MAYO MOOSE MANAGEMENT UNIT

SUMMARY OF EARLY-WINTER 2006 MOOSE SURVEY

5-13 NOVEMBER 2006

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Mayo Moose Management Unit
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SUMMARY

- We conducted an early-winter survey of moose in the Mayo area on November 5-13, 2006, using a Cessna 206 fixed-wing aircraft and Bell 206 helicopters. The main purpose of this survey was to estimate the abundance, distribution and population composition of the moose population.

- We counted all moose in survey blocks covering about 24% of the total area, and found a total of 418 moose, of which 112 were adult bulls, 224 were adult and yearling cows, 14 were yearling bulls, and 68 were calves.

- We calculated a population estimate of 1,030 ± 18% moose for the area, which is equal to a density of about 205 per 1,000 km^2 over the whole area, or 218 per 1,000 km^2 in suitable moose habitat. This is about the same as the estimated density of 200 moose per 1,000 km^2 in suitable moose habitat calculated from the last survey in 1998, in an overlapping area to the southwest.

- We estimated that there were about 36 calves and 10 yearlings for every 100 adult cows in the survey area. This suggests that survival of calves was good in the summer and fall of 2006, but that calves born in 2005 did not survive as well.

- We estimated that there were about 43 bulls for every 100 cows in the survey area, which is a quite low sex ratio.

- Harvest of moose in the Mayo area is likely near the upper limit of the sustainable rate.

INTRODUCTION

This report summarizes the results of the early-winter survey of moose in part of the Mayo Moose Management Unit (see Map 1), conducted on November 5-13, 2006. The main purpose of this survey was to estimate abundance, distribution and population composition of the local moose population.

Previous Surveys

The Yukon Fish and Wildlife Branch has monitored populations of moose in the Mayo area since the mid-1970s, using a variety of methods and survey areas. We conducted early-winter surveys using different survey areas (see Map 2) in 1988 (results in Larsen, Markel & Ward 1989), 1993 (results in Ward & Larsen 1994), and 1998 (results in Yukon Fish & Wildlife Branch file reports). 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.

We conducted late-winter surveys to measure recruitment of calves in a large area around Mayo (see Map 2) annually from 1993 to 1999 and in 2003 (results in Ward and Larsen 1994, Ward and Larsen 1995, Sinnott & O'Donoghue 2003, and Yukon Fish and Wildlife Branch file reports). We also measured recruitment of moose at the end of winter in the same survey area as this year's in 2001, 2002, and 2004 (results in Fraser, O'Donoghue & Westover 2001, O'Donoghue & Sinnott 2003, and Yukon Fish and Wildlife Branch file reports).

Finally, we have worked with local residents to conduct ground-based monitoring of composition of the Mayo-area moose population each fall annually since 2001.

Community Involvement

Residents of the Mayo area have consistently placed a high priority on monitoring the health of the local moose population. This was emphasized in the Integrated Big Game Management Plan for the Mayo Region in 1993-1996, in the Integrated Wildlife Management Plan for the Nacho Nyak Dun Traditional Territory for 1997-2000, and in the Community-based Fish and Wildlife Management Plan for the Nacho Nyak Dun Traditional Territory for 2002-2007. All three documents were 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 Mayo survey area was re-located in 2001 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 Mayo Moose Management Unit is about 9,760 km², and includes Game Management Sub-zones (GMS) 2-56, 2-58, 2-59, 2-62, 2-63, 4-04, 4-05 and 4-06 (see Map 1). The survey area within the Mayo Moose Management Unit is about 5,013 km². The border runs northeast from the site of Forty Mile on the South McQuesten River to McQuesten Lake. From here, it roughly extends south to Roop Lakes and along Mayo Lake to the Stewart River. The Stewart River and Nogold Creek, up to Francis Creek, form the southeast boundary. The southwest boundary runs along Francis and Talbot Creeks northwest to Mayo, and back to Forty Mile.

Most of the study area (about 4,716 km²) is considered suitable moose habitat, except for approximately 6% of the area, which includes large water bodies (more than 0.5 km²) 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 Stewart and South McQuesten Rivers. Most of the area is forest-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, scattered throughout the study area, and the mountainous area in the northeastern corner (the Keno Hill area) of the survey area. Old and recent forest fires have occurred throughout the study area (see Map 3). The most recent large fires were a 55 km² burn northwest of Elsa in 2005, a 66 km² burn near Hanson Lakes in 1998, a 73 km² burn south of the Nelson Arm on Mayo Lake in 1994, and a 183 km² burn north and west of Janet Lake in 1990.

METHODS

We have adopted a relatively new survey technique, developed by Jay Ver Hoef with the Alaska Department of Fish and Game, to survey moose. 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 km² in size.

2. Observers in fixed-wing aircraft fly over all the blocks quickly, and classify ("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.

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

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 only classify cows as older animals or calves, and later estimate the number of yearlings 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.

This method can be used for both low and high-intensity surveys. Generally, the more blocks that are counted (a greater proportion of the blocks are flown in high-intensity surveys), the more precise and reliable the population estimate is.

WEATHER AND SNOW CONDITIONS

The weather and snow conditions were mostly excellent for this survey. Temperatures ranged from - 33°C to - 14°C, and winds were light. We were able to fly on all days, although we had to work around low-hanging fog in valleys throughout the stratification survey and during some census days, and light snow the last three days of the survey. Light conditions ranged from flat to bright. Snow depths were low, mostly less than 15 cm, especially at lower altitudes in the southern

part of the survey area, but were adequate for sighting moose throughout the area.

RESULTS AND DISCUSSION

Identification of High and Low-Density Blocks

We flew over the whole survey area in a 4-seat Cessna 206 with the pilot and 3 observers. We were unable to see the ground in low-altitude survey blocks in the Janet Lake and Mayo Lake valleys, as well as many blocks in the Mayo River valley north to about Mount Haldane, so we classified the expected moose density in these blocks as low based on their closed forest habitat. We averaged 0.12 minutes per km^2 during the stratification flights.

We classified 26 (8%) of the 328 survey blocks as high, 59 (18%) as medium, 77 (23%) as low, and 166 (51%) 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 Davidson Range south of McQuesten Lake, the Gustavus Range near Keno City, the ridges around Williamson and Janet Lakes, and in the Scheelite Dome area. 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 85 blocks, and considered the 243 blocks with low and very low expected numbers of moose to make up the Low stratum.

Coverage

We counted moose in 80 of the 328 blocks (see Map 5). Our original intention was to only count 60 blocks, so we randomly selected 36 blocks from the High stratum, and 24 from the Low stratum. After completing the count in 47 of these blocks on 11 November, however, the precision of our population estimate was still fairly low, and so we randomly selected another 12 High and 8 Low-stratum blocks to get a more precise estimate. It took us about 42.6 hours to count moose in these blocks, or about 2.09 minutes per km^2—survey intensity was about the same in low-abundance (2.11 minutes per km^2) and high-abundance (2.08 minutes per km^2) blocks. We needed an additional 6.6 hours to recount survey blocks to calculate our sightability correction factor, and 16.3 hours to ferry between survey blocks, a fuel cache in Keno City, and back and forth to Mayo.

Observations of Moose

We counted a total of 418 moose, 112 of them adult bulls, 224 adult and yearling cows, 14 yearling bulls and 68 calves (see Table 1). We observed an average of 526 moose for every 1,000 km² in the high-abundance blocks, and 67 moose per 1,000 km² in the low blocks.

Table 1. Observations of moose during the November 2006 survey in the Mayo Moose Management Unit.

	High Blocks	Low Blocks	Total
Number of Blocks Counted	48	32	80
Number of Adult Bulls Observed	110	2	112
Number of Adult and Yearling Cows Observed*	203	21	224
Number of Yearling Bulls Observed	14	0	14
Number of Calves Observed	58	10	68

* 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 good numbers of moose in them. Forested lowlands and lower-elevation slopes typically had few moose in them.

Table 2. Estimated abundance of moose in the Mayo Moose Management Unit survey area in November 2006.

	Best Estimate ± 90% Confidence Interval*	Estimates within 90% Confidence Interval*
Estimated Total Number of Moose	1,030 ± 18%	840-1,220
Adult Bulls	232 ± 28%	167-297
Adult Cows	546 ± 20%	439-653
Yearlings	55 ± 44%	31-79
Calves	197 ± 26%	145-250
Density of Moose (per 1,000 km²)		
Whole Area	205	
Moose Habitat Only**	218	

* 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 km² in size.

The estimated number of moose in the whole survey area, based on our census counts, is 1,030 ± 18% (see Table 2). This includes a correction for moose missed during the census of 11%, as calculated from our repeated searches of selected areas at double our usual search intensity.

The estimated density of moose in the survey area is 205 per 1,000 km², or 218 per 1,000 km² of suitable moose habitat (see Table 2). This is higher than the Yukon-wide average of 150 moose per 1,000 km², and very similar to the estimate of 200 per 1,000 km² of suitable moose habitat made in the overlapping survey area (see Map 2) to the southwest in 1998. This year's survey area was different from that used in previous years though, so the estimates are not directly comparable. We calculated estimates of moose abundance for the overlap areas only (see Map 2) in order to discern changes among years. There was an

increasing trend in abundance of moose from 1988 to 1998 in the overlap areas, but the 2006 estimate of population was slightly lower (but not statistically different) from the 1998 estimate (see Table 3).

Table 3. Comparison of the results of the 2006, 1998, 1993, and 1988 surveys of moose in the Mayo Moose Management Unit in the areas where the censuses overlapped in all four years (see Map 2).

	1988	1993	1998	2006
Estimated Abundance				
Number of Moose (± 90% Confidence Interval*)	146 ± 35%	175 ± 17%	280 ± 17%	252 ± 24%
Density (per 1,000 km² suitable habitat)	79	94	150	135
Estimated Composition (± 90% Confidence Interval*)				
Adult Bulls	28 ± 49%	48 ± 9%	72 ± 29%	60 ± 36%
Adult Cows	48 ± 66%	80 ± 27%	100 ± 19%	117 ± 31%
Yearlings	32 ± 115%	16 ± 0%	39 ± 27%	22 ± 37%
Calves	38 ± 49%	31 ± 31%	69 ± 22%	50 ± 38%

* 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.

Ages and Sexes of Moose

Calf survival to the early winter was good in 2006 in the survey area. Based on our survey results, there were an estimated 36 calves for every 100 cows (see Table 4). In general, about 25-30 calves per 100 cows are considered necessary for maintaining stable moose populations in areas with typical mortality rates. Calves made up an estimated 19% of the population in 2006. Ten percent of cow-calf groups contained twins.

The estimated percentage of yearlings in the population in the survey area—5%—was fairly low, however (see Table 4). There were an estimated 10 yearlings per 100 cows, or about 7 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). Ground-based monitoring in the Mayo Moose

Management Unit showed that 2005 was a good year for calf production—on average, about 6 of every 10 cows seen still had calves with them in the fall. So, the low numbers of yearlings seen in this survey may reflect low survival of 2005 calves during the last year. Another possibility is that we underestimated the number of yearlings in this survey. We assume that bull and cow yearlings have equal survival rates when we use the number of yearling bulls seen to estimate the number of yearling cows. However, bull yearlings are harvested by hunters, and the overall harvest rate in the Mayo area is fairly high. Yearling bulls therefore likely have lower survival rates than yearling cows, and we may underestimate the number of yearling cows in the population by assuming that their numbers equal those of yearling bulls.

Survival of calves is typically variable among years, but ground-based monitoring and our late-winter recruitment surveys suggest that the long-term average in the Mayo area has been adequate for sustaining moose populations (O'Donoghue & Sinnott 2003).

Table 4. Estimated composition of the moose population in the Mayo Moose Management Unit survey area in November 2006.

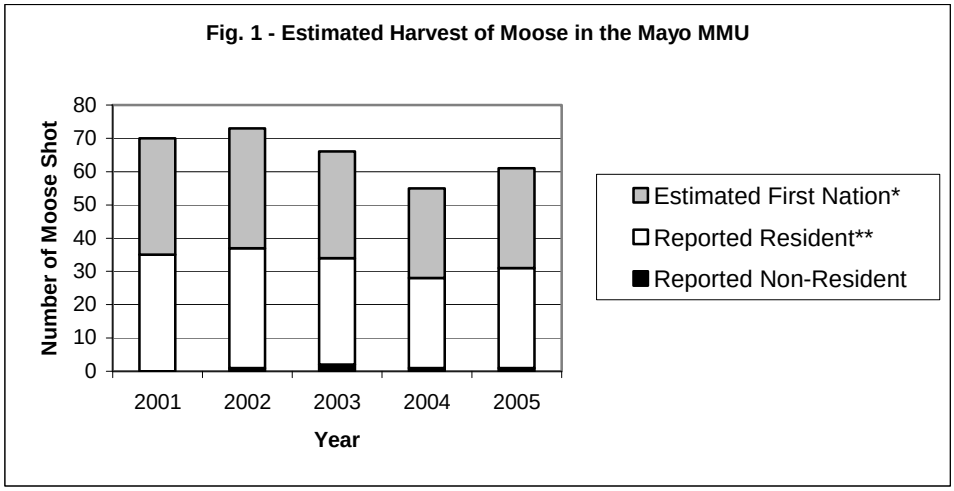
	Best Estimate	Estimates within 90% Confidence Interval*
% Adult Bulls	23%	18-27%
% Adult Cows	53%	49-57%
% Yearlings	5%	3-8%
% Calves	19%	16-23%
Bulls per 100 Adult Cows	43	32-53
Yearlings per 100 Adult Cows	10	5-15
Calves per 100 Adult Cows	36	30-43
% of Cow-Calf Groups with Twins	10%	3-18%

* 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.

We estimate that there were 43 bulls for every 100 cows in the survey area (see Table 4). This is considerably lower than the Yukon-wide average of 68 bulls per 100 cows in areas that have been surveyed, but 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). Relatively high harvest rates in the Mayo Moose Management Area are the most likely reason for the low percentage of bulls seen during this survey. Fewer bulls and smaller group sizes of bulls were seen in the high-density survey blocks north and south of Keno City, where access to hunters and 4-wheelers along mining roads is good, compared to more remote parts of the survey area (see Map 6). Consistent with these findings of a low bull:cow ratio, we found fewer bulls and more cows in 2006 compared to 1998 in the areas where the surveys overlapped (see Table 3, Map 2), but these differences were not statistically significant.

Harvest

The reported harvest of moose by licenced hunters in the Mayo Moose Management Unit, during the last 5 years for which we have complete records (2001 to 2005), averaged about 32 moose per year (see Figure 1). We don't have complete harvest data from First Nation hunters. For the purpose of estimating total harvest levels though, we can assume that harvest by First Nation hunters is about equal to that by resident licenced hunters—based on local knowledge, this is probably about the case. Using our latest estimates of moose density, we estimate that the annual harvest is presently at about 3.6% of the total moose population in the Mayo Moose Management Unit. This is near the recommended maximum allowable harvest rate of 4% for this area. The low percentage of bulls that we observed during this survey provides further evidence that harvest in this area is likely high. Neither known harvest levels nor the percentage of bulls in the population are presently at levels at which we would consider harvest restrictions mandatory (although restrictions could be considered as a precautionary measure). The data suggest though that harvest is high, and that we need to closely monitor both harvest and the moose population in this area to ensure that the population remains healthy.



* Harvest by First Nation hunters estimated to be equal to that of licenced resident hunters.
** Includes reported harvest by licenced First Nation and special-guided hunters.

CONCLUSIONS AND RECOMMENDATIONS

- We estimate that there are about 1,030 moose in the survey area in the Mayo Moose Management Area. The estimated density is about 218 per 1,000 km^2 of suitable moose habitat, which is above average for the Yukon and about equal to the 1998 estimate in an overlapping survey area to the southwest.

- There was good survival of calves in this area during the summer and fall of 2006. Survival of calves born in 2005 (yearlings in this survey) apparently was quite low. Long-term recruitment appears adequate to maintain moose numbers in the Mayo Moose Management Unit.

- The number of bulls in the survey area, compared to the number of cows, was low in this survey. This likely reflects the relatively high harvest rates in the area.

- Harvest of moose in the Mayo Moose Management Unit is close to the maximum recommended allowable rate.

- We should continue discussions with affected First Nations and Renewable Resources Councils about options for managing harvest in this area to ensure that it does not exceed sustainable levels.

- We should continue to closely monitor the status and harvest of the moose population in the Mayo Moose Management Unit.

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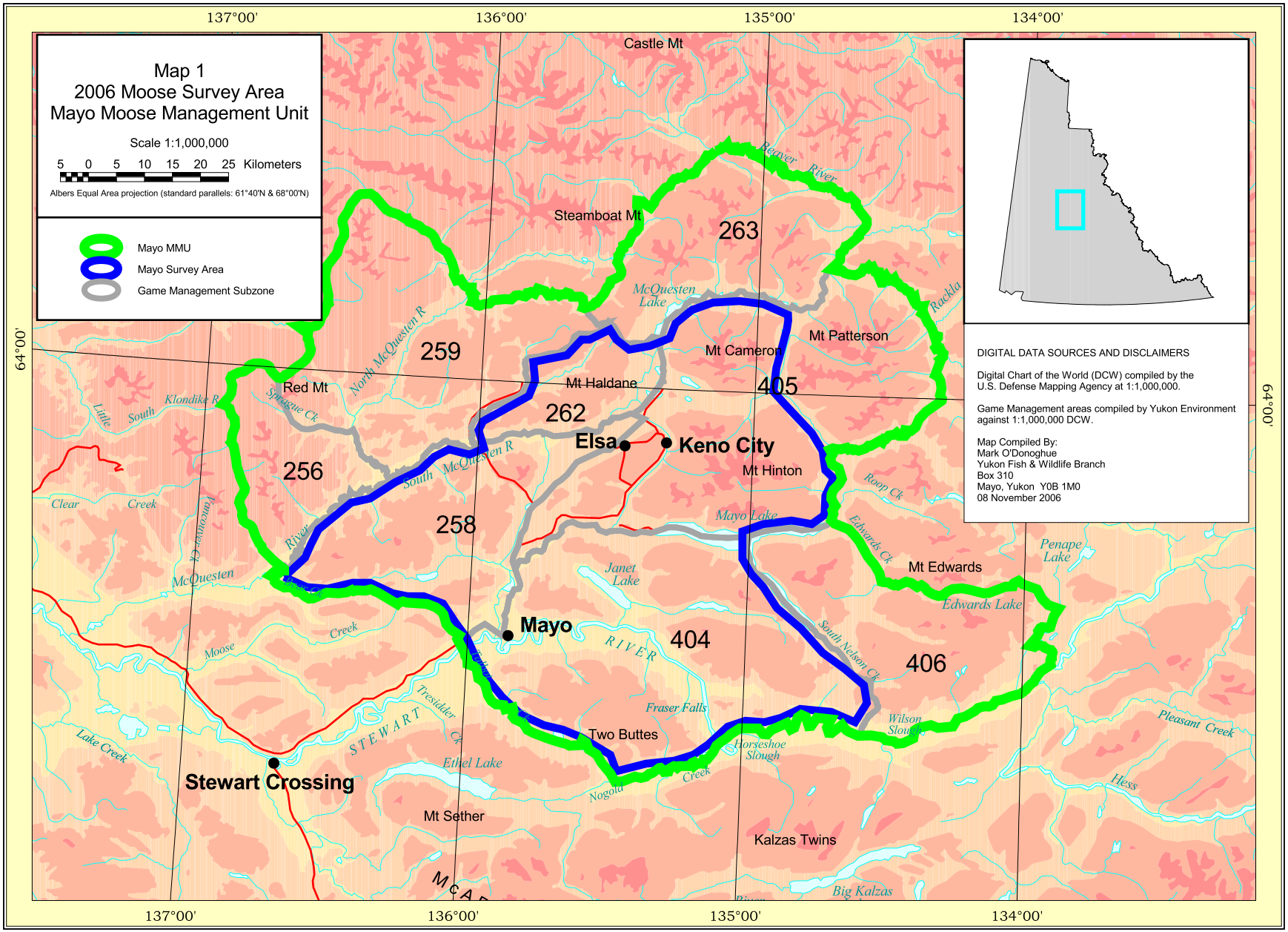
MAPS



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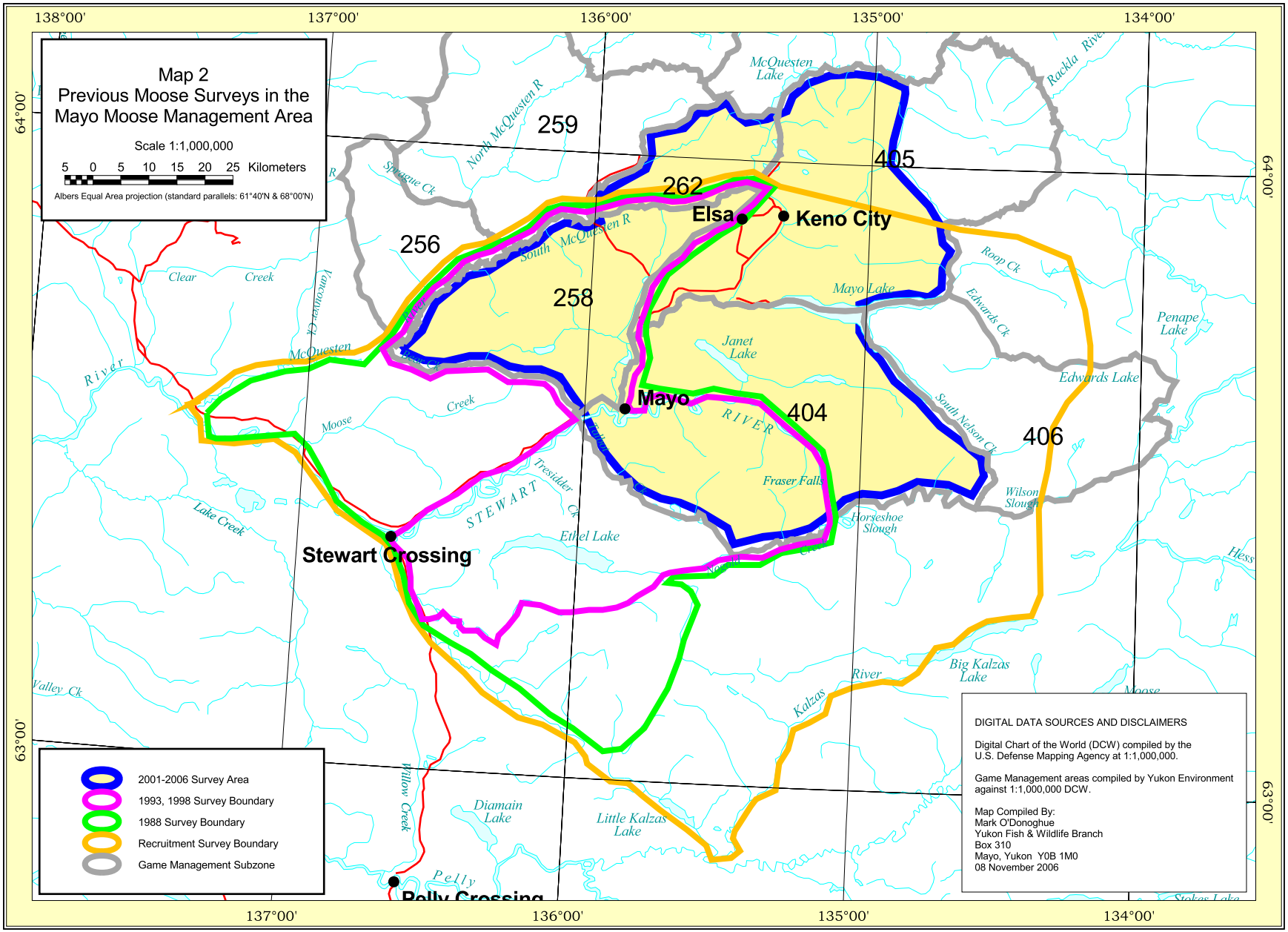

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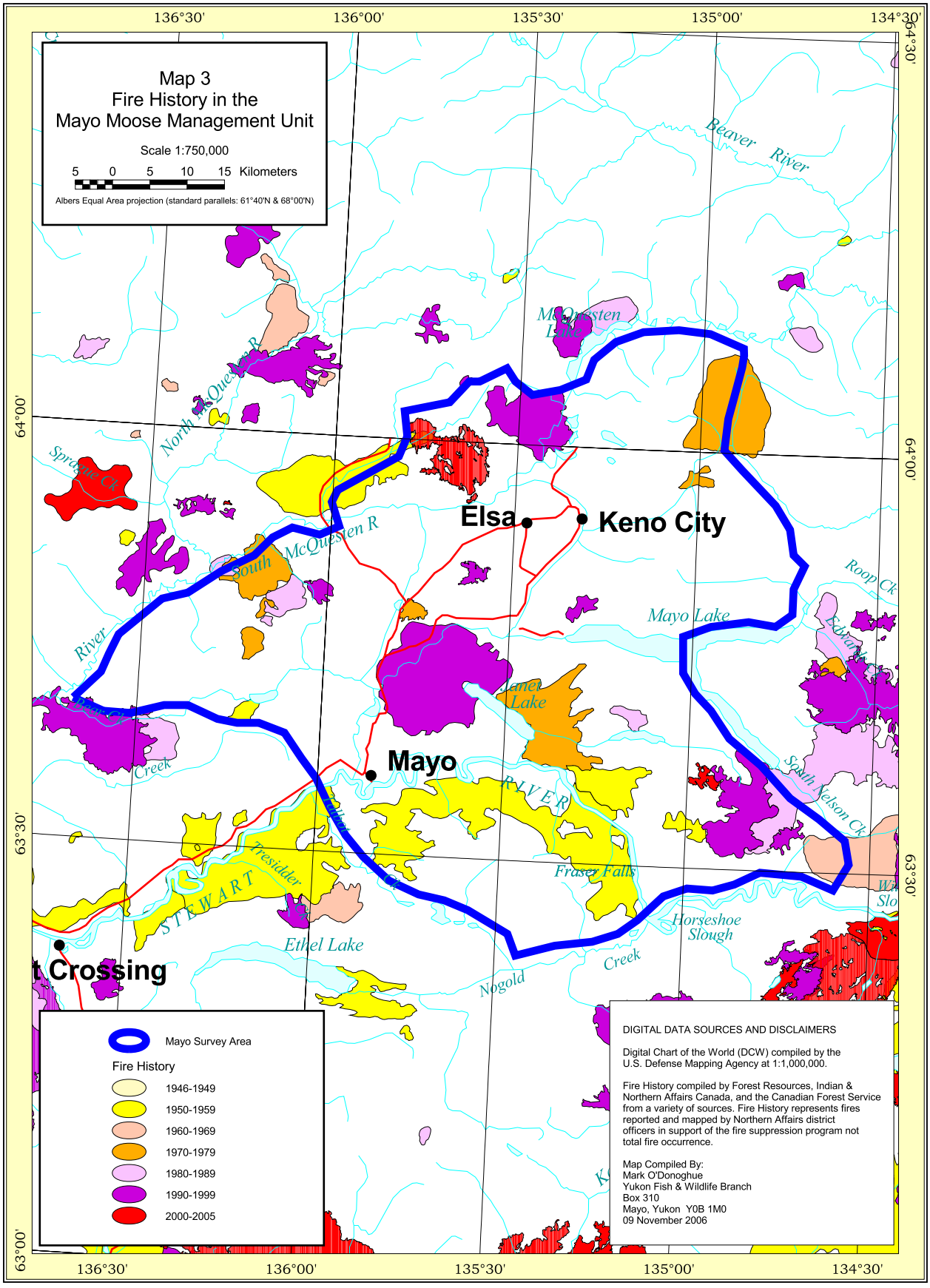

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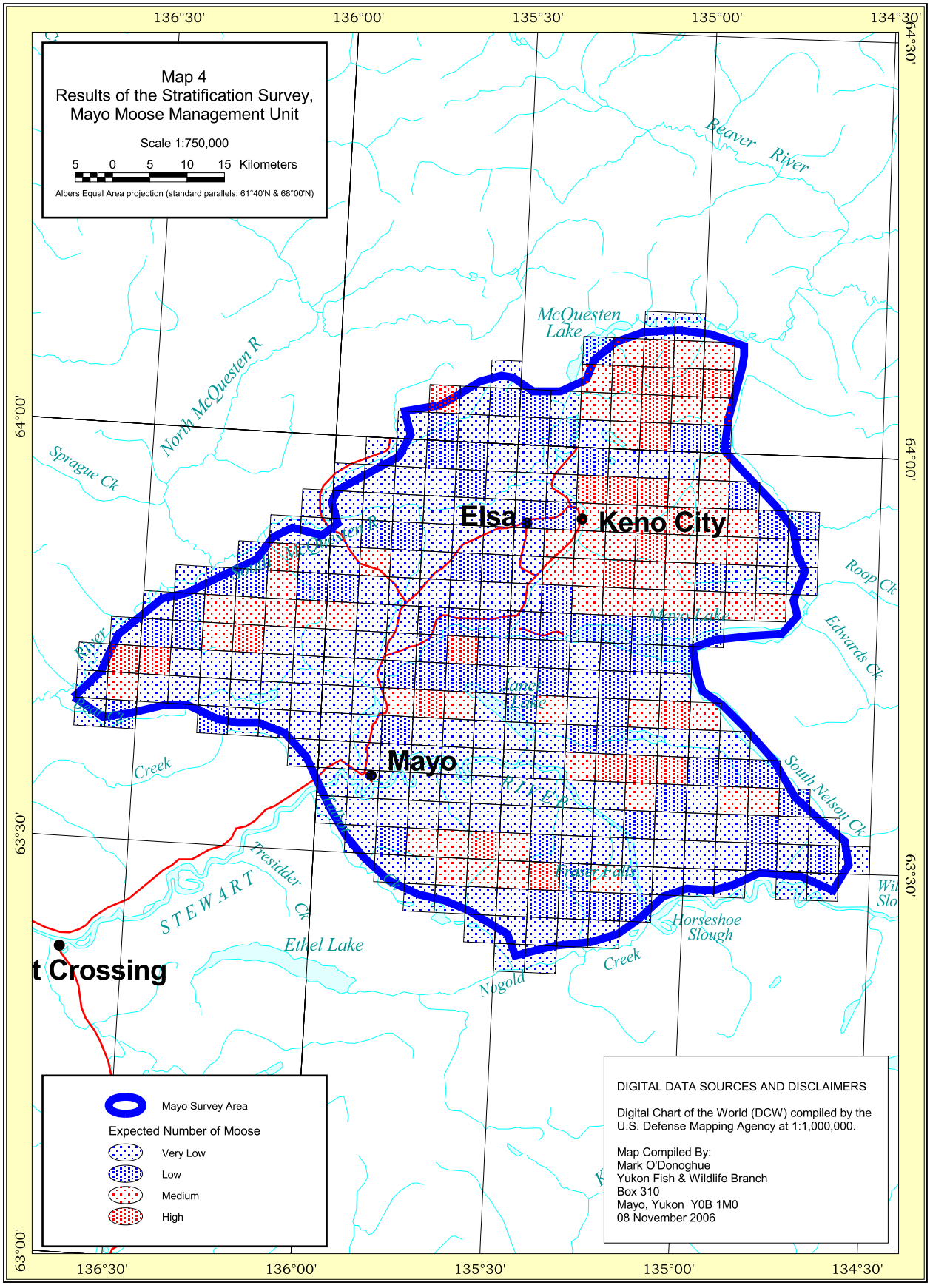

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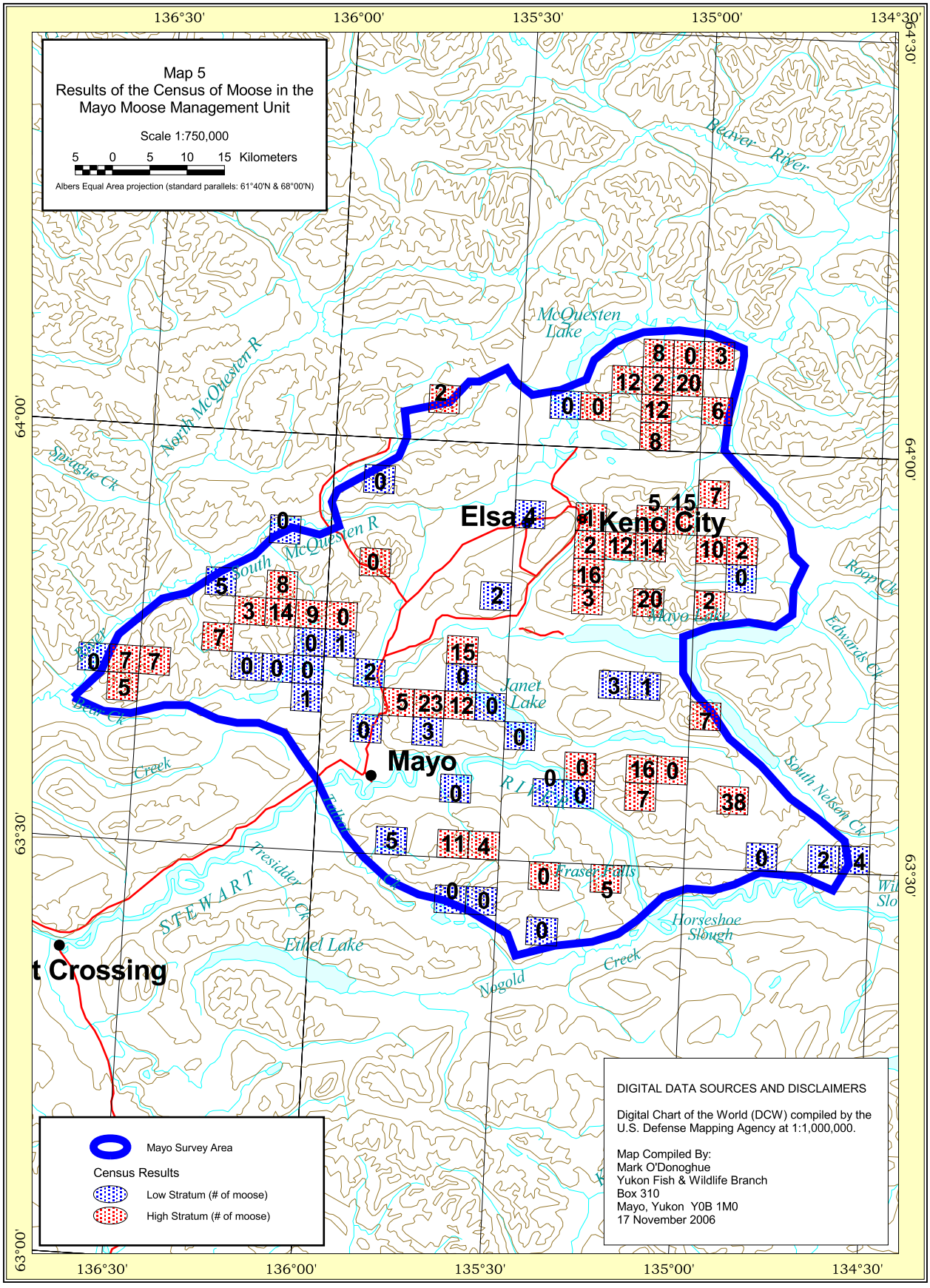

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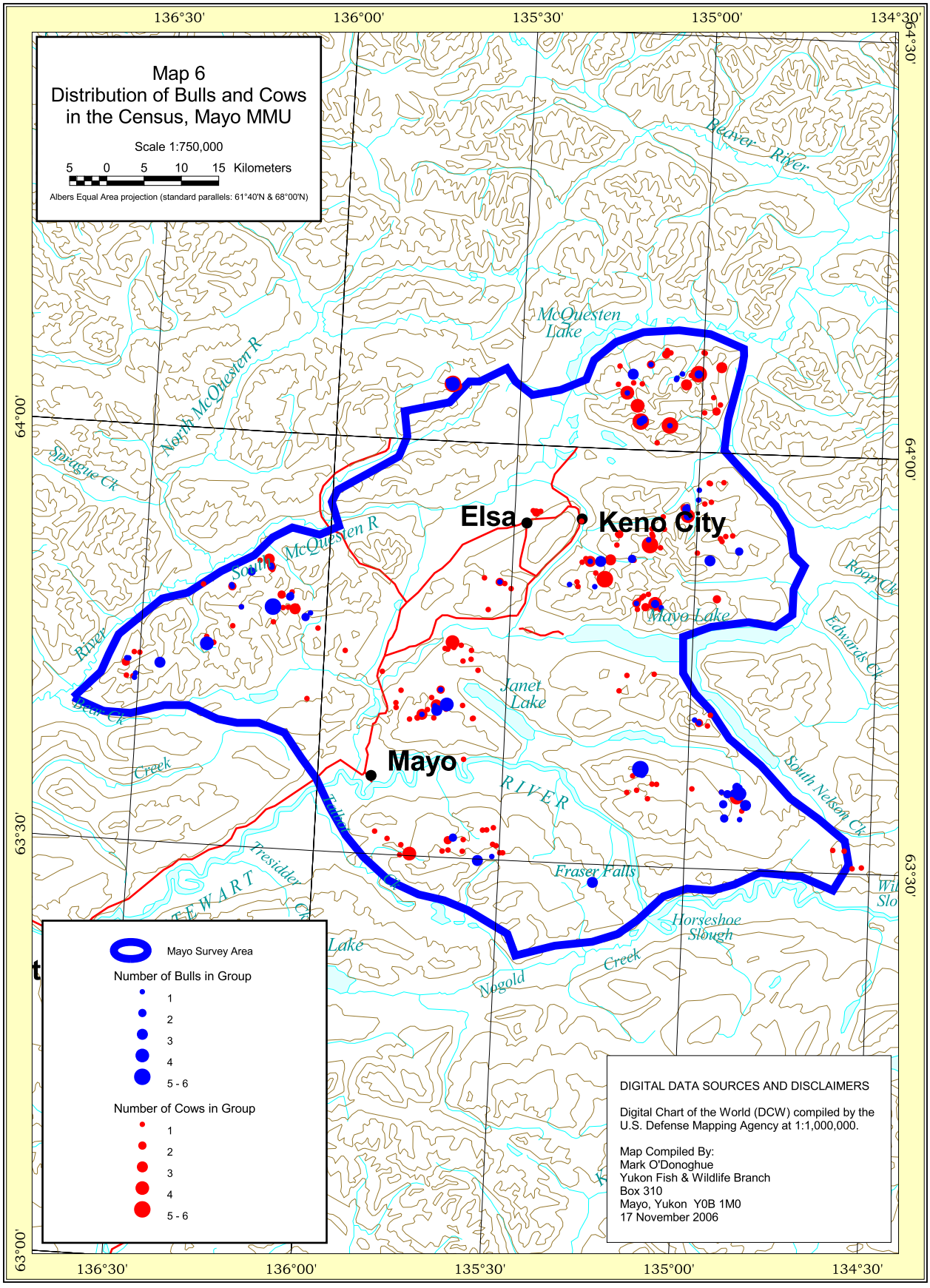

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