MOOSE SURVEY
LOWER STEWART RIVER
WEST – WHITE GOLD AREA

EARLY-WINTER 2012

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Summary

- We conducted an early-winter survey of moose in the area around the confluences of the Stewart and White rivers with the Yukon River on 30 October to 17 November 2012, using helicopters. This was the first count of moose in this area, which is experiencing a high level of advanced mineral exploration. The main purposes of this survey were to estimate the abundance, distribution and population composition of the moose population.

- We counted all moose in survey blocks covering about 24% of the entire area, and found a total of 349 moose, of which 120 were adult bulls, 178 were adult and yearling cows, 20 were yearling bulls, and 31 were calves.

- We calculated a population estimate of 1,147 ± 16% moose for the area, which is equal to a density of about 170 per 1,000 km^2 over the whole area, or 173 per 1,000 km^2 in suitable moose habitat. The overall density estimate is slightly higher than the Yukon average of about 157 moose per 1,000 km².

- We estimated that there were about 21 calves and 23 yearlings for every 100 adult cows in the survey area. This suggests that survival of calves was fairly poor in 2012 but that calves born in 2011 had about average survival in this area.

- We estimated that there were about 70 adult bulls for every 100 adult 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.

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Introduction

This report summarises the results of the early-winter survey of moose in the area around the confluences of the Stewart and White rivers with the Yukon River (see Map 1), conducted 30 October to 17 November 2012. This area is experiencing high levels of mineral exploration and the proposed development of several new mines and associated all-season access roads. The main purposes of this survey were to estimate abundance, distribution and population composition of the local moose population.
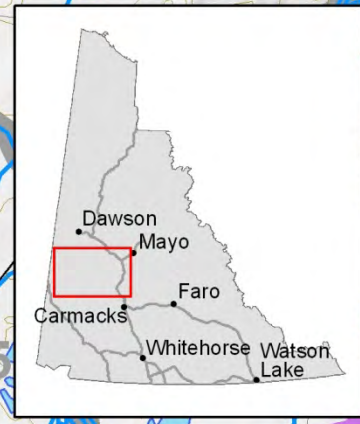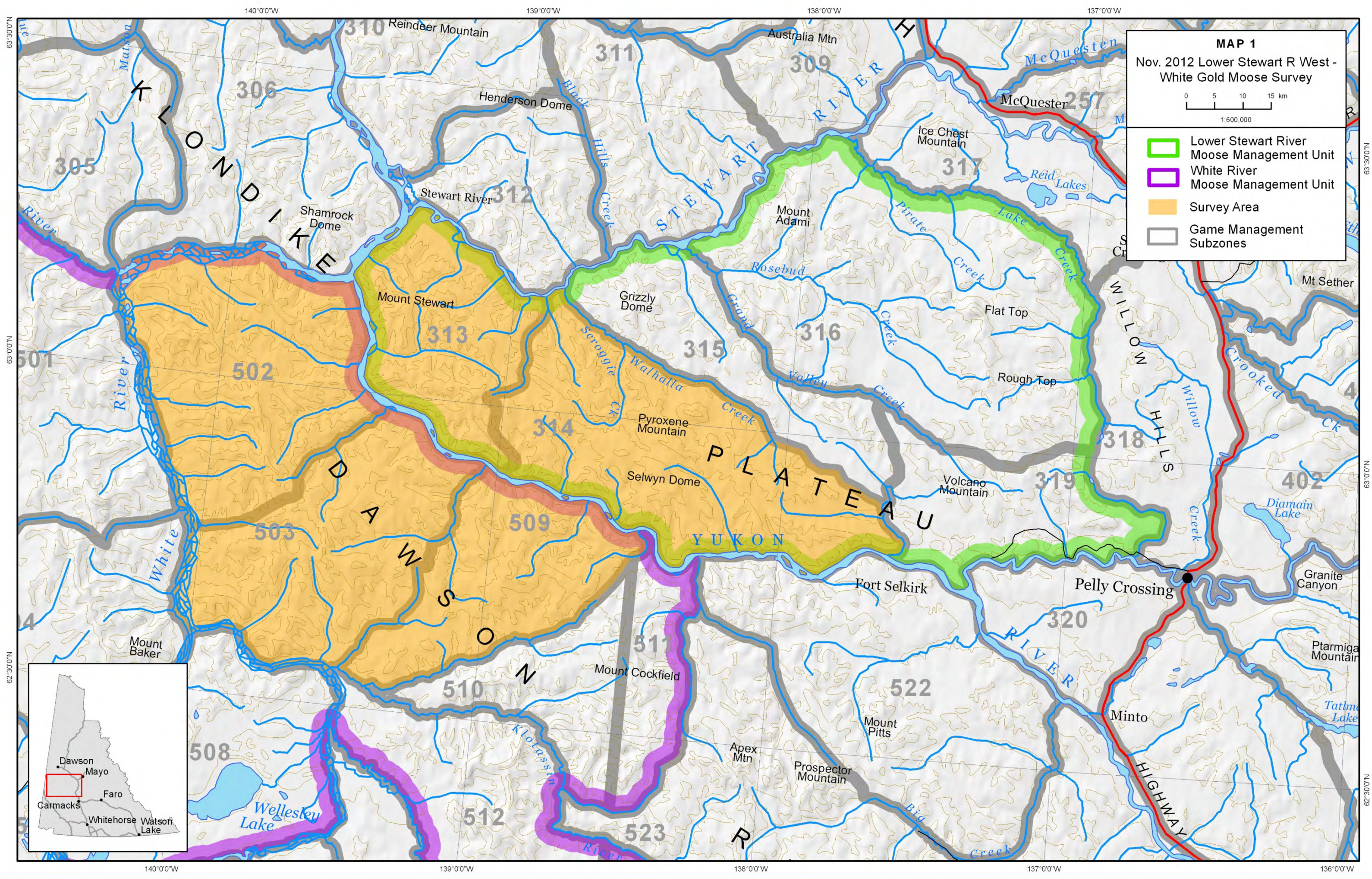
Previous Surveys

This is the first early-winter census of moose in this area. 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 ages and proportion of bulls in the population.

Environment Yukon has conducted 3 other moose surveys in previous years in areas that overlapped substantially with this survey area. We mapped late-winter distribution of moose in the same survey area in February-March 2012 (results in O'Donoghue et al. 2012), except for the area south of the Yukon River and east of Coffee Creek which had been covered in a survey in March 2011 (see Map 2; results in O'Donoghue and Bellmore 2011).

We also conducted a low-intensity early-winter survey in the southwestern part of the survey area in 1997 out of Beaver Creek to gather data on the sex and age composition of the moose population (see Map 2; results in Yukon Fish and Wildlife Branch files).

Community Involvement

This survey was conducted largely because of the high level of mining exploration and development in this area. Gathering baseline data and mapping key wildlife habitats in areas with concentrated industrial activity was recommended in the *Community-based Fish and Wildlife Management Work Plan for the Na-Cho Nyäk Dun Traditional Territory* for 2008-2013, 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. Surveying moose populations in this area was also recommended by the Dawson District Renewable Resources Council and at annual Northern Tutchone May Gatherings. The First Nation of Na- Cho Nyäk Dun and the Tr'ondëk Hwëch'in provided staff to help conduct this survey.

MAP 1

Nov. 2012 Lower Stewart R West - White Gold Moose Survey

0 5 10 15 km

1:600,000

Lower Stewart River Moose Management Unit

White River Moose Management Unit

Survey Area

Game Management Subzones
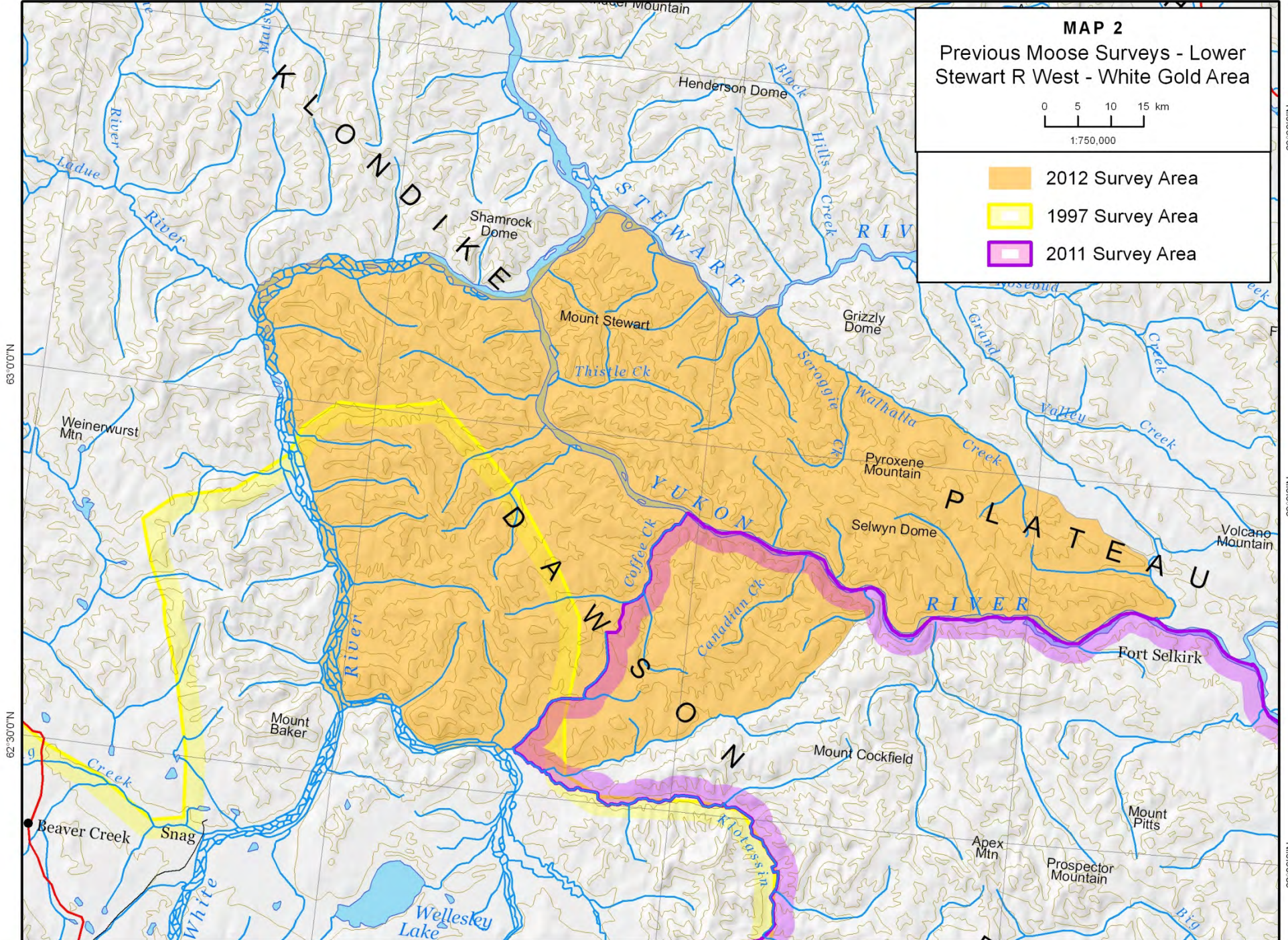
MAP 2
Previous Moose Surveys - Lower
Stewart R West - White Gold Area

0   5   10   15 km

1:750,000

2012 Survey Area
1997 Survey Area
2011 Survey Area

Study Area

The survey area boundaries were delineated to cover an area with high levels of recent mineral staking and where we have few data on moose numbers or distribution (see Map 1). This included the western part of the Lower Stewart River Moose Management Unit (Game Management Subzones 3-13 and 3-14) and the northeastern part of the White River Moose Management Unit (Game Management Subzones 5-02, 5-03, and 5-09). The survey area was about 6,751 km².

Most of the study area (about 6,635 km²) is considered suitable moose habitat, except for approximately 2% of the area, which includes large water bodies (0.5 km² or more in size) and land at or over 1,524 m (5,000 feet) in elevation. The study area consists mostly of rolling hills and plateaus, dissected by numerous creeks, in the drainages of the Stewart, Yukon, and White 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 Yukon and Stewart 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 the Dawson Range southwest of the Yukon River, and the Klondike Plateau to the north.

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, from east to west in the survey area, were a total of 325 km² of burns from 2003 to 2009 to the west and northwest of Pyroxene Mountain, a 255 km² 2004 burn near Mount Stewart, a 168 km² 2010 burn and a 274 km² 2004 burn southwest of the Yukon-White River confluence, and a 408 km² 1998 burn along the White River.

Much of the survey area has abundant roads, trails, and cut lines associated with past and present mining activities; there are fewer mining roads and trails in the western part of the survey area between the Yukon and White rivers.

Methods

We have adopted and modified a relatively new technique to survey moose, developed by Alaska Department of Fish and Game (Kellie and 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.
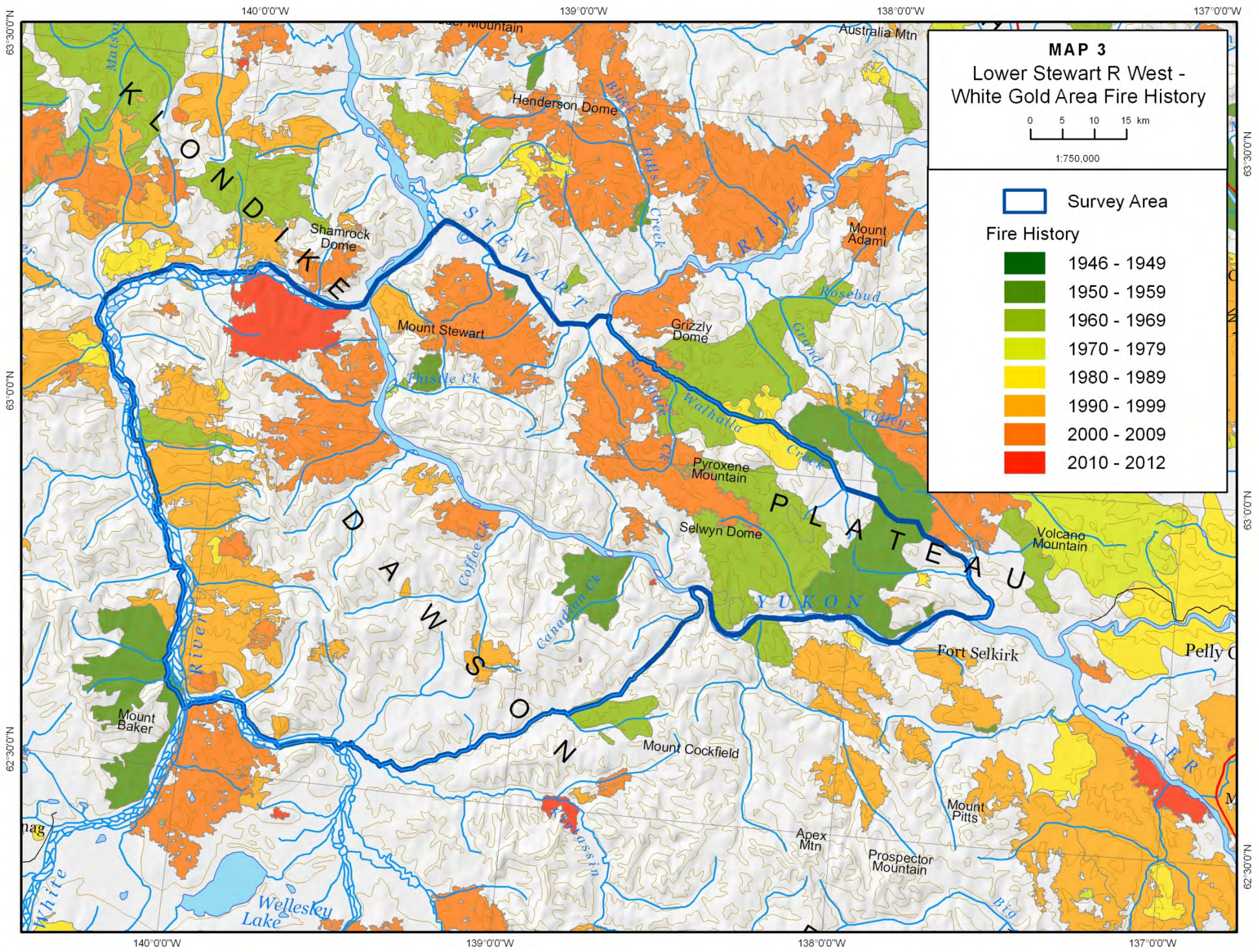
MAP 3

Lower Stewart R West - White Gold Area Fire History

0 5 10 15 km
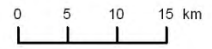
1:750,000

Survey Area

Fire History

- 1946 - 1949
- 1950 - 1959
- 1960 - 1969
- 1970 - 1979
- 1980 - 1989
- 1990 - 1999
- 2000 - 2009
- 2010 - 2012

The technique involves five steps:

1. The survey area is divided into 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 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 helicopters, at a search intensity of about 2 minutes per km². 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. We correct our population estimates for moose that we overlooked during the census with a "sightability correction factor" calculated as the average from previous early-winter censuses (equal to 1.09, or assuming we missed about 9% of moose, with a variance of 0.00008). Generally, the more blocks that are searched during the census part of the survey, the more precise and reliable is the resulting population estimate.

Weather and Snow Conditions

Weather conditions were variable and challenging for this survey. It took us 8 days to complete 3 days of flying for the stratification part of the survey because of persistent low clouds, snow, and icing conditions. We had one crew working out of Mayo and the other out of Dawson for the census. The Mayo crew was unable to fly on 2 days and was restricted to lower altitude areas on 3 others because of weather. The Dawson crew was able to fly every day, but was limited by low clouds and poor visibility on 5 of 9 days.

Temperatures ranged from -36°C to -8°C. Skies were mostly clear on 3 days and cloudy on the remaining 7 days. Light snow fell on most days during the census so we always had fresh snow on the ground.

Winds were mostly calm or light on 5 of the days and moderate to strong on 5 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-Density Blocks

We classified 58 (14%) of the 429 survey blocks as high, 146 (34%) as medium, 122 (28%) as low, and 103 (24%) as very low expected abundance of moose (see Map 4), based on our observations from the air. For the purpose of selecting blocks for the census, we grouped the 204 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.

Most of the blocks with higher expected numbers of moose were located in burns in hilly areas and subalpine ridges scattered through the survey area.

Coverage

We counted moose in 104 of the 429 blocks, or about 24% of the total area (see Map 5). We initially randomly selected 130 blocks to survey—78 from the High stratum and 52 from the Low stratum. We were able to reach our goal of an adequately precise population estimate by counting fewer blocks, however, so we only counted a randomly selected subsample of these—in all, 73 High and 31 Low-stratum blocks were surveyed. It took us about 55.5 hours to count moose in these blocks, for a search intensity of 2.04 minutes per km². Survey intensity was about the same in low-abundance (1.97 minutes per km²) and high-abundance (2.07 minutes per km²) blocks. Another 50.7 hours were used in ferrying between survey blocks, to fuel caches at Pelly Farm (near Fort Selkirk) and Thistle Creek, and back and forth to Mayo and Dawson. The time devoted to ferrying was about 48% of the total flight time, which is relatively high compared to most moose surveys due to the remote location of the survey area and the need to fly around low-lying clouds on some days.

Observations of Moose

We counted a total of 349 moose, 120 of them adult bulls, 178 adult and yearling cows, 20 yearling bulls and 31 calves (see Table 1). We observed an average of 289 moose for every 1,000 km² in the high-abundance blocks, and 35 moose per 1,000 km² in the low blocks.
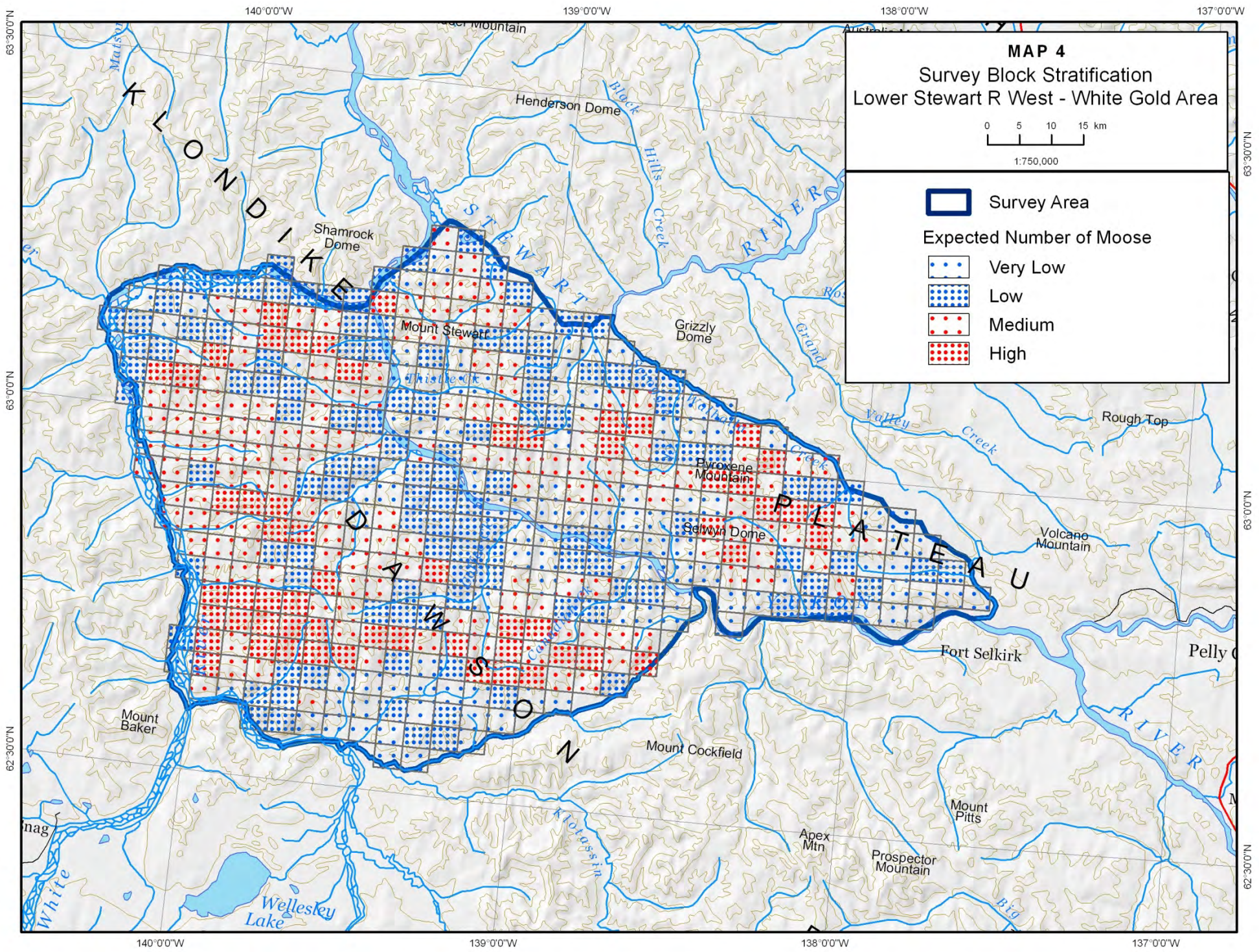
MAP 4
Survey Block Stratification
Lower Stewart R West - White Gold Area

0   5   10   15 km

1:750,000

Survey Area

Expected Number of Moose

Very Low
Low
Medium
High

MAP 5
Moose Census Results
Lower Stewart R West - White Gold Area

0   5   10   15 km

1:750,000

Survey Area

Expected Number of Moose

Low (# of moose)

High (# of moose)
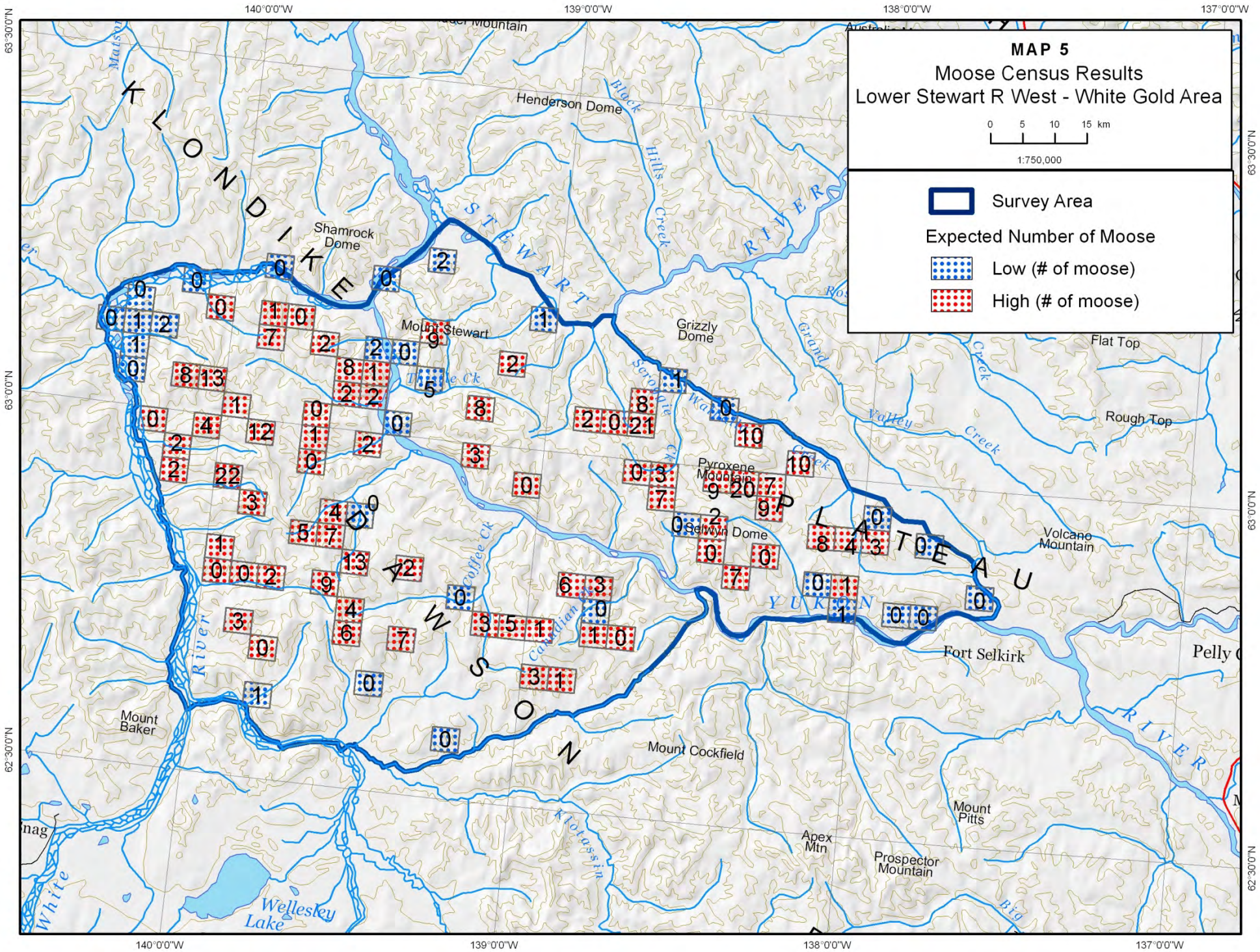
Distribution and Abundance of Moose

Moose were widely distributed in the survey area (see Maps 5 and 6; Map 6 includes moose seen during the census and while we were flying between survey blocks) and we found them in a variety of habitats.

As expected for the early winter, subalpine willow flats and creek draws with abundant willows generally had good numbers of moose in them. We saw few moose in forested or burned areas in lowlands or lower-elevation slopes.

Table 1 Observations of moose during the November 2012 survey in the Lower Stewart River West - White Gold area.

	High Blocks	Low Blocks	Total
Number of Blocks Counted	73	31	104
Number of Adult Bulls Observed	118	2	120
Number of Adult and Yearling Cows Observed*	167	11	178
Number of Yearling Bulls Observed	20	0	20
Number of Calves Observed	27	4	31

* 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 are 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.

MAP 6
Moose Observations
Lower Stewart R West - White Gold Area

0   5   10   15 km

1:750,000

Survey Area

Bulls
● 1 - 2 Bulls
● 3 - 4 Bulls
● 5 - 11 Bulls

Cows
● 1 - 2 Cows
● 3 - 4 Cows
● 5 - 9 Cows

Yearling Bulls
● 1 - 2 Bulls

Cows with Calves
● 1 - 2 Calves
● 3 Calves
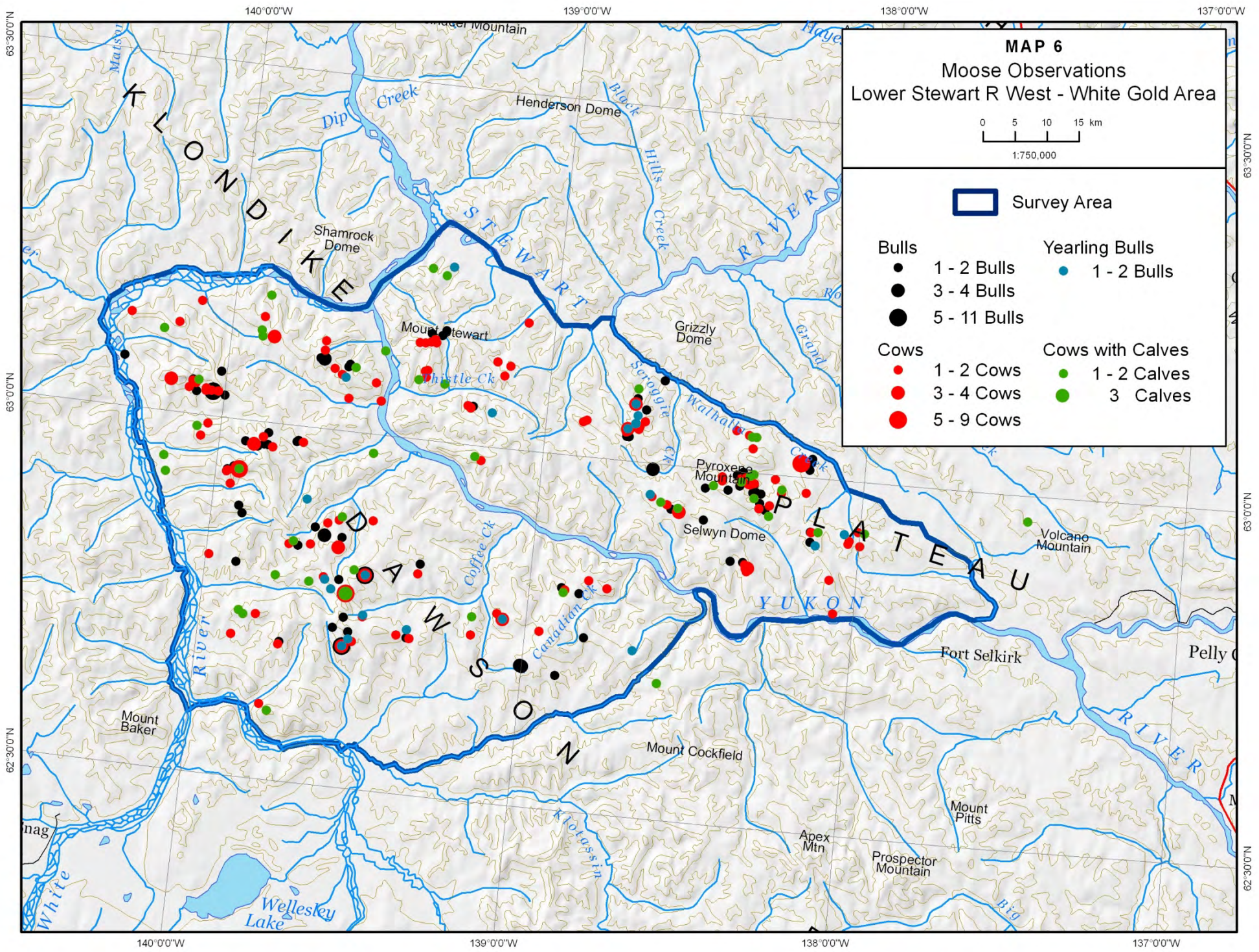
The estimated number of moose in the whole survey area, based on our census counts, is 1,147 ± 16% (see Table 2). This includes corrections for moose missed during the census of about 9%, as calculated from the average of previous early-winter moose surveys.

The estimated density of moose in the survey area was 170 per 1,000 km², or 173 per 1,000 km² of suitable moose habitat (see Table 2). This is slightly higher than the Yukon-wide average of 156 moose per 1,000 km².

Table 2. Estimated abundance of moose in the Lower Stewart River West-White Gold area in November 2012.

	Best Estimate ± 90% Confidence Interval*	Estimates within 90% Confidence Interval*
Estimated Total Number of Moose	1,147 ± 16%	960-1,333
Adult Bulls	375 ± 22%	294-457
Adult Cows	535 ± 18%	438-633
Yearlings	122 ± 38%	75-169
Calves	114 ± 27%	84-145
Density of Moose (per 1,000 km²)		
Whole Area	170	
Moose Habitat Only**	173	

* 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 km² or greater in size.

Ages and Sexes of Moose

Calf survival to the early winter was fairly low in 2012 in the survey area. Based on our survey results, there were an estimated 21 calves for every 100 adult cows (see Table 3).

In general, about 25 calves per 100 adult cows are considered necessary for maintaining stable moose populations in areas with typical mortality rates (Environment Yukon in prep). Calves made up an estimated 10% of the population in 2011.

We saw no cow-calf groups with twins during the census, but we did see 4 sets of twins with cows outside of the blocks we counted. The estimated percentage of yearlings in the population in the survey area—11%—was healthy (see Table 3). There were an estimated 23 yearlings per 100 adult cows, or about 12 per 100 adults. Depending on mortality rates, about 8-15 yearlings per 100 adults are required for maintaining stable populations (Environment Yukon in prep).

We estimate that there were 70 adult bulls for every 100 adult cows in the survey area (see Table 3). This is slightly higher than the Yukon-wide average of 64 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 (Environment Yukon in prep).

Table 3. Estimated composition of the moose population in the Lower Stewart River West-White Gold area in November 2012.

	Best Estimate	Estimates within 90% Confidence Interval*
% Adult Bulls	33%	28-37%
% Adult Cows	47%	42-51%
% Yearlings	11%	7-14%
% Calves	10%	8-12%
Adult Bulls per 100 Adult Cows	70	55-85
Yearlings per 100 Adult Cows	23	14-32
Calves per 100 Adult Cows	21	17-26
% 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 West-White Gold area during the most recent 5 years for which we have complete records (2008 to 2012) averaged about 21 moose per year (see graph below). This does not include harvest data from First Nation hunters. 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 this area. This is near the recommended maximum allowable harvest rate of 3-4% for this area. Harvest is especially high (about 7% harvest by licensed hunters) in the Game Management Subzone southeast of the confluence of the Yukon and Stewart rivers (GMS 3-13: see Map 1).

Harvest of Moose in the Lower Stewart R West - White Gold Area
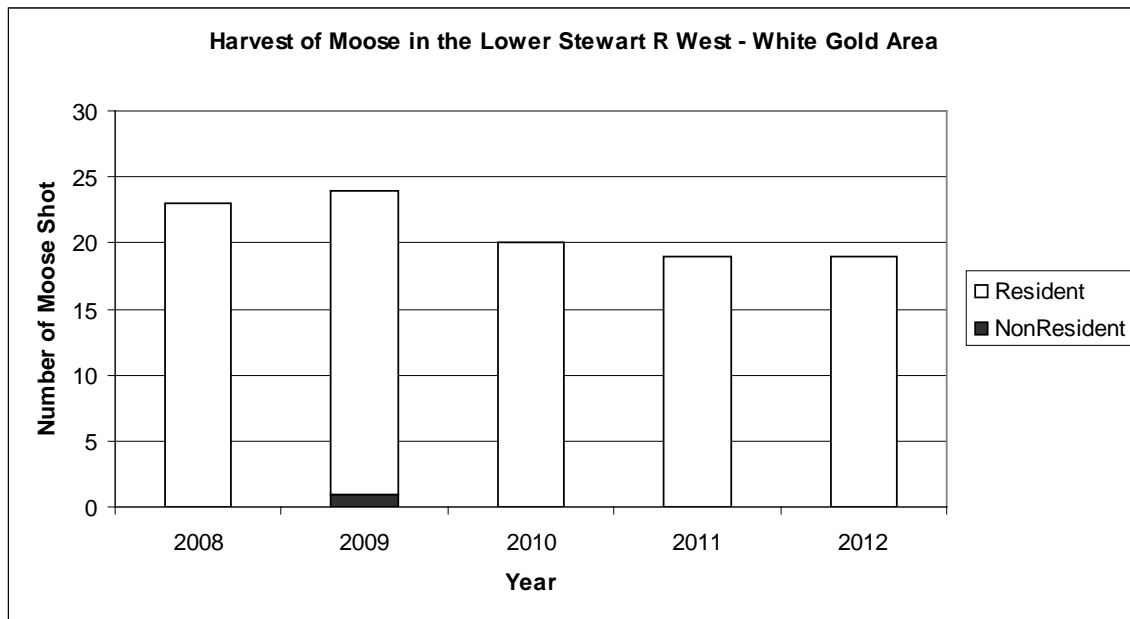
Other Wildlife Sightings

In addition to the 349 moose we counted during the 2012 census, we observed 154 moose outside of the blocks that were surveyed (these are included in Map 6).

During the survey, we also recorded other notable observations of wildlife besides moose. We saw 4 groups of caribou (71 animals) during the census, all to the north of Mount Maclennan, and caribou tracks along Home Creek to the White River. We also saw a group of more than 50 caribou and tracks in the Mount Maclennan area during our stratification flights. These caribou were outside the mapped core ranges of Yukon herds, but are likely part of either the Nelchina barren ground herd or the Chisana woodland herd.

We saw a buck and doe mule deer on the open south-facing slopes overlooking the Yukon River west of Fort Selkirk during the census, and another lone buck to the east when we stratified the survey area. We saw one pack of 8 wolves and a single wolf, all near the concentration of caribou near Mount Maclennan, and another single animal along Thistle Creek during the census. We also saw a single wolf near Canadian Creek during the stratification flights. Finally, we also observed a freshly dug grizzly bear den on the south-facing slopes over Canadian Creek, about 5 km from the proposed Casino mine.

Conclusions and Recommendations

- We estimate that there were about 1,147 moose in the survey area in the Lower Stewart River West-White Gold area in November 2012. The estimated density was about 170 moose per 1,000 km², which is slightly higher than the Yukon-wide average.

- There was fairly low survival of calves in this area during the summer and fall of 2012. Survival of calves born in 2011 (yearlings in this survey) was average. We would need more years of data to determine if long-term recruitment is adequate to maintain moose numbers in this area.

- The number of bulls in the survey area, compared to the number of cows, was healthy in this survey.

- Harvest of moose in this area is close to the maximum recommended allowable rate. Harvest in the area of the Stewart River's confluence with the Yukon River is especially high.

- Data on moose distribution from this survey can be used to identify post-rut concentrations and important early-winter habitats, for use in environmental assessments of mining projects.

- We should continue to closely monitor the status, total harvest, and distribution of the moose population in this area as development projects proceed, to develop mitigations aimed at avoiding negative impacts.

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