MOOSE SURVEY

TATCHUN MOOSE MANAGEMENT UNIT

LATE WINTER 2011

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Summary

- We conducted a late-winter survey of moose in the area northeast of Carmacks and southeast of Pelly Crossing on 8–22 February 2011, using fixed-wing aircraft and helicopters. Poor weather prevented us from conducting this survey during the preferred early-winter season. This count was the first one of moose in the southern part of this area. The main purpose of this survey was to estimate the abundance, distribution, and composition of the moose population.
- We counted all moose in survey blocks that covered about 20% of the entire area. We found a total of 101 moose: 30 adult bulls, 43 adult and yearling cows, 2 yearling bulls, 20 calves, and 6 adults or yearlings of unknown sex.
- We calculated a population estimate of 424 moose (plus or minus 28%) for the area. This number is equal to a density of about 76 moose per 1,000 km² over the whole area, or 79 per 1,000 km² in suitable moose habitat. These density estimates were considerably lower than the Yukon average of about 155 per 1,000 km².
- We estimated that there were about 42 calves for every 100 cows in the survey area. This ratio suggests that, during the past year, survival of calves born in this area in 2010 was good.
- We estimated that there were about 68 bulls for every 100 cows in the survey area, which is a healthy sex ratio.
- Harvest of moose in this area appears to be near the maximum sustainable level.

Table of Contents

List of Figures

List of Tables

Introduction

This report summarizes the results of the late-winter survey of moose in a part of the Tatchun Moose Management Unit (see Map 1), conducted from February 8–22, 2011. The purpose of the survey was to estimate numbers (abundance), distribution, and composition of the moose population.

Previous Surveys

This census was the first full one of moose that focused on the Tatchun Moose Management Unit. We tried to do this survey in the preferred early-winter season, in October-December 2010, when moose are easier to see and classify by sex. However, poor weather and snow conditions prevented us from completing the survey at that time.

We have carried out moose surveys in previous years in areas that overlapped with this survey area (see Map 2). We conducted early-winter surveys to evaluate moose numbers in 1982 along the Pelly and Macmillan rivers (results in Johnston and McLeod 1983) and in 1995 in the Pelly Crossing area (results in Ward et al. 1998).

In November and December 2000, the Yukon Fish and Wildlife Branch and the Selkirk First Nation conducted an early-winter census of moose over a very large area that overlapped the northern part of the 2011 survey area (results in Ward 2001). However, we counted relatively few survey blocks in the Tatchun Moose Management Unit. We covered most of this area again in March 2001 to map late-winter distribution of moose (results in O'Donoghue 2005). Finally, we flew surveys in 2007 to map late-winter habitats of moose along the Little Salmon, Magundy, and Yukon rivers (results in O'Donoghue 2012a, 2012b).

Community Involvement

Residents of the Pelly Crossing and Carmacks areas have consistently placed a high priority on monitoring the health of local moose populations. People have expressed concerns about low numbers of moose in what is an important hunting area for both the Selkirk and Little Salmon/Carmacks First Nations. Those concerns have been expressed at Northern Tutchone May Gatherings and in the *Community-based Fish and Wildlife Management Plan for the Little Salmon/Carmacks First Nation Traditional Territory, 2004-2009*. The Selkirk First Nation co-funded the survey, and both the Selkirk and [Little Salmon/Carmacks First Nations provided staff to help conduct it.

Study Area

The Tatchun survey area covers the areas most accessible to and used by hunters, and conforms to the boundaries of Yukon Moose Management Units. Moose Management Units were developed to help us monitor and manage

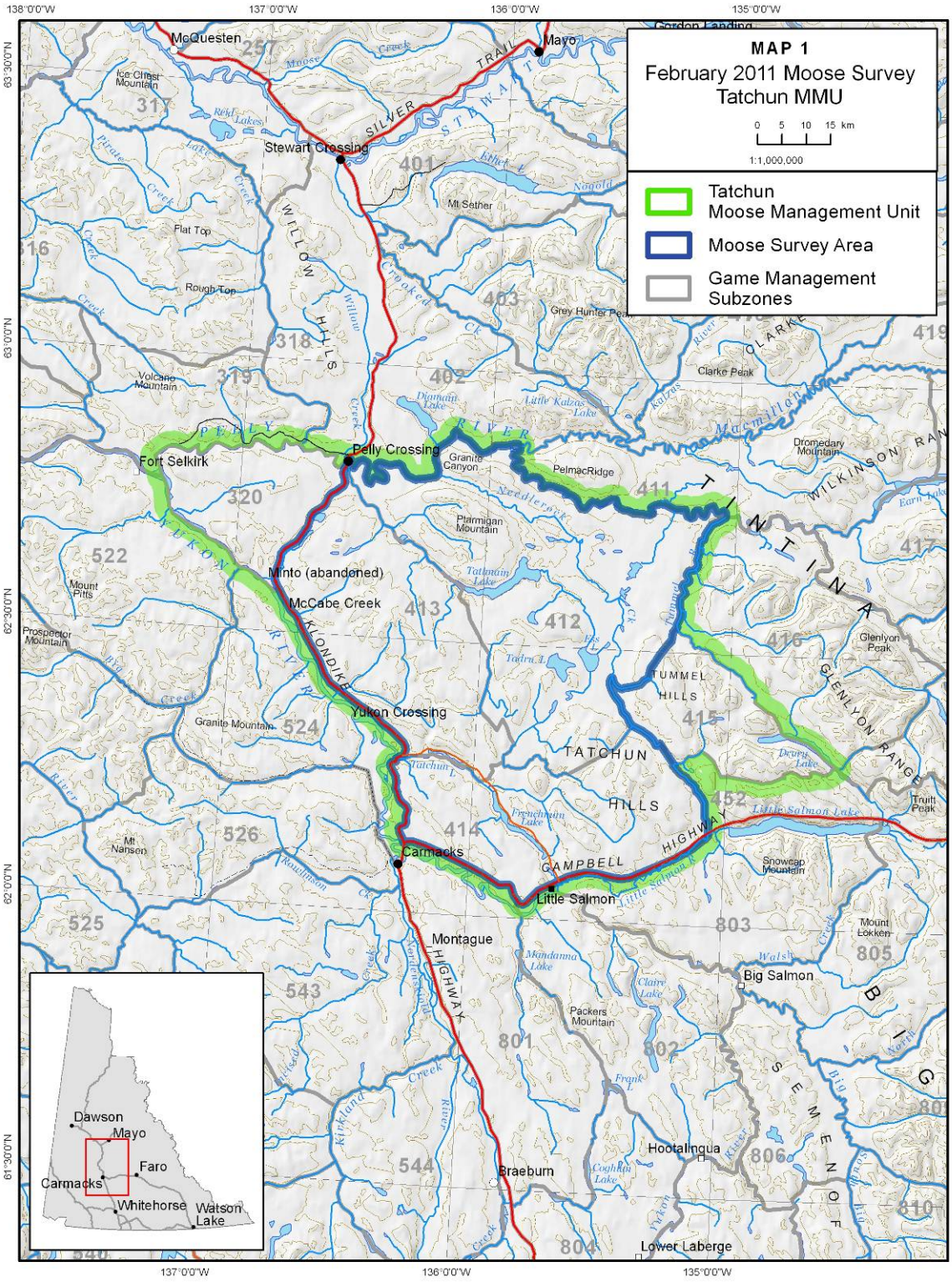


Figure 1. February 2011 Moose Survey, Tatchun Moose Management Unit.

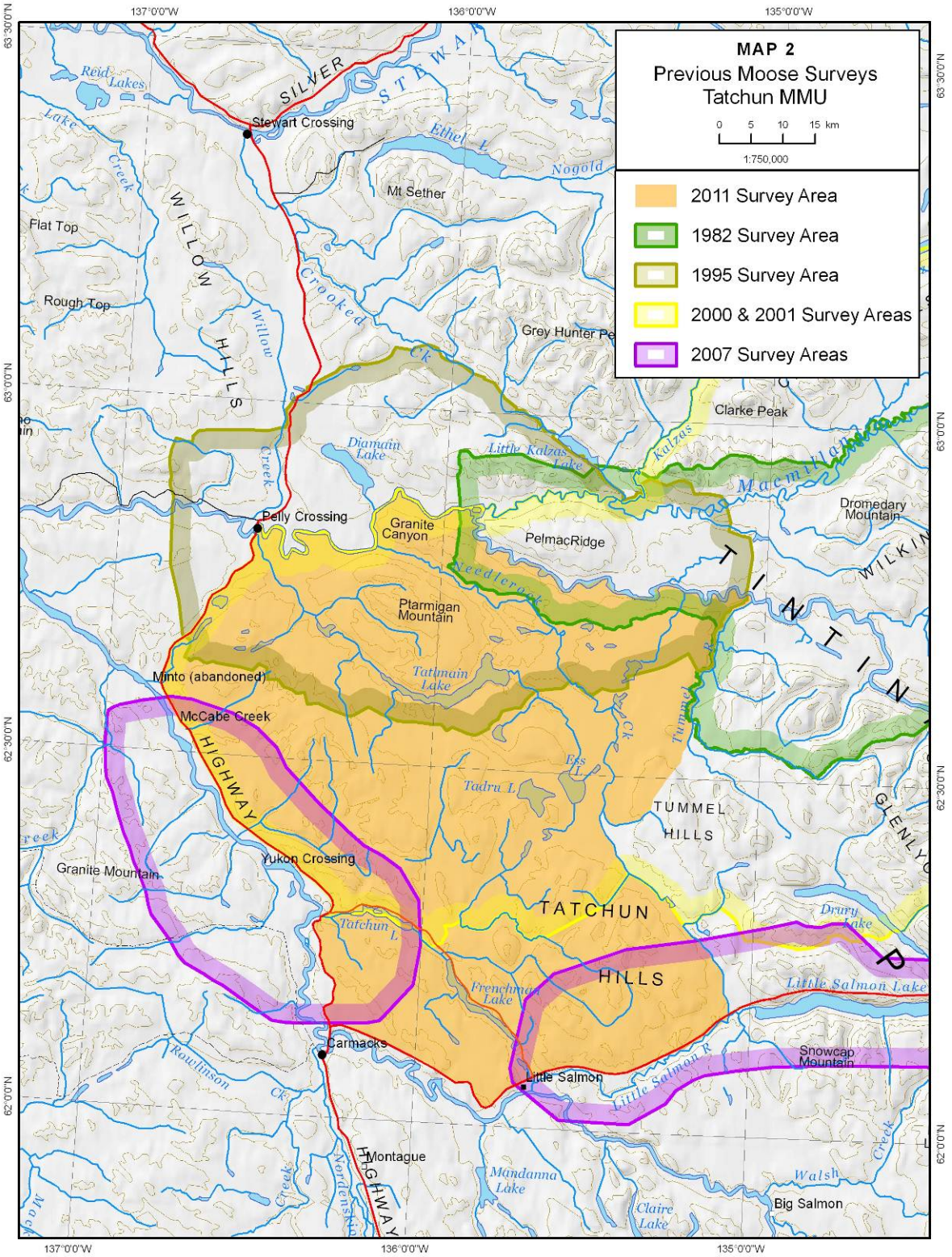


Figure 2. Previous Moose Surveys, Tatchun Moose Management Unit.

moose more consistently throughout Yukon. We plan to monitor the health of moose populations in priority moose management units on a regular basis, using both aerial and ground-based surveys.

The Tatchun Moose Management Unit is about 6,874 km² and includes Game Management Subzones (GMS) 320, 412, 413, 414, and 415 (see Map 1). The survey area within this Moose Management Unit is about 5,541 km². The northern border runs east along the Pelly River. The eastern border is the Tummel River and the headwaters of Needlerock Creek. The Campbell and Klondike highways make up the southern and western borders, respectively.

Most of the study area (about 5,392 km²) is considered suitable moose habitat, except for approximately 3%, which includes large water bodies (0.5 km² or more in size) and land at or above 1,524 m (5,000 feet) in altitude. The study area consists mostly of rolling hills and plateaus, dissected by numerous creeks, in the drainages of the Pelly and Yukon rivers. Most of the area is covered with black and white spruce, lodgepole pine, aspen, and paper birch. Willow and dwarf birch shrub habitats, alpine tundra, and unvegetated rocky areas typify the higher plateaus in the Tatchun Hills, Ptarmigan Mountain, and ridges east of the Yukon River.

Old and recent burns occur throughout the study area (see Map 3), and these vary in quality as moose habitat. Large areas in the northwestern part of the survey area burned in 1969. These areas have regenerated mostly as young aspen, spruce, and pine forest. Much of the remaining northern half of the survey area burned in large fires (1,213 km²) in 1995, while another large area (407 km²) northeast of Frenchman Lake burned in 1998. Some of the areas burned in the 1990s are regenerating in willows, but there are also extensive patches of dense young pine (which is not often used by moose as food) in the recently burned habitat.

Methods

We have adopted a relatively new technique to survey moose, developed by the Alaska Department of Fish and Game (Kellie & DeLong 2006). The field sampling is similar to the way we conducted our moose surveys in the past, except that we count moose in rectangular rather than irregularly shaped survey units. The technique consists of six steps:

1. The survey area is divided into uniform rectangular blocks about 16 km² (2' latitude x 5' longitude) in size.
2. Observers in fixed-wing aircraft fly over all the blocks quickly, and classify (or "stratify") them as having either high, medium, low, or very low expected moose numbers, based on local knowledge, number of moose seen, tracks, and habitat. This is called the "stratification" part of the survey.
3. We combine these categories of blocks into high or low "strata,"

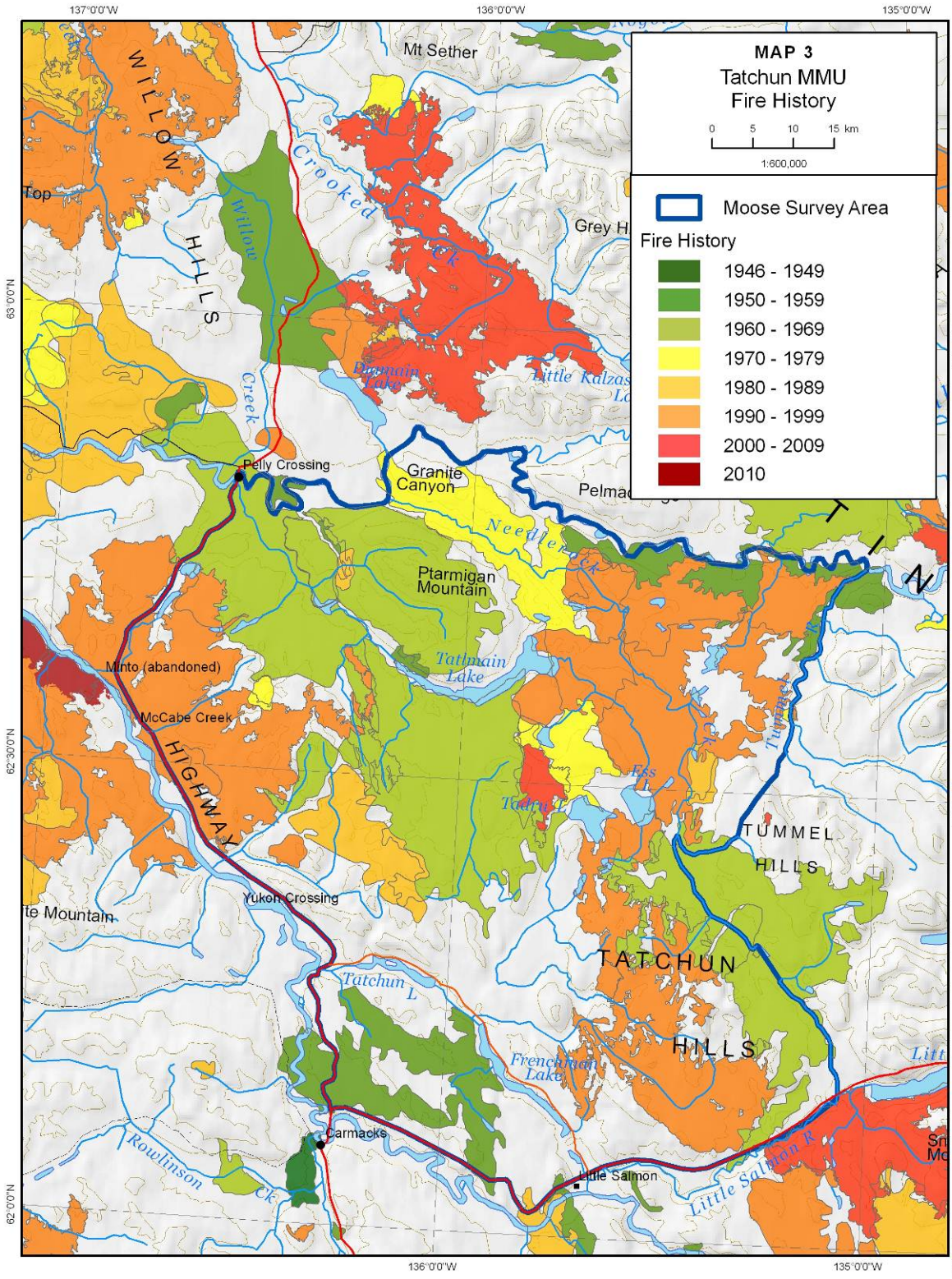


Figure 3. Tatchun Moose Management Unit Fire History.

and then randomly select a sample of each stratum for our census. We typically select a higher proportion of the high blocks than the low blocks to survey.

4. Using helicopters, we try to count every moose within the selected blocks (the "census" part of our survey), at a search intensity of about 2 minutes per km². We classify all moose by age (adult or calf) and sex. In early-winter surveys, it is possible to reliably distinguish yearling bulls from adults based on antler size, and thus estimate the total number of yearlings in the population. In late-winter surveys such as this one, however, it is not possible to get a good estimate of yearling numbers.
5. To estimate the number of moose that we missed during Step 4, we repeat our counts at double the search intensity in a portion of our survey blocks. We use these double counts to develop a "sightability correction factor" to correct the census results for moose that we overlooked.
6. We use a computer program (Gasaway et al. 1986) to estimate the total number of moose by age and sex in the entire survey area. We base the estimate on the numbers of moose counted in the blocks during the census, the distribution of these blocks, how we classified the blocks we didn't count, and the sightability corrections (Becker and Reed 1990). Generally, the more blocks searched during the census part of the survey, the more precise and reliable the resulting population estimate.

Weather and Snow Conditions

Weather conditions were variable for this survey. During the stratification part of the survey, it was mostly cloudy with temperatures ranging from -35°C to -10°C and slight winds. This period was followed by 2 days of snow and then several days of very cold temperatures that delayed the start of the census by a week.

During the census part of the survey, temperatures ranged from -35°C to -13°C. Skies were partly cloudy for the most part. We had light snow on one day and ground fog on another, but were able to work around the weather and complete the census in 5 consecutive days. Winds were mostly calm or light on 3 of the days and moderate on 2 days. Light conditions ranged from flat to bright and snow coverage was complete, so visibility was generally good for spotting moose.

Results and Discussion

Identification of High and Low Moose Density Blocks

Based on our observations from the air, we classified the 347 survey blocks for expected numbers of moose as follows: 20 (6%) as high, 102 (29%) as medium, 134 (39%) as low and 91 (26%) as very low (see Map 4). Most of the blocks with higher expected numbers of moose were located in the parts of the survey area burned in the 1990s (see Map 3). For the purpose of selecting blocks for the census, we grouped the 122 blocks expected to have high and medium numbers of moose into a high stratum, and the 225 blocks with low and very low expected numbers of moose into the low stratum.

Coverage

We counted moose in 70 of the 347 blocks, or about 20% of the total area (see Map 5). We began by randomly selecting 60 blocks to survey: 36 from the high stratum and 24 from the low stratum. After completing the count in these blocks, however, the precision of our population estimate was still fairly low, so we selected and continued to survey more blocks—41 high and 29 low-stratum blocks in all.

It took us about 36.6 hours to count moose in these blocks, for a search intensity of 1.97 minutes per km². Search intensity was about the same in low-abundance blocks (1.96 minutes per km²) and high-abundance ones (1.97 minutes per km²). We needed an additional 7.0 hours to recount portions of 26 survey blocks (at an intensity of 4.05 minutes per km²) to calculate our sightability correction factors. We used another 19.4 hours of helicopter time in ferrying between survey blocks, to fuel caches at Minto and Pelly Crossing, and back and forth to Carmacks.

Observations of Moose

We counted a total of 101 moose: 30 adult bulls, 43 adult and yearling cows, 2 yearling bulls, 20 calves, and 6 unclassified adults or yearlings (see Table 1). We observed an average of 124 moose for every 1,000 km² in the high-abundance blocks, and 43 moose per 1,000 km² in the low- abundance blocks.

Distribution and Abundance of Moose

Moose were widely distributed in the survey area; with the highest numbers observed in the northern part (see Maps 5 and 6). We saw most moose in areas with good willow cover that were burned in the 1990s. We saw relatively few moose in areas that were regenerating with pines. Habitats along the Pelly River with riparian, or riverside, willow flats also had higher numbers of moose.

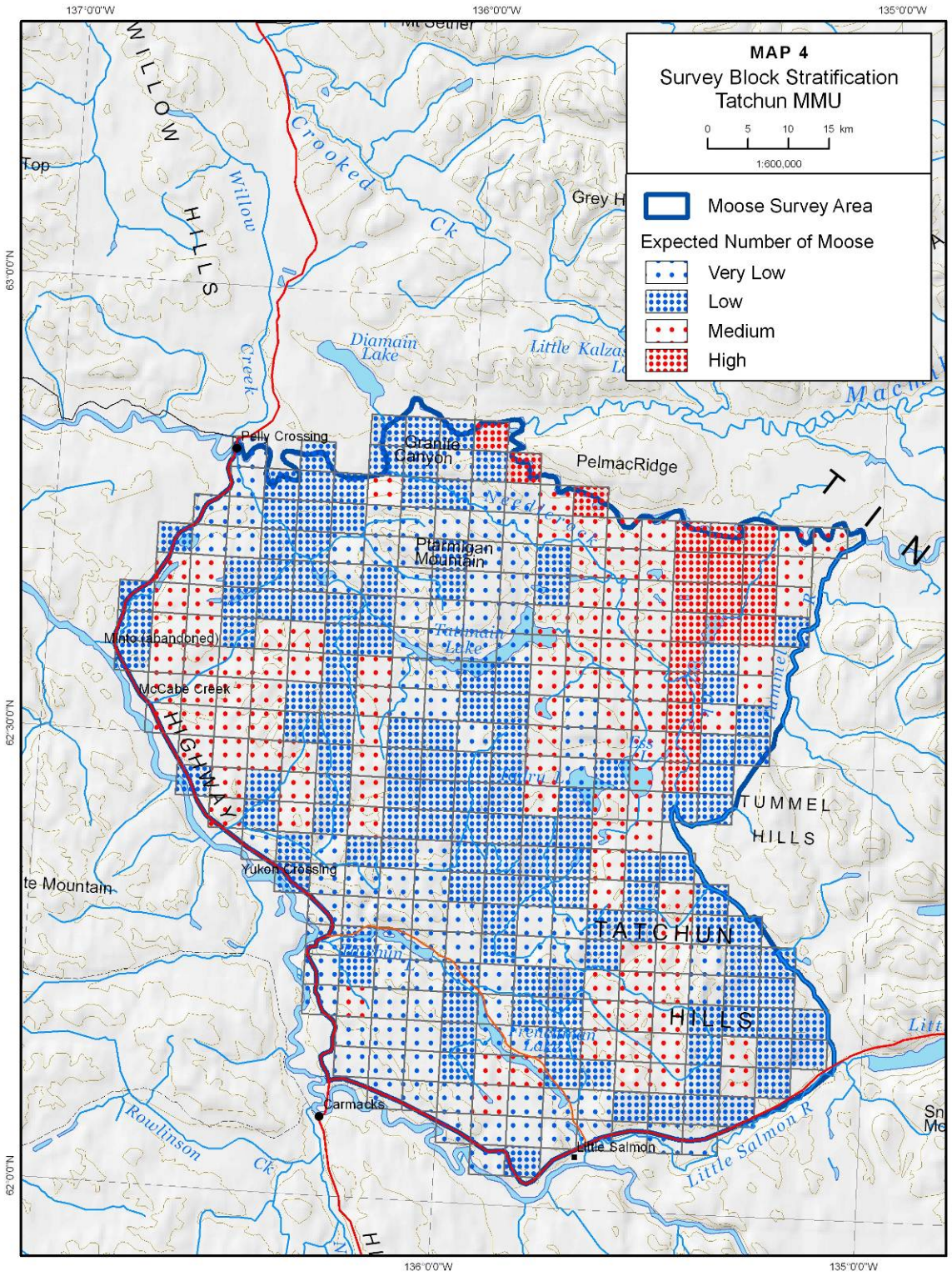


Figure 4. Survey Block Stratification, Tatchun Moose Management Unit 2011.

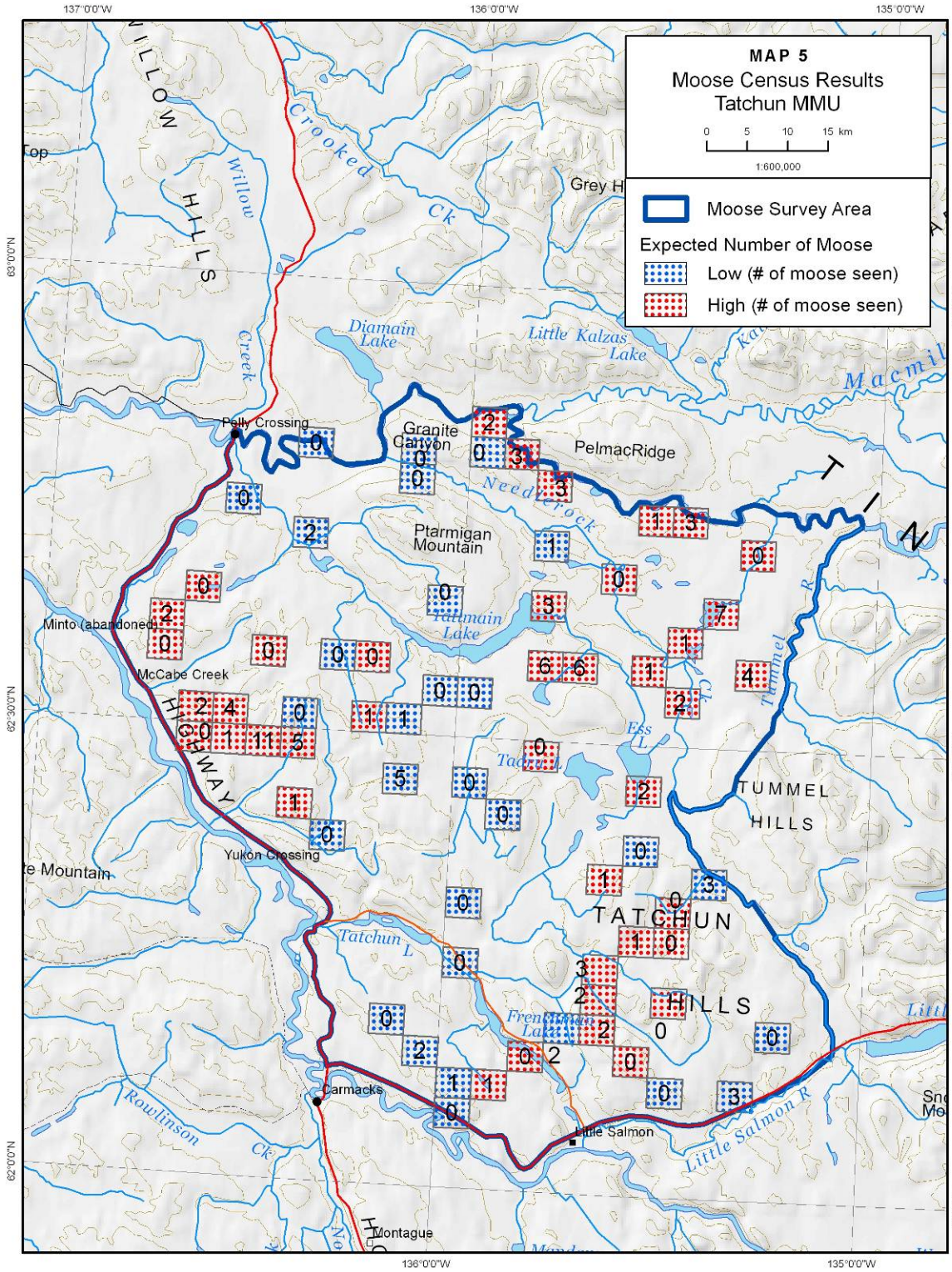


Figure 5. Moose Census results, Tatchun Moose Management Unit 2011.

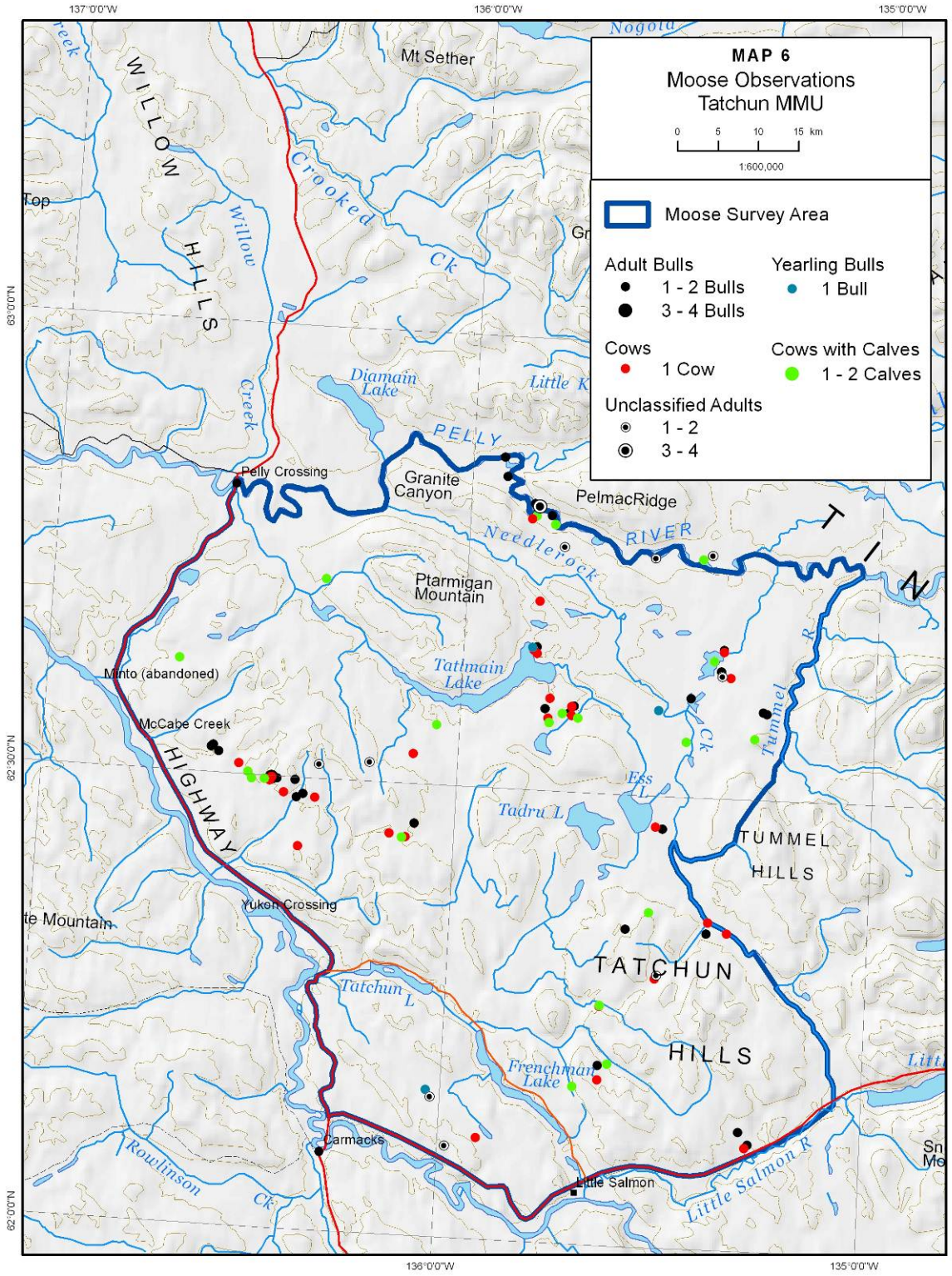


Figure 6. Moose Observations, Tatchun Moose Management Unit 2011.

Table 1. Observations of moose during the February 2011 survey in the Tatchun Moose Management Unit.

	High Blocks	Low Blocks	Total
Number of blocks counted	41	29	70
Number of adult and yearling bulls observed*	26	4	30
Number of adult and yearling cows observed*	33	10	43
Number of identified yearling bulls observed*	1	1	2
Number of calves observed	17	3	20
Number of unclassified adults and yearlings observed	4	2	6

* Adults and yearlings could not be reliably distinguished from the air in this late-winter survey, so they were counted together. Two yearling bulls with antlers were seen, however, and are listed separately in this table; other yearling bulls were likely counted along with adult bulls.

The estimated number of moose in the entire survey area, based on our census counts, is 424 plus or minus 28% (see Table 2). This number includes corrections for moose missed during the census of about 6% in the high blocks and 8% in the low blocks, calculated from our repeated searches of selected areas at double our usual search intensity.

The estimated density of moose in the entire survey area was 76 per 1,000 km², or 79 per 1,000 km² of suitable moose habitat (see Table 2). This figure is lower than the current Yukon-wide average of 155 moose per 1,000 km². It is also lower than our previous estimate of 150 moose per 1,000 km² of suitable habitat, based on nearby surveys and habitat quality in this area.

Our moose population censuses are usually carried out in the early winter when moose are in subalpine habitats, are more visible, and are easier to classify. Because of weather and snow conditions, we had to wait to conduct this survey until late winter. Some moose may have moved out of this survey area in mid-winter to riparian (riverside) habitats along the Yukon, Pelly, and Little Salmon rivers that border the area. That movement could have contributed to the lower-than-expected densities estimated from this survey.

Moose typically concentrate in river valleys in the central Yukon during winters of deep snow. They move down from their preferred early-winter subalpine habitats as the winter progresses (Fraser et al. 2001; O'Donoghue 2005). Snowfall was above normal in the Carmacks area during the winter of 2010–2011 (Yukon Department of Environment 2011), with snow depths of 60–74 cm at nearby snow stations at the beginning of March. This depth approaches levels that could negatively affect movements of moose (above 70 cm; Peek 1997).

However, in March 2011 we saw most moose in areas away from the main Yukon River valley in a survey of moose distribution to the

immediate west (O'Donoghue and Bellmore 2012). We would need to conduct an early-winter survey of this same area to test whether there is any substantial over-winter movement of moose out of the survey area.

Ages and Sexes of Moose

Calf survival to late winter was good in the survey area in 2010–2011. Based on our survey results, there were an estimated 42 calves for every 100 adult and yearling cows (see Table 3). In general, about 25–30 calves per 100 adult cows are considered necessary for maintaining stable moose populations. We were not able to estimate calves per 100 adult cows from this survey because we could not distinguish adults from yearlings, but that ratio would be higher than 42, so calf survival was good. Calves made up an estimated 19% of the population. Only four percent of cow-calf groups contained twins.

We estimate that there were 68 adult and yearling bulls for every 100 cows in the survey area (see Table 3). This number is about the same as the current Yukon-wide average of 65 bulls per 100 adult cows, and well above the minimum level of 30 bulls per 100 cows needed to make sure that all adult cows are bred (Yukon Fish & Wildlife Branch 1996). While our estimate of bulls per 100 cows from this survey includes yearlings, it is probably not greatly different from the ratio of adults, so the sex ratio in this area appears healthy.

Table 2. Estimated abundance of moose in the Tatchun Moose Management Unit survey area in February 2011.

	Best estimate ± 90% confidence interval*	**Estimates within 90% confidence interval***
Estimated total number of moose	424 ± 28%	306-541
Adult and yearling bulls	127 ± 36%	81-173
Adult and yearling cows	188 ± 33%	125-251
Unclassified adults and yearlings	29 ± 72%	8-51
Calves	79 ± 37%	50-108
Density of moose (per 1,000 km^2)		
Whole area	78	
Moose habitat only**	79	

* A "90% confidence interval" means that, based on our survey results, we are 90% sure that the true number lies within this range. Our best estimate is near the middle of this range.

** Suitable moose habitat is considered as all areas at elevations lower than 1,524 m (5,000 ft), excluding water bodies 0.5 km^2 or greater in size.

Table 3. Estimated composition of the moose population in the Tatchun Moose Management Unit survey area in February 2011.

	Best Estimate	Estimates within 90% confidence interval*
% Adult and yearling bulls	30%	23-37%
% Adult and yearling cows	44%	38-51%
% Unclassified adults and yearlings	7%	2-12%
% Calves	19%	14-24%
Total bulls per 100 total cows	68	46-89
Calves per 100 total cows	42	29-54
% of cow-calf groups with twins	4%	2-11%

**A "90% confidence interval" means that, based on our survey results, we are 90% sure that the true number lies within this range, and that our best estimate is near the middle of this range.

Harvest

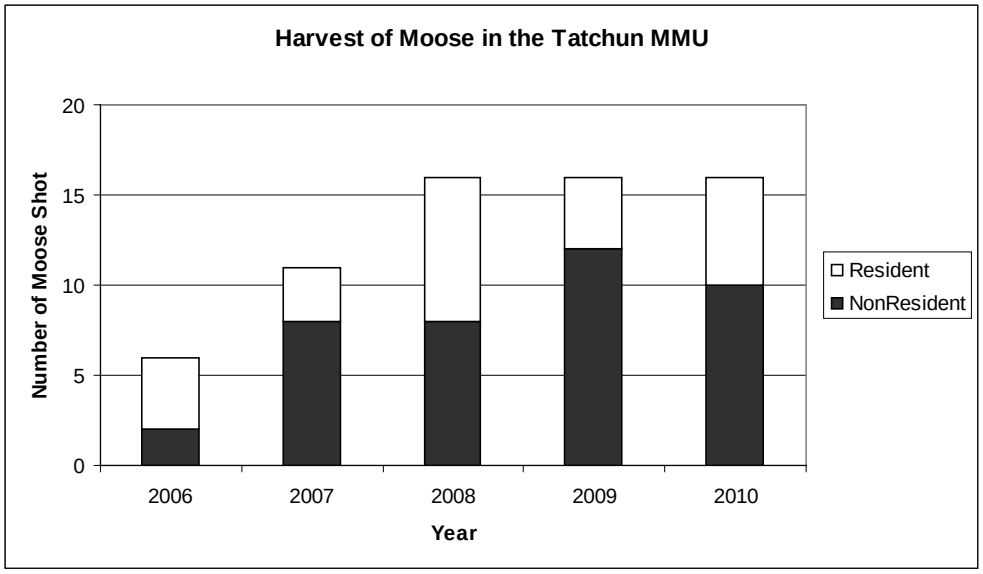
During the last 5 years for which we have complete records (2006 to 2010), the reported harvest of moose by licensed hunters in the Tatchun Moose Management Unit averaged about 13 moose per year (see graph on next page). This figure does not include harvest data from First Nation hunters, which are reported annually at Northern Tutchone May Gatherings. First Nation harvest rates are similar to those of licensed resident hunters in much of the central Yukon.

Using our best estimates of moose density, we estimate that the annual harvest in the Tatchun Moose Management Unit is close to the recommended maximum sustainable harvest rate for this area. This area is an important and accessible one for hunters from the Selkirk and Little Salmon/Carmacks First Nations and resident licensed hunters. We need to continue to closely monitor both the harvest and the moose population in this area to make sure that the population remains healthy.

Other Wildlife Sightings

Besides the 101 moose we counted during the 2011 survey, we saw 18 moose outside the surveyed blocks.

We also saw 83 caribou in 13 groups, mostly in the northern part of the survey area near the Pelly River and Needlerock Creek. These animals were woodland caribou from the Tatchun herd, which usually concentrates further south near Tatchun and Frenchman lakes during winter. Deeper-than-usual snow may have caused these caribou to move further north this winter. We saw 4 sheep rams in the canyon along MacGregor Creek to the east of Yukon Crossing. We also saw 9 mule deer in 3 groups on bluffs overlooking the Yukon and Pelly rivers. Finally, we saw one pack of 8 wolves southeast of Ta'tla Mun (Tatlmain Lake).


Harvest of Moose in the Tatchun MMU
Number of Moose Shot
20
15
10
5
0
2006
2007
2008
2009
2010
Year
Resident
NonResident

Conclusions and Recommendations

- We estimate that there were about 424 moose in the survey area in the Tatchun Moose Management Area. The estimated density was about 79 moose per 1,000 km^2 of suitable habitat, which is lower than the Yukon-wide average.
- Survival of calves in this area from summer 2010 to late-winter of 2011 was good. We do not have information about long-term recruitment rates in this area to determine if they are adequate to maintain moose numbers in the Tatchun Moose Management Unit.
- The ratio of bulls to cows in the survey area is healthy.
- Assuming there are not more moose in this area in the fall than the low numbers we counted in late winter, present harvest levels may be as high as the area can sustain.
- We should discuss harvest management in the area with the affected First Nations and Renewable Resource Councils.
- We should continue to monitor moose populations in this area using aerial and ground-based monitoring, and try to conduct an early-winter census to compare with these late-winter results.

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