

MOOSE SURVEY

**SOUTH CANOL MOOSE
MANAGEMENT UNIT**

EARLY-WINTER 2013



Prepared by:
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June 2016

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**Yukon Department of Environment
Fish and Wildlife Branch
SR-16-03**

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Summary

We conducted an early-winter survey of moose in the South Canol study area south of Faro from 15 to 29 November 2013. The main purpose of this survey was to estimate the abundance, distribution, and composition of the moose population in the South Canol Moose Management Unit.

- We counted all moose observed in survey blocks covering about 51% of the entire survey area. We counted a total of 289 moose: 87 adult bulls, 156 adult and yearling cows, 9 yearling bulls, and 37 calves.
- We estimated the population in the entire survey area at $516 \pm 18\%$ moose. This represents an average density of approximately 133 moose per 1,000 km² of suitable moose habitat or 107 moose per 1,000 km² over the total survey area.
- We estimated there were $57 \pm 14\%$ adult bulls for every 100 adult cows. This figure is well above the minimum of 30 adult bulls per 100 adult cows recommended in the *Science-based Guidelines for Management of Moose in Yukon*.
- We estimated that there were 26 calves for every 100 adult cows and 7 yearlings for every 100 adult moose in the total survey area. This suggests that survival of calves was moderate during the summer and fall 2013 but that calves born in 2012 had poor survival in this area.
- The current harvest rate within the South Canol Moose Management Unit appears to exceed the sustainable harvest as set out in the *Science-based Guidelines for Management of Moose in Yukon*.
- Complete harvest information that includes harvest data from all users is required to ensure this moose population is managed within sustainable limits.

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Table of Contents

Acknowledgements	inside cover
Summary	iii
Table of Contents.....	v
List of Figures.....	vi
List of Tables	vi
Introduction	1
Previous Surveys.....	1
Community Involvement	3
Study Area	3
Methods.....	6
Snow and Weather Conditions.....	7
Stratification.....	7
Census	7
Results and Discussion	9
Stratification: Identification of High and Low Moose Density Blocks	9
Census	9
Moose Observations and Distribution.....	10
Population Abundance	11
Population Composition	11
Harvest	11
Other Wildlife Sightings	14
Conclusions and Recommendations	17
References	18

List of Figures

Figure 1.	South Canol Moose Management Unit early-winter moose survey area for 2013 and census survey history, southeast Yukon.	2
Figure 2.	Fire history in the South Canol Moose Management Unit, southeast Yukon, 2013.	5
Figure 3.	Stratification results and census survey blocks of the South Canol Moose Management Unit early-winter moose survey, southeast Yukon, 2013.	8
Figure 4.	Bull moose licenced harvest rates in the South Canol Moose Management Unit, southeast Yukon, 2009 to 2013.	15
Figure 5.	Annual reported bull moose harvest (1995 to 2013) by licenced hunters in the South Canol Moose Management Unit (Game Management Subzones: 8-19, 8-20, 8-22, 10-01 to 10-03).....	16

List of Tables

Table 1.	Observations of moose during the South Canol Moose Management Unit early-winter moose census survey, southeast Yukon, 2013.	10
Table 2.	Results of the South Canol Moose Management Unit early-winter moose census survey, southeast Yukon, 2013.	12
Table 3.	Average annual (2009 to 2013) licenced bull moose harvest ¹ for the South Canol Moose Management Unit, southeast Yukon. Game Management Subzones 8-19, 8-20, 8-22, 10-01 to 10-03.....	13

Introduction

This report summarizes the results of the early-winter moose survey in the South Canol Moose Management Unit (MMU) conducted between 15 and 29 November, 2013 (Figure 1). The main purpose of this survey was to estimate the abundance, composition, and distribution of the moose population to accurately assess the status of the population and the harvest pressure on the population. The South Canol Road corridor has a history of mineral exploration that has left behind a network of access roads and trails that penetrate the mountain blocks throughout the South Canol MMU. Hunters often favour accessible areas and ensuring the sustainability of moose harvest in such areas requires that moose populations be monitored and harvest management actions be implemented if necessary.

The 2013 South Canol survey is part of the ongoing monitoring Environment Yukon conducts in high-priority MMUs throughout the territory. Yukon-wide priorities for moose inventory and monitoring are established in consideration of access levels, harvest levels, quality of ecological information, current and anticipated land use activities, habitat availability, and population health. These factors are weighed together with social, financial, and political considerations to produce annual and multi-year survey schedules (Environment Yukon, 2016).

Previous Surveys

This is the first moose population survey conducted in this area.

However, two moose surveys flown in 2007 partially overlap the South Canol study area: the Little Salmon and Magundy rivers late-winter survey, and the South Canol West early-winter survey.

The Little Salmon and Magundy rivers late-winter intensive stratification survey was flown west of the South Canol study area, but overlapped with only one survey block (O'Donoghue 2013). The survey covered a corridor along the Robert Campbell Highway and Little Salmon and Magundy rivers from Little Salmon to Faro. The purpose of this survey was to identify key moose wintering areas along the two rivers. We did not assess population abundance and composition as part of this survey and, therefore, the results are not comparable to the South Canol early-winter moose population survey.

The South Canol West early-winter moose population survey overlapped Game Management Subzone (GMS) 8-22 at the southwest corner of the 2013 South Canol study area (Westover et al. 2008; Figure 1). This survey covered a block of eight GMSs bordered by the Teslin River to the southwest, the Big Salmon River to the north, and the South Canol Road to the east. The purpose of this survey was to estimate the abundance, composition, and distribution of the moose population and, therefore, the results from the two surveys can only be compared for GMS 8-22.

Environment Yukon conducted two other early-winter population surveys near the South Canol study area in recent years: the 2011 Faro, and the 2012 North Canol surveys (Clarke et al. 2012, Fontaine et al. 2016.). These surveys had the same purpose and

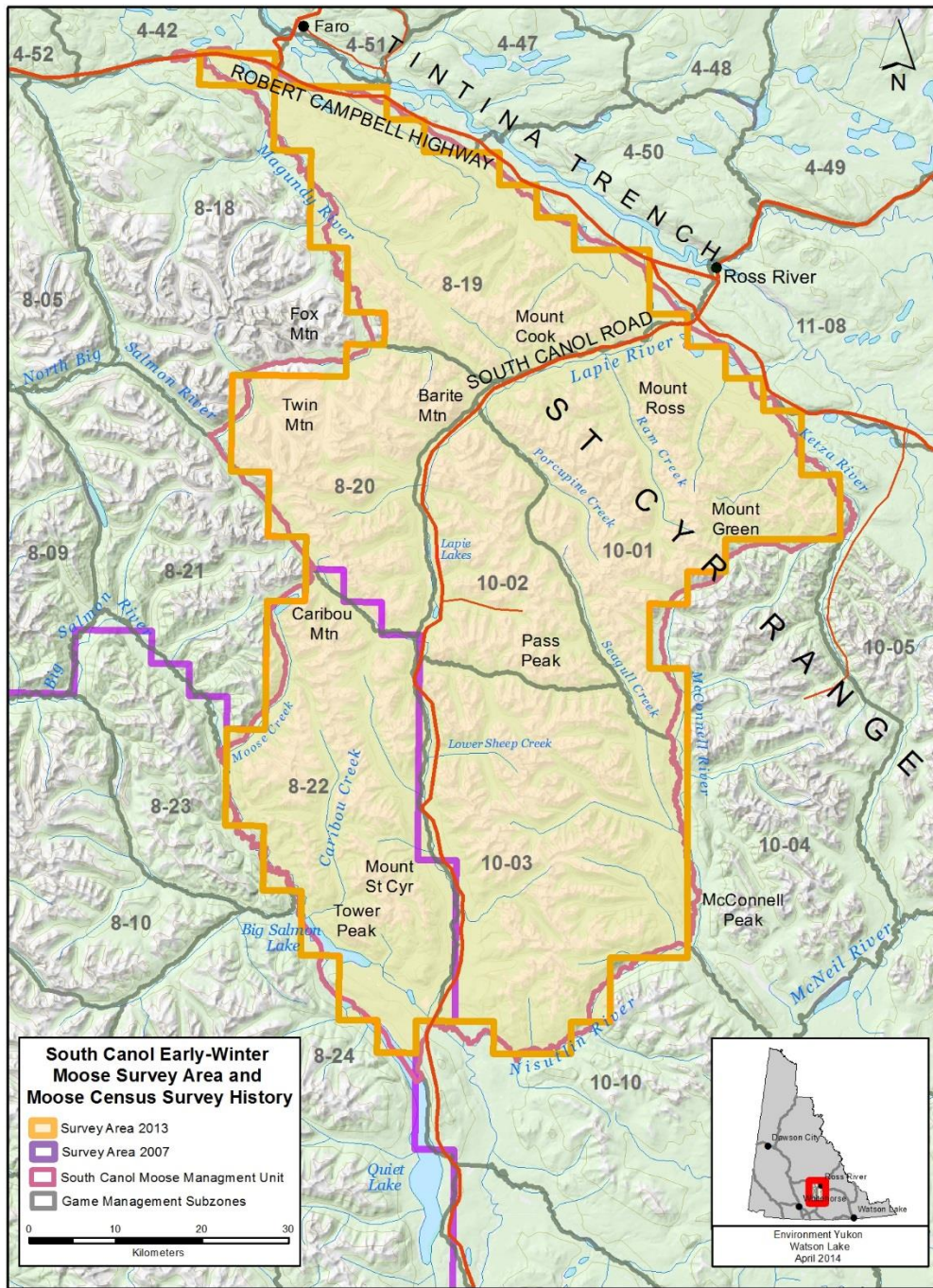


Figure 1. South Canol Moose Management Unit early-winter moose survey area for 2013 and census survey history, southeast Yukon.

design as the 2007 South Canol West survey and although they did not overlap, the results from these surveys

can assist with interpretation of the results of the 2013 South Canol survey.

Community Involvement

Moose have been a key part of First Nation peoples' subsistence lifestyle for generations and today are the most widely hunted game species by both First Nation and non-First Nation hunters throughout Yukon.

Reflecting their interest in responsible moose management and their concerns about the perceived high hunting pressure along the South Canol Road, community members from Ross River, Faro, and Teslin have participated in arranging observers or taking part as observers in this and other moose surveys in the area (e.g. Westover et al. 2008, Clarke et al. 2012, Fontaine et al. 2016.).

In 2005 and 2006, the Teslin Tlingit Council (TTC), the Teslin Renewable Resources Council (TRRC) and Environment Yukon drafted the *Teslin Integrated Fish & Wildlife Plan for 2006-2011*. The draft plan was developed following a final review of the previous integrated fish and wildlife plan, an open house hosted by TRRC in 2005, and a public planning workshop in 2006. The community identified declining moose populations as an element of concern in the plan and that better information on the status of moose populations was needed. To address this concern, the plan suggested that moose populations continue to be monitored through aerial surveys.

Although the 2006 to 2011 plan was never finalized, and consequently the planning participants did not undertake all of the suggested actions, the planning efforts are indicative of the high level of community interest in maintaining healthy moose

populations within the TTC traditional territory.

Study Area

The South Canol survey area covers about 4,807 km² of predominantly mountainous terrain. Of this, 915 km² (19%) is comprised of alpine habitats that are 1,676 m (5,500 ft.) or more above sea level, and water bodies 0.5 km² or larger in size. Neither is considered suitable moose habitat. This leaves 3,982 km² of habitable moose range.

The survey area was bounded to the north by the Robert Campbell Highway from Faro to the Ketzka River and extended south on either side of the South Canol Road to Big Salmon and Quiet lakes and the Nisutlin River. It was bounded loosely to the east by the Ketzka and McConnell rivers and to the west by the Magundy, North Big Salmon, and Big Salmon rivers (Figure 1). It encompassed all of the South Canol Moose Management Unit (MMU) and was comprised of GMS 8-19, 8-20, 8-22, and 10-01 to 10-03.

The predominant geographic feature of the area is the mountainous terrain of the Pelly Mountains and its subrange the St Cyr Mountain Range. These mountains are deeply incised with a multitude of valleys in which flow numerous rivers and creeks such as the Magundy, Lapie, North Big Salmon, McConnell, Big Salmon, and Nisutlin rivers. Other than Big Salmon and Quiet lakes on the southwestern boundary of the study area, and the Lapie Lakes along the South Canol Road near the center of the study area, most of the waterbodies in the

study area consist of small lakes associated with creeks in wider valley bottoms or kettle lakes. The South Canol Road divides the study area nearly in half.

Most of the survey area lies within the Pelly Mountains ecoregion, with only a small portion of the Yukon Plateau North ecoregion found along the northern boundary of the study area, and the Yukon Southern Lakes ecoregion present along the southern boundary of the study area in the vicinity of Quiet and Big Salmon lakes (Yukon Ecoregions Working Group 2004).

The high elevations result in cooler summers and less severe winters. Mean annual temperatures are near -3°C, but temperatures vary moderately by season and elevation. Mean temperatures are near -20°C in January and near 10°C in July. Temperatures are generally 5°C warmer at higher elevation in January but conversely the higher terrain is generally 5°C colder in July. The incidence of temperature extremes is higher in the lower valley floors than at higher elevations.

The Pelly Mountains are the first major barrier to the flow of weather systems east of the St. Elias and Coast mountains so precipitation is relatively heavy. Mean annual amounts range from 500 to 650 mm, with the drier months being April through June and the highest amount of precipitation occurring between September and January. Winds are usually light but can be moderate in the fall and winter in association with passing Pacific weather systems.

Much of the region is above treeline between 1,350 and 1,500 m above sea

level (asl). Dwarf shrubs dominate the vegetation at higher elevations whereas coniferous forests cover the slopes and valleys below 1,350 m asl.

The vegetation found in alpine environments is typical of dry lichen heath plant communities. It is characterized by mountain avens (*Dryas* sp.), lichens, grasses (e.g. *Hierochloe alpina*, *Poa* sp.), and ground shrubs like willows (*Salix* sp.), shrub birch (*Betula glandulosa*), and ericaceous shrubs. Shrub birch and willows with scattered subalpine fir (*Abies lasiocarpa*) dominate subalpine environments. Extensive shrublands dominated by dwarf birch are common on steep slopes subject to cold air drainage.

White spruce (*Picea glauca*) is the dominant tree species in the ecoregion on most soil types. It is generally established on warmer sites and is often found in mixed stands with subalpine fir and black spruce (*Picea mariana*). Black spruce occupies cooler wet sites, typically on the valley floors and north-facing slopes. Lodgepole pine (*Pinus contorta*) stands are common along both the northern and southern boundary of the study area but are uncommon in the rest of the region except as part of other coniferous stands. In the southern part of the study area, pine stands are typically found in association with the incursions of the Yukon Southern Lakes ecoregion and in the north they are found in a narrow east-west band along the northern boundary of the study area in association with old forest fires and the Yukon Plateau North ecoregion (Yukon Ecoregions Working Group 2004).

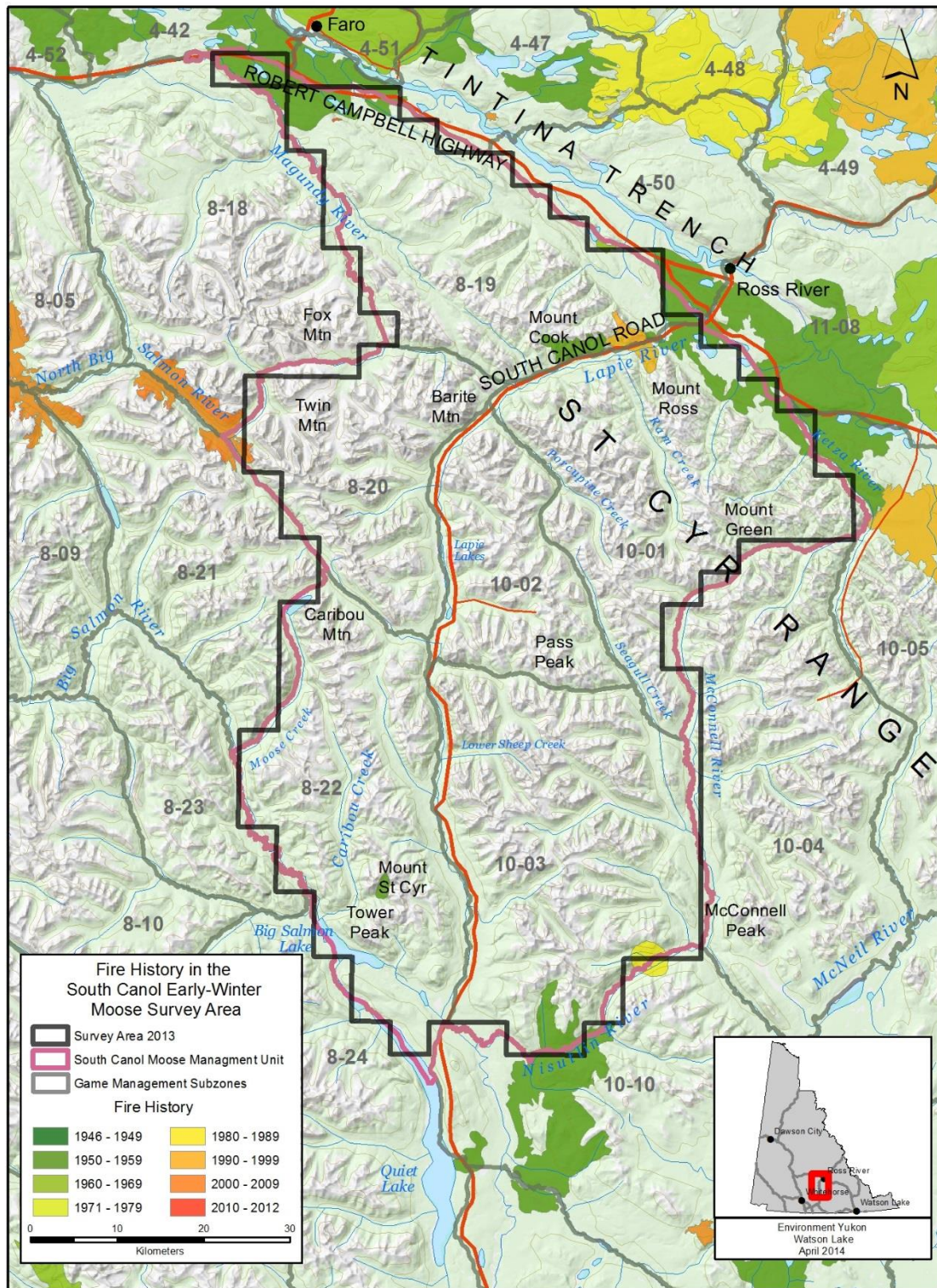


Figure 2. Fire history in the South Canol Moose Management Unit, southeast Yukon, 2013.

The South Canol survey area has had few fires and as a result, the forest lacks the complexity found elsewhere in the region along and north of the Tintina Trench (Figure 2). In terms of extent, the largest burns date back to 1958, and are located south of Faro, south of Ross River, and at the far south end of the study area near the Nisutlin River. Other fires within the study area occurred between 1951 and 2011 but all were small, isolated, and intermittent, with some decades having no fire activity in the area (Figure 2).

Methods

We have adapted a technique, developed by the Alaska Department of Fish and Game (Kellie and DeLong 2006) to survey moose. The technique has 6 steps:

1. The survey area is divided into rectangular blocks about 16 km² each in size based on lines of latitude and longitude.
2. Observers in fixed-wing aircraft fly over all the blocks, and classify (or “stratify”) each block as having either high, medium, low, or very low expected moose numbers. This classification is based on local knowledge, number of moose seen, tracks, and habitat. This is called a “low intensity stratification” survey. We flew this portion of the survey with a Cessna 185 and a crew of three observers in addition to the pilot.
3. We combine these categories of blocks into high or low “strata,” and then randomly select a sample of blocks in each stratum for our census. Given that the variability in the data is usually found in the high blocks, we usually select a higher proportion of the high blocks to survey than the low blocks.
4. We try to count every moose within the selected blocks (the “census” part of the survey), using helicopters at a search intensity of about 2 minutes per km². We classify all moose by age (adult or calf) and sex. Bull moose are classified as either mature or immature (yearlings). Yearling cows are often difficult to distinguish from adults, so they are counted together. We flew the census survey with two Bell 206 helicopters, each with a crew of three observers in addition to the pilot.
5. We use a computer program to estimate the total number of moose by age and sex in the entire survey area (Gasaway et al. 1986). We base the estimate on the numbers of moose counted in the blocks during the census, the distribution of these blocks and how we classified the blocks we did not count. Generally, the more blocks that are searched during the census portion of the survey, the more precise and reliable the resulting population estimate.
6. To estimate the number of moose that we missed during Step 4, we use a “sightability correction factor” (SCF) to correct the census results for moose that we overlooked (Becker and Reed 1990). This correction factor is the Yukon average calculated from previous early-winter censuses that repeated moose counts at double the search

intensity in a portion of survey blocks. It is equal to 1.09 (i.e., it assumes we missed about 9% of moose) with a variance of 0.004.

In the harvest section of this report, we estimate total moose numbers in each GMS by multiplying the average estimated moose density in the high and low stratum blocks by the number of high and low stratum blocks per GMS, respectively.

Snow and Weather Conditions

Snow coverage was complete across the study area. Snow depth averaged approximately 20 cm at the start and 30 cm at the end of the survey. There was some variability in snow depth across the study area due to terrain characteristics but snow was generally deeper at higher elevations. Skies were generally overcast with low ceilings and humidity and temperature conditions often led to the formation of ice fog. These conditions maintained fresh snow on the landscape, particularly at higher elevations where most moose were observed, and helped survey crews track and sight moose. Snow precipitation in the study area between November and December 2013 was 50% below normal (Yukon Department of Environment 2014) and should not have affected the distribution of moose.

Stratification

We conducted the stratification survey from 15 to 18 November. Weather conditions were generally poor throughout the survey and, as a

result, the crew was able to fly only a few hours per day (2.3 to 3.8 hours per day).

Winds were calm to light on all days except on 15 November when winds reached 52 km/h over the study area with high turbulence and wind gusts. Ground temperature at mid-day steadily decreased throughout the survey with temperatures of -12°C on 15 November decreasing to -37°C on 18 November. Skies were clear on 15 and 18 November with bright light conditions and overcast on 16 and 17 November with cloud cover varying in elevation from above to below mountain tops.

Census

Poor weather conditions on 19 November delayed the start of the census survey to 20 November; the survey ended on 29 November. Weather was highly variable throughout the survey and poor or unsafe weather conditions did not allow us to fly on two of these ten days (21 and 28 November).

From 20 to 21 November, skies were mainly clear with calm winds but with ice fog throughout the day. Ground temperatures were very cold, at the warmest rising only to -30°C by mid-day on 20 November. Temperatures then began to rise with a mid-day temperature of -14°C on 22 November and 0°C on 23 November. Winds ranged from 20 to 55 km/h on both days and skies were overcast. Crews experienced a variety of survey conditions over these two days including variable cloud ceiling, ice fog, light rain, and flurries.

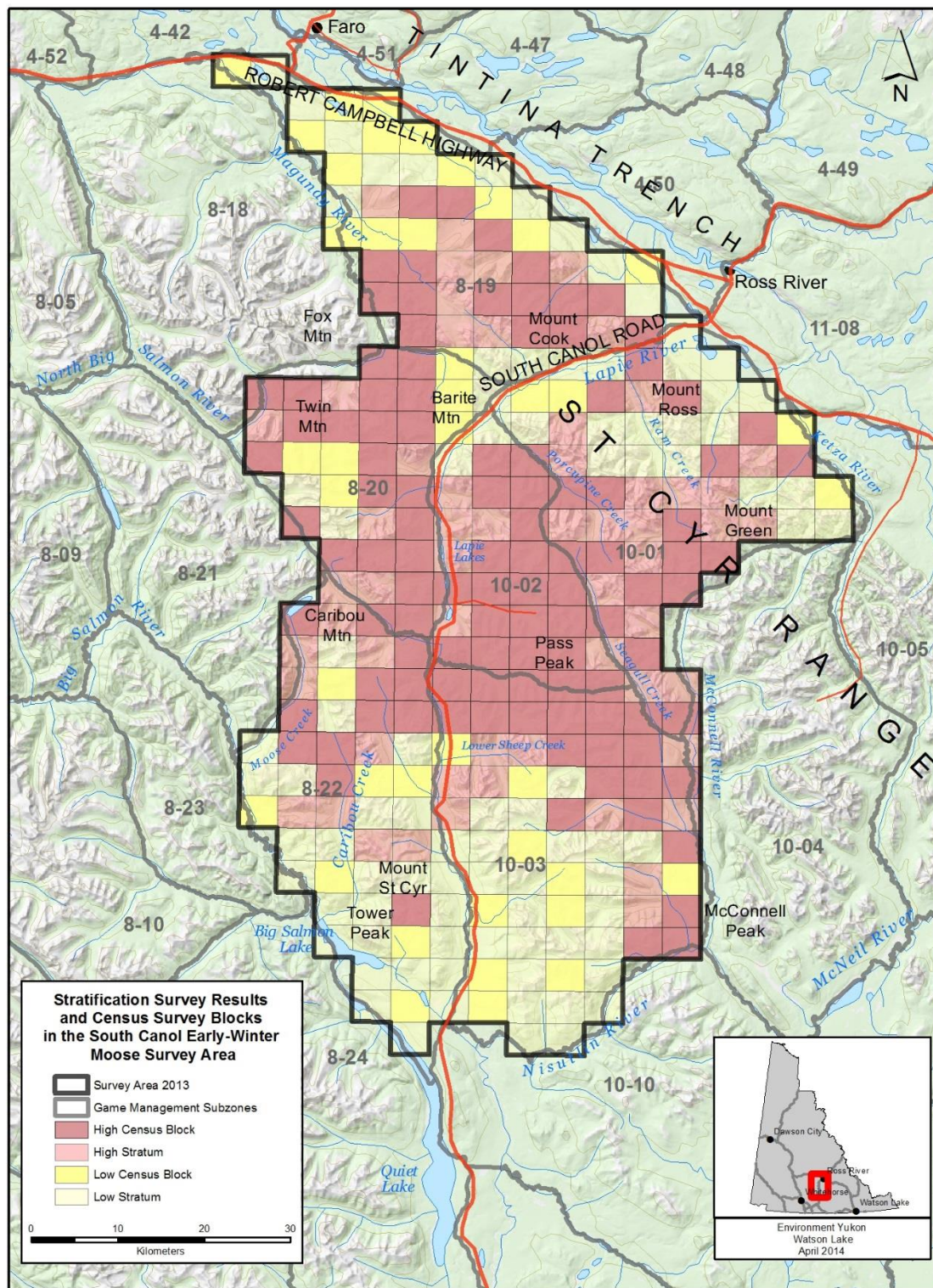


Figure 3. Stratification results and census survey blocks of the South Canol Moose Management Unit early-winter moose survey, southeast Yukon, 2013.

Survey conditions improved on 24 November with clear skies, calm to light wind, and ground temperatures rising to -10°C by mid-day. From 25 to 29 November, skies were mainly overcast with variable ceilings. Ground temperatures were highly variable in the range of -28°C to -8°C , generally with a warming trend from sunrise to mid-day.

Results and Discussion

Stratification: Identification of High and Low Moose Density Blocks

We classified 165 (56.3%) of the 293 survey blocks as having high expected moose numbers, and 128 (43.7%) as having low expected moose numbers (Figure 3).

It took 9.1 hours to stratify all 293 blocks, for a total search intensity of 0.11 minutes per km^2 . We used an additional 3.8 hours of flight time ferrying back and forth between our home base of Faro and the survey area, as well as flying around weather systems. Total flight time was 12.9 hours.

We observed 71 moose over the course of the stratification survey. Most of the blocks with expected higher moose numbers were located in the subalpine valleys and willow flats typical of post-rut habitats scattered between Porcupine Creek and Lower Sheep Creek, between Caribou Mountain and Mount St Cyr, and in the vicinity of Twin Mountain, Barite Mountain, and Mount Cook (Figure 3). Blocks with expected lower moose numbers were located along the

Robert Campbell Highway to the north and in the more uniform pine and spruce forests and lower relief terrain north of Quiet Lake in the southern end of the study area (Figure 3).

Census

Coverage

We surveyed a total of 149 blocks of the 293 survey blocks, or approximately 50.8% of the total survey area (Figure 3). This included 108 of 165 (65.4%) blocks expected to contain relatively high numbers of moose, and 41 of 128 (32.0%) blocks expected to contain few or no moose.

It took 56.5 hours to survey these blocks, for a total search intensity of 1.39 minutes per km^2 . This is 30% lower than our target search intensity of 2 minutes per km^2 . However, our search intensity was close to optimal when we factor in that nearly 20% of the survey area was comprised of non-suitable habitat that was not surveyed. Search intensity was lower in the high-abundance blocks (1.31 minutes per km^2) than in the low-abundance blocks (1.61 minutes per km^2), the former having a higher proportion of high elevation habitat not suitable for moose.

We used another 33.2 hours of helicopter time ferrying between survey blocks and our fuel caches located at the Faro and Ross River airports, Lapie Lakes, and Quiet Lake, as well as back and forth to our home base in Faro. We also spent many hours flying around weather to find locations with suitable survey conditions. The total flight time was 89.8 hours.

Table 1. Observations of moose during the South Canol Moose Management Unit early-winter moose census survey, southeast Yukon, 2013.

	High Blocks	Low Blocks	Total
Number of blocks counted	108	41	149
Number of adult bulls	83	4	87
Number of adult and yearling cows ¹	144	12	156
Number of yearling bulls	9	0	9
Number of calves	33	4	37
Number of unknown age/sex	0	0	0
Total moose observed	269	20	289
Density of moose (per 1,000 km ²)	152	30	118

¹ Adult and yearling cows cannot always be reliably distinguished from the air, so they are counted together. Assuming that equal numbers of males and females are born and that survival is similar between sexes, the number of yearling cows and bulls observed should be approximately equal. We therefore estimate the total number of adult cows in the survey area by subtracting the number of yearling bulls observed from the total number of cows counted. Similarly, we estimate the total number of yearlings by doubling the number of observed yearling bulls. The estimate of adult cows and total yearlings in the population are presented in Table 2 below.

Moose Observations and Distribution

We counted a total of 289 moose: 87 adult bulls, 156 adult and yearling cows, 9 yearling bulls, and 37 calves (Table 1). Three of the bulls we observed had shed one antler and two had shed both antlers. All were mature bulls based on body size. We closely examined all antlerless moose without calves following the sighting of the first bull with shed antlers on 24 November to ensure we were obtaining an accurate bull count. We observed an average of 152 moose for every 1,000 km² in the high abundance blocks, and 30 moose per 1,000 km² in the low abundance blocks.

More than 80% of the moose we observed during the census were located in and near high-elevation

subalpine habitats at elevations of 1,375 to 1,625 m above sea level, typically in creek draws as there were few willow flats available. However, the few subalpine willow flats present in the study area were consistently occupied by moose and/or showed sign of recent use. Moose appeared concentrated east of the South Canol Road between Porcupine Creek and Lower Sheep Creek, between Caribou Mountain and Mount St Cyr, and in the vicinity of Twin Mountain, Barite Mountain, and Mount Cook. In general, the distribution of moose was consistent with the early-winter surveys of the Faro and North Canol areas (Clarke et al. 2012, Fontaine et al. 2016.).

The South Canol study area, however, does not have the quality and quantity of post-rut habitats that are present in the study areas located

north of the Tintina Trench. The survey crew characterised the South Canol MMU as having highly mountainous terrain with high relief and a low quantity of high quality early-winter moose habitat such as subalpine willow and shrub flats, wide and well vegetated subalpine creek draws, and well revegetated burns following forest wildfires located just below subalpine areas.

Population Abundance

Based on our census counts, we estimated a population of $516 \pm 18\%$ moose in the 2013 South Canol survey area (Table 2). This represents an average density of 133 moose per 1,000 km² of suitable moose habitat or 107 moose per 1,000 km² over the entire survey area (Table 2).

Of the $516 \pm 18\%$ moose estimated to occupy the survey area, $152 \pm 22\%$ were adult bulls (29% of the estimated population), $266 \pm 19\%$ were adult cows (51%), $30 \pm 42\%$ were yearlings (6%), and $69 \pm 23\%$ were calves (13%; Table 2). We observed only one cow with twin calves during the survey.

Population Composition

We observed an adult bull to 100 adult cow ratio of $57 \pm 14\%$ (Table 2). This is well above the minimum of 30 adult bulls per 100 adult cows needed to prevent impacts on reproductive rates (Environment Yukon, 2016).

Calf survival to early-winter was $26 \pm 17\%$ calves per 100 adult cows (Table 2). Yearling recruitment was $11 \pm 40\%$ yearlings per 100 adult cows or $7 \pm 38\%$ yearlings per 100 adult moose. These ratios suggest that the

survival of calves was moderate during summer and fall of 2013 and poor for calves born in 2012. Individual estimates of recruitment are “snapshots” in time that will vary from year to year and at least 5 years of recruitment ratio data are required to determine if a population is stable (Environment Yukon, 2016).

Harvest

Licensed harvest averaged 12.6 bull moose annually between 2009 and 2013 for a 5-year average licensed harvest rate of 2.4% (Table 3). This harvest rate is skewed low compared to longer term averages because the lowest two years of licensed harvest of the past 19 years occurred in the past five years (2010 and 2013; Figure 5). First Nation harvest information was not available. Therefore, we estimated First Nation harvest to be 1.4 and 2.0 times (these multipliers include a cow harvest equivalency) that of resident licensed hunters for GMSs in Game Management Zones 8 and 10, respectively, for a First Nation harvest rate of 3.8% or 19.6 bull moose equivalents (Dept. of Environment, unpubl. data). Summing licensed and FN harvest, we estimate a *total average* annual harvest of 6.2% (32 bull moose); however, we cannot accurately evaluate the *total* harvest rate without reported First Nation harvest data.

Recognizing the uncertainty in harvest estimates, results strongly suggest that moose harvest of the South Canol MMU population is currently above sustainable levels. The *Science-based Guidelines for*

Table 2. Results of the South Canol Moose Management Unit early-winter moose census survey, southeast Yukon, 2013.

	Best Estimate ± 90% Confidence Interval^a
Estimated Abundance^b	
Total Moose	516 ± 18% (423-610)
Adult Bulls (≥ 30 months)	152 ± 22% (119-185)
Adult Cows (≥ 30 months)	266 ± 19% (216-315)
Yearlings (Approx. 18 months) ^c	30 ± 42% (17-43)
Calves (≥ 12 months)	69 ± 23% (53-84)
Unknown age/sex	-
Estimated Population Ratios^b	
% Adult Bulls	29% ± 11% (26-32%)
% Adult Cows	51% ± 5% (49-54%)
% Yearlings	6% ± 37% (4-8%)
% Calves	13% ± 16% (11-15%)
% Unknown Age/Sex	-
Adult Bulls per 100 Adult Cows	57 ± 14% (49-65)
Yearlings per 100 Adult Cows	11 ± 40% (7-16)
Yearlings per 100 Adults	7 ± 38% (4-9)
Calves per 100 Adult Cows	26 ± 17% (21-30)
% of Cow-Calf Groups with Twins ^d	2% ± 98% (0-5%)
Density of Moose (per 1,000 km²)^b	
Total Area (4806.7 km ²)	107
Moose Habitat Only (3891.8 km ²) ^e	133

^a A “90% confidence interval” means that, based on our survey results, we are 90% sure that the true number of moose in the study area lies within the range of moose numbers given in the brackets, and that our best estimate is near the middle of this range.

^b Estimated abundance and population ratios provided were obtained using MoosePop software and are based on a SCF Pooled “sightability correction factor” or SCF. In this survey, a SCF of 1.09 was applied to the High and Low stratum to correct the estimate of moose abundance for animals that were missed by the survey crews (see Step 6 of the Methods section for a description of how the SCF is calculated).

^c To account for yearling cows that cannot be identified from the air, the total number of yearlings is assumed to equal twice the estimated number of yearling bulls in the population.

^d Twinning Rate = the number of cows with 2 calves divided by the total number of cows with calves. It represents what percentage of cows that had calves, had twins.

^e Suitable moose habitat is considered to be all areas at elevations lower than ~1,676 m (5,500 ft.), excluding water bodies 0.5 km² or greater in size.

Table 3. Average annual (2009 to 2013) licenced bull moose harvest for the South Canol Moose Management Unit, southeast Yukon. Game Management Subzones 8-19, 8-20, 8-22, 10-01 to 10-03.

GMS	GMS Area (km²)^a	Estimated Density^b (moose / 1000 km²)	Total Estimated number of Moose^a	Average Resident Harvest	Average Non- Resident Harvest	Average Special Guided Harvest	Average Licenced Harvest (2009-2013)^c
8-19	868.8	95	82.5	0.2	0.2	0.0	0.4
8-20	593.5	130	77.2	0.4	0.0	0.0	0.4
8-22	877.4	85	74.6	4.8	0.0	0.0	4.8
10-01	970.5	115	111.6	0.6	0.2	0.4	1.2
10-02	446.9	155	69.3	3.4	0.0	0.0	3.4
10-03	1067.8	95	101.4	2.0	0.0	0.4	2.4
Total	4824.9	107.1	516.6	11.4	0.4	0.8	12.6

^a Differences in the total area and estimated number of moose in Tables 2 and 3 for the 2013 South Canol Moose Management Unit (MMU) survey are due to the slightly different area covered by each table. Table 2 shows the total area (4806.7 km²) covered by the South Canol study area, which did not exactly match Game Management Subzone (GMS) boundaries, whereas Table 3 shows the total area (4824.9 km²) covered by all GMS that are part of the South Canol MMU.

^b Estimated density is based on 2013 South Canol MoosePop SCF Pooled moose survey results.

^c Does not include licenced or subsistence harvest by First Nation hunters.

Management of Moose in Yukon recommend a maximum harvest of 10% of the adult bull population for MMUs that have been recently surveyed (Environment Yukon, 2016). For this MMU, harvest at this rate would represent 15 bull moose or 2.9% of the total population annually.

The local perception is that this region is experiencing increasing harvest activity from hunters from other communities that are compelled to find other hunting areas due to hunting closures and restrictions and population declines in other parts of Yukon. The ease of access and proximity to Whitehorse are thought to be contributing factors to the perceived increased harvest activity.

At a finer scale, licenced harvest is high in GMS 8-22 and 10-02 and moderate in GMS 10-03 (average of 4.8, 3.4, and 2.4 moose per year, respectively; Table 3, Figure 4). Combined, these three GMS account for 84.1% of all licenced harvest within this MMU. We use harvest patterns at the GMS scale to guide where management options may be most effective to maintain MMU harvest rates at sustainable levels. This area has a high level of access, with well-developed trails in the GMS bordering the South Canol Road. The expansion of mineral exploration roads and Off Highway Vehicle (OHV) trails into areas with high concentrations of moose such as open subalpine habitats may influence harvest levels in these GMS.

Although there is some year-to-year variation in the reported moose harvest by licenced hunters in the South Canol MMU, licenced harvest has remained stable over the past 19

years, averaging 14.8 bull moose per year (Figure 5). Based on the current total estimated number of bull moose in the South Canol MMU (152 bulls; Table 2), the licenced harvest has been near the 2.9% (15 bull moose) annual sustainable harvest level between 1995 and 2013 (Figure 5). Licenced harvest rates equal to or greater than 2.9% occurred in 11 of the past 19 years. Historical First Nation harvest data is not available for this area so we cannot speak to long-term trends in *total* harvest. Harvest by non-resident hunters over the past 19 years has been low within the South Canol MMU, averaging 1 bull moose per year (Figure 5).

Other Wildlife Sightings

In addition to the 289 moose we counted during the 2013 census survey, we also recorded 70 moose in groups of 1 to 6 animals, at 31 separate locations outside the surveyed blocks or just outside the survey boundary, for a total of 359 observed moose.

We also saw 214 caribou in groups of 1 to 21 animals (average group size was 7 caribou) at 32 separate locations. We observed only one group of 5 caribou just outside the survey area boundary. Based on the location of these observations, we presume that most, if not all of these caribou, were part of the Pelly Herds. We observed the majority of these caribou (126) in the northern foothills of the St Cyr Mountain Range within, or north of the Magundy River valley. We observed another 40 caribou in the area of Twin Mountain, 23 caribou in

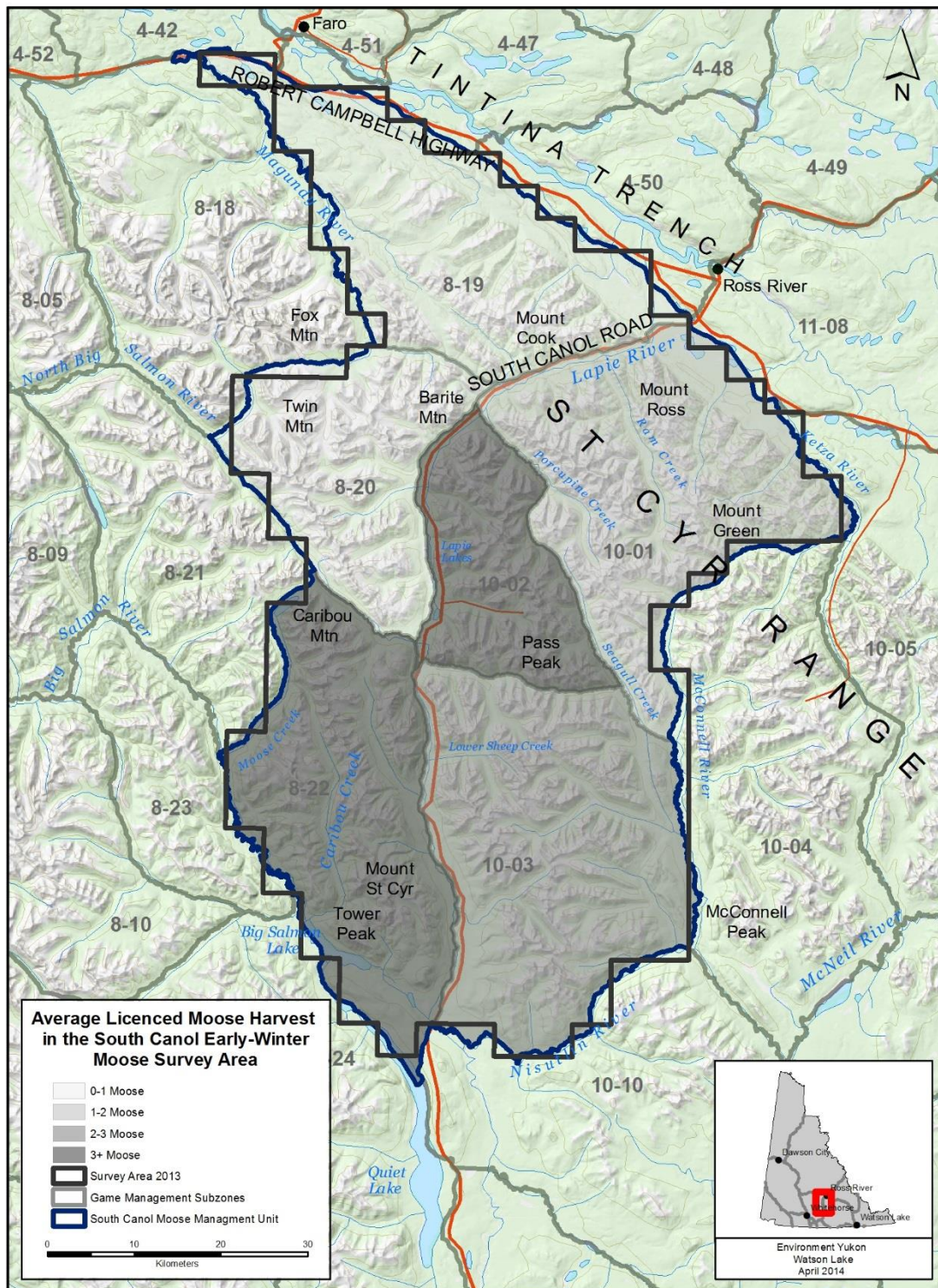


Figure 4. Bull moose licenced harvest rates in the South Canol Moose Management Unit, southeast Yukon, 2009 to 2013.

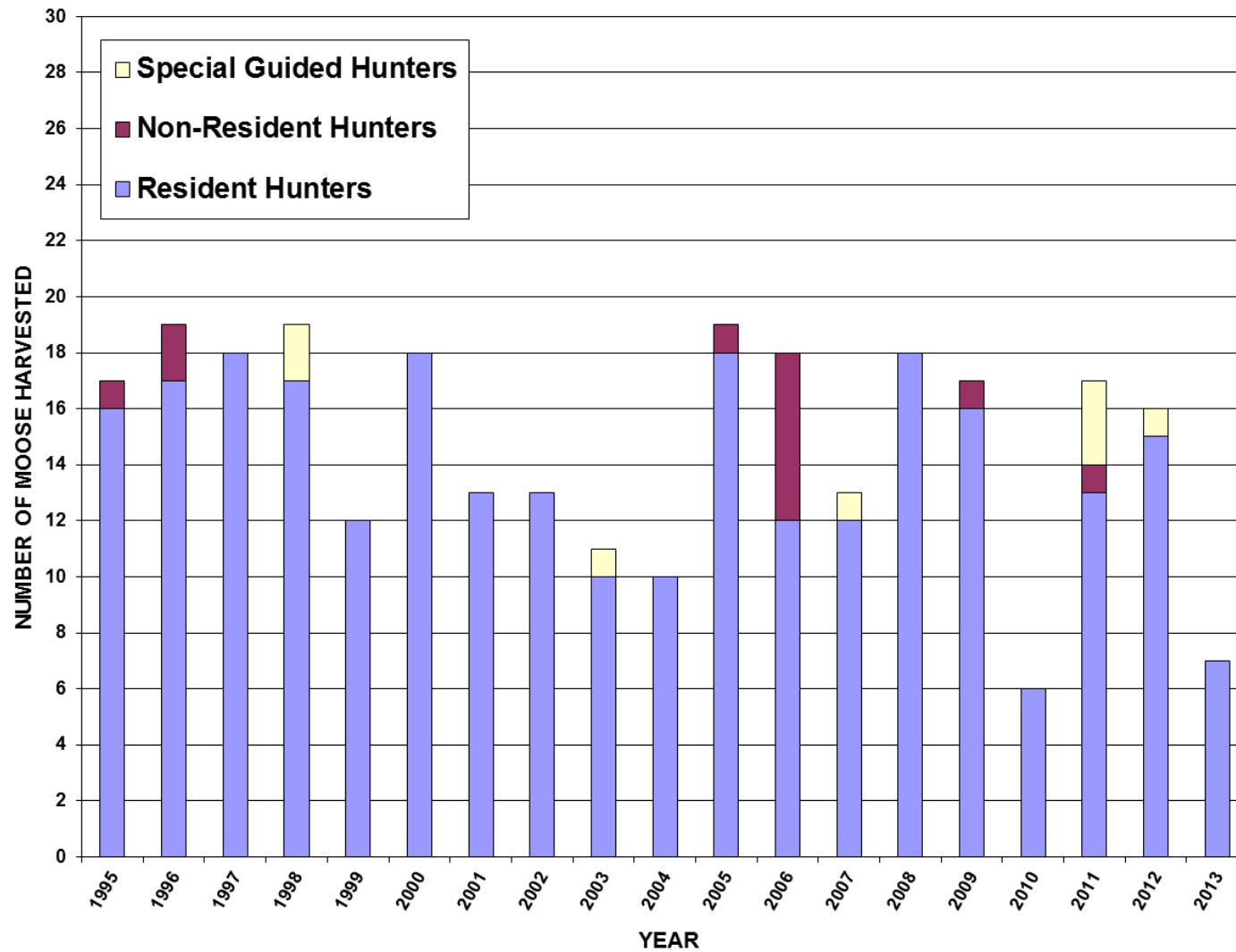


Figure 5. Annual reported bull moose harvest (1995 to 2013) by licenced hunters in the South Canol Moose Management Unit (Game Management Subzones: 8-19, 8-20, 8-22, 10-01 to 10-03).

the Caribou Creek valley, and the rest distributed throughout the study area.

Overall, we observed 14 wolves in 5 groups within the study area. All were singles or pairs except for one pack of 8 wolves located along the Magundy River just south of Faro. Based on the density and distribution of fresh tracks, we believe that the pack of 8 and two pairs are likely part of the same wolf pack. This pack occupied an area covering the foothills of the St Cyr Range to the Robert Campbell Highway between Faro and the South Canol Road.

We observed 38 thimhorn sheep at 8 separate locations in groups of 1 to 8 animals. All were located within the northern half of the study area. We also observed the tracks left by bands of sheep in numerous locations.

Of note were the many tens of thousands, of Rock and Willow ptarmigan we observed throughout the study area in flocks ranging from a few birds to many hundreds. Ptarmigan were especially common in subalpine habitats but were observed anywhere with an abundance of shrubs.

Additionally, we recorded the presence of a Golden Eagle nest on a rock cliff shelf approximately 7 km southwest of the mouth of Ram Creek, at least six Gyrfalcons (not all were recorded), and one grizzly bear den in a cave at the top of a cliff face northwest of McConnell Peak. We observed small game animals such as snowshoe hare, spruce grouse, and porcupine as well as small furbearers throughout the study area.

Conclusions and Recommendations

- We estimate that there were $516 \pm 18\%$ moose in the entire South Canol survey area in 2013, for an average density of about 107 moose per 1,000 km².
- Licenced harvest averaged 12.6 bull moose annually between 2009 and 2013 for a 5-year average licenced harvest rate of 2.4%. The recommended maximum sustainable harvest rate for this MMU is 2.9% or 15.2 bull moose.
- The 2009 to 2013 *estimated* 5-year average *total* harvest rate (combination of reported licenced harvest and estimated First Nation harvest) for bulls in the South Canol Moose Management Unit (MMU) was 6.2%.
- Combined licenced harvest and estimates of First Nation harvest suggest the moose population of the South Canol MMU may be currently harvested at more than twice the recommended maximum sustainable harvest rate.
- We need complete harvest information from both licenced hunters and First Nation subsistence hunters to more accurately estimate harvest and ensure that total harvest stays within sustainable limits.
- Management actions in partnerships with First Nations are required to achieve and maintain sustainable harvest levels.

References

- BECKER, E. F., AND D. J. REED. 1990. A modification of a moose population estimator. *Alces* 26:73-79.
- CLARKE, M., R. DRUMMOND, R. WARD, AND S. WESTOVER. 2012. Moose Survey: Faro early-winter 2011. Yukon Fish and Wildlife Branch Report TR-21-31, Whitehorse, Yukon, Canada.
- ENVIRONMENT YUKON. 2016. Science-based Guidelines for Management of Moose in Yukon. Fish and Wildlife Branch Report, Department of Environment, Whitehorse, Yukon, Canada.
- FONTAINE, A.J., M. CLARKE, R. DRUMMOND, T. MORGAN, AND S. WESTOVER. 2016. Moose Survey: North Canol early-winter 2012. Yukon Fish and Wildlife Branch Report, Whitehorse, Yukon, Canada.
- GASAWAY, W. C., S. D. DUBOIS, D. J. REED, AND S. J. HARBO. 1986. Estimating moose population parameters from aerial surveys. University of Alaska, Institute of Arctic Biology, Biological Paper No. 22.
- KELLIE, K. A., AND R. A. DELONG. 2006. Geospatial survey operations manual. Division of Wildlife Conservation, Alaska Department of Fish and Game, Fairbanks, Alaska, USA.
- O'DONOGHUE, M. 2013. Moose Survey: Little Salmon and Magundy rivers, late-winter 2007. Yukon Fish and Wildlife Branch Report TR-13-10, Whitehorse, Yukon, Canada.
- WESTOVER, S., R. FLORKIEWICZ, J. MCLELLAND, AND R. WARD. 2008. Summary of the South Canol West early-winter 2007 moose survey, 5-11, 13 November 2007. Yukon Fish and Wildlife Branch Report SR-08-01, Whitehorse, Yukon, Canada.
- YUKON DEPARTMENT OF ENVIRONMENT. 2014. Yukon snow survey bulletin and water supply forecast, March 1, 2014. Yukon Water Resources Branch, Department of Environment, Whitehorse, Yukon, Canada.
- YUKON ECOREGIONS WORKING GROUP. 2004. Yukon Plateau-North, Yukon Southern Lakes, and Pelly Mountains. Pages 197-226 in C. A. S. Smith, J. C. Meikle, and C. F. Roots, editors. Ecoregions of the Yukon Territory: Biophysical Properties of Yukon Landscapes. Agriculture and Agri-Food Canada, PARC Technical Bulletin No. 04-01, Summerland, British Columbia, Canada.