Nordenskiold River
Moose Management Unit

Summary of Early-Winter 2009 Moose Survey

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NORDENSKIOLD RIVER
MOOSE MANAGEMENT UNIT

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Acknowledgements

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SUMMARY

We conducted an early-winter survey of moose in the area southwest of Carmacks in the lower Nordenskiold River watershed on 12-19 November, 2009, using Bell 206 helicopters. This was the first count of moose in this area. 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 40% of the entire area, and found a total of 169 moose, of which 39 were adult bulls, 97 were adult and yearling cows, 4 were yearling bulls, and 29 were calves.

We calculated a population estimate of 299 ± 20% moose for the area, which is equal to a density of about 92 per 1,000 km² over the whole area, or 93 per 1,000 km² in suitable moose habitat. These density estimates are considerably lower than the Yukon average of about 160 per 1,000 km².

We estimated that there were about 32 calves and 7 yearlings for every 100 adult cows in the survey area. This suggests that survival of young moose was good this year, but was fairly low for calves born in this area last year.

We estimated that there were about 36 mature bulls for every 100 adult cows in the survey area, which is near the minimum acceptable sex ratio to ensure that all cows get bred during rutting season.

Relatively few moose are reported harvested annually in this area but, given the low densities of moose, overall harvest levels are presently near the upper sustainable level.

INTRODUCTION

This report summarises the results of the early-winter survey of moose in the Nordenskiold River Moose Management Unit (see Map 1), conducted on 12-19 November 2009. The main purposes of the survey were to estimate the abundance, distribution and population composition of the local moose population.

Previous Surveys

While this was the first full early-winter census of moose in the Nordenskiold River Moose Management Unit, there have been two other lower intensity surveys of moose in this area. In November 2005, the same survey area was overflown at a low intensity (about 0.17 minutes

per km²) to divide it into survey blocks of high and low expected numbers of moose in preparation for a planned census (results in O'Donoghue & Fraser 2009). This "stratification" part of the survey was completed, but the subsequent planned census of the area could not be conducted because of poor snow and weather conditions. In March 2009, the survey area was covered in an "intensive stratification" survey, in which the area was overflown at a higher intensity of 0.49 minutes per km² to map late-winter distribution (results in O'Donoghue & Bellmore 2009).

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 area 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 a recommendation that we conduct this survey in the 2004-2009 Community-based Fish and Wildlife Management Plan for the Little Salmon/Carmacks First Nation Traditional Territory. Community members participated in this survey as observers on all of the flights, and Little Salmon/Carmacks First Nation funded involvement of staff of its Lands and Resources Department in the survey.

STUDY AREA

The Nordenskiold River survey area was delineated in 2001 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 Nordenskiold River Moose Management Unit is about 3,235 km², and includes Game Management Sub-zones 543 and 544 (see Map 1). The survey area covers the whole moose management unit. The border of the survey area follows Rowlinson Creek and headwaters of the Nisling River in the north, Mackintosh Creek and headwaters of Kirkland Creek in the west, Klusha Creek in the south, and the Klondike Highway in the east.

Most (about 3,210 km²) of the study area is considered suitable moose habitat, but approximately 1% of the area is made up of large water bodies (0.5 km² or greater in size) and land over 1,524 m (5,000 feet) in altitude which are not considered moose habitat. The study area consists mostly of rolling hills and plateaus dissected by numerous creeks, many with steep canyons, in the drainage of the Nordenskiold River. Much of the area is forest-covered with black and white spruce, aspen, and lesser amounts of lodgepole pine and paper birch. Forest cover varies from dense mature white spruce and aspen in the main river and creek valleys, to dense black spruce in many lowlands, to more open scrubby spruce on slopes. Willow and dwarf birch shrub habitats and alpine tundra typify the higher plateaus, mostly in the western part of the study area. There are extensive wetlands along the lower Nordenskiold River and Klusha Creek on the eastern border of the survey area. Forest cover in parts of the survey area has burned during the past 50 years (see Map 2). The most recent forest fires occurred in the western part of the study area in 2009, 1995, and 1996, covering about 540 km². Large parts of the southeastern and southern survey area burned in 1958 and are now mostly forested again with dense aspen, spruce, and pine.

The survey area has access from the Klondike Highway in the east and off of the Mount Nansen road in the north. There are also numerous mining exploration roads in the southern part of the survey area and an expanding network of trails used mostly by bison hunters in winter.

METHODS

We have adopted a relatively new 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 rectangular rather than irregularly shaped survey units. The technique involves six steps:

The survey area is divided into uniform rectangular blocks about 16 km² in size.

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.

We combine these categories of blocks into high and low "strata", and then randomly select a sample of each stratum for our census.

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 by assuming it equals the number of yearling bulls we saw.

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 regular search intensity. We use these double counts to develop a "sightability correction factor" to correct the census results for moose that we overlooked.

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. 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 mixed for this survey. Temperatures ranged from -22°C to -2°C, and skies were mostly clear on five days and cloudy on the others. Low clouds and snow prevented us from flying on one morning and forced us to stop early on two days, once before getting any counting of moose done. We encountered strong winds on some days, but they were generally moderate during the majority of the survey period. 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 our 2005 stratification survey to classify the survey blocks by expected density of moose. Before starting the census, however, we flew over the survey blocks burned in a 2009 fire (see Map 2) to confirm that our 2005 classifications were still valid.

We classified 31 (16%) of the 198 survey blocks as high, 56 (28%) as medium, 12 (6%) as low, and 99 (50%) as very low expected abundance of moose (see Map 3), based on our observations from the air. Most of the blocks with higher expected numbers of moose were located

in the subalpine and hilly open forested areas in the western part of the survey area. For the purpose of selecting blocks for the census, we grouped the 87 blocks expected to have high and medium numbers of moose into a High stratum, and the 111 blocks with low and very low expected numbers of moose into the Low stratum.

Coverage

We counted moose in 80 of the 198 blocks (see Map 4). We initially randomly selected 61 blocks to survey—36 from the High stratum and 25 from the Low. After completing the count in these blocks on 16 November, however, the precision of our population estimate was still fairly low, so we randomly selected and continued to survey more blocks—in all, 55 High and 25 Low-stratum blocks were selected—to get a more precise estimate. It took us about 43.5 hours to count moose in these blocks, for a search intensity of 2.00 minutes per km². Survey intensity was about the same in low-abundance (2.03 minutes per km²) and high-abundance (1.98 minutes per km²) blocks. We needed an additional 6.3 hours to recount portions of 24 survey blocks (at an intensity of 3.84 minutes per km²) to calculate our sightability correction factor. Another 20.0 hours was used in ferrying between survey blocks, to remote fuel caches at Braeburn and near Mount Nansen, and back and forth to Carmacks. Survey costs are summarised in the Appendix.

Observations of Moose

We counted a total of 169 moose, 39 of them adult bulls, 97 adult and yearling cows, 4 yearling bulls and 29 calves (see Table 1). We observed an average of 176 moose for every 1,000 km² in the high-abundance blocks, and 27 moose per 1,000 km² in the low abundance blocks.

Table 1. Observations of moose during the November 2009 survey in the Nordenskiold River Management Unit.

	High Blocks	Low Blocks	Total
Number of Blocks Counted	55	25	80
Number of Adult Bulls Observed	39	0	39
Number of Adult and Yearling Cows Observed*	89	8	97
Number of Yearling Bulls Observed	4	0	4
Number of Calves Observed	26	3	29

* 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, with the highest numbers in the western part of the survey area (see Maps 4 and 5). As expected for the early winter, subalpine willow habitats and creek draws with abundant willows generally had the most moose in them. We saw few moose in forested and recently burned lowlands, in the Nordenskiold River valley, or on lower-elevation slopes.

Table 2. Estimated abundance of moose in the Nordenskiold River Moose Management Unit survey area in November 2009.

	Best Estimate ± 90% Confidence Interval*	Estimates within 90% Confidence Interval*
Estimated Total Number of Moose	299 ± 20%	239-359
Adult Bulls	62 ± 26%	46-78
Adult Cows	170 ± 24%	130-210
Yearlings	13 ± 51%	6-19
Calves	55 ± 31%	38-71
Density of Moose (per 1,000 km2)		
Whole Area	92	
Moose Habitat Only**	93	

* 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 of 1,524 m (5,000 ft) or lower, including water bodies less than 0.5 km2 in size.

The estimated number of moose in the whole survey area, based on our census counts, is 299 ± 20% (see Table 2). Our repeated searches of selected areas at double our usual search intensity suggested that we did not miss any moose in the blocks that we counted, so we did not need to correct this population estimate for sightability.

The estimated density of moose in the entire survey area is 92 per 1,000 km², or 93 per 1,000 km² of suitable moose habitat (see Table 2). This is lower than the current Yukon-wide average of 158 moose per 1,000 km², and considerably lower than our previous estimate based on habitat quality in this area of 170 moose per 1,000 km² of suitable habitat.

Ages and Sexes of Moose

Calf survival to the early winter was fairly good in 2009 in the survey area. Based on our survey results, there were an estimated 32 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 18% of the population in 2009. Twenty-one percent of cow-calf groups contained twins, which is quite high by Yukon standards.

The estimated percentage of yearlings in the population—4%—was low (see Table 3). There were an estimated 7 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 moose populations (Yukon Fish & Wildlife Branch 1996).

We estimate that there were only 36 mature bulls for every 100 adult cows in the survey area (see Table 3). This is considerably lower than the current Yukon-wide average of 67 bulls per 100 cows in areas that have been surveyed, and close to the minimum level of 30 bulls per 100 cows needed to ensure that all adult cows are bred (Yukon Fish & Wildlife Branch 1996).

Table 3. Estimated composition of the moose population in the Nordenskiold River Moose Management Unit survey area in November 2009.

	Best Estimate	Estimates within 90% Confidence Interval*
% Adult Bulls	21%	16-25%
% Adult Cows	57%	53-61%
% Yearlings	4%	2-6%
% Calves	18%	14-22%
Bulls per 100 Adult Cows	36	27-45
Yearlings per 100 Adult Cows	7	3-12
Calves per 100 Adult Cows	32	24-40
% of Cow-Calf Groups with Twins	21%	11-32%

* 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

The reported harvest of moose by licensed hunters in the Nordenskiold River Moose Management Unit, during the last 5 years for which we have complete records (2004 to 2008), averaged about 6 moose per year (see Figure 1). With estimated annual First Nation harvest and our latest estimates of moose density, we estimate that the annual harvest is presently about 3% of the total moose population in the Nordenskiold River Moose Management Unit, which is the recommended maximum allowable harvest rate for this area. The low percentage of bulls that we observed during this survey may be partly due to harvest, but the overall numbers harvested per year are still quite low and there is limited access

into most of the survey area. It seems unlikely that harvest is the main factor behind the low overall density of moose and the low proportion of bulls.

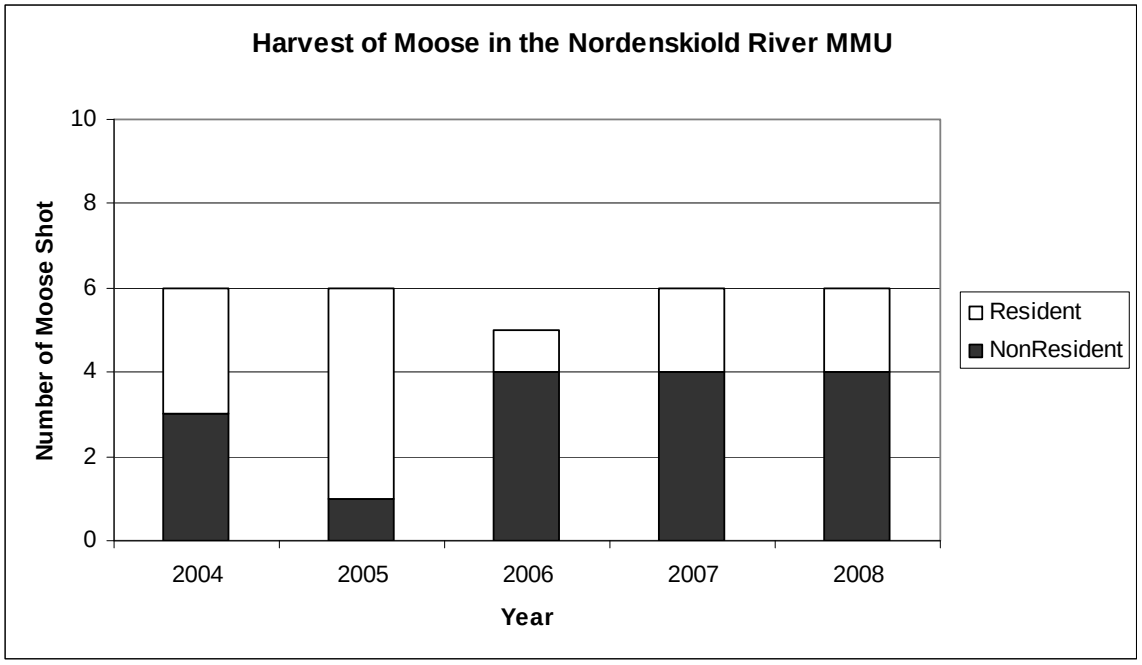

Figure 1. Harvest of Moose in the Nordenskiold River MMU.

Other Wildlife Sightings

During the moose census, we recorded sightings of moose seen outside of our survey blocks, and notable observations of other mammals and birds. We recorded 72 moose—9 adult bulls, 42 cows, 5 yearling bulls, 7 calves, and 9 unclassified—outside of blocks we were counting (locations are mapped along with those inside survey blocks on Map 5; locations for 8 moose were not recorded). We saw 273 caribou distributed throughout the northern half of the survey area and 135 bison, mostly concentrated along the Nordenskiold River and Kirkland Creek valleys (see Map 6). Other observations included 22 elk (17 in one group just southeast of Braeburn), 3 mule deer, 1 wild horse, 18 wolves in 3 packs, 1 wolverine, and 1 red fox (see Map 6).

CONCLUSIONS AND RECOMMENDATIONS

We estimate that there are about 300 moose in the survey area in the Nordenskiold River Moose Management Area. The estimated density is about 93 moose per 1,000 km2 of suitable habitat, which is lower than the Yukon-wide average.

There was fairly good survival of calves in this area during the summer and fall of 2009. Survival of calves born in 2008 (yearlings in this survey), however, was apparently 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 Nordenskiold River Moose Management Unit.

The number of mature bulls in the survey area, compared to the number of adult cows, is low.

Relatively few moose are harvested each year in the Nordenskiold River Moose Management Unit but, given the low numbers of moose in the area, 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 Resources Councils.

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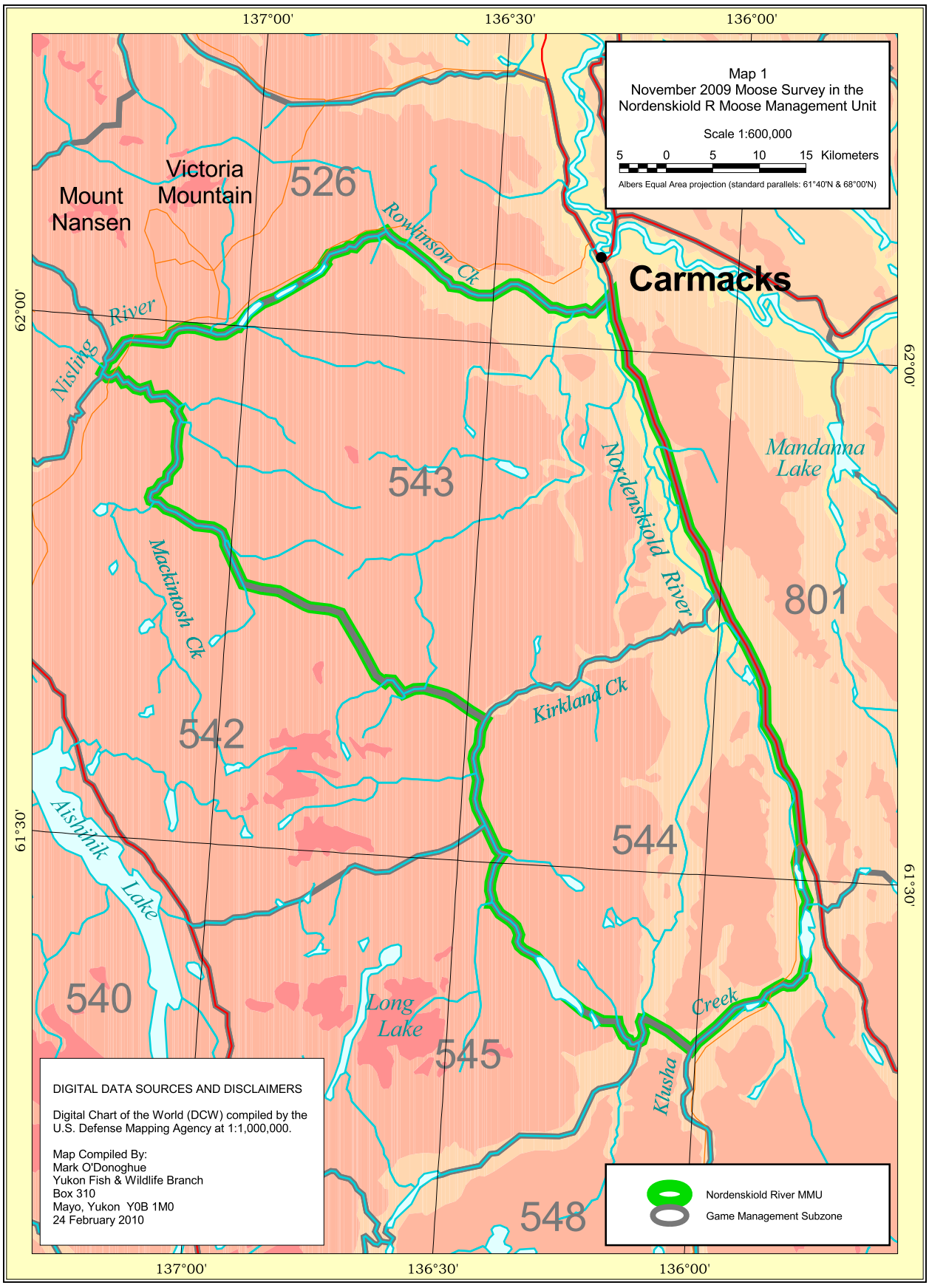
Maps



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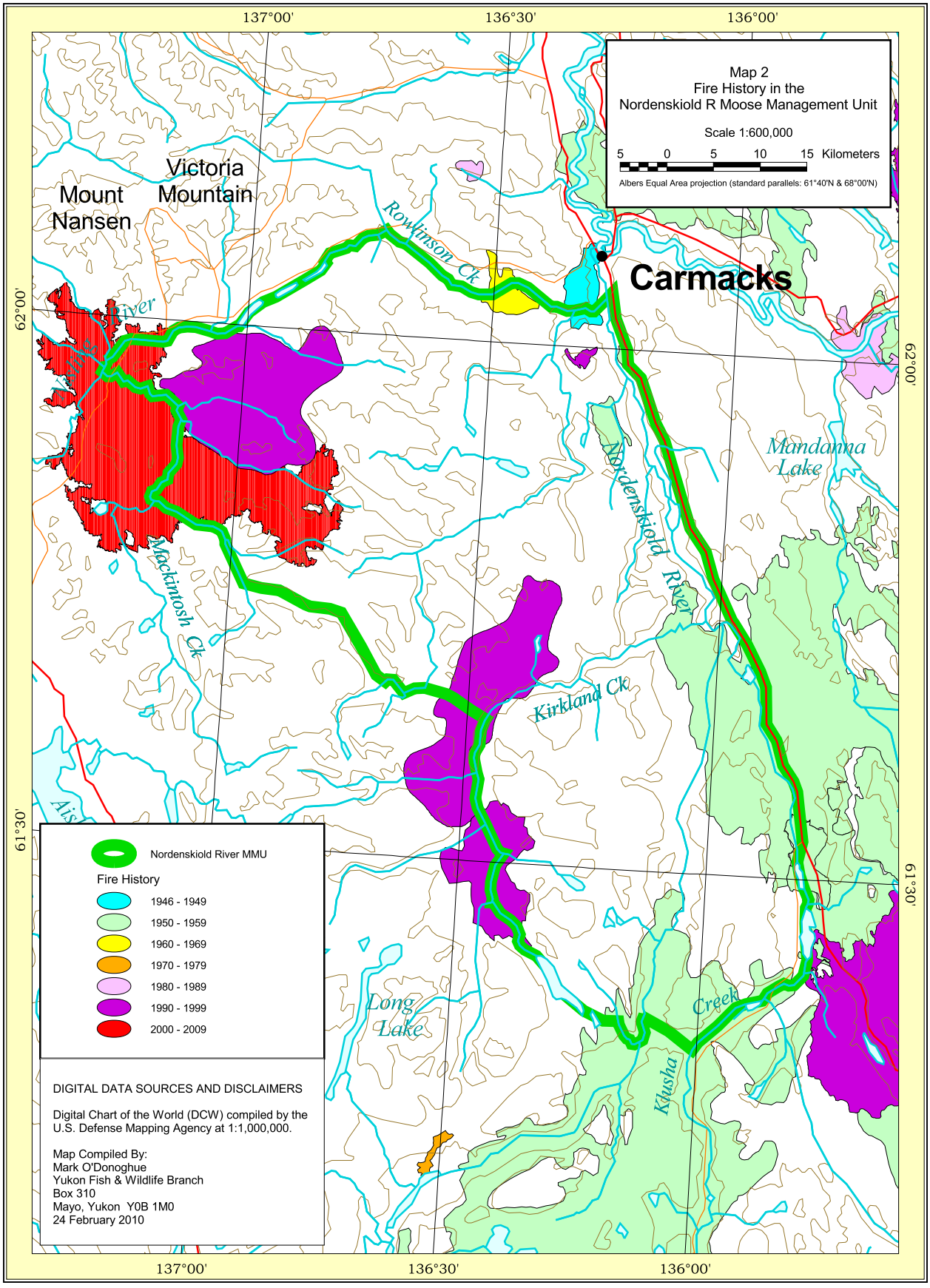
Map 2
Fire History in the
Nordenskiold R Moose Management Unit
Scale 1:600,000
5 0 5 10 15 Kilometers
Albers Equal Area projection (standard parallels: 61°40'N & 68°00'N)
137°00'
136°30'
136°00'
62°00'
61°30'
Mount Nansen
Victoria Mountain
Rowlinson Ck
Carmacks
Mandanna Lake
Nordenskiold River
Mackintosh Ck
Kirkland Ck
Long Lake
Khusha Creek
Nordenskiold River MMU
Fire History
1946 - 1949
1950 - 1959
1960 - 1969
1970 - 1979
1980 - 1989
1990 - 1999
2000 - 2009
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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24 February 2010
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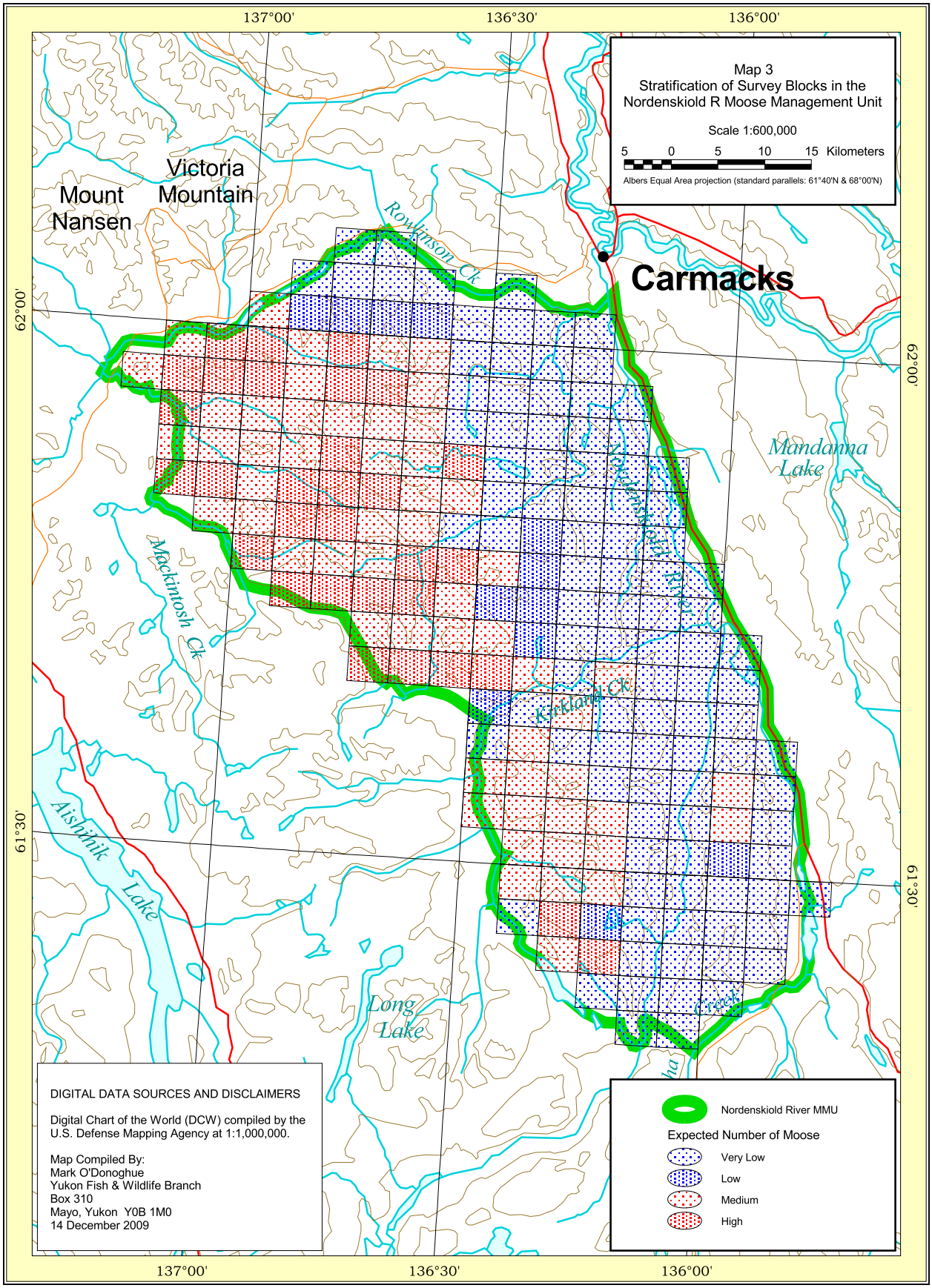

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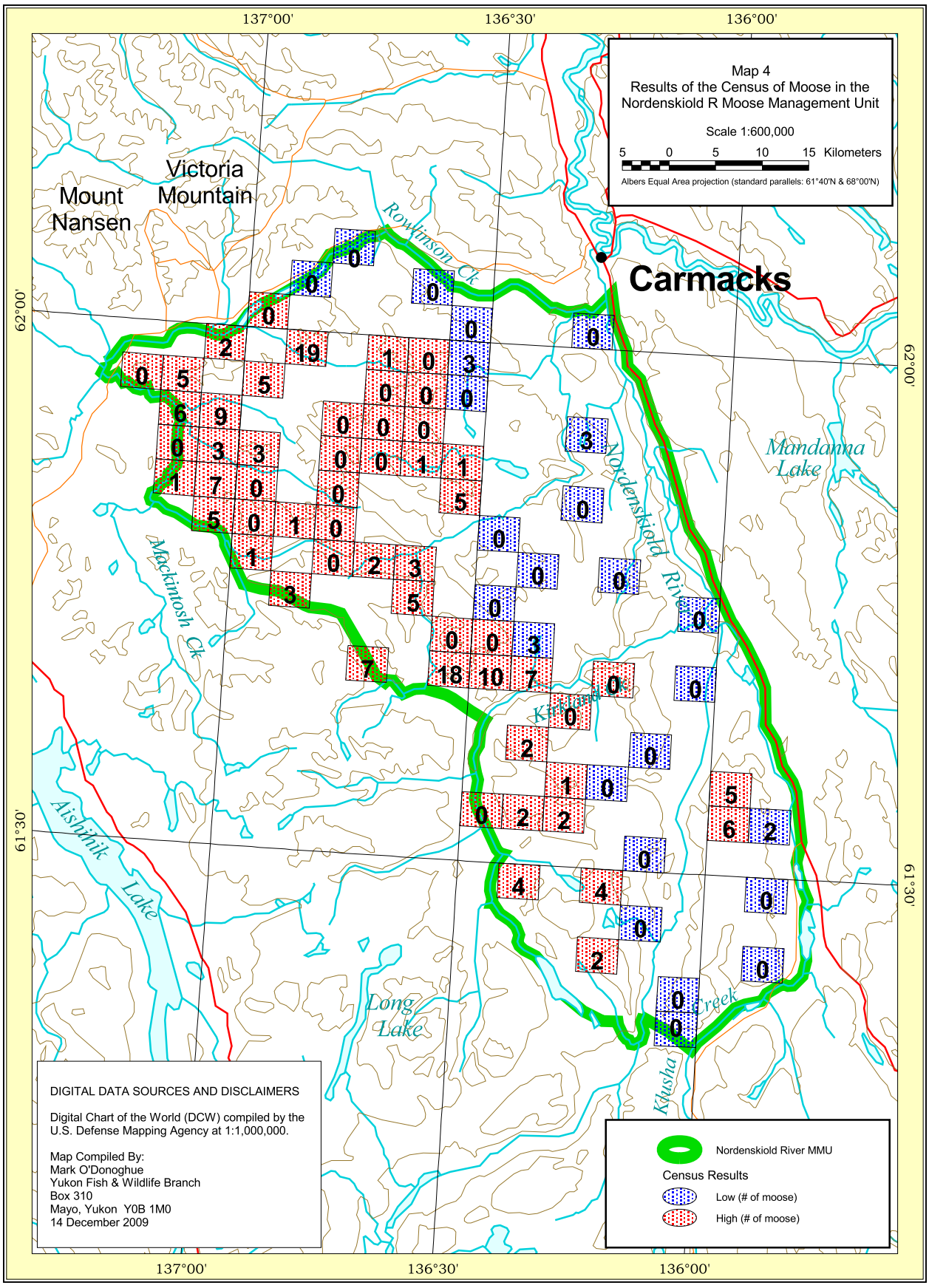

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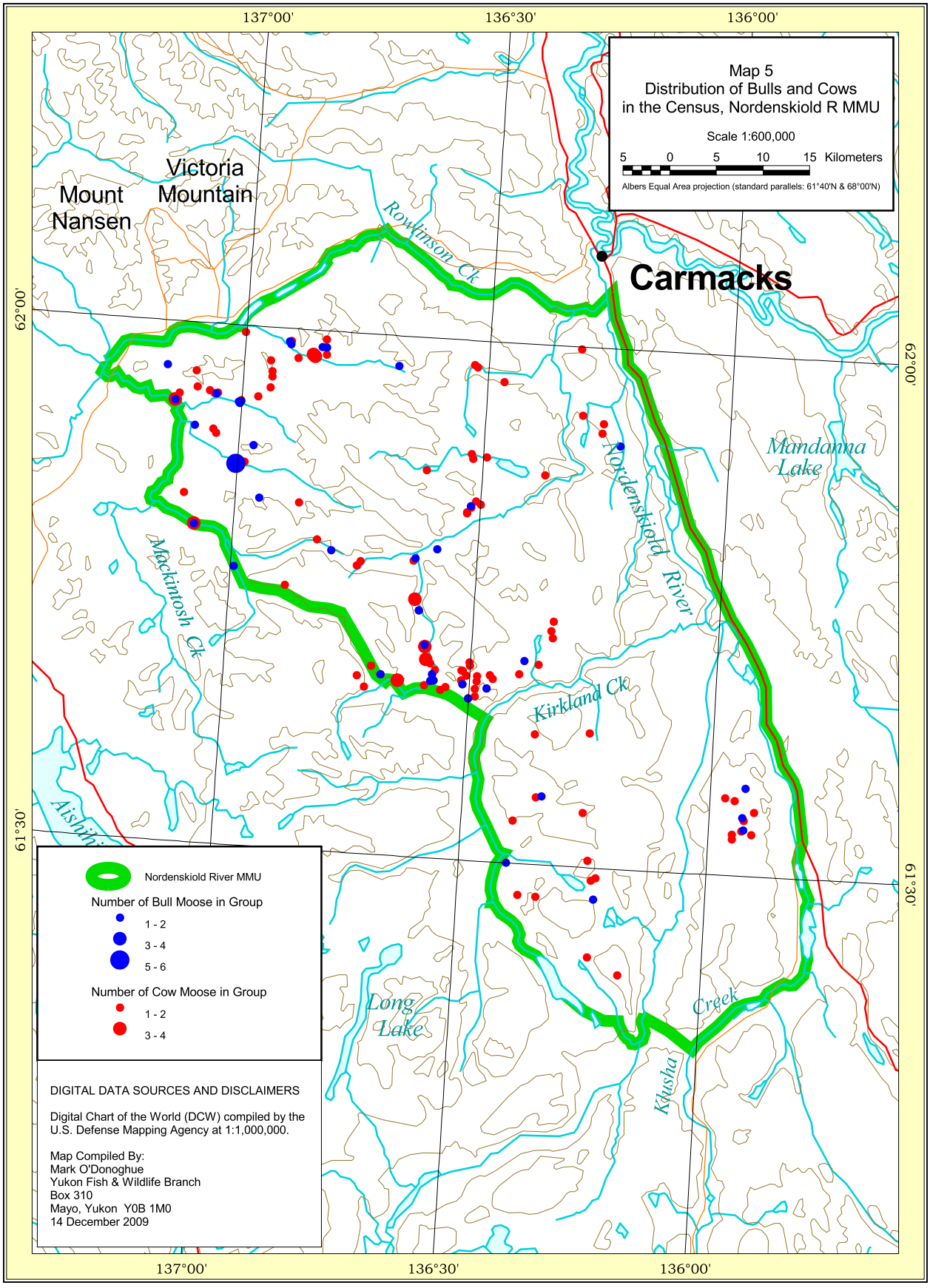
Map 5
Distribution of Bulls and Cows
in the Census, Nordenskiold R MMU
Scale 1:600,000
5 0 5 10 15 Kilometers
Albers Equal Area projection (standard parallels: 61°40'N & 68°00'N)
137°00'
136°30'
136°00'
62°00'
61°30'
Mount Nansen
Victoria Mountain
Rowlinson Ck
Carmacks
Mandanna Lake
Nordenskiold River
Mackintosh Ck
Kirkland Ck
Aishihik
Long Lake
Creek
Klusha
Nordenskiold River MMU
Number of Bull Moose in Group
1 - 2
3 - 4
5 - 6
Number of Cow Moose in Group
1 - 2
3 - 4
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Digital Chart of the World (DCW) compiled by the U.S. Defense Mapping Agency at 1:1,000,000.
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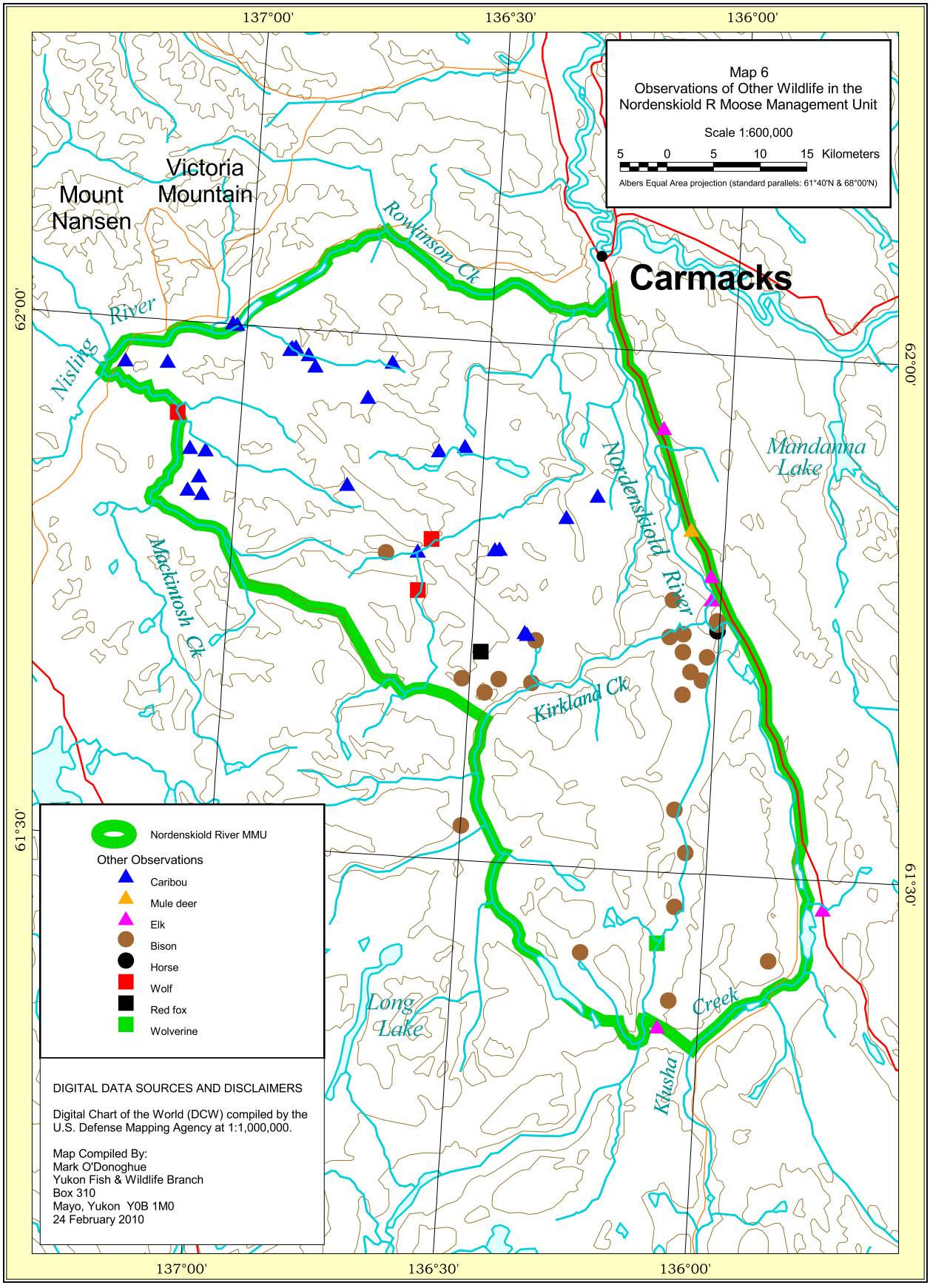
Map 6
Observations of Other Wildlife in the
Nordenskiold R Moose Management Unit
Scale 1:600,000
5 0 5 10 15 Kilometers
Albers Equal Area projection (standard parallels: 61°40'N & 68°00'N)
137°00'
136°30'
136°00'
62°00'
61°30'
Mount Nansen
Victoria Mountain
Rowlinson Ck
Carmacks
Nisling River
Mandanna Lake
Nordenskiold River
Mackintosh Ck
Kirkland Ck
Long Lake
Creek
Khusha
Nordenskiold River MMU
Other Observations
Caribou
Mule deer
Elk
Bison
Horse
Wolf
Red fox
Wolverine
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