figure 7. Areas burned within range of the Porcupine Caribou Herd in Alaska, Yukon and Northwest Territories from 1960 to 2015. The darker green areas surrounded by a grey border represent protected areas.

Includes NWT fire data (© 1960-14). Alaska and Yukon fire data 1960 to 2015.

Total number of fires and number of large fires
(greater than 10,000 hectares) in PCH range, by year

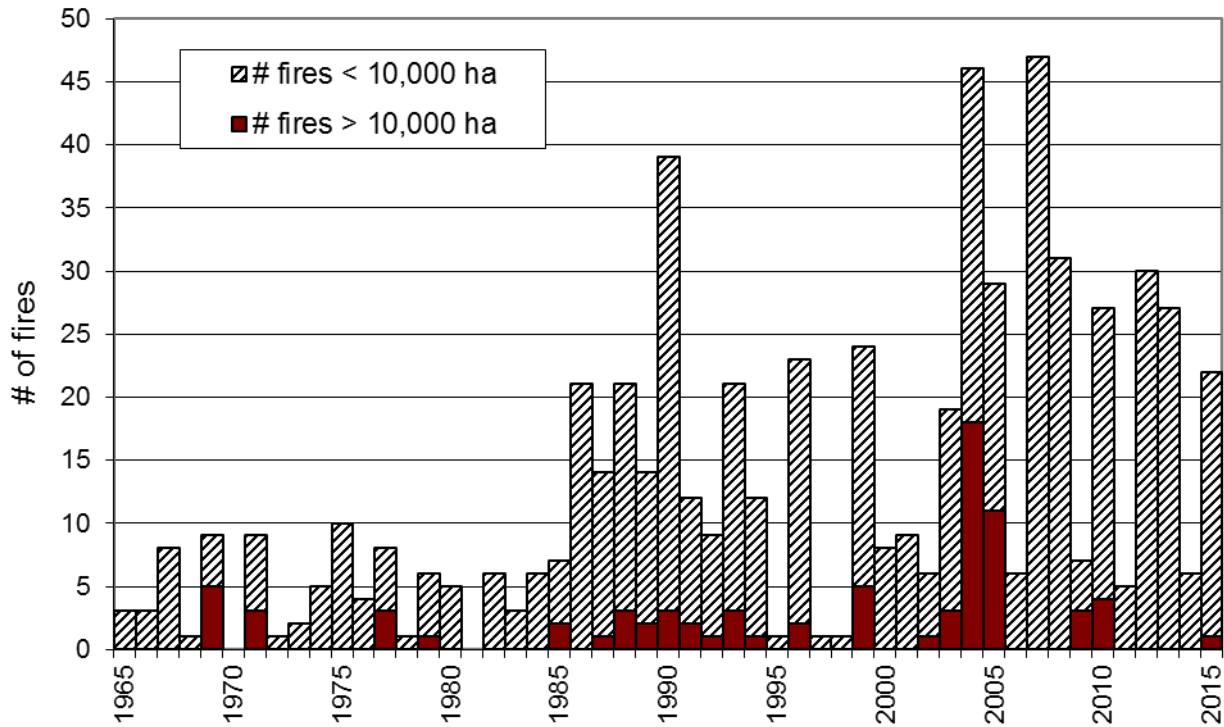


Figure 8. Total number of fires and number of large fires to 2015 within the range of the Porcupine Caribou Herd in Alaska, Yukon and Northwest Territories.

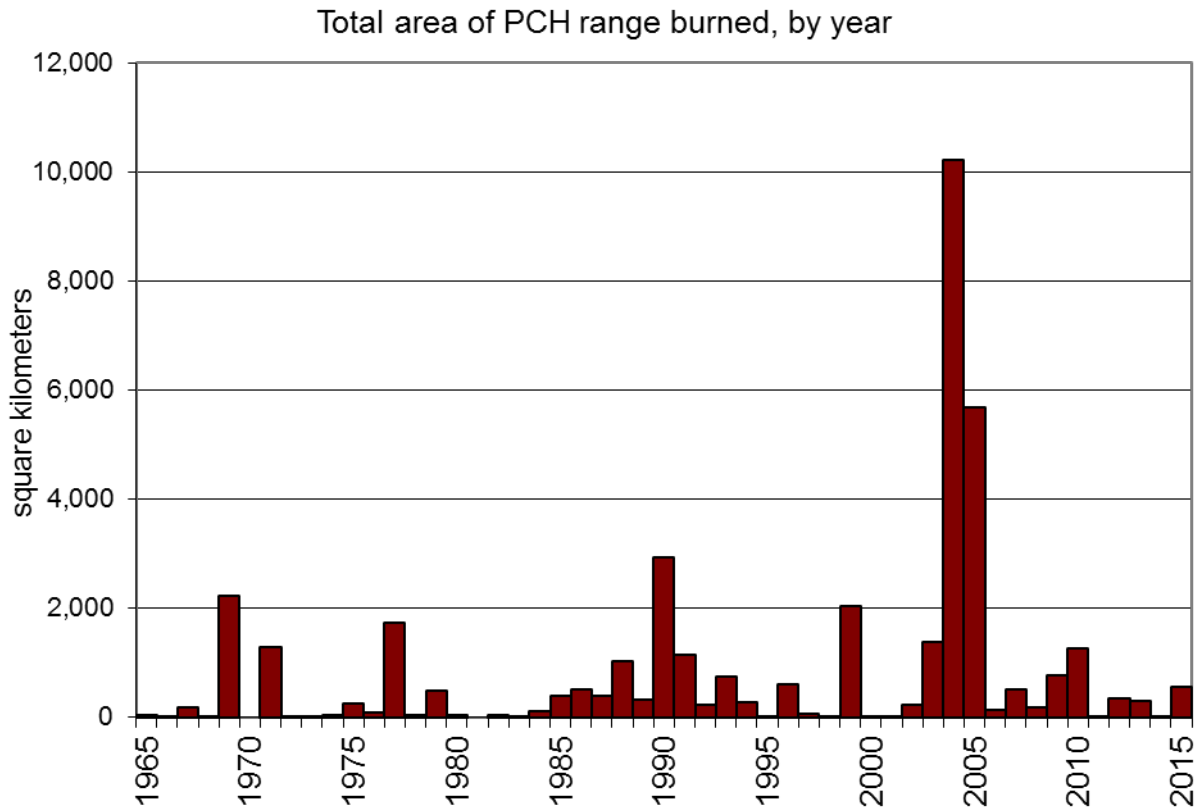


Figure 9. Total area burned by fire, by year to 2015 within the range of the Porcupine Caribou Herd in Alaska, Yukon and Northwest Territories.

Linear disturbance and human development footprint

Objective

To monitor the amount of linear disturbance and development footprint present on the herd's range.

Methods

Data is acquired from a number of sources in NWT, Yukon, and Alaska. Much of the historical data was acquired during a cumulative effects assessment completed for the PCMB in 2008-2012. Newer data was acquired for specific activities known to have been carried out within the range of the herd. Data quality varies for historical data but is thought to be more accurate for recent disturbances. Smaller developments (e.g., individual gravel quarries) may not be accounted for. In the case of historical disturbances (e.g., seismic lines cut in the 1960's), it is unknown whether features have adequately recovered or not to be removed from datasets, and in most cases a wide range of vegetation recovery can be expected even on the same feature.

Data is mapped at a range scale and areas with significant new development are provided with a map of the specific area that has been disturbed. Where appropriate the total linear footprint has been summarized for different disturbance types and a total area of the footprint provided where possible.

Results

Most development in the range of the Porcupine Caribou herd occurred prior to the 1980's so we know relatively little about the disturbances except when they are still active (Figure 10). In 2013-2014 a major 3D seismic project occurred in the Eagle Plains area of Yukon. Based on data provided by Yukon Oil and Gas Branch and the company responsible for conducting the work, a total of 2124 km of seismic line varying in width from 1.75-5 meters was cut, totaling approximately 5.35 km² of footprint. Access roads in the area totaled 228 km and varied in width between 3-5 meters (Figure 11). In 2015-16 no detectable changes occurred in linear disturbance and human footprint. A current proposal has been submitted to the Yukon Environment and Socio-economic Assessment Board to construct new all season roads, drill up to 20 wells and conduct up to 2 years of extended flow testing on each.

Discussion

Linear disturbances and human footprint can affect caribou in multiple ways. Increased access can provide hunters with increased success and in some cases may facilitate predator movements resulting in higher predation levels or increased stress levels for caribou. Footprint can also impact habitat and habitat use by either directly impacting the habitat or by creating behavioural responses where caribou do not use high quality habitat as they may perceive it to be too risky. Large patches of intact habitat are known to be critical to caribou herds.

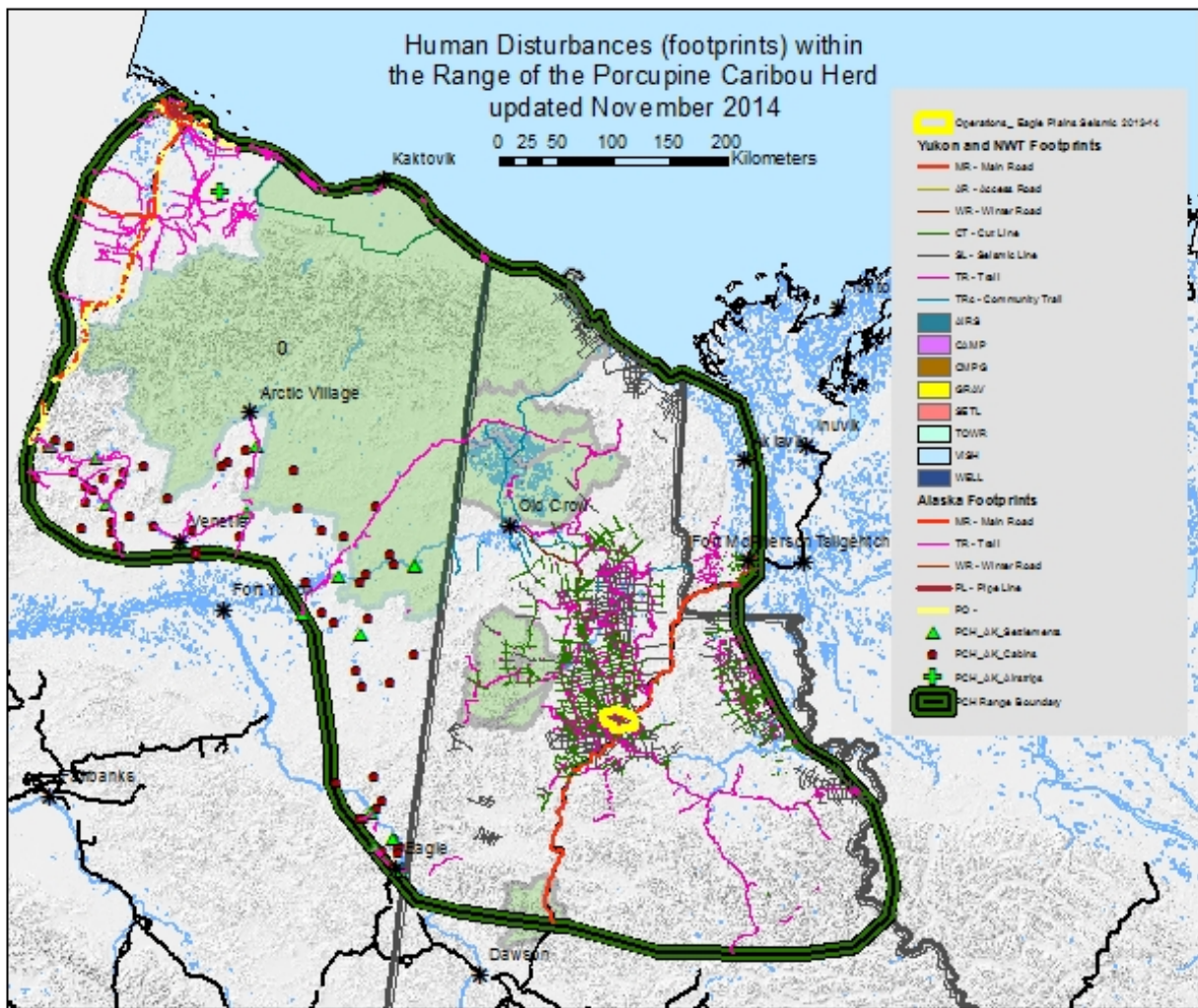


Figure 10. Human disturbance within the range of the Porcupine Caribou herd (updated Nov. 14, 2014 – NO detectable change to present, October 31, 2016) in Alaska, Northwest Territories, and Yukon.

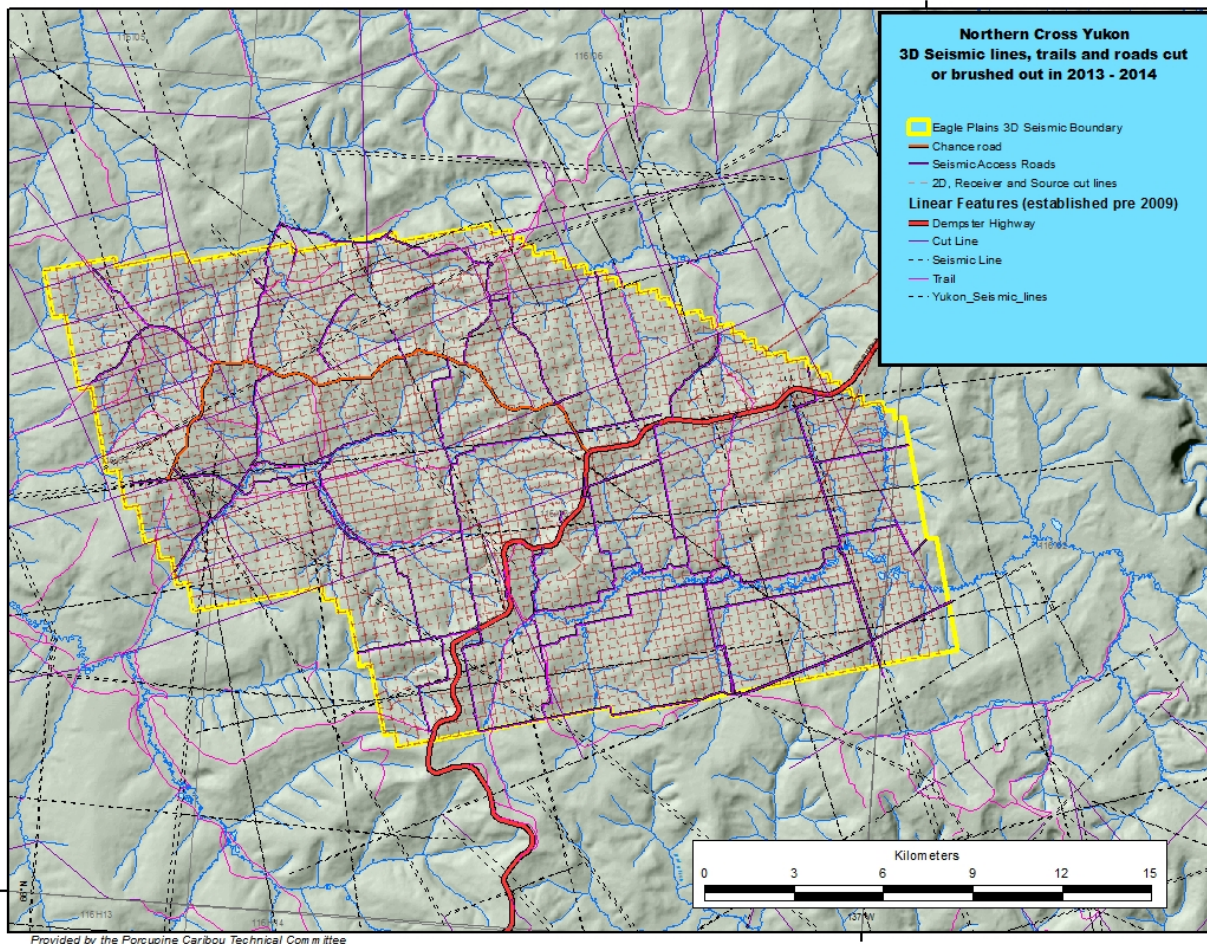


Figure 11. The extent of 3D seismic lines, trails and roads cut or brushed out in 2013-14 by Northern Cross within the range of the Porcupine Caribou Herd in Yukon

Snow condition

Objective

To gather an index of snow depth and hardness.

Methods

Water Resources (when under Environment Canada and now under Yukon Government) recorded late winter snow depth and snow water equivalent back to the 1970's. The Yukon Fish and Wildlife Branch also did late winter snow measurements along the Dempster Highway and Yukon north coast since the 1990's.

At specified permanent locations, a series of measurements are made, usually 10 repeated measures and depth and either snow density or snow water equivalent (SWE) is recorded. Where necessary, SWE is converted to density by dividing SWE by the depth of snow. Not all stations were measured in all years. Data presented in this report represents results from 17 stations from the Yukon since 2013. Data from other jurisdictions were not available in a compatible format for this report. For example the GNWT records SWE and not depth so snow density measurements cannot be calculated and do not appear on Figure 12.

A very small portion of the PCH wintered in the Yukon, in the upper Ogilvie and Miner, and lower Blackstone drainages. The majority of the PCH wintered in Alaska adjacent to Arctic Village and the Dalton Highway.

Results

Snow depth in the northern Yukon was above average to slightly below average in 2015-16 while density was average (Figure 12). The Porcupine River drainage (Old Crow and Eagle Plains Regions) experienced above average snow depth, while the Peel River drainage (Ogilvie and Blackstone Regions) had slightly below average snow depth. Snow measures were not collected in the Richardson or North Slope regions. Recent data doesn't show any significant trends or large deviations from long term averages.

Discussion

When snow is deep or hardened by wind, caribou expend more energy digging through the snow which can potentially affect their body condition, and reproductive capability. Caribou are not always in the areas where we measure snow but this information can be used as an index of winter conditions affecting caribou.

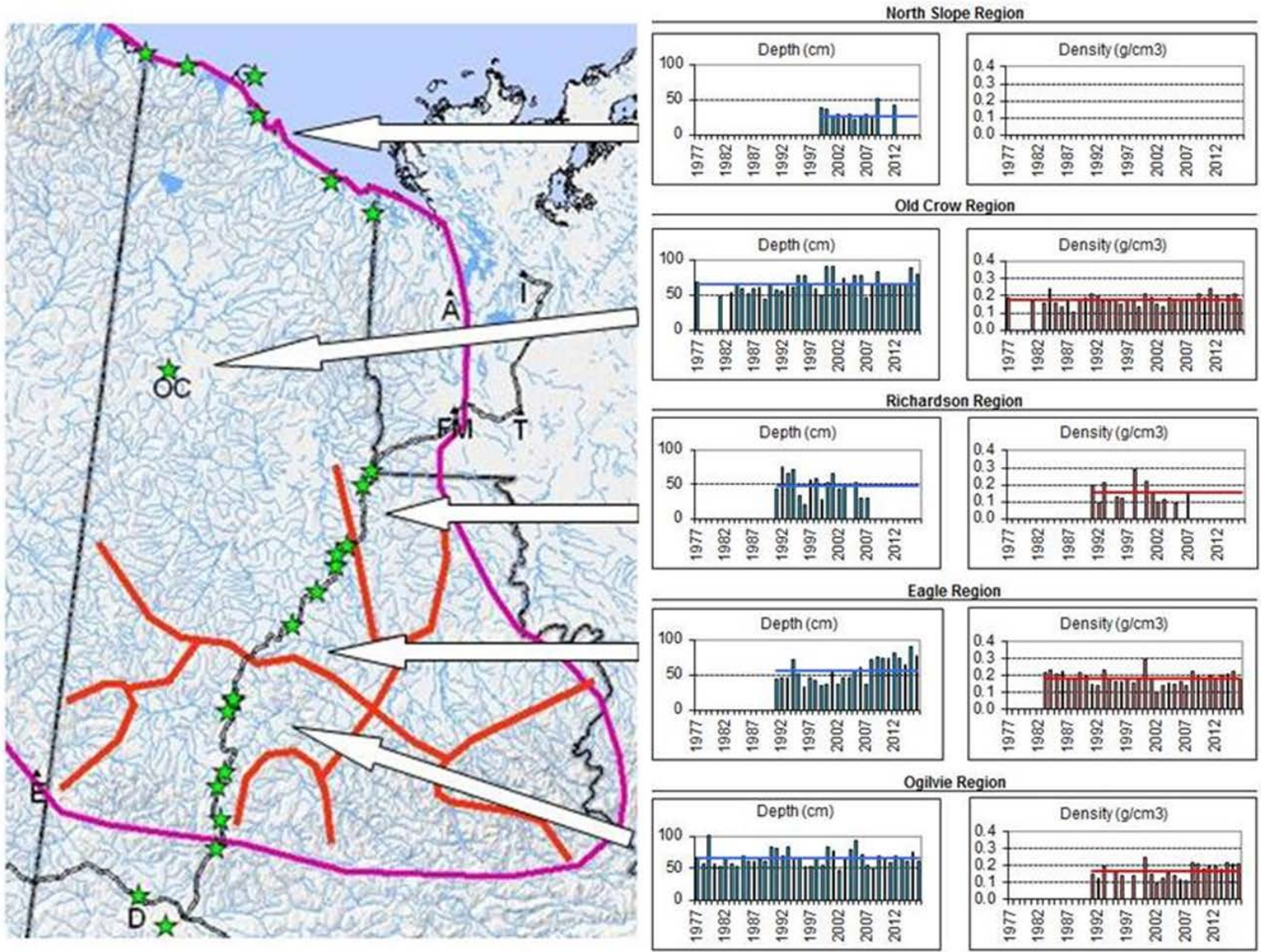


Figure 12. Summary of snow depth and density by snow region from permanent stations (indicated by green stars) for the Yukon portion of the Porcupine Caribou Herd range. Red lines on the map delineate snow regions relevant to caribou (Russell et al 1993).

TRADITIONAL KNOWLEDGE

POPULATION

Were hunters' needs met?

Objective

To determine if hunter's met their needs for caribou that year.

Methods

The ability of hunters to meet their needs for caribou is an important indicator tracked during yearly ABEKC interviews (ABEKC 2015). Interviewees (125) were asked whether they met their needs for caribou for that years' hunting period with answers of "yes" or "no".

Results

The majority of respondents (79%) met their needs for caribou in 2015 (Figure 13). This represents the highest result since 2010 and 14% greater than the 5-year average. The percent of interviewees that met their needs in 2015 is most similar to years between 2005 – 2008.

Discussion

The majority of the Porcupine Caribou herd was along the Dempster highway corridor for the first time in any numbers since 2010. The main herd reached the NWT border north of Eagle Plains around October 8th and slowly moved south along the Dempster highway corridor to the northern edge of Tombstone Territorial Park. In mid-November the main group moved off the highway corridor to the west up the Porcupine river. While the main group stayed in the mountains west of Eagle Plains for a number of months small groups remained on the Dempster, Oligivie and Peel river drainages until heading to their calving grounds in early May 2016. The appearance of caribou along the Dempster highway corridor improved access and increased the ability of hunters from more communities to meet needs for caribou.

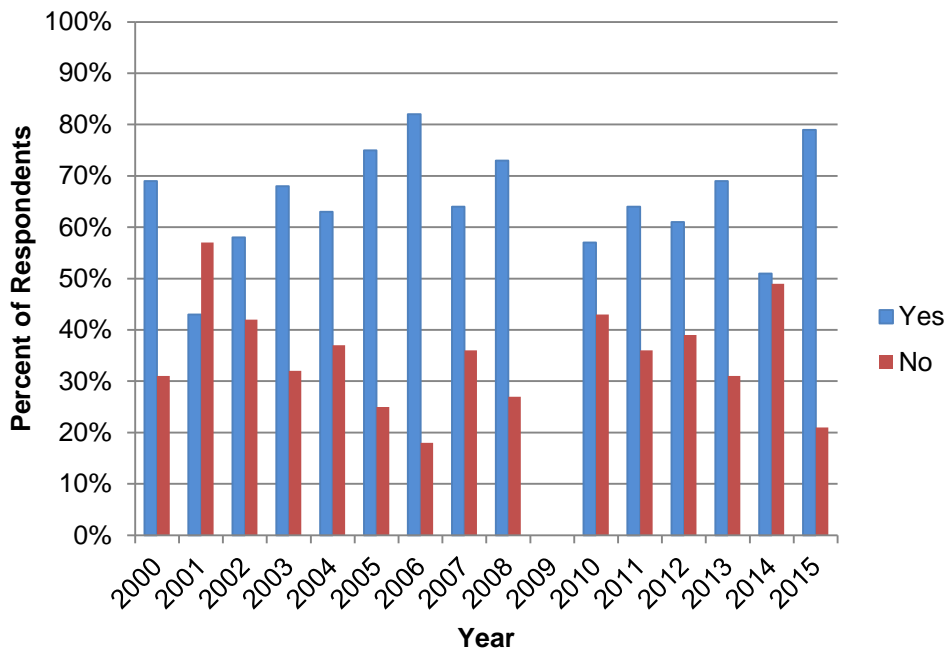


Figure 13. The percentage of respondents that met their needs for caribou from 2000 to 2015.

Caribou abundance – adult females and calves

Objective

To determine trends in abundance of adult female caribou and calves across seasons.

Methods

Adult female survival and calf recruitment are important indicators and represents the ability of the herd to reproduce and grow. Interviews conducted by ABEKC (2015) asked “In your observations for each season, were there more, equal or fewer Porcupine Caribou over the last year than usual?” Seasons included winter, spring, summer and fall. Interviewees were asked to separate their observations by male bulls, adult females, calves, young males and young females. There are four possible responses to this question: More, Same, Less and Don’t Know. We included calf abundance in the summer and winter to find traditional knowledge indicators that may correspond with late June calving surveys and March composition surveys.

Results

Calves

People interviewed in 2015 most often observed the same number of caribou calves in the summer and winter compared to previous years (Figure 14 and 15). The percentage of respondents seeing more caribou calves in winter 2015 was 13% above average.

Adult females

Respondents observed “more than usual” adult female caribou in the winter and fall of 2015 with less or same in the spring and summer respectively. In fall result was 9% above the 3-year average. There are no obvious trends in adult female abundance across years with the exception of significantly lower percentage of respondents observing “more” cows in the summer and fall of 2014 (Figure 16).

Discussion

The survival of adult females and calf recruitment is important to ensure that calves are born and survive into the next generation and the population can continue to grow in the face of predation, hunting, and changes in climate that affects insects, food availability and energy use of caribou. Fancy et al. (1994) found that the growth of the herd is most sensitive to the survival of females 3 years of age and older followed by calf production and survival. A decline in the annual adult female survival from 0.8781 to 0.847 would cause a decline in the population (Walsh et al. 1995). Although the PCTC did not measure adult female survival directly in 2016, the overall trend from the ABEKC interviews can be used to track trends in adult female abundance and alert researchers to possible changes in survival rates that would affect growth of the herd.

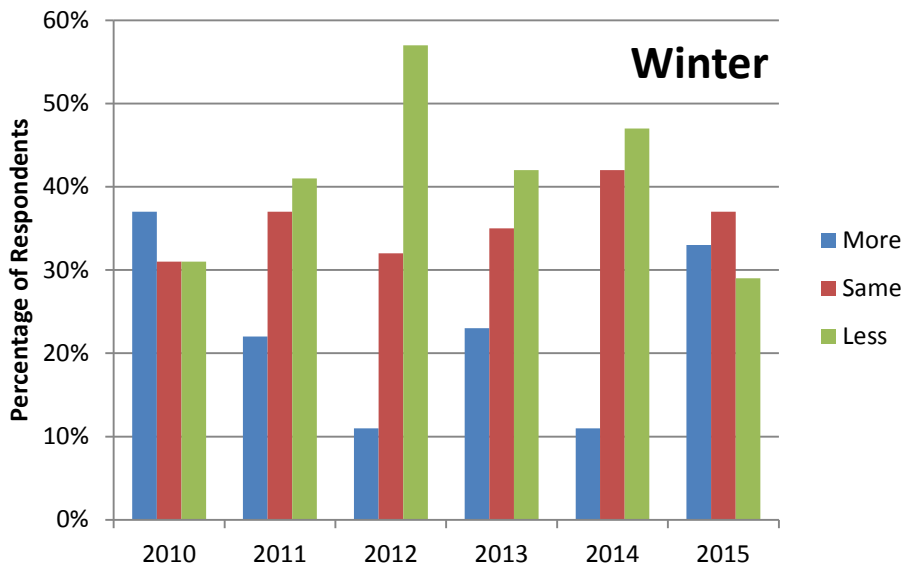


Figure 14. A summary of Arctic Borderlands Ecological Knowledge Coop interview results from 2013-2015. Respondents were asked if they saw more, equal or fewer adult female Porcupine over the last year than usual by season.

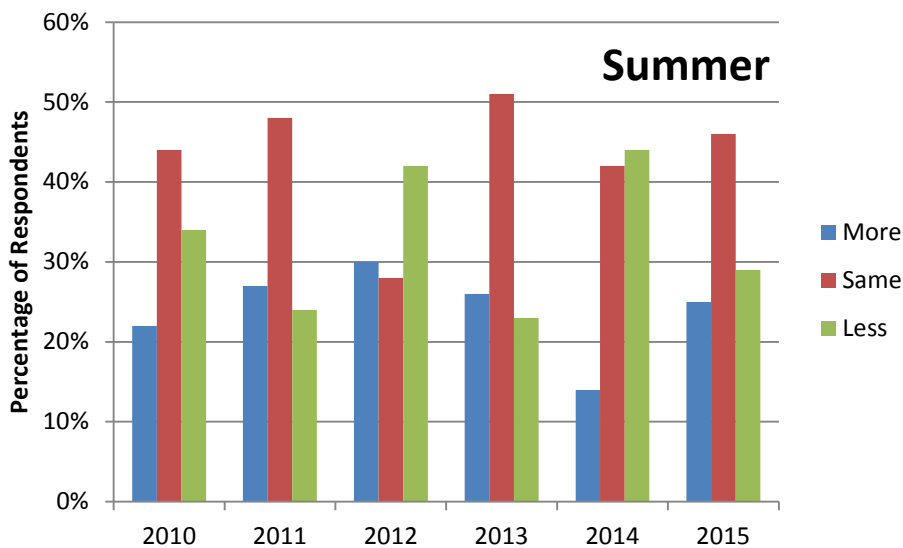


Figure 15. A summary of Arctic Borderlands Ecological Knowledge Coop interview results from 2013-2015. Respondents were asked if they saw more, equal or fewer adult female Porcupine over the last year than usual by season.

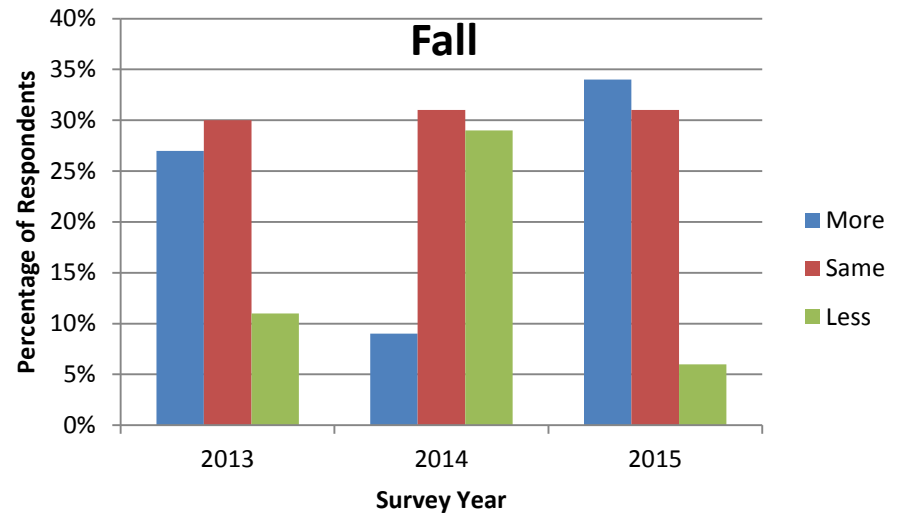
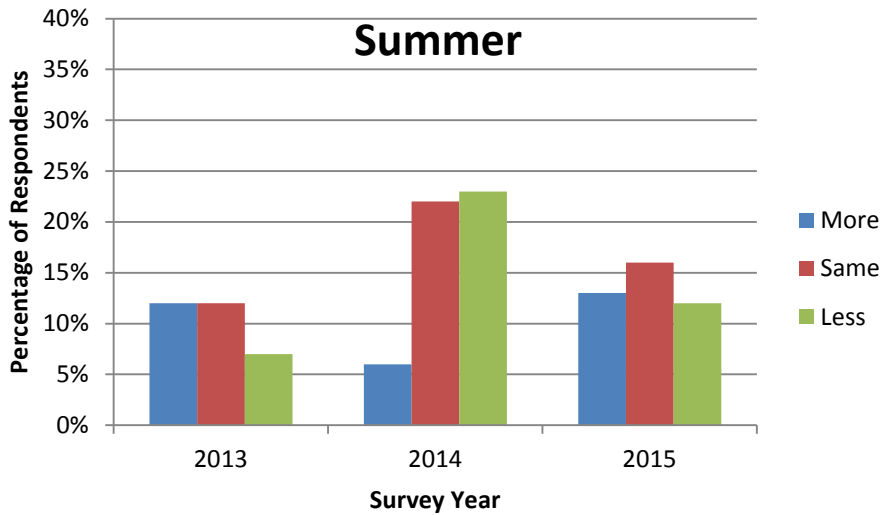
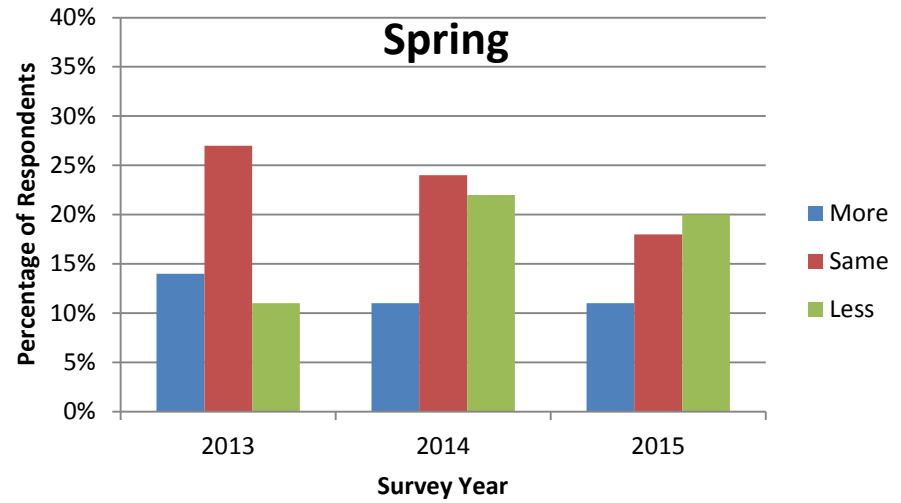
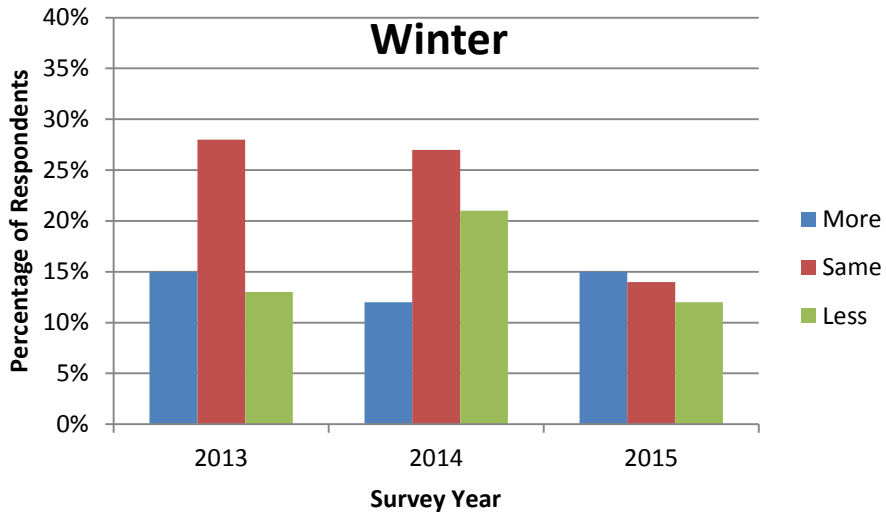


Figure 16. A summary of Arctic Borderlands Ecological Knowledge Coop interview results from 2013-2015. Respondents were asked if they saw more, equal or fewer adult female Porcupine over the last year than usual by season.

CARIBOU BODY CONDITION

Observed body condition and health of caribou

Objective

To determine trends in body condition of Porcupine caribou between years and seasons.

Methods

Body condition and health of caribou are important indicators tracked during their yearly ABEKC interviews (ABEKC 2015). Interviewees were asked to about the condition of caribou they observed each season over the past year. There are six possible responses to this question: Don't Know; Excellent, Good, Mixed, Fair and Poor.

Results

Respondents observed caribou most often in "Good" condition across all seasons in 2015. This is consistent with the past five years with the exception of summer 2014 (Figure 17; indicated by blue rectangle). However, respondents increasingly observed caribou in "poor" condition in the summer and "fair" and "poor" condition in the fall compared to recent years. This result is based on reports from a small number of people so should be interpreted with caution.

Discussion

The ABEKC data is useful because provides additional body condition information on the entire herd that might not be captured with the body condition monitoring of harvested caribou only (e.g. males only in some management regimes).

Poor summer body condition may be related to inadequate foraging conditions possibly due to poor summer range conditions. Poor range conditions during the first month of lactation may deplete female fat reserves resulting in lighter, slower growing calves and may impact female body development (shorter and lighter).

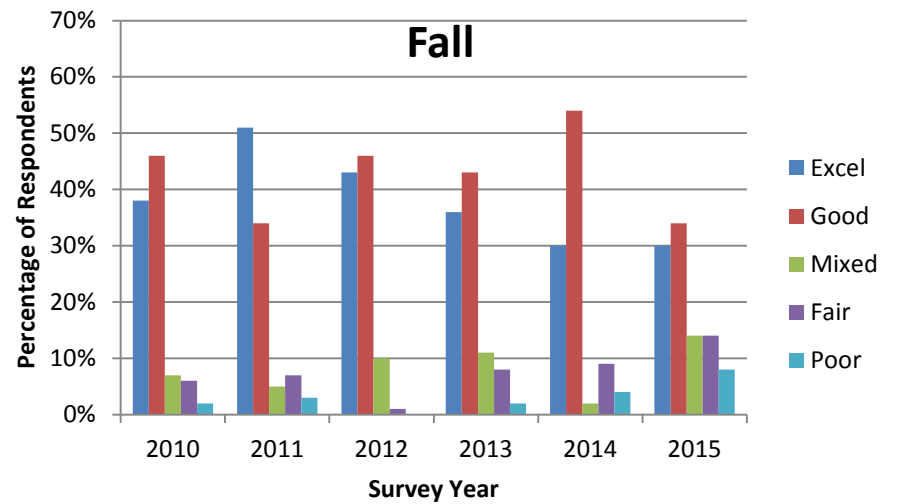
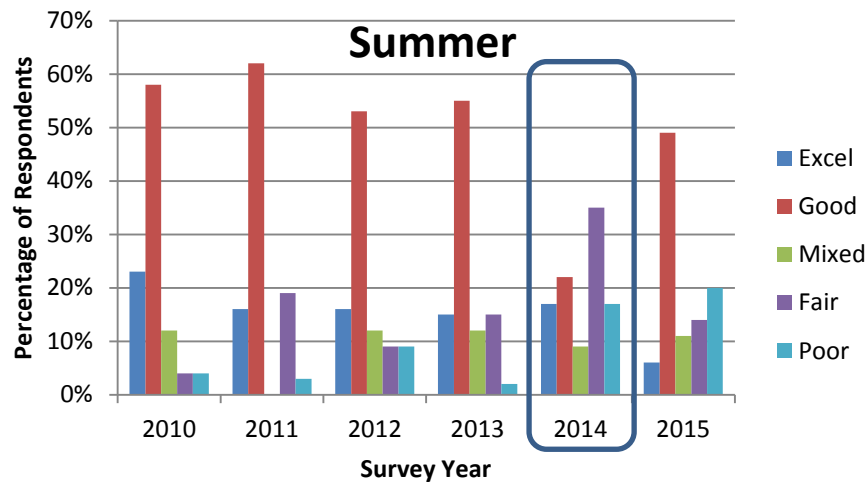
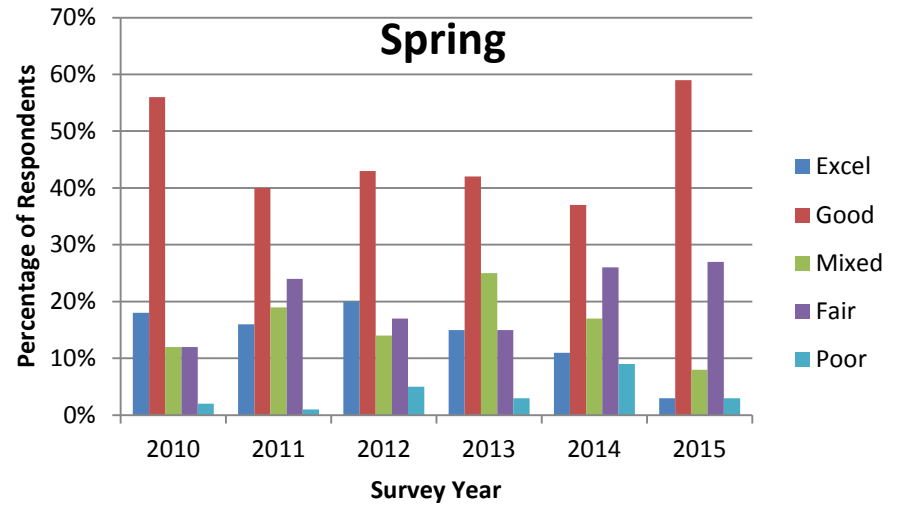
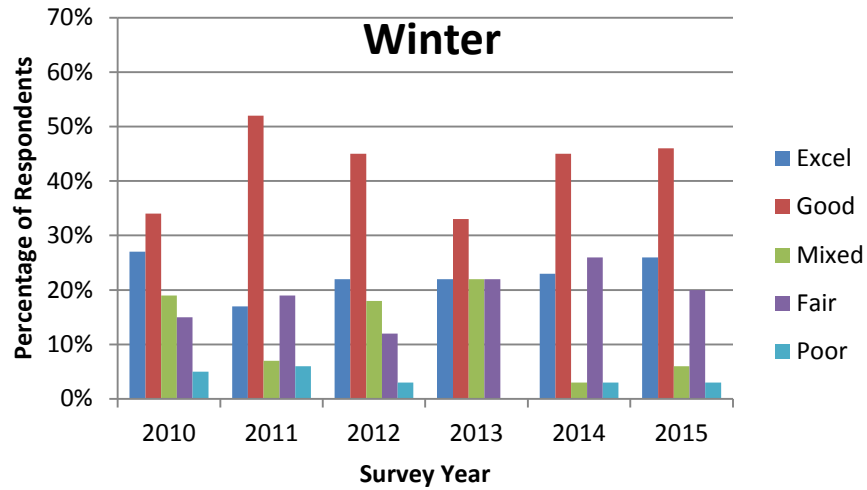


Figure 17. A summary of Arctic Borderlands Ecological Knowledge Coop interview results from 2010-2015. Respondents were asked about the overall condition of Porcupine caribou that they observed in each of the four seasons.

HABITAT

Extreme weather events

Objective

To gather information on unusual and rare weather events (icing and more snow than normal) that may affect Porcupine caribou.

Methods

Unusual, extreme and rare weather related events are important indicators tracked during yearly ABEKC interviews with some years lacking data (ABEKC 2015). Interviewees were asked to identify the months when they observed any of the following usual, extreme or rare weather-related events; torrential rain, icing, really frosty, more thunderstorms, more wind, colder or hotter than normal, more or less snow than normal, drought, and other (specified) or none. Each month could have one or more options checked. “More snow than normal” and “more ice than normal” were summarized by season. Icing event is further defined as a rain that freezes and snow and makes a crust. Fall (October, November and December) and winter (January, February, and March) results are presented.

Results

Fall (October, November and December):

There was a slight decrease in the percent of people interviewed that reported that there was “more snow than normal” in 2015, but 5% higher than the 5-year average (Figure 18). Although the percent of respondents reporting “more ice than normal” increased by 5%, this is slightly below the 5-year average (Figure 18).

Winter (January, February, and March):

Both “more snow” and “more ice than normal” were above the 5-year average for 2015. However, in 2015 the percent of respondents that noted “more snow” decreased by 2%, and “more ice increased by 9% since 2014 (Figure 19).

Discussion

Deep snow and periodic icing events on the winter range can restrict the ability of caribou to access their food and travelling through deep snow can expend limited energy reserves. These weather events are often suggested to be the cause of mass starvation, catastrophic declines and extirpation of local populations in reindeer and caribou herds. However, a comprehensive review of the impact of climate, snow and ice in the declines of reindeer and caribou populations states that there is little evidence to suggest that this is true across the extent of caribou distribution (Tyler 2010). In some cases there was a lack of data on weather and ground conditions at the same time as changes in population size so it was difficult to determine the cause of the decline. Therefore, it is important to track snow and icing conditions in conjunction with other population indicators. Unusual, extreme and rare weather may become increasingly important with long-term changes in climate.

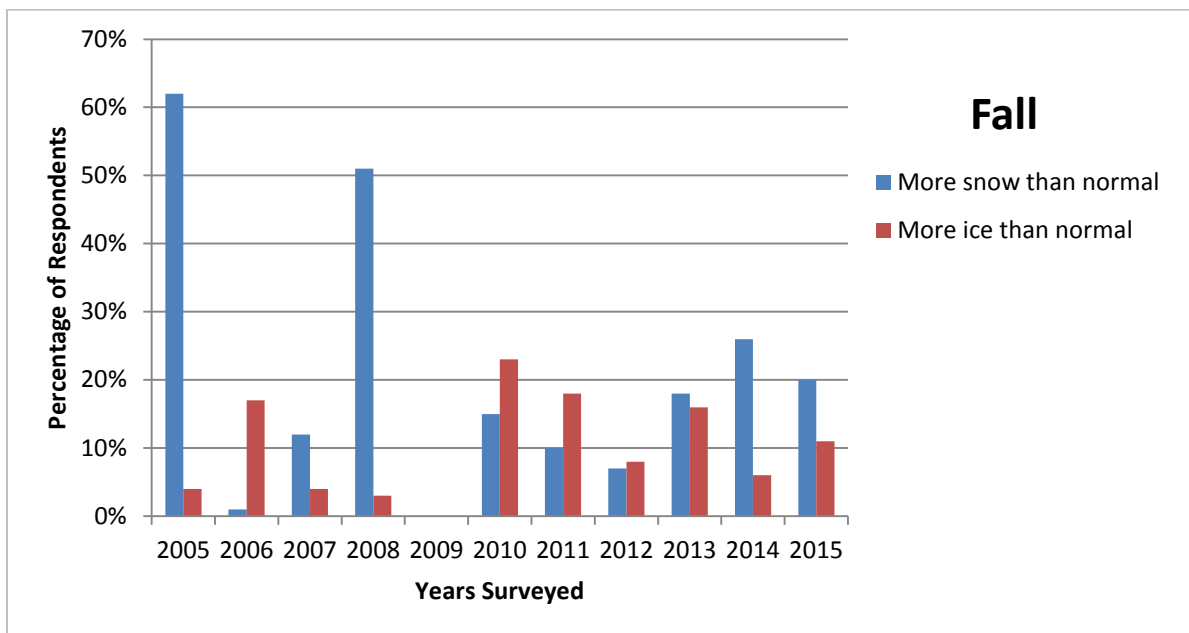


Figure 18. The percentage of respondents that identified icing events or more snow than normal in the fall (October, November and December) of that year during Arctic Borderlands Ecological Knowledge Coop interviews from 2005 - 2015.

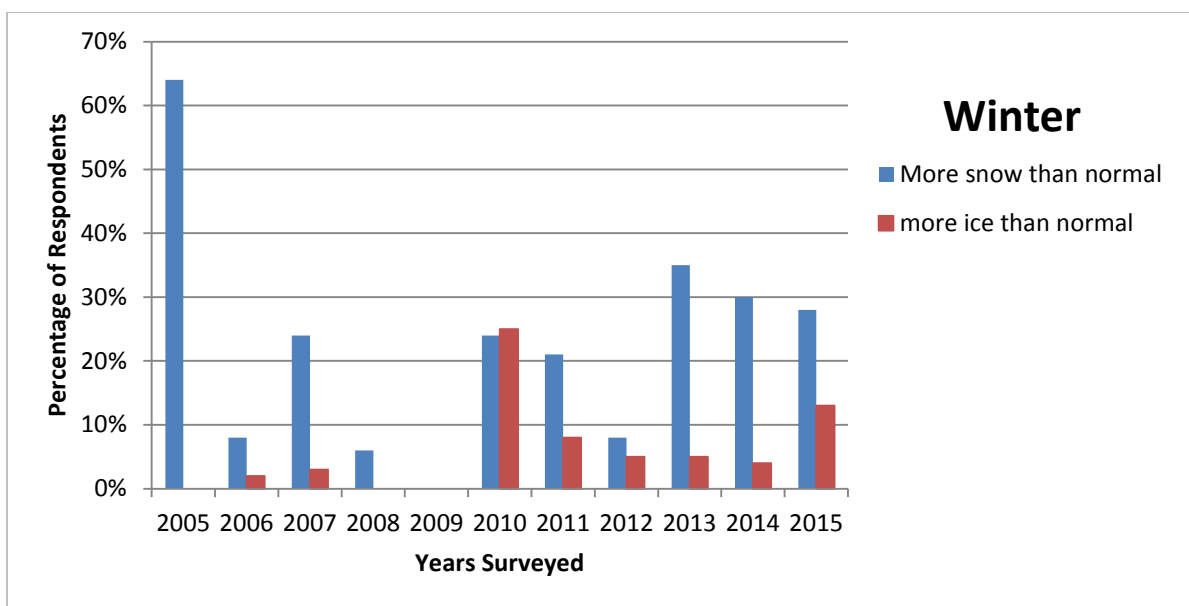


Figure 19. The percentage of respondents that identified icing events or more snow than normal in the winter (January, February and March) of that year during Arctic Borderlands Ecological Knowledge Coop interviews from 2005 - 2015.

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Appendix A. Summary of biological parameters

Year	Cows Observed ^b	Parturition Rate	June Calf Survival ^c	Post-calving Survival ^d	Late June Calf: Cow ^e	March Calf: Cow ^f	Population Estimate	Peak of calving	Calving note
1985		0.77			0.46				
1986		0.74							
1987	51	0.78	0.71		0.55		165,000		
1988	91	0.84	0.65		0.55				
1989	74	0.78	0.74		0.58	0.43	178,000		
1990	74	0.82	0.90		0.74				
1991	77	0.74	0.82		0.61	0.22			
1992	78	0.86	0.57		0.49	0.33	160,000		
1993	63	0.81	0.56	0.83	0.45	0.32			
1994	98	0.91	0.77	0.93	0.70	0.40	152,000		
1995	95	0.69	0.85	0.92	0.59	0.41			
1996	74	0.89	0.81	0.91	0.72	0.46			
1997	48	0.75	0.77	0.90	0.58	0.38			
1998	58	0.83	0.82	0.94	0.68	0.27	129,000		
1999	39	0.84	0.83	0.86	0.70	0.56		3-Jun	1-5 June
2000	44	0.73	0.61	0.82	0.44	0.28		7-Jun	
2001	70	0.84	0.61	0.79	0.51	0.31	123,000	8-Jun	5-10 June
2002	68	0.87	0.65	0.85	0.56	0.38		5-Jun	
2003	70	0.87	0.79	0.85	0.69	0.33		1-Jun	
2004	74	0.82	g	g	g	0.24		3-Jun	3-4 June
2005	55	0.64	0.77	0.88	0.49	h		2-Jun	1 - 4 June
2006	66	0.79	0.73	0.86	0.58	0.39		2-Jun	
2007	67	0.88	0.83	0.90	0.73	h		30-May	
2008	63	0.79	0.73	0.92	0.59	h		30-May	29 or 30 May
2009	65	0.77	0.57	0.75	0.44	0.19		2-Jun	
2010	41	0.85	0.76	0.87	0.65	h	169,000	1-Jun	prior to 2 Jun

Year	Cows Observed ^b	Parturition Rate	June Calf Survival ^c	Post-calving Survival ^d	Late June Calf:Cow ^e	March Calf:Cow ^f	Population Estimate	Peak of calving	Calving note
2011	59	0.86	0.48	0.59	0.41	h		30-May	prior to 1 Jun
2012	g	g	g	g	g	g		30-May	prior to 1 Jun
2013	42	0.86	i	i	i		197,000	04-Jun	3-4 June
2014	39	g	g	g	0.49			no data	
2015	g	g	g	i	i			no data	
2016	28	0.75	0.61	1.00	0.46				
Mean	63	0.81	0.72	0.86	0.57	0.35			
5 yr mean	34	0.81	0.61	1.00	0.48			1-Jun	

^a Data are from Fancy et al. (1994, Can. J. Zool. 72:840–846), Alaska Department of Fish and Game, and Yukon Department of Environment.

^b Number of radiocollared adult cows for which parturition status was determined in early June, excluding those known to be <4 years old. Includes caribou of unknown age, but most likely > or equal to 4 years olds. Prior to 2003, all caribou were of unknown age.

^c Estimated as (July calf:cow ratio)/(parturition rate).

^d Includes only calves observed during early June that were subsequently observed in late June (i.e., does not include most perinatal mortality).

^e Excludes radiocollared cows known to be < 4 years old.

^f As of March of the year following birth of each cohort; includes all cows >1 year old.

^g No data due to adverse weather conditions.

^h No data due to mixing of herds on winter range.

ⁱ No data due to dense caribou groups making identification of cow:calf pairs not possible.

Appendix B. Previous research findings

Short yearling survival to 3 years of age

Objective

To document the survival of 9 month old calves to 3 years of age (2003-2010 only).

Methods

Starting in 2003, we captured about 10 female caribou in March that were born the previous spring (9 months old) and put conventional radio collars on them. The data from all years of captures were pooled to estimate how many calves survived to breeding age. Because we know exactly how old these caribou were, we recapture them after 3 years or sooner and replaced their collars to maintain a collared sample.

Results

The average survival rate of female Porcupine caribou appears to decline as caribou age from 9 months to 3 years but because of the error bars overlap on the estimates we cannot say for certain that there is any change in survival rate as caribou survive to breeding age (Figure 18). The average survival rates of female caribou 9 mo. – 3 yrs of age are similar (87%) to adult female survival rates taken from the same time period (84%). The last year of this seven year study was completed in 2010.

Discussion

In 2003, we started a 7-year study to estimate how well calves survive to 3 years of age when they should enter the breeding portion of the population. This has been estimated only once before in 1983-88 (Fancy et al 1994). We have been assuming that once calves reach one year of age, they survive at the same rate as adults. We are testing this assumption because, as with the survival of adult females, the survival of young females is important to population dynamics. Computer population modeling shows that it would take a decrease of only 6% in adult female survival or a decrease of 50% of calves to cause a decline like we have documented for the Porcupine Caribou Herd between 1989 and 2001 (Arthur et al 2003). Other work has shown that survival of calves in their first year of life is very low. Survival of these young, non-breeding animals is similar to adult females.

Small sample sizes are an issue for this analysis. The estimates are based on data pooled over multiple years of collaring efforts, however the sample size at step one of the analysis is 59 animals. In order to be able to detect small changes in short yearling survival with confidence, we would have to maintain collars on many more young caribou. There are constraints to doing that in terms of funding, availability of free radio frequencies, logistics of flying, and community concerns. Despite these constraints, we decided to continue small numbers collaring short yearling females each year to continue recording survival estimates (low statistical power given the small sample size) but also to ensure the collared sample of caribou is not biased toward older animals.

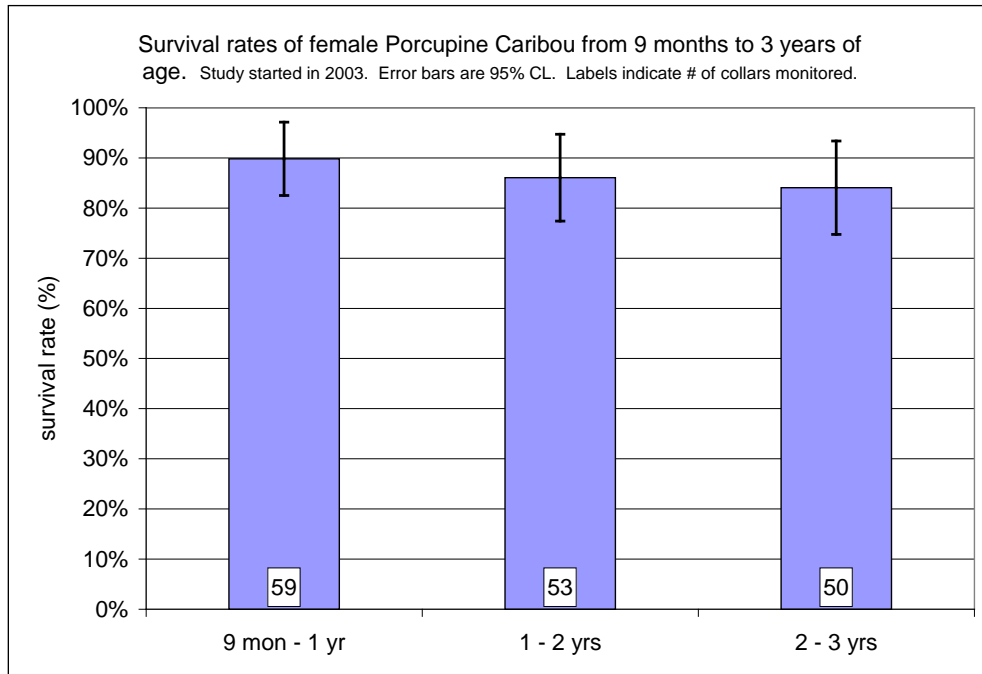


Figure 20. Survival of Porcupine Caribou females from 9 months to 3 years of age from 2003-2010.

Adult bull survival

Objective

To document the survival of adult bull caribou (2003-2010 only).

Methods

Each year before a census attempt, we deploy a number of collars on adult bull caribou so we can locate the bull groups during the census field work. Because we've been preparing for a census each year for 8 years running, we have an unprecedented number of bulls collared. We are able to do an analysis similar to the short yearling analysis. All collared bulls were pooled and we calculated their survival rate in years following capture.

Results

Between 2003 and 2006, more bulls died during the fall than any other season. Bull mortality rate increases dramatically about 5 years after collaring (Figure 19). Assuming bulls were at least 3 years old at the time of capture, bulls start dying at an increased rate at 8 or more years of age. The study on adult bull survival extended from 2003 – 2010. No further collaring of bulls is planned.

Discussion

As expected, we see that bulls seem to survive at a lower rate than adult cows. Bulls are probably more stressed during the rut which contributes to a lower survival rate.

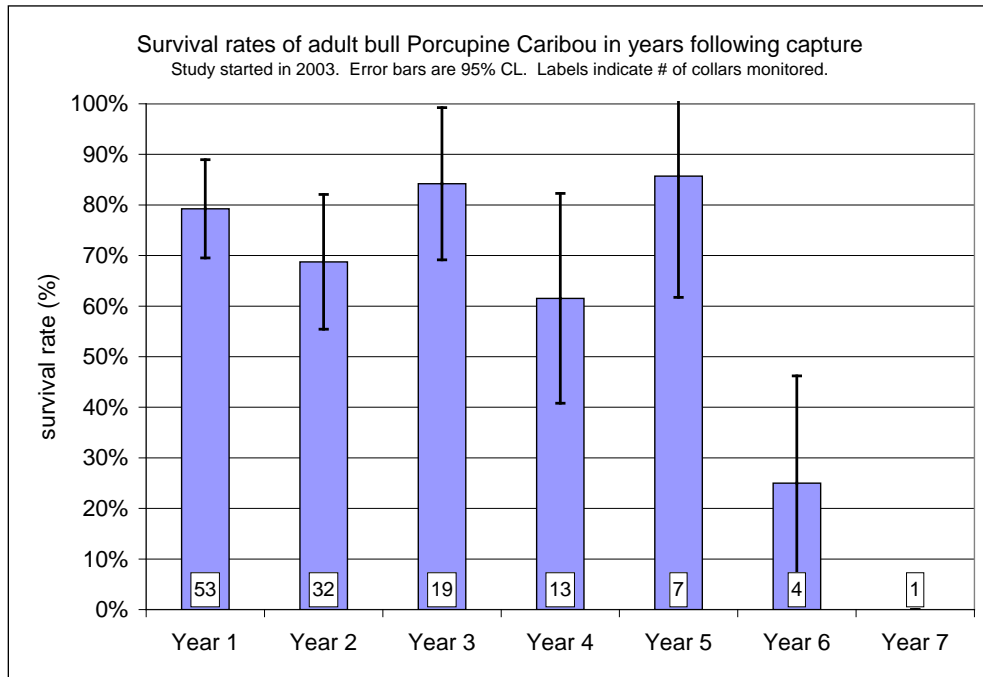


Figure 21. Survival of male Porcupine Caribou from 2003 to 2010.