

**MOOSE SURVEY**

**LOWER STEWART RIVER  
MOOSE MANAGEMENT UNIT**

**EARLY-WINTER 2001**



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**Yukon**  
Environment

**2013**

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MOOSE MANAGEMENT UNIT  
EARLY-WINTER 2001**

**Yukon Fish and Wildlife Branch  
TR-13-08**

## **Acknowledgements**

Environment Yukon and Selkirk First Nation provided funding and staff for this survey. I thank Derek Drinnan, Michel Menelon, and Craig Untershute for safe, efficient flying in often difficult conditions. Kent Sinnott and Susan Westover acted as navigators and observers on the census and did a fine job guiding the plane and recording data. Rick Ward acted as navigator for one day of the stratification. I also thank Alec Joe and Robert Van Bibber for providing their keen eyesight and knowledge of the area as observers with the stratification crew.

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Suggested citation:

O'Donoghue, M. 2013. Moose Survey: Lower Stewart River Moose Management Unit, early-winter 2001. Yukon Fish and Wildlife Branch Report TR-13-08. Whitehorse, Yukon, Canada.

## Summary

- We conducted an early-winter survey of moose in the Lower Stewart River Moose Management Area 10 November-23 December 2001 using Super Cub aircraft. The main purposes of this survey were to estimate the abundance and distribution of moose, and proportions of calves, yearlings, cows, and bulls in the population.
- We counted all moose in survey blocks covering about 14% of the total area. This was only about two-thirds of the area we had intended to survey because a lack of aircraft availability, cold temperatures, and windy conditions precluded completing the full survey. We found a total of 106 moose, of which 48 were adult bulls, 48 were adult and yearling cows, 3 were yearling bulls, and 7 were calves.
- We calculated a population estimate of  $652 \pm 35\%$  moose for the area, which is equal to a density of about 154 per 1,000 km<sup>2</sup> over the whole area, or 156 per 1,000 km<sup>2</sup> in suitable moose habitat. This estimate may be slightly low because we did not correct it for the number of moose that we missed during the survey. In addition, poor weather prevented us from counting moose in much of the area and the precision of our estimate is low, so these results may not be reliable.
- We estimated that there were about 16 calves and 11 yearlings for every 100 adult cows in the survey area. This suggests that survival of calves and young moose was fairly low during 2000 and 2001.
- We estimated that there were about 108 bulls for every 100 cows in the survey area, which is a very high sex ratio compared to most areas in the Yukon. This estimate has low precision, however, because we were unable to complete the survey, and it may be biased high because of the lower visibility of cows.
- Harvest of moose in this area appears to be within but near maximum sustainable limits.

## Table of Contents

Acknowledgements.....	Inside Cover
Summary.....	i
Table of Contents.....	ii
List of Tables.....	ii
List of Maps.....	ii
Introduction.....	1
Previous Surveys.....	1
Community Involvement.....	1
Study Area.....	1
Methods.....	2
Weather and Snow Conditions.....	6
Results and Discussion.....	6
Identification of High and Low-Density Blocks.....	6
Coverage.....	6
Observations of Moose.....	7
Distribution and Abundance of Moose.....	7
Ages and Sexes of Moose.....	7
Harvest.....	12
Other Wildlife Sightings.....	12
Conclusions and Recommendations.....	13
Literature Cited.....	14

## List of Tables

Table 1. Observations of moose during the November-December 2001 survey in the Lower Stewart River Moose Management Unit.....	11
Table 2. Estimated abundance of moose in the Lower Stewart River Moose Management Unit survey area in November-December 2001.....	11
Table 3. Estimated composition of the moose population in the Lower Stewart River Moose Management Unit survey area in November-December 2001. .	11

## List of Maps

Map 1. Nov – Dec 2001 Moose Survey Lower Stewart River MMU.....	3
Map 2. Previous Moose Surveys Lower Stewart River MMU.....	4
Map 3. Lower Stewart River MMU Fire History.....	5
Map 4. Survey Block Stratification Lower Stewart River MMU.....	8
Map 5. Moose Census Results Lower Stewart River MMU.....	9
Map 6. Moose Observations Lower Stewart River MMU.....	10

## Introduction

This report summarises the results of the early-winter survey of moose in a part of the Lower Stewart River Moose Management Unit (see Map 1), conducted on 10 November - 23 December 2001. The main purposes of this survey were to estimate abundance, distribution and population composition of the local moose population.

### **Previous Surveys**

Environment Yukon has conducted only one other moose survey in previous years in areas that overlapped substantially with this survey area (see Map 2). We conducted an early-winter census that included part of the southeastern survey area in 1995 (results in Ward et al. 1998).

Early winter is the best time of year to estimate abundance of moose because of their concentration in high-altitude open habitats. Bull moose still have antlers at this time of year, so early-winter surveys also allow us to estimate the proportion of bulls in the population.

### **Community Involvement**

Residents of the Mayo area have consistently placed a high priority on monitoring the health of the local moose population. Regular monitoring of moose populations in the Na-Cho Nyäk Dun traditional territory was recommended in the *Integrated Wildlife Management Plan for the Na-Cho Nyäk Dun Traditional Territory, May 1997*, which was developed cooperatively by the Mayo District Renewable Resources Council, the First Nation of Na-Cho

Nyäk Dun, and the Yukon Fish and Wildlife Branch.

## Study Area

The Lower Stewart River 2001 survey area was located to conform to the boundaries of Yukon Moose Management Units. These Moose Management Units were developed to help us more consistently monitor and manage moose in all areas throughout the Yukon. We plan to monitor the health of moose populations in priority moose management units using both aerial and ground-based surveys.

The Lower Stewart River Moose Management Unit is about 7,118 km<sup>2</sup>, and includes Game Management Subzones (GMS) 3-13, 3-14, 3-15, 3-16, and 3-19 (see Map 1). The survey area is about 4,224 km<sup>2</sup> and includes GMSs 3-16 and 3-19 in the eastern part of the Lower Stewart Moose Management Unit, and also GMS 3-20 in the northwestern Tatchun Moose Management Unit. The border runs along the Stewart River in the north, Lake Creek and the Klondike Highway in the east, the Yukon River in the south, and Grand Valley Creek in the west.

Most of the survey area (about 4,179 km<sup>2</sup>) is considered suitable moose habitat, except for approximately 1% of the area, which includes large water bodies (0.5 km<sup>2</sup> or more in size) and land at or over 1,524 m (5,000 feet) in elevation. The survey area consists mostly of rolling hills and plateaus, dissected by numerous creeks, in the drainages of the Stewart, Pelly, and Yukon rivers. Much of the area is forest-covered with black and white spruce, aspen, paper birch, and

lesser amounts of lodgepole pine; balsam poplar also grows along the larger rivers. Forest cover varies from dense mature white spruce and poplar in the main river valleys, to dense younger spruce in many lowlands, to more open mixed spruce, birch and aspen on slopes. Many of the creek valleys have shrubby willow flats along them. Willow and dwarf birch shrub habitats, alpine tundra, and unvegetated rocky areas typify the higher plateaus and peaks of Flat Top and Rough Top in the White Mountains and Mount Adami in the northern part of survey area.

Old and recent burns occur throughout the study area (see Map 3), and these vary in quality as moose habitat. The most recent large fires were a 745 km<sup>2</sup> 1998 burn in the Willow Hills, a 589 km<sup>2</sup> 1995 burn around Minto in the southern part of the area, and a 421 km<sup>2</sup> 1980 burn along the Pelly River.

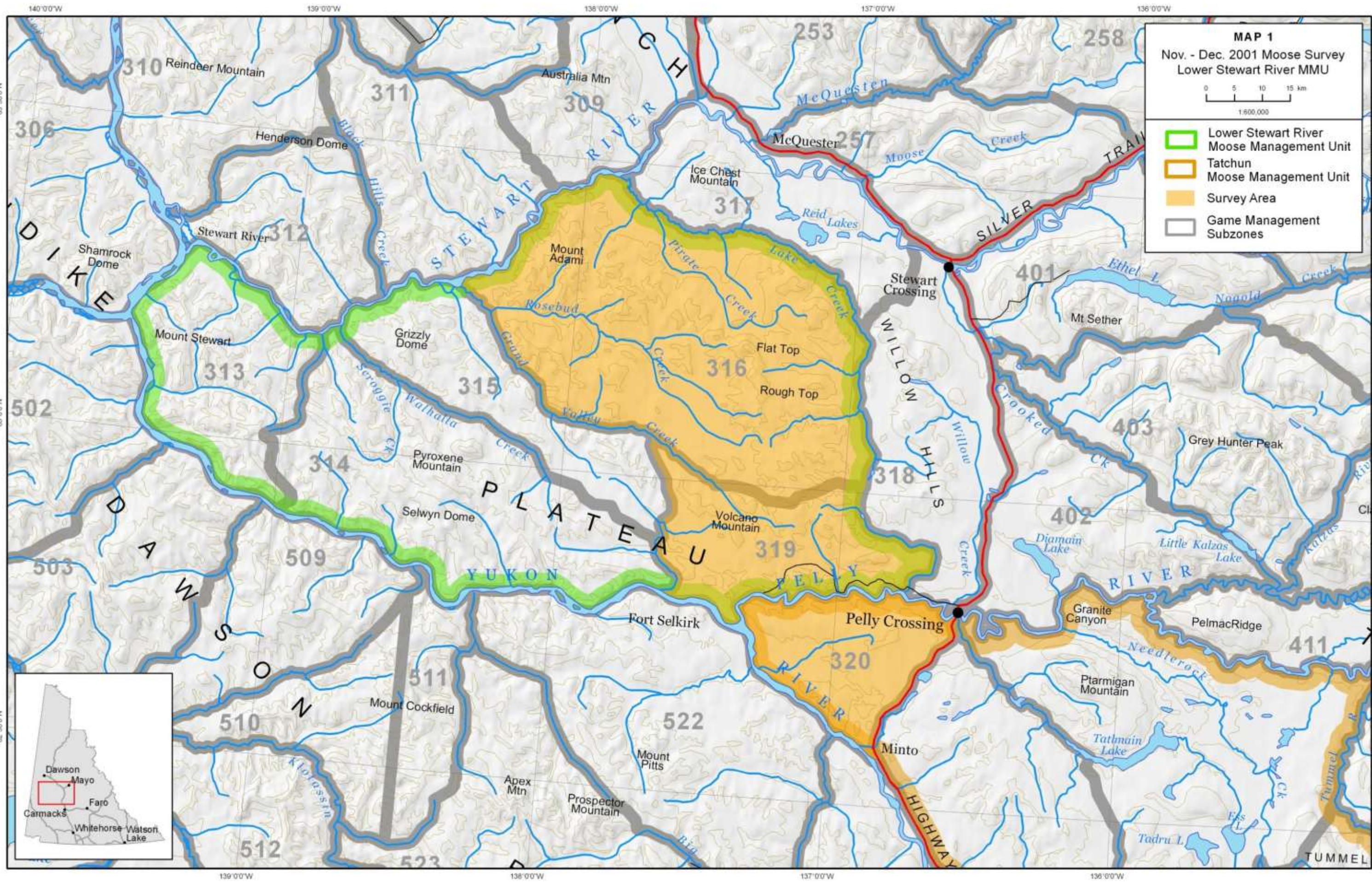
## Methods

We have adopted a relatively new survey technique to survey moose, developed by the Alaska Department of Fish and Game. This method is similar to the way we conducted our moose surveys in the past, except it is less expensive because we use only fixed-wing aircraft for the entire survey instead of helicopters. The technique involves 5 steps:

1. The survey area is divided into uniform rectangular blocks about 15-16 km<sup>2</sup> (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 abundance, 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 and low "strata", 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. We try to count every moose within the selected blocks (the "census" part of our survey) using Super Cubs, at a search intensity of about 2 minutes per km<sup>2</sup>. We classify all moose seen by age (adult, yearling, or calf) and sex. Yearling cows are often difficult to distinguish from adults, so we classify all cows as adults, and later estimate the number of yearling cows that were present among the older cows by assuming it equals the number of yearling bulls we saw.
5. 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 based on the numbers of moose counted in the blocks during the census, the distribution of these blocks, and how we classified the blocks we didn't count. Generally, the more blocks that are searched during the census part of the survey, the more precise and reliable is the resulting population estimate.



**MAP 1**  
 Nov. - Dec. 2001 Moose Survey  
 Lower Stewart River MMU

0 5 10 15 km  
 1:600,000

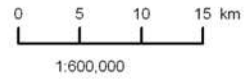
- Lower Stewart River Moose Management Unit
- Tatchun Moose Management Unit
- Survey Area
- Game Management Subzones



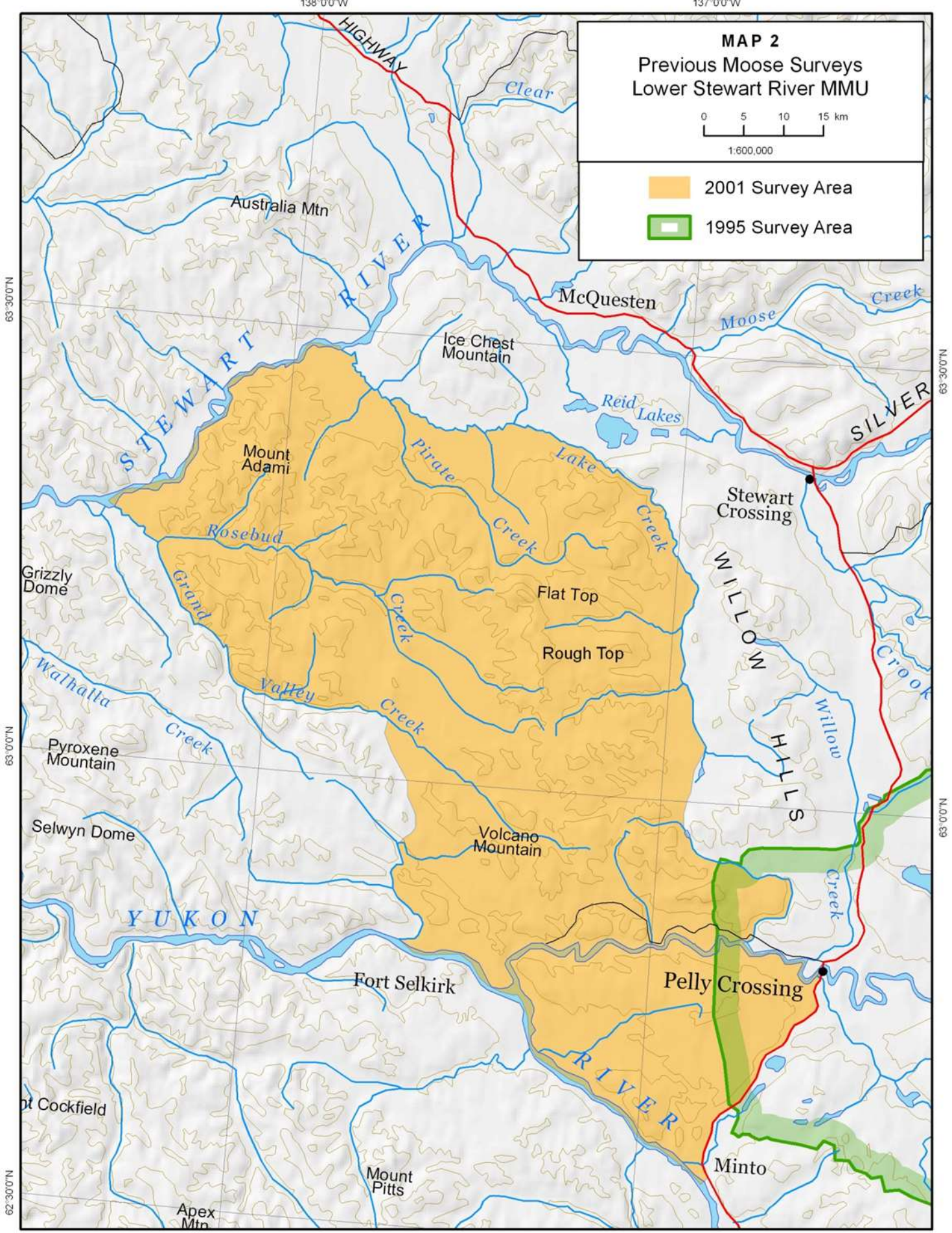
138°0'0"W

137°0'0"W

**MAP 2**  
**Previous Moose Surveys**  
**Lower Stewart River MMU**



- 2001 Survey Area
- 1995 Survey Area



138°0'0"W

137°0'0"W

63°30'0"N

63°0'0"N

62°30'0"N

63°30'0"N

63°0'0"N

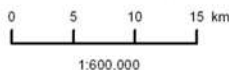
62°30'0"N



138°00'W

137°00'W

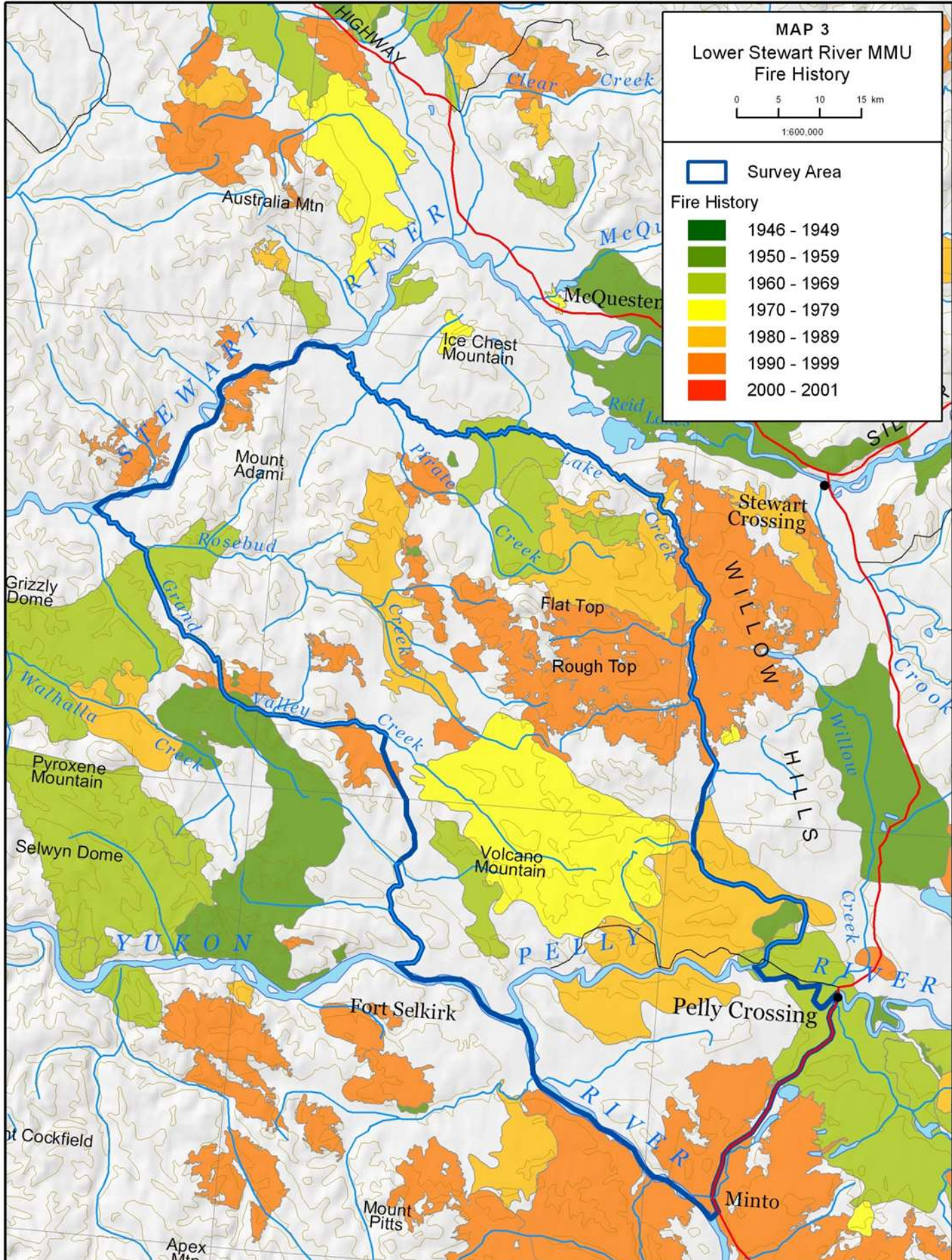
### MAP 3 Lower Stewart River MMU Fire History



Survey Area

#### Fire History

- 1946 - 1949
- 1950 - 1959
- 1960 - 1969
- 1970 - 1979
- 1980 - 1989
- 1990 - 1999
- 2000 - 2001



63°30'0"N

63°00'0"N

62°30'0"N

63°30'0"N

63°00'0"N

62°30'0"N

138°00'W

137°00'W

## Weather and Snow Conditions

Weather conditions made it difficult to fly and ultimately delayed the survey long enough that we were not able to complete it. We had good weather conditions for the stratification part of the survey in mid-November, but then had an 8-day delay before Super Cubs were available for the census. Once we started the census on 20 November, we tried for over a month to complete it. We were completely shut down by poor flying conditions (high winds, snow, freezing drizzle, or low clouds) and 2 cold snaps on 27 days, and had to stop flying early because of poor weather on 2 other days. Temperatures ranged from  $-44^{\circ}\text{C}$  to  $+1^{\circ}\text{C}$ . Light conditions ranged from flat to bright and snow coverage was complete, so visibility was generally good for spotting moose. Day lengths, however, were very short by the end of the survey, greatly limiting the amount of time we could fly.

## Results and Discussion

### *Identification of High and Low-Density Blocks*

We flew over the entire survey area in a 4-seat Cessna 185 with the pilot and 3 observers. We averaged 0.11 minutes per  $\text{km}^2$  during the stratification flights.

We classified 31 (11%) of the 270 survey blocks as high, 62 (23%) as medium, 54 (20%) as low, and 123 (46%) as very low expected abundance of moose (see Map 4), based on our observations from the air. Most of the blocks with higher

expected numbers of moose were located in the northern part of the survey area in recent burns and mountainous areas, and in areas burned in the 1970s and 1980s near the Pelly River. For the purpose of selecting blocks for the census, we grouped the 93 blocks expected to have high and medium numbers of moose into a High stratum, and the 177 blocks with low and very low expected numbers of moose into the Low stratum.

### **Coverage**

We counted moose in 38 of the 270 blocks, or about 14% of the total area (see Map 5). This was less than the 60 blocks we had originally intended to survey, but availability of aircraft and poor weather prevented us from completing the survey. It took us about 17.9 hours to count moose in these blocks, for a search intensity of 1.80 minutes per  $\text{km}^2$ , which is slightly less than our target search intensity of 2 minutes per  $\text{km}^2$ . Survey intensity was about the same in low-abundance (1.73 minutes per  $\text{km}^2$ ) and high-abundance (1.87 minutes per  $\text{km}^2$ ) blocks. We used an additional 28.9 hours ferrying between survey blocks, to fuel caches at the McQuesten and Pelly Crossing air strips, and back and forth to Mayo. Ferry time (62% of total flying time) was far higher than for most surveys because of poor weather and the remoteness of the survey area.

### **Observations of Moose**

We counted a total of 106 moose, 48 of them adult bulls, 48 adult and yearling cows, 3 yearling bulls, and 7 calves (see Table 1). We observed an average of 257 moose for every 1,000 km<sup>2</sup> in the high-abundance blocks, and 101 moose per 1,000 km<sup>2</sup> in the low blocks.

### **Distribution and Abundance of Moose**

Moose were widely distributed in the survey area (see Maps 5 and 6), and we found them in a variety of habitats. As expected for the early winter, subalpine willow flats, higher altitude burns, and creek draws with abundant willows generally had good numbers of moose in them. We saw few moose in forested lowlands and lower-elevation slopes.

The estimated number of moose in the entire survey area, based on our census counts, was  $652 \pm 35\%$  (see Table 2). The degree of uncertainty ( $\pm 35\%$ ) is higher than the target precision ( $\pm 20\%$ ) that we aim for in these surveys, largely because of the relatively low number of blocks we were able to survey.

The estimated density of moose in the survey area was 154 per 1,000 km<sup>2</sup> of total area, or 156 per 1,000 km<sup>2</sup> of suitable moose habitat (see Table 2). This is about equal to the Yukon-wide average of 153 moose per 1,000 km<sup>2</sup> of total area. We did not correct our estimates of density for sightability in this survey, so this year's estimate is likely an underestimate of the true

density because some moose (about 7% in early-winter moose surveys to date) are inevitably missed by observers.

### **Ages and Sexes of Moose**

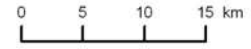
Calf survival to the early winter was poor in 2001 in the survey area. Based on our survey results, there were an estimated 16 calves for every 100 adult cows (see Table 3). In general, about 25-30 calves per 100 adult cows are considered necessary for maintaining stable moose populations in areas with typical mortality rates. Calves made up an estimated 7% of the population in 2001. We saw no cows with twins.

The estimated percentage of yearlings in the population in the survey area—5%—was also low (see Table 3). There were an estimated 11 yearlings per 100 adult cows, or about 5 per 100 adults. Depending on mortality rates, about 10-20 yearlings per 100 adults are required for maintaining stable populations (Yukon Fish and Wildlife Branch 1996). We estimate that there were 108 adult bulls for every 100 adult cows in the survey area (see Table 3). This is considerably higher than the Yukon-wide average of 69 bulls per 100 cows in areas that have been surveyed, and well above the minimum level of 30 bulls per 100 cows needed to ensure most cows are bred (Yukon Fish and Wildlife Branch 1996). This estimate may be biased high, however, because cows are generally less visible than bulls because of their use of denser cover.

138°00'W

137°00'W

**MAP 4**  
**Survey Block Stratification**  
**Lower Stewart River MMU**



1:600,000

Survey Area

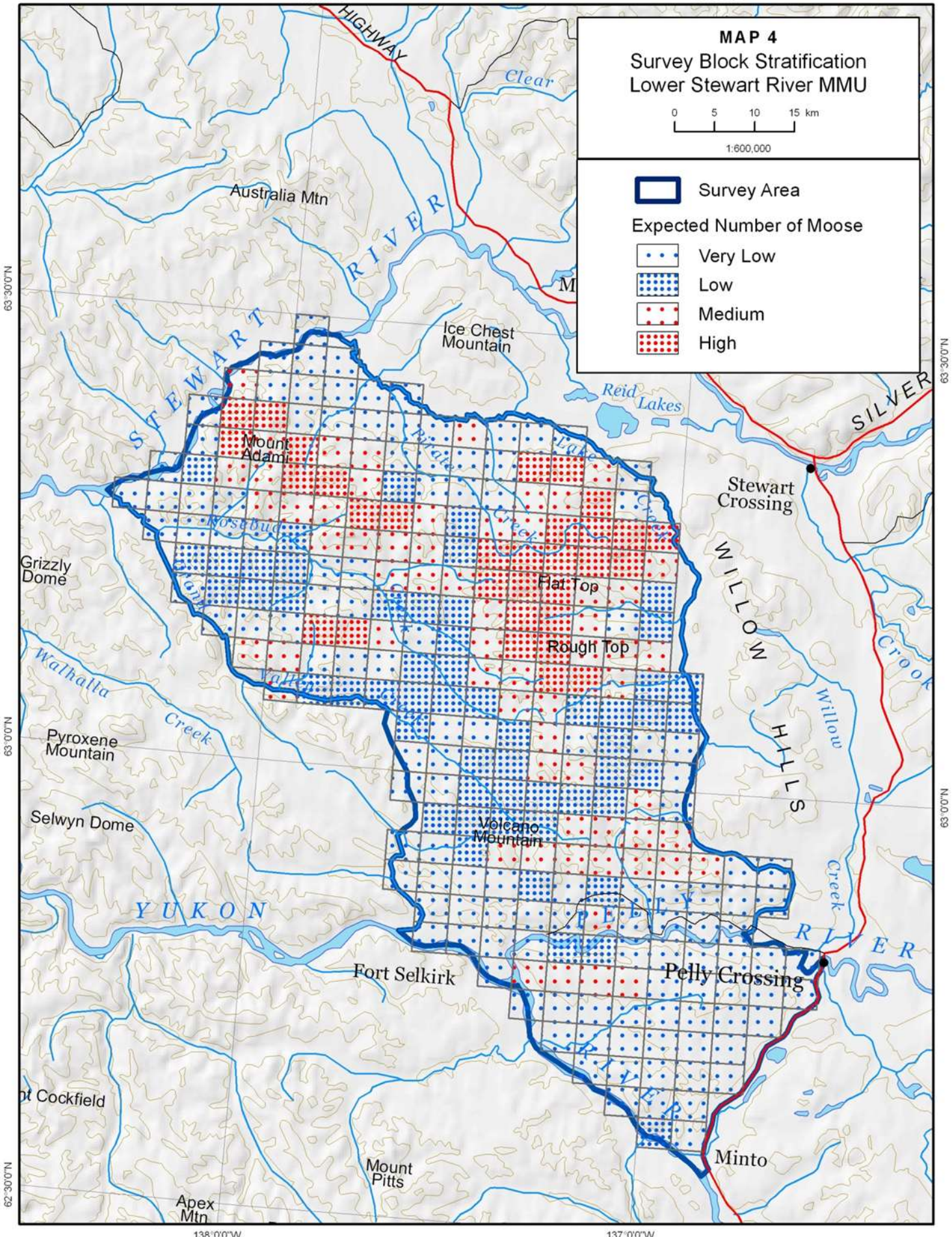
Expected Number of Moose

Very Low

Low

Medium

High



138°00'W

137°00'W

63°30'00"N

63°00'00"N

62°30'00"N

63°30'00"N

63°00'00"N

62°30'00"N

138°0'0"W

137°0'0"W

**MAP 5**  
**Moose Census Results**  
**Lower Stewart River MMU**

0 5 10 15 km

1:600,000



Survey Area

Expected Number of Moose



Low (# of moose seen)



High (# of moose seen)

63°30'0"N

63°30'0"N

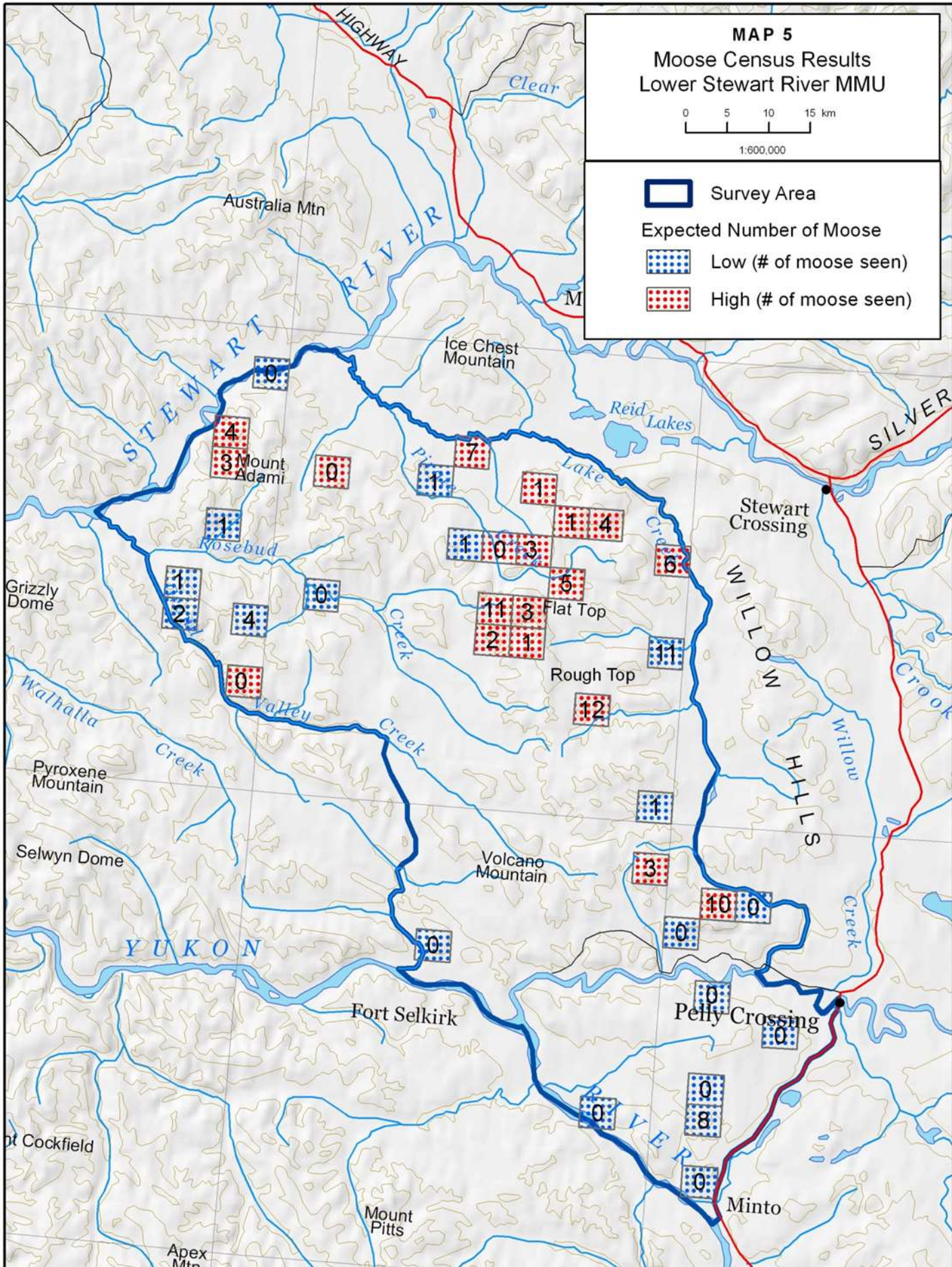
63°0'0"N

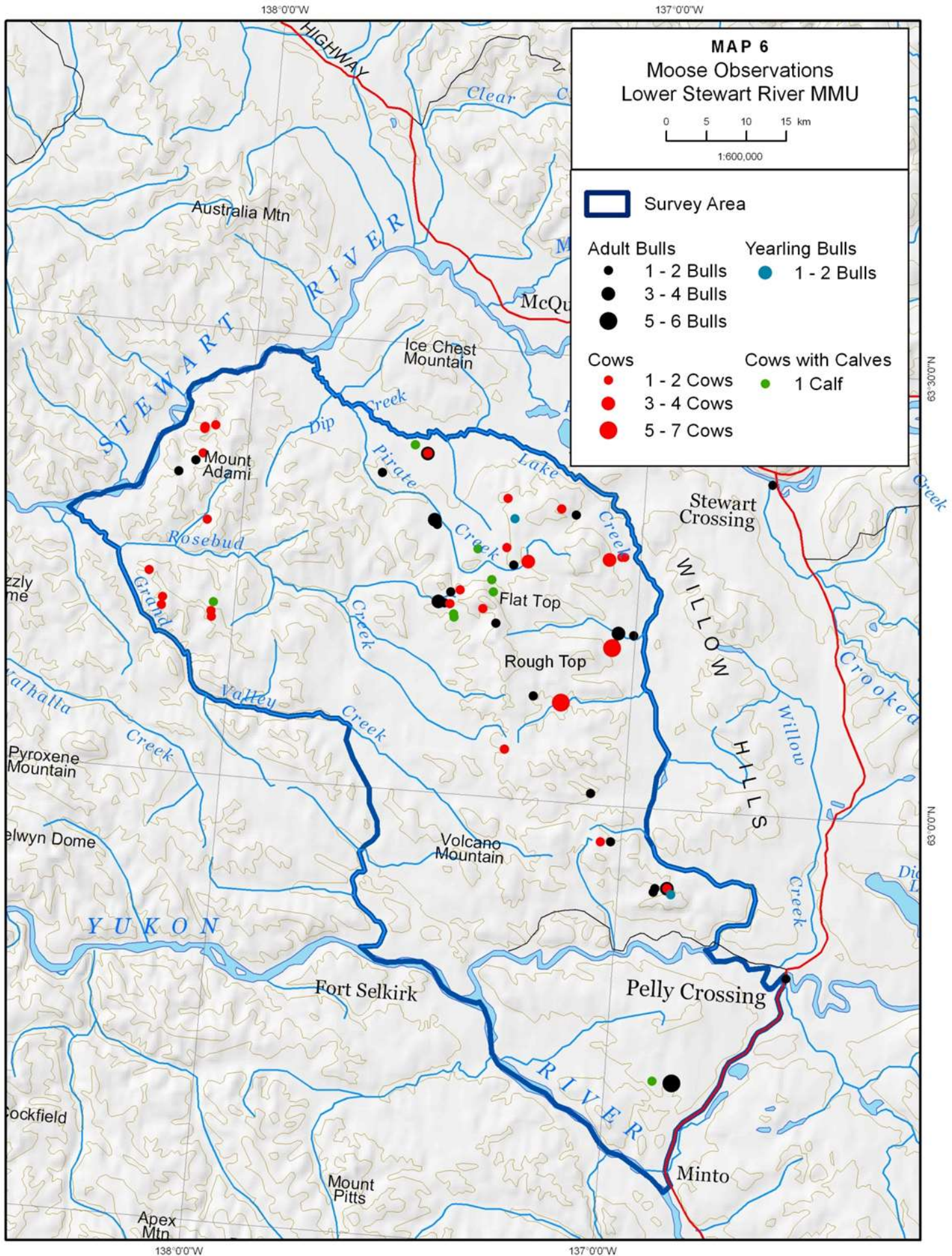
63°0'0"N

62°30'0"N

138°0'0"W

137°0'0"W





**Table 1.** Observations of moose during the November-December 2001 survey in the Lower Stewart River Moose Management Unit.

	High Blocks	Low Blocks	Total
Number of Blocks Counted	19	19	38
Number of Adult Bulls Observed	33	15	48
Number of Adult and Yearling Cows Observed*	35	13	48
Number of Yearling Bulls Observed	3	0	3
Number of Calves Observed	5	2	7

\* 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 they survive about equally well until they're yearlings, the number of yearling cows in these totals should be about the same as the number of yearling bulls observed during the survey. We used this assumption to estimate the total number of yearlings in the survey area presented in Table 2.

**Table 2.** Estimated abundance of moose in the Lower Stewart River Moose Management Unit survey area in November-December 2001.

	Best Estimate $\pm$ 90% Confidence Interval*	Estimates within 90% Confidence Interval*
Estimated Total Number of Moose	652 $\pm$ 35%	423-881
Adult Bulls	302 $\pm$ 47%	160-443
Adult Cows	278 $\pm$ 39%	169-387
Yearlings	29 $\pm$ 113%	0-63
Calves	43 $\pm$ 58%	18-68
Density of Moose (per 1,000 km <sup>2</sup> )		
Whole Area	154	
Moose Habitat Only**	156	

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

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

**Table 3.** Estimated composition of the moose population in the Lower Stewart River Moose Management Unit survey area in November-December 2001.

	Best Estimate	Estimates within 90% Confidence Interval*
% Adult Bulls	46%	37-56%
% Adult Cows	43%	32-53%
% Yearlings	5%	0-10%
% Calves	7%	3-10%
Bulls per 100 Adult Cows	108	61-156
Yearlings per 100 Adult Cows	11	0-24
Calves per 100 Adult Cows	16	6-25
% of Cow-Calf Groups with Twins	0%	0-0%

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

## Harvest

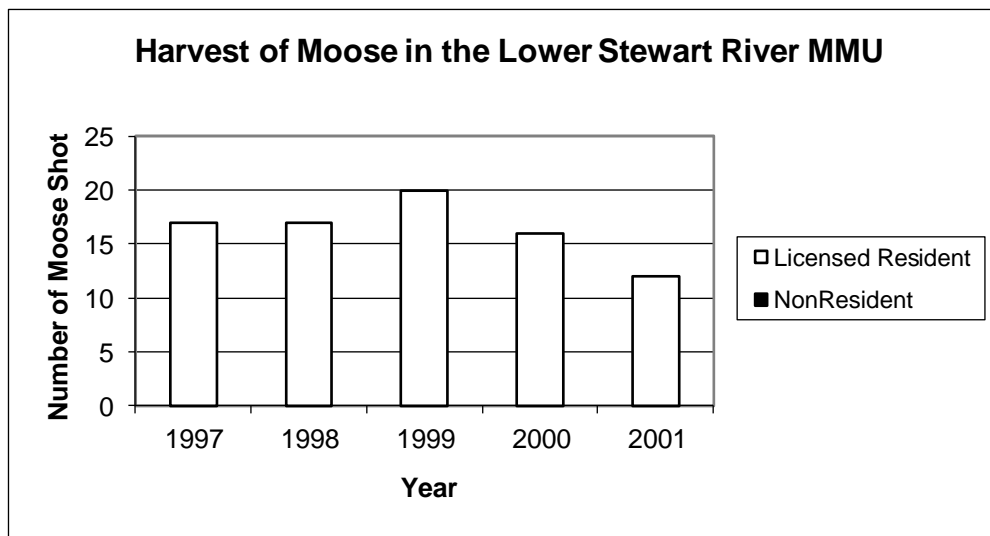
The reported harvest of moose by licensed hunters in the Lower Stewart River Moose Management Unit during the 5 years prior to this survey (1997 to 2001), averaged about 16 moose per year (see graph below). This does not include harvest data from First Nation hunters, which are reported annually at Northern Tutchone May Gatherings. We estimate that First Nation harvest rates are similar to those of licensed resident hunters in much of the central Yukon.

Using our latest estimates of moose density, we estimate that the annual harvest was about 3% of the total moose population in the Lower Stewart River Moose Management Unit. This is near the recommended maximum allowable harvest rate of 3-4% for this area.

## Other Wildlife Sightings

In addition to the 106 moose we counted during the 2001 survey, we also observed 8 moose outside of the blocks that were surveyed.

We did not observe any other species of wildlife during the survey.





## Conclusions and Recommendations

- We estimate that there were about 652 moose in the survey area in the Lower Stewart River Moose Management Area. The estimated density was about 154 moose per 1,000 km<sup>2</sup>, which is about equal to the Yukon-wide average.
- There was poor survival of calves in this area during the summer and fall of 2001. Survival of calves born in 2000 (yearlings in this survey) was also quite poor. We have no data on long-term trends in recruitment in the area.
- The number of bulls in the survey area, compared to the number of cows, was very high in this survey. The proportion of bulls may be over-estimated, but we have no long-term data in the area.
- Harvest of moose in the Lower Stewart River Moose Management Unit was within but close to the maximum recommended allowable rate.
- Using ground based monitoring and local knowledge we should continue to closely monitor the status and harvest of the moose population in the Lower Stewart River Moose Management Unit. If harvest levels approach upper sustainable limits a census should be considered as an action to update the population status.

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