

# **CARMACKS WEST MOOSE MANAGEMENT UNIT SUMMARY OF EARLY-WINTER 2007 MOOSE SURVEY**

**30 NOVEMBER – 7 DECEMBER 2007**



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**30 November – 7 December 2007**

**Fish and Wildlife Branch  
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### SUMMARY

- ❖ We conducted an early-winter survey of moose in the area northwest of Carmacks on November 30-December 7, 2007, using a Bell 206 helicopter. 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 44% of the entire area, and found a total of 208 moose, of which 73 were adult bulls, 108 were adult and yearling cows, 5 were yearling bulls, and 22 were calves.
- ❖ We calculated a population estimate of  $520 \pm 21\%$  moose for the area, which is equal to a density of about 124 per 1,000 km<sup>2</sup> over the whole area, or 127 per 1,000 km<sup>2</sup> in suitable moose habitat. This is considerably higher than the estimated densities of 53 moose per 1,000 km<sup>2</sup> in suitable habitat calculated in the same survey area in 2003, and 45 per 1,000 km<sup>2</sup> in an overlapping area to the west in 1987. The low estimate in 2003, however, was likely biased due to poor survey conditions.
- ❖ We estimated that there were about 21 calves and 10 yearlings for every 100 adult cows in the survey area. This suggests that survival of young moose has been fairly low in this area during the past two years.
- ❖ We estimated that there were about 75 mature bulls for every 100 adult cows in the survey area, which is a healthy sex ratio.
- ❖ Harvest of moose in this area has been closed to licenced hunters since 1987 due to low moose numbers, but there is some harvest from First Nation hunters.

## INTRODUCTION

This report summarises the results of the early-winter survey of moose in the southeastern part of the Carmacks West Moose Management Unit (see Map 1), conducted on November 30-December 7, 2007. The main purposes of the survey were to estimate the abundance, distribution and population composition of the local moose population.

### Previous Surveys

The Yukon Fish and Wildlife Branch has previously conducted two other surveys of moose in the area northwest of Carmacks. The first was conducted in 1987 in an overlapping area to the west of this year's survey, in response to a new road and mine proposed at Casino Mountain (see Map 2; results in Markel & Larsen 1988). The second was a partially completed survey in 2003 in the same area as this year's count that had to end prematurely because of poor weather conditions (results in O'Donoghue, Ward, Fraser & Westover 2008).

Early winter is the best time of year to estimate abundance of moose because they concentrate 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 Carmacks and Pelly Crossing areas have consistently placed a high priority on monitoring the health of local moose populations. Concerns about low abundance of moose and our lack of recent information about moose populations in this area led to recommendations at Northern Tutchone May Gatherings that we conduct this survey. The 2004-2009 Community-based Fish and Wildlife Management Plan for the Little Salmon/Carmacks First Nation Traditional Territory also noted the low numbers of moose northwest of Carmacks. Selkirk First Nation co-funded the survey.

## STUDY AREA

The Carmacks West survey area was re-located in 2001 to cover the areas most accessible and used by hunters, and to conform to the boundaries of Yukon Moose Management Units. 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 Carmacks West Moose Management Unit is about 6,710 km<sup>2</sup>, and includes Game Management Sub-zones 522, 523, 524, and 526 (see Map 1). The survey area within this Moose Management Unit is about 4,206 km<sup>2</sup>. The border of the survey area follows the Klondike Highway in the east, the Yukon River and Wolverine Creek in the north, Klaza River, Lonely Creek, the Nisling River and Rowlinson Creek (west to east) in the south, and extends west almost to Prospector Mountain.

Most (about 4,081 km<sup>2</sup>) of the study area is considered suitable moose habitat, except for approximately 3% of the area, which includes large water bodies (0.5 km<sup>2</sup> or greater in size) and land over 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 Klaza, Nisling, and Yukon Rivers. Much of the area is forest-covered with black and white spruce, aspen, and lesser amounts of lodgepole pine and paper birch; balsam poplar also grows along the Yukon River. 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 and aspen on slopes. Many of the creek valleys have wide shrubby willow flats along them. Willow and dwarf birch shrub habitats, alpine tundra, and unvegetated rocky areas typify the higher plateaus scattered throughout the study area, especially in the mountainous area in the southwestern and western parts (including Victoria Mountain, Mount Nansen, Klaza Mountain, and Mount Pitts) of the survey area. The most recent forest fires have occurred in the northern and west-central parts of the study area; the largest were two that burned a combined total of about 798 km<sup>2</sup> in 1994 and 1995, and another that covered 160 km<sup>2</sup> in 2004 (see Map 3).

The survey area has abundant roads, trails, and cut lines associated with past and present mining activities throughout most of the area. The Nansen and Freegold roads and their spurs are all regularly used by miners, hunters, and others.

## METHODS

We have adopted a relatively new survey technique to survey moose, developed by Jay Ver Hoef with 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 square rather than irregularly shaped survey units. The technique involves six steps:

1. The survey area is divided into uniform rectangular blocks 15-16 km<sup>2</sup> 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.
4. We try to count every moose within the selected blocks (the “census” part of our survey) using helicopters. 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 based on the number of yearling bulls we saw.
5. We repeat our counts at double the search intensity in a portion of our survey blocks to estimate the number of moose that we missed at our typical search intensity.
6. We estimate the total number of moose by age and sex in the entire survey area based on the numbers of moose we see in the blocks during the census, the distribution of these blocks; how we classified the blocks we didn’t count, and the “sightability correction factor” to account for moose that we overlooked. 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

Overall, the weather and snow conditions were good for this survey. Temperatures ranged from -10°C to -40°C, and skies were

mostly clear. We encountered strong winds (up to 130 km per hour) on some days, but they were generally more moderate the majority of the survey period. We were able to fly on all days, although we had to work around low-hanging fog in some valleys, especially along the Yukon River. Light conditions were mostly bright and snow coverage was complete, so visibility was good for spotting moose.

## **RESULTS AND DISCUSSION**

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

We used the results of the stratification survey done in 2003 to classify the survey blocks by expected density of moose. Before starting the census, however, we flew over the survey blocks in the 2004 burned area (see Map 3) to check to see if our 2003 classifications were still valid.

We classified 74 (28%) of the 262 survey blocks as high, 43 (16%) as medium, 36 (14%) as low, and 109 (42%) 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 subalpine areas in the Dawson Range in the southwestern part of the survey area and in the partially burned hilly areas in the northwest. For the purpose of selecting blocks for the census, we grouped the blocks classified as expected high and medium numbers of moose into a High stratum with 117 blocks, and considered the 145 blocks with low and very low expected numbers of moose to make up the Low stratum.

### **Coverage**

We counted moose in 116 of the 262 blocks (see Map 5). We initially randomly selected 60 blocks to survey—36 from the High stratum and 24 from the Low. After completing the count in 55 of these blocks on 3 December, however, the precision of our population estimate was still fairly low, so we randomly selected and continued to survey more blocks—in all, 43 High and 73 Low-stratum blocks were selected—to get a more precise estimate. It took us about 61.9 hours to count moose in these blocks, for a search intensity of 1.99 minutes per km<sup>2</sup>—survey intensity was about the same in low-abundance (2.01 minutes per km<sup>2</sup>) and high-abundance (1.97 minutes per km<sup>2</sup>) blocks. We needed an additional 6.9 hours to recount portions of some survey blocks to calculate our sightability correction factor. Another 22.3 hours was used in ferrying between survey blocks, to remote fuel caches at Minto and near Mount Nansen, and back and forth to Carmacks.

## Observations of Moose

We counted a total of 208 moose, 73 of them adult bulls, 108 adult and yearling cows, 5 yearling bulls and 22 calves (see Table 1). We observed an average of 153 moose for every 1,000 km<sup>2</sup> in the high-abundance blocks, and 87 moose per 1,000 km<sup>2</sup> in the low blocks.

**Table 1. Observations of moose during the November-December 2007 survey in the Carmacks West Moose Management Unit.**

	High Blocks	Low Blocks	Total
Number of Blocks Counted	43	73	116
Number of Adult Bulls Observed	45	28	73
Number of Adult and Yearling Cows Observed*	49	59	108
Number of Yearling Bulls Observed	3	2	5
Number of Calves Observed	9	13	22

\* 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.

## Distribution and Abundance of Moose

Moose were widely distributed in the survey area, 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 the most moose in them. We saw few moose in forested and recently burned lowlands and lower-elevation slopes.

**Table 2. Estimated abundance of moose in the Carmacks West Moose Management Unit survey area in November-December 2007.**

	Best Estimate ± 90% Confidence Interval*	Estimates within 90% Confidence Interval*
Estimated Total Number of Moose	520 ± 21%	412-628
Adult Bulls	189 ± 27%	138-240
Adult Cows	253 ± 22%	197-308
Yearlings	26 ± 59%	11-41
Calves	53 ± 32%	36-70
Density of Moose (per 1,000 km <sup>2</sup> )		
Whole Area	124	
Moose Habitat Only**	127	

\* 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 in the middle of this range.

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

The estimated number of moose in the whole survey area, based on our census counts, is 520 ± 21% (see Table 2). This includes a correction for moose missed during the census of 6%, as calculated from our repeated searches of selected areas at double our usual search intensity.

The estimated density of moose in the entire survey area is 124 per 1,000 km<sup>2</sup>, or 127 per 1,000 km<sup>2</sup> of suitable moose habitat (see Table 2). This is lower than the current Yukon-wide average of 158 moose per 1,000 km<sup>2</sup>, but considerably higher than the estimated densities of 53 moose per 1,000 km<sup>2</sup> in suitable habitat calculated in the same survey area in 2003, and 45 per 1,000 km<sup>2</sup> in the overlapping area (see Map 2) to the west in 1987. The 2003 estimate was likely biased low because of poor survey conditions, so we cannot interpret the difference in population estimates as an increase between 2003 and 2007. We can

compare abundance of moose seen in the overlap area between the 1987 and 2007 surveys to discern changes among years. Only 4 moose (all bulls) were seen in the 11 “sample units” (survey “blocks” were irregularly-shaped in 1987) counted in the overlap area in the 1987 survey, resulting in a population estimate of only  $19 \pm 128\%$  moose. In 2007, 58 moose were seen in 23 survey blocks in the overlap area, and the population estimate is  $181 \pm 30\%$  moose. Despite limited sample sizes and the low precision of the 1987 estimate, it does appear that moose numbers have increased in the overlap area since 1987.

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

Calf survival to the early winter was fairly low in 2007 in the survey area. Based on our survey results, there were an estimated 21 calves for every 100 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 10% of the population in 2007. Nine percent of cow-calf groups contained twins.

The estimated percentage of yearlings in the population—5%—was also fairly low (see Table 3). There were an estimated 10 yearlings per 100 adult cows, or about 6 per 100 adults. Depending on mortality rates, about 10-20 yearlings per 100 adults are required for maintaining stable populations (Yukon Fish & Wildlife Branch 1996).

We estimate that there were 75 mature bulls for every 100 adult cows in the survey area (see Table 3). This is slightly higher than the current Yukon-wide average of 67 bulls per 100 cows in areas that have been surveyed, and well above the minimum level of 30 bulls per 100 cows below which we become concerned that substantial numbers of cows might not be bred (Yukon Fish & Wildlife Branch 1996). More bulls than cows were seen in the 2003 survey in this same area, and in the 1987 survey in the overlapping area to the west, but sample sizes in both previous surveys were low.

**Table 3. Estimated composition of the moose population in the Carmacks West Moose Management Unit survey area in November-December 2007.**

	Best Estimate	Estimates within 90% Confidence Interval*
% Adult Bulls	36%	31-42%
% Adult Cows	49%	44-54%
% Yearlings	5%	2-8%
% Calves	10%	8-12%
Bulls per 100 Adult Cows	75	56-93
Yearlings per 100 Adult Cows	10	4-16
Calves per 100 Adult Cows	21	16-26
% of Cow-Calf Groups with Twins	9%	1-18%

\* 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 in the middle of this range.

## Harvest

Harvest of moose by licenced hunters has been closed in the Carmacks West Moose Management Unit since 1987 because of very low densities of moose found during that survey. There is some harvest of moose in this area by First Nation hunters, but total harvest is thought to be quite low based on harvest surveys conducted by the Little Salmon/Carmacks and Selkirk First Nations. Given the higher densities of moose observed in this survey, a limited harvest in this area may be sustainable, but it would need to be carefully managed and planned because of the easy and increasing access provided by mining roads and trails.

**Other Wildlife Sightings**

During the moose survey, we recorded sightings of moose seen outside of our survey blocks, and other notable observations of mammals and birds. We recorded 26 moose—4 adult bulls, 9 cows, 1 yearling bull, 2 calves, and 10 unclassified—outside of blocks we were counting. We saw 100 caribou in the western part of the survey area, mostly in the subalpine ridges from Mount Pitts in the north to Klaza Mountain in the south; there were also caribou tracks in the Mount Nansen area and along the Nansen Road to the east. One mule deer and numerous deer tracks were seen on open ridges overlooking the Yukon River and near Carmacks. We also saw 9 wolves, 2 wolverines, 2 coyotes, 3 lynx, 3 red foxes, 2 bald eagles, and 1 snowy owl.

### **CONCLUSIONS AND RECOMMENDATIONS**

- ❖ We estimate that there are about 520 moose in the survey area in the Carmacks West Moose Management Area. The estimated density is about 127 per 1,000 km<sup>2</sup> of suitable moose habitat, which is lower than the Yukon-wide average but higher than estimates made in and near the same area in 1987 and 2003.
- ❖ There was fairly low survival of calves in this area during the summer and fall of 2007. Survival of calves born in 2006 (yearlings in this survey) apparently was also quite low. 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 Carmacks West Moose Management Unit.
- ❖ The number of mature bulls in the survey area, compared to the number of adult cows, appears to be healthy.
- ❖ Harvest of moose in the Carmacks West Moose Management Unit is presently closed to resident hunters. These survey results suggest that a closely managed sustainable harvest may be possible, but the high amount of access and industrial activity in this area dictate that caution will be needed in opening the area.
- ❖ We should continue discussions with affected First Nations and Renewable Resources Councils about options for managing harvest of moose in this area.
- ❖ We should gather information about recruitment rates of moose in this area from ground-based or low-intensity aerial monitoring.

## **Acknowledgments**

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- Yukon Fish & Wildlife Branch. 1996. Moose management guidelines. Yukon Fish & Wildlife Branch.

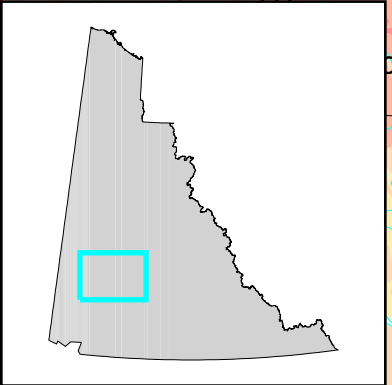
## **MAPS**

Map 1  
2007 Moose Survey Area  
Carmacks West Moose Management Unit

Scale 1:1,000,000

Albers Equal Area projection (standard parallels: 61°40'N & 66°00'N)

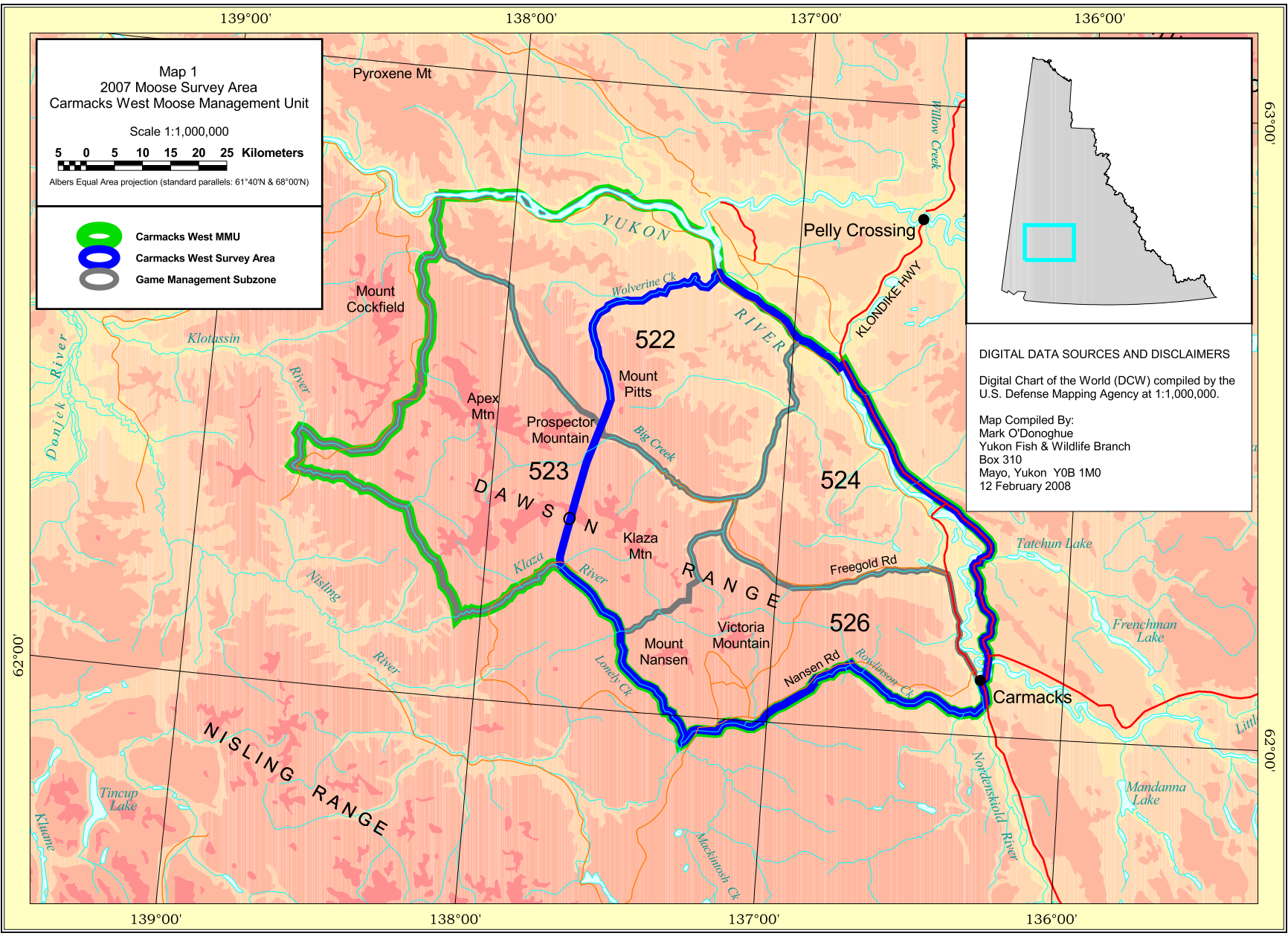
- Carmacks West MMU
- Carmacks West Survey Area
- Game Management Subzone



DIGITAL DATA SOURCES AND DISCLAIMERS

Digital Chart of the World (DCW) compiled by the U.S. Defense Mapping Agency at 1:1,000,000.

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12 February 2008



Map 2  
 Previous Moose Surveys in the  
 Carmacks West Moose Management Unit

Scale 1:1,000,000

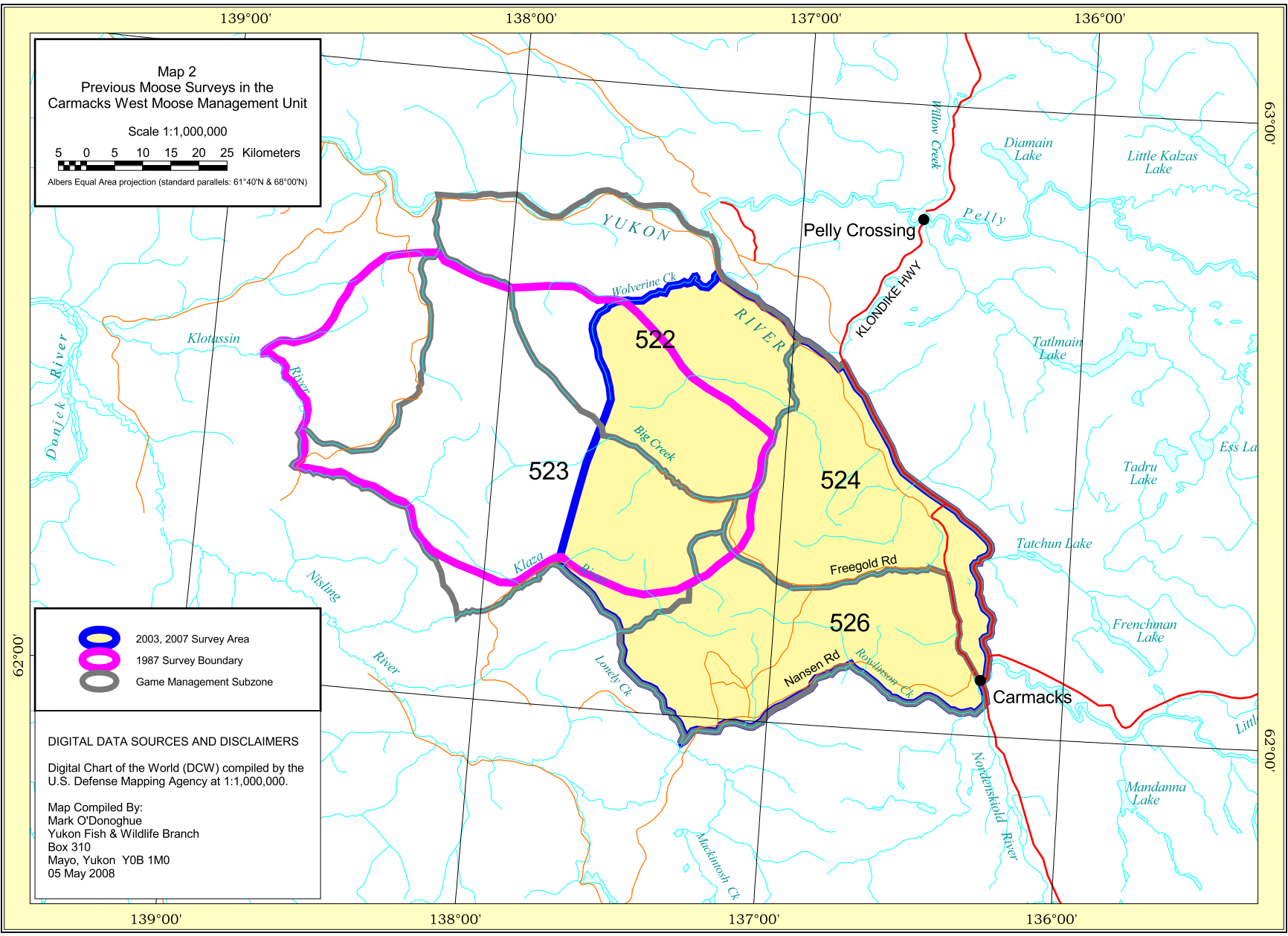
Albers Equal Area projection (standard parallels: 61°40'N & 68°00'N)

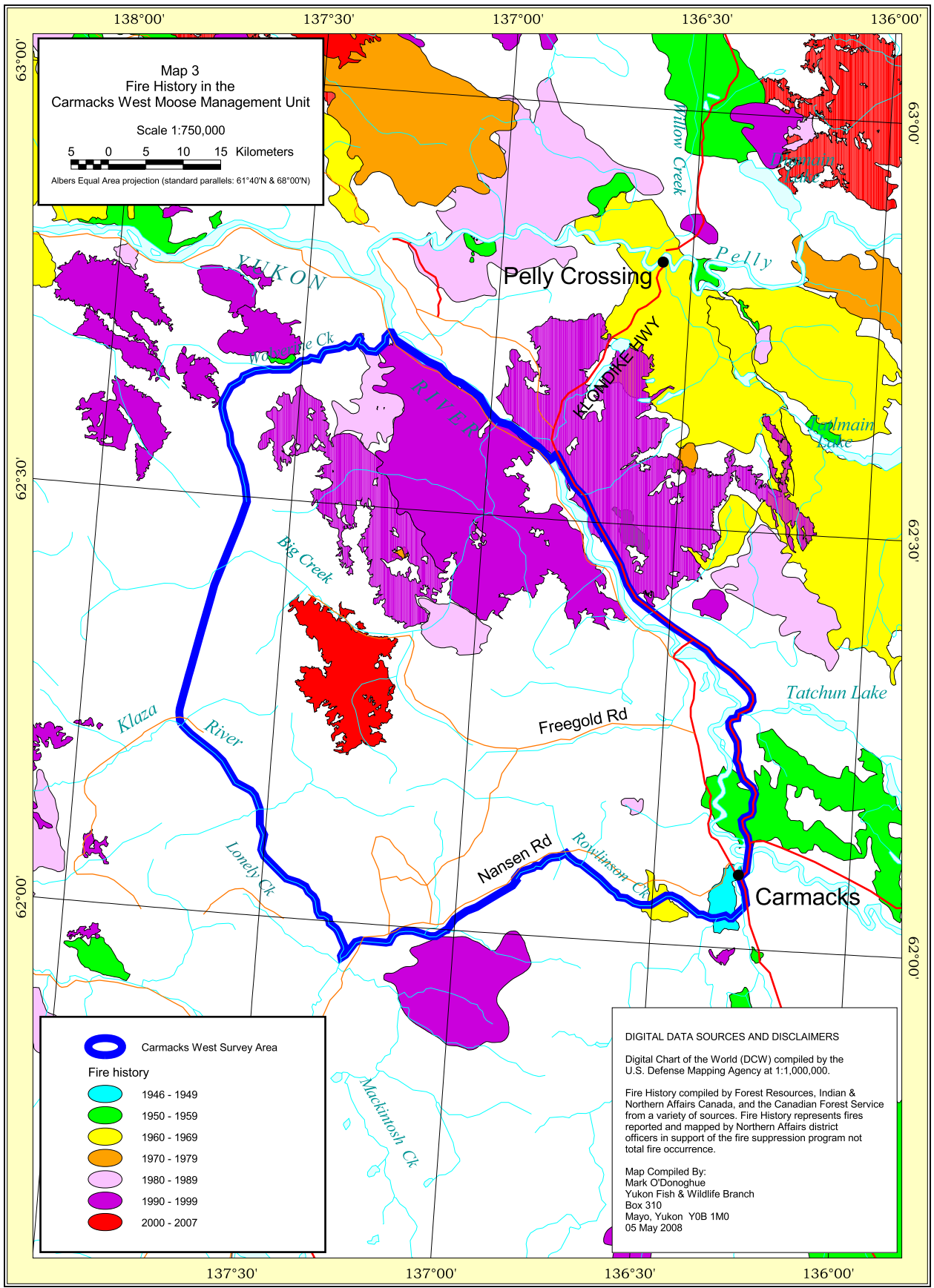
2003, 2007 Survey Area  
 1987 Survey Boundary  
 Game Management Subzone

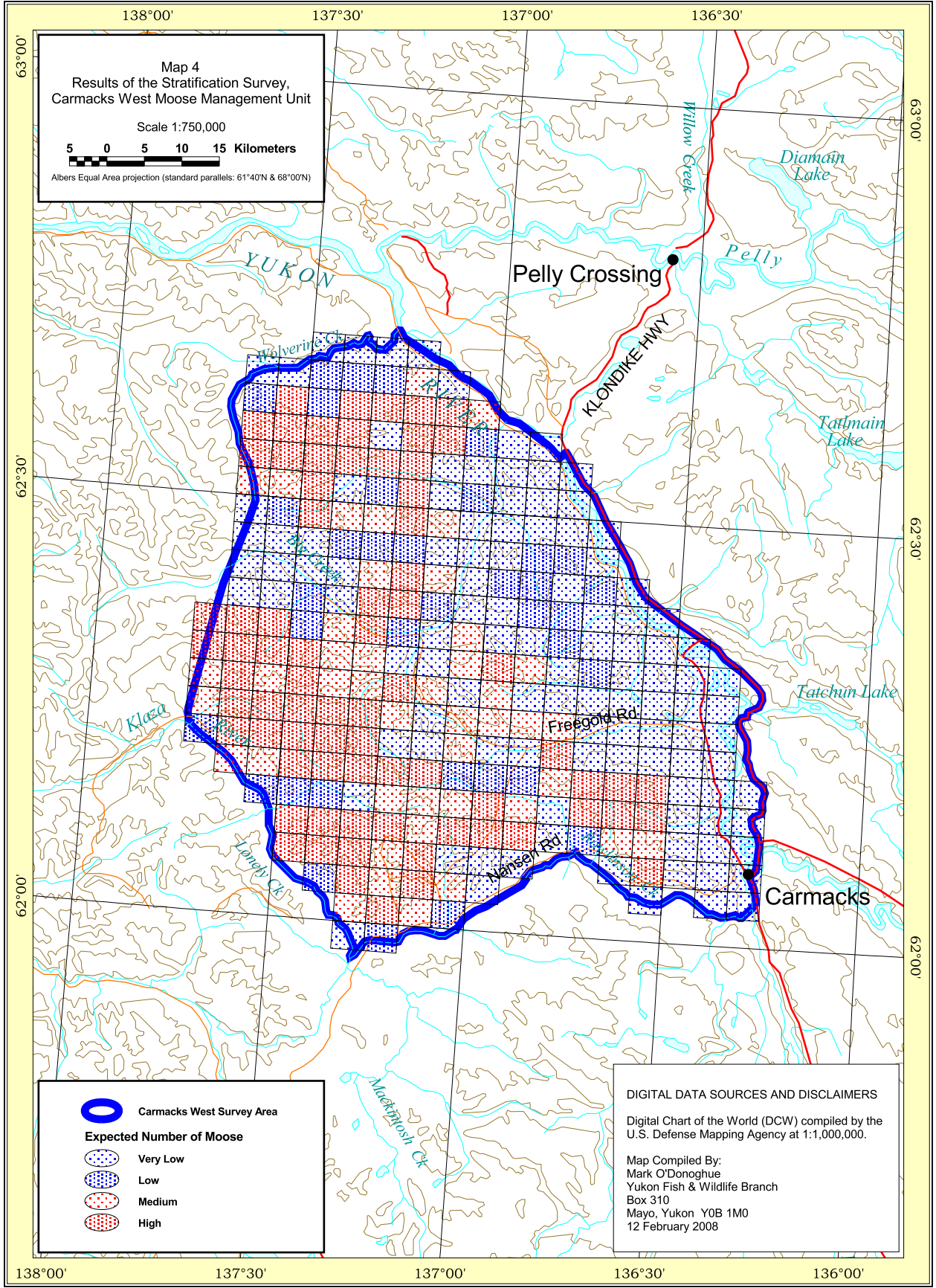
DIGITAL DATA SOURCES AND DISCLAIMERS

Digital Chart of the World (DCW) compiled by the U.S. Defense Mapping Agency at 1:1,000,000.

Map Compiled By:  
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 05 May 2008







Map 4  
 Results of the Stratification Survey,  
 Carmacks West Moose Management Unit

Scale 1:750,000

5 0 5 10 15 Kilometers

Albers Equal Area projection (standard parallels: 61°40'N & 68°00'N)

**Carmacks West Survey Area**

**Expected Number of Moose**

- Very Low
- Low
- Medium
- High

**DIGITAL DATA SOURCES AND DISCLAIMERS**

Digital Chart of the World (DCW) compiled by the U.S. Defense Mapping Agency at 1:1,000,000.

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