

**UPPER KLONDIKE HIGHWAY MOOSE  
MANAGEMENT UNIT**

**SUMMARY OF EARLY-WINTER 2002  
MOOSE SURVEY**

**11-22 NOVEMBER 2002**



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**Yukon**  
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**UPPER KLONDIKE HIGHWAY MOOSE MANAGEMENT  
UNIT SUMMARY OF EARLY-WINTER 2002 MOOSE  
SURVEY 11-22 NOVEMBER 2002**

**Fish and Wildlife Branch  
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### **SUMMARY**

- ❖ We conducted an early-winter survey of moose in the Upper Klondike Moose Management Area on 11-22 November 2002, 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 20% of the total area, and found a total of 176 moose, of which 50 were adult bulls, 90 were adult and yearling cows, 6 were yearling bulls, and 30 were calves.
- ❖ We calculated a population estimate of  $846 \pm 25\%$  moose for the area, which is equal to a density of about 147 per 1,000 km<sup>2</sup>. This is about average for the Yukon. This estimate may be slightly low because we did not correct it for the number of moose that we missed during the survey.
- ❖ We estimated that there were about 37 calves and 14 yearlings for every 100 cows in the survey area. This suggests that survival of calves was good in the summer and fall of 2002, but that calves born in 2001 did not survive as well.
- ❖ We estimated that there were about 61 bulls for every 100 cows in the survey area, which is a healthy sex ratio.
- ❖ Harvest of moose in the Upper Klondike Moose Management Unit is likely close to 5%, which is above the recommended maximum allowable rate. The estimated harvest of moose in Game Management Subzones 2-52, 2-53, 3-17, and 4-02 within this Moose Management Unit is also above recommended levels. However, we need to know the harvest by First Nation hunters to know the actual present levels of harvest.

## **INTRODUCTION**

This report summarises the results of the early-winter survey of moose in part of the Upper Klondike Highway Moose Management Unit (see Map 1), conducted on November 11-22, 2002. The main purposes of this survey were to estimate the abundance and distribution of moose, and the proportions of calves, yearlings, cows, and bulls in the population.

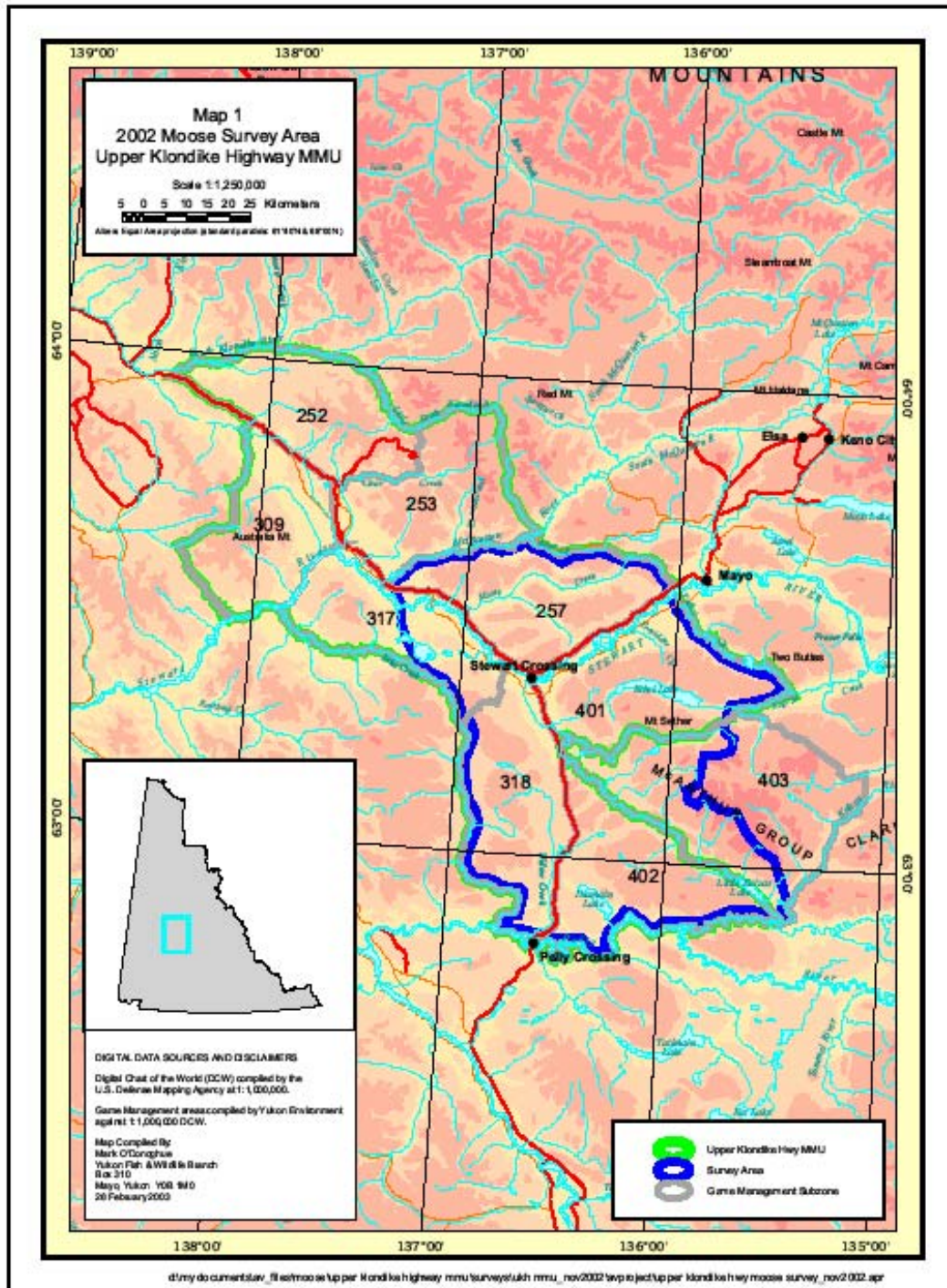
The Yukon Fish and Wildlife Branch has monitored populations of moose in the Mayo and Pelly Crossing areas since the mid-1970s. During the last 2 years, we have revised the methods and survey areas we use, to allow us to monitor the health of moose populations more regularly and cost-effectively.

### **Previous Surveys**

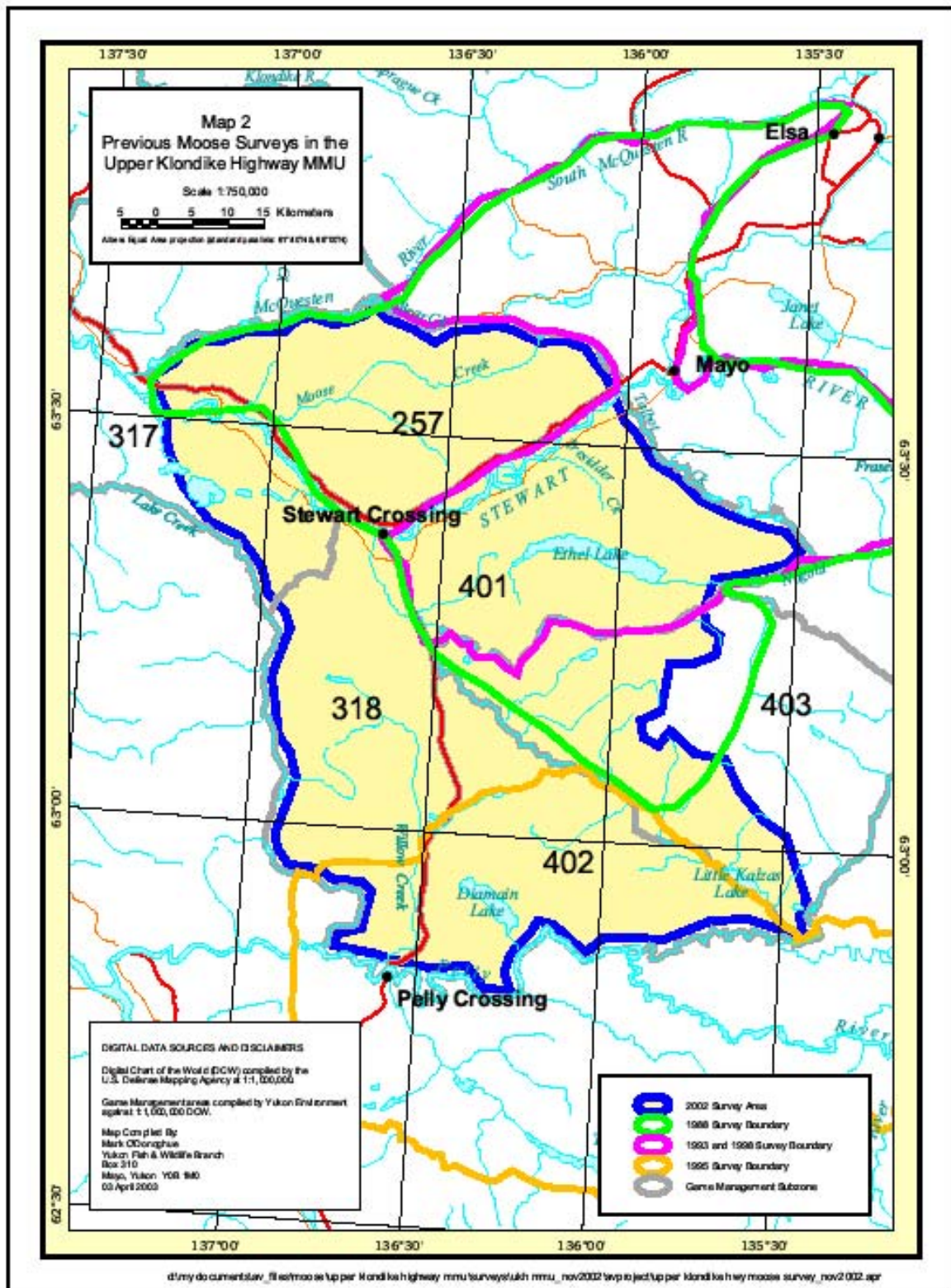
The 2002 survey was the first conducted in the survey area identified in Map 1. There have been surveys in previous years, however, in areas that overlapped with this survey area (see Map 2). We conducted early-winter surveys that included areas south and west of Mayo in 1988, 1993, and 1998 (results in Larsen, Markel & Ward 1989, Ward & Larsen 1994, and Yukon Fish and Wildlife Branch file reports), and in the Pelly Crossing area in 1995 (results in Yukon Fish & Wildlife Branch file reports). We have also monitored over-winter survival of moose calves with late-winter surveys in the Mayo area, including the northern part of the 2002 survey area, from 1993 to 2002 (results in O'Donoghue & Sinnott 2003).

### **Community Involvement**

This survey was co-funded by the Selkirk First Nation. Members of the Selkirk and Nacho Nyak Dun First Nations took part in the stratification part of this survey, and the Selkirk First Nation game guardian conducted the census in some of the survey blocks. Residents of the Pelly Crossing and Mayo areas have consistently placed a high priority on monitoring the health of the local moose population. This survey area was identified as high priority during the May Gathering of the Selkirk First Nation in 2002, because of concerns about high levels of harvest. It was also listed as a high-priority area in the Community-based Fish and Wildlife Management Plan for the Nacho Nyak Dun Traditional Territory, 2002-2007, a plan developed cooperatively by the Mayo District Renewable Resources Council, the First Nation of Nacho Nyak Dun, and the Yukon Fish and Wildlife Branch.





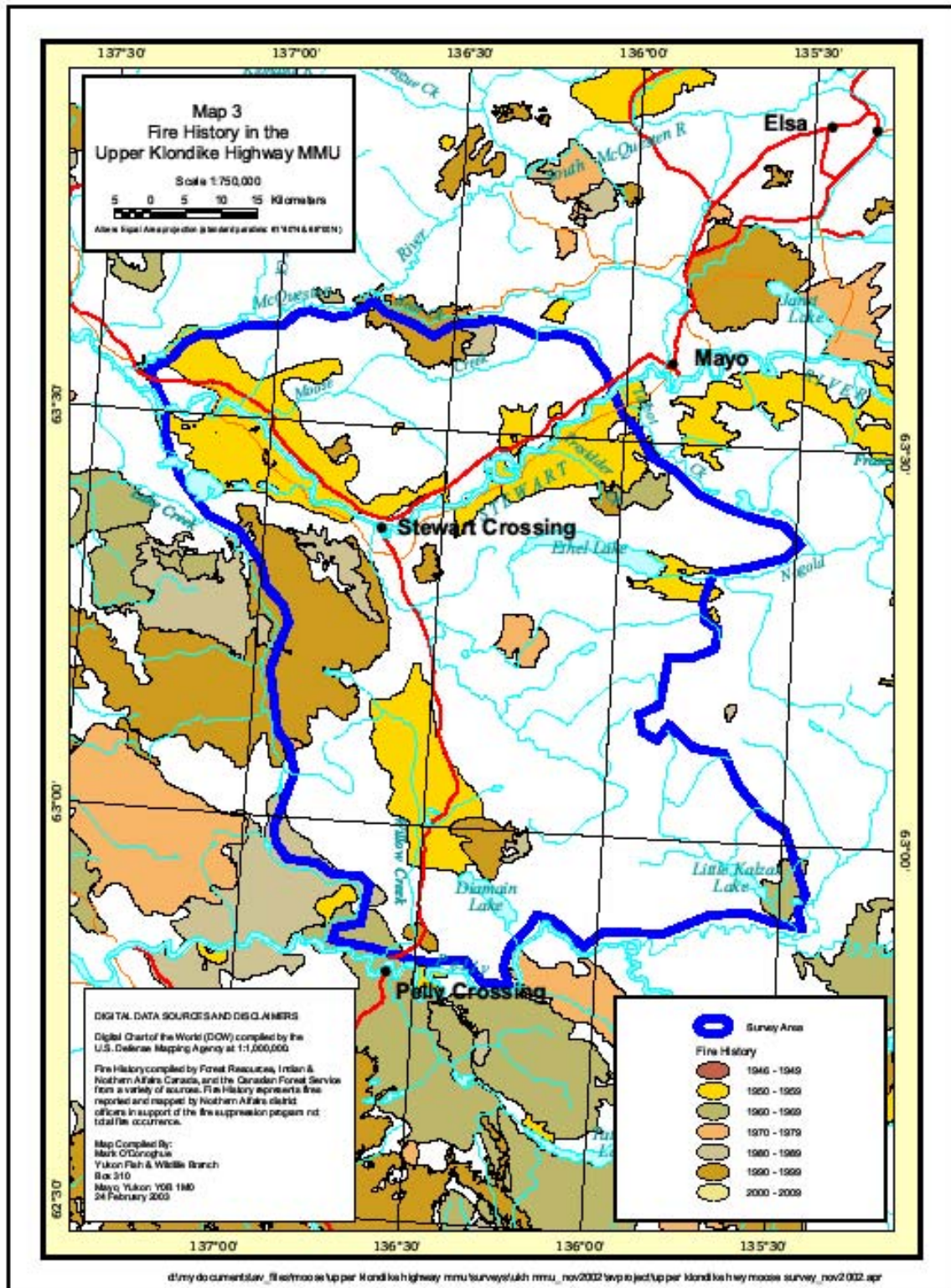


## STUDY AREA

The Upper Klondike Highway survey area was located to conform to the development of Yukon Moose Management Units. The survey area also includes the western portion of the Ddhaw Ghro Moose Management Unit (Game Management Subzone 4-03; see Map 1). 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 on a regular basis, using both aerial and ground-based surveys.

The Upper Klondike Highway Moose Management Unit is about 8,690 km<sup>2</sup>, and includes Game Management Subzones (GMS) 2-52, 2-53, 2-57, 3-09, 3-17, 3-18, 4-01 and 4-02 (see Map 1). The survey area within this Moose Management Unit is about 5,956 km<sup>2</sup>. The north border runs east from the McQuesten site along the McQuesten River and Bear Creek. The eastern border is Talbot Creek, south to Nogold Creek, and along the western flank of the McArthur Range, south to the Macmillan River. The Macmillan and Pelly Rivers are the southern border, and Lake Creek and Reid Lakes make up the western border.

Most of the study area (about 5,764 km<sup>2</sup>) is considered suitable moose habitat, except for approximately 3% of the area, which includes large water bodies (more than 0.5 km<sup>2</sup>) 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 Pelly 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, especially around Ethel Lake, the west flank of the McArthur Range, and the ranges north of the Macmillan River. Old and recent burns occur throughout the study area (see Map 3), and these vary in quality as moose habitat. The most recent fires were an 804 km<sup>2</sup> burn southwest of Stewart Crossing and a 90 km<sup>2</sup> burn in the north of the survey area along Bear Creek, both in 1998.





## **METHODS**

In the last few years, we have adopted a relatively new survey technique, recently developed by Jay Ver Hoef with 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 five steps:

1. The survey area is divided into uniform blocks 15-16 km<sup>2</sup> in size.
2. Observers in fixed-wing aircraft fly over all the blocks quickly, and they classify (“stratify”) them as having either high, medium, low, or very low 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” or classes, 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). We use Super Cubs for their maneuverability and low air speed. We classify all moose seen by age and sex.
5. We estimate the total number, ages, and sexes of moose in the entire survey area based on the numbers of moose we see in the blocks during the census, the distribution of these blocks, and how we classified the blocks we didn’t count. We do not correct these estimates for animals missed by observers during the survey.

## **WEATHER AND SNOW CONDITIONS**

The weather was quite variable during the survey period. Temperatures ranged from - 22°C to + 2°C. It was too cloudy to fly on 3 days, and we experienced some problems with icing on the planes on 2 other days. We were unable to fly due to high winds on 1 day, and limited by wind to half days on 2 others; on days we could fly, we also had to abandon surveys in 4 blocks because of the wind. It was mostly calm on only 3 days that we flew. We received 5-10 cm of fresh snow on 9-10 November, so snow conditions were good for the stratification survey. There were additional light snowfalls during the census, so we had fresh snow on the ground during all days but the last. Snow cover was complete in about half the blocks, and moderate in most of the rest. Light conditions when we surveyed were bright for about half the blocks, and flat for the others.

## **RESULTS AND DISCUSSION**

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

We flew over the whole survey area in a 4-seat Cessna 185 with the pilot and 3 observers. We were unable to complete the flights over 15 of the 383 blocks in the western part of the burn southwest of Stewart Crossing because of low clouds and icing, so we classified the expected moose density in these blocks based on the habitat. We averaged 0.09 minutes per km<sup>2</sup> during the stratification flights.

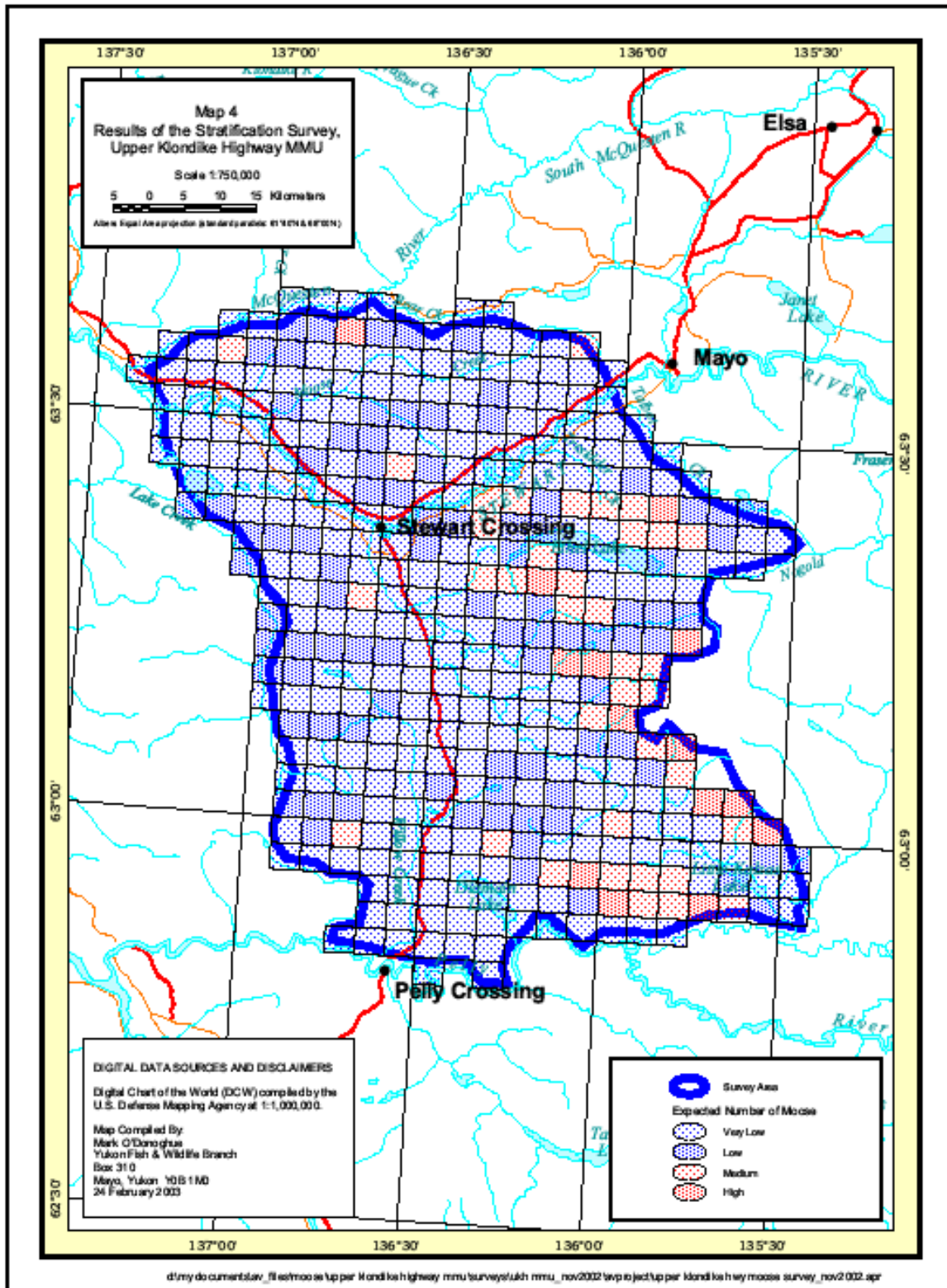
We classified 14 (4%) of the 383 survey blocks as high, 37 (10%) as medium, 90 (23%) as low, and 242 (63%) as very low expected abundance of moose (see Map 4), based on our observations from the air. Most of the blocks with higher expected numbers of moose were located in the subalpine areas around Ethel Lake, the McArthur Range, and the Macmillan Range west of Little Kalzas Lake. For the purpose of selecting blocks for the census, we grouped the blocks classified as expected high, medium, and low numbers of moose into a High stratum with 141 blocks, and considered the blocks with very low expected numbers of moose to make up the Low stratum.

### **Coverage**

We counted moose in 77 of the 383 blocks. 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 of these (plus one more) on 21 November, however, the precision of our population estimate was still  $\pm 32\%$ , and so we randomly selected and surveyed another 16 low-stratum blocks to get a more precise estimate. It took us about 42 hours to count moose in these blocks, or about 2.1 minutes per km<sup>2</sup>—survey intensity was about the same in low-abundance (2.0 minutes per km<sup>2</sup>) and high-abundance (2.1 minutes per km<sup>2</sup>) blocks. We needed an additional 32 hours to ferry between survey blocks, fuel caches (in Pelly Crossing and at the McQuesten airstrip), and back and forth to Mayo.

### **Observations of Moose**

We counted a total of 176 moose, 50 of them adult bulls, 90 adult and yearling cows (these can't be reliably distinguished from the air, so they're grouped), 6 yearling bulls and 30 calves (see Table 1). We observed an average of 172 moose for every 1,000 km<sup>2</sup> in the high-abundance blocks, and 126 moose per 1,000 km<sup>2</sup> in the low blocks.



**Table 1. Observations of moose during the November 2002 survey in the Upper Klondike Highway Moose Management Unit.**

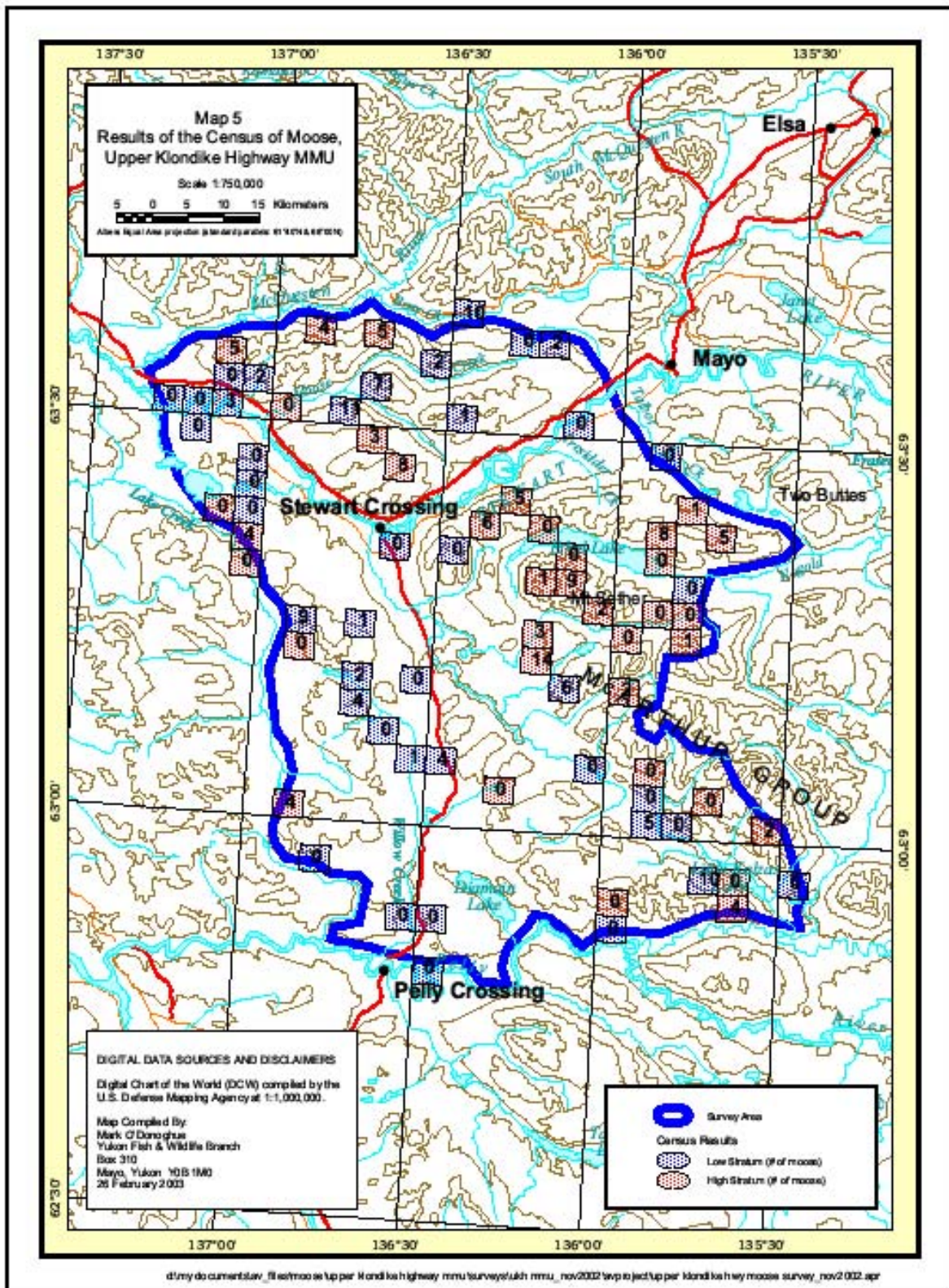
	High Blocks	Low Blocks	Total
Number of Blocks Counted	36	41	77
Number of Adult Bulls Observed	29	21	50
Number of Adult and Yearling Cows Observed*	49	41	90
Number of Yearling Bulls Observed	4	2	6
Number of Calves Observed	14	16	30

\* 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 (see Map 5). As expected for the early winter, subalpine willow flats, burns, and creek draws with abundant willows generally had good numbers of moose in them. Heavily forested lowlands and lower-elevation slopes typically had few moose in them. The patchy nature of the habitat caused by old burns and creek valleys made it difficult to classify whole blocks into the high and low-abundance strata though. There were several blocks that we classified into the low-abundance stratum because they were mostly forested, but where we observed good numbers of moose in burns or creek bottoms that were on their edges. Some low-stratum blocks in the 1990's burns also had good numbers of moose in scattered willow patches. In general, moose in the survey area were not highly concentrated in large post-rut groups in the subalpine, as they are in some areas.





The estimated number of moose in the whole survey area, based on our census counts, is  $846 \pm 25\%$  (see Table 2). The degree of uncertainty ( $\pm 25\%$ ) is slightly higher than the target precision ( $\pm 20\%$ ) that we aim for in these surveys, mostly because of the variable numbers of moose we spotted in our low-abundance blocks.

**Table 2. Estimated abundance of moose in the Upper Klondike Highway Moose Management Unit survey area in November 2002.**

	Best Estimate $\pm 90\%$ Confidence Interval*	Estimates within 90% Confidence Interval*
Estimated Total Number of Moose	$846 \pm 25\%$	637-1056
Adult Bulls	$246 \pm 34\%$	162-331
Adult Cows	$404 \pm 28\%$	292-516
Yearlings	$57 \pm 74\%$	15-99
Calves	$150 \pm 35\%$	97-203
Density of Moose (per 1,000 km <sup>2</sup> )		
Whole Area	142	
Moose Habitat Only**	147	

\* 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.

\*\* 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 density of moose in the survey area is 147 per 1,000 km<sup>2</sup> of suitable moose habitat (see Table 2). This is about equal to the Yukon-wide average of 150 moose per 1,000 km<sup>2</sup>. It is, however, considerably lower than the last estimates of just over 200 per 1,000 km<sup>2</sup> made in nearby overlapping survey areas to the south in 1995 and northeast in 1998 (see Map 2, Table 3). There may be several reasons for this. First, as we did not correct our estimates of density for sightability in 2002, this year's estimate is likely an underestimate of the true density. The estimated moose density in this survey area is very similar

to the estimate of 156 moose per 1,000 km<sup>2</sup> made in the Mayo area in 1998 (see Table 3), before it was corrected up to 202 per 1,000 km<sup>2</sup> to account for moose missed by the survey team. Second, the Upper Klondike Highway survey area is different than the areas counted in 1995 and 1998, so the results of these surveys aren't directly comparable. Finally, numbers of moose in this area may have declined during since the last surveys. We will need to closely monitor numbers, recruitment, and harvest of moose in this area to ensure that the population of moose is healthy here.

**Table 3. Comparison of the results of the 2002 survey of moose in the Upper Klondike Highway Moose Management Unit with those from nearby, overlapping survey areas in previous years (see Map 2).**

	Pelly 1995	Mayo 1998	Upper Klondike Highway 2002
Density of Moose (per 1,000 km <sup>2</sup> )			
With no SCF*	197	156	147
With SCF*	209	202	- **
SCF*	1.06	1.28	- **

\* SCF is a "sightability correction factor", which is used to correct estimates of moose abundance for animals that were missed by the survey crews. These are calculated during the survey by flying over parts of some census blocks a second time at a higher search intensity. For example, an SCF of 1.28 means that the calculated density of moose needs to be multiplied by 1.28 to get a true density.

\*\* No SCF was calculated in the 2002 survey.

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

Calf survival to the early winter was very good in 2002 in the survey area. Based on our survey results, there were an estimated 37 calves for every 100 cows (in other words, an average of 37 out of every 100 cows still had a calf with them; 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 18% of the population in 2002.

The estimated percentage of yearlings in the population in the survey area—7%—was fairly low, however (see Table 4). There were an estimated 14 yearlings per 100 cows, or about 9 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). This may reflect poorer survival of calves born in 2001, as we observed in the Mayo Moose Management Unit to the northeast (O'Donoghue & Sinnott 2003). Survival of calves is typically variable among years, but the long-term average in the nearby Mayo area has been adequate for sustaining moose populations.

**Table 4. Estimated composition of the moose population in the Upper Klondike Highway Moose Management Unit survey area in November 2002.**

	Best Estimate	Estimates within 90% Confidence Interval*
% Adult Bulls	29%	19-39%
% Adult Cows	48%	36-60%
% Yearlings	7%	2-12%
% Calves	18%	11-24%
Bulls per 100 Adult Cows	61	34-88
Yearlings per 100 Adult Cows	14	3-25
Calves per 100 Adult Cows	37	20-54

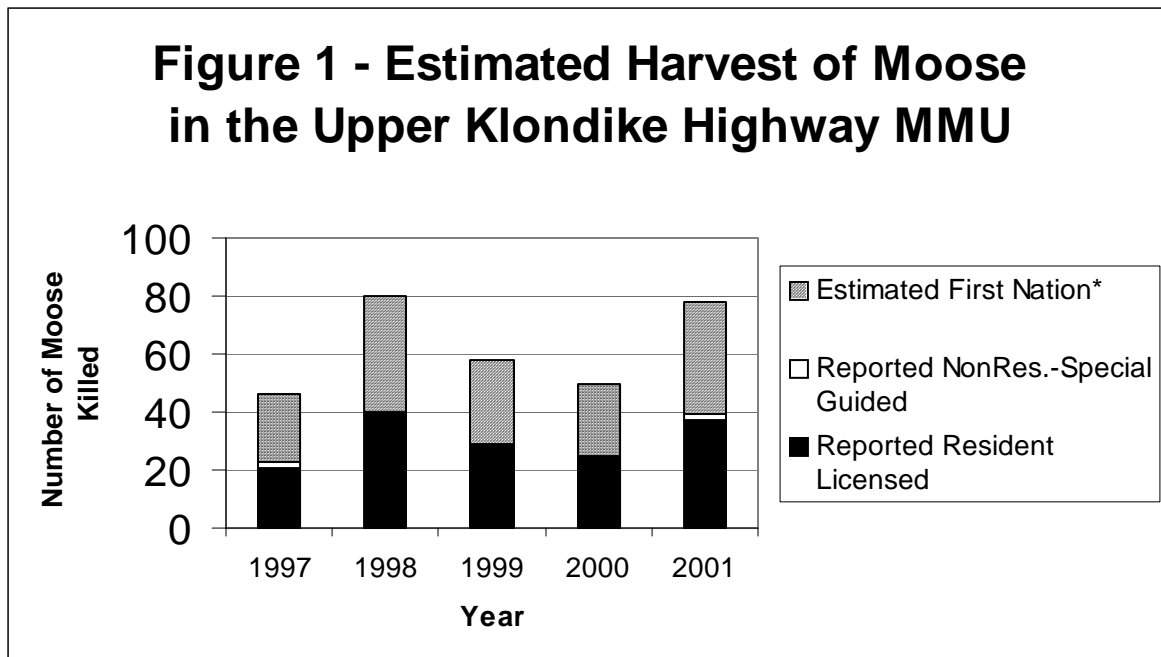
\* A "90% confidence interval" means that, based on our survey results, we are 90% sure that the true number lies within this range of numbers, and that our best estimate is in the middle of this range.

We estimate that there were 61 bulls for every 100 cows in the survey area (see Table 4). This is a bit below 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 some cows might not be bred (Yukon Fish & Wildlife Branch 1996).



**Harvest**

The average annual harvest of moose by licensed hunters in the Upper Klondike Highway Moose Management Unit, during the last 5 years for which we have complete records (1997 to 2001), was about 31 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 approximately the case. Using our latest estimates of moose density from this survey, we estimate that the annual harvest is presently at about 4.8% of the total moose population in the Upper Klondike Moose Management Unit. This is above the recommended maximum allowable harvest rate of 4% for this area. In addition, estimated harvest in 4 GMS's is above the recommended maximum level of 5% for an individual GMS—GMS 2-52 (9.6%), GMS 2-53 (5.8%), GMS 3-17 (8.4%), and GMS 4-01 (7.4%). Given that we do not have complete data on harvest by First Nation hunters, these estimates of harvest may not be accurate. This does, however, point out the need for gathering good harvest data in this area so we can take appropriate management actions.



\* For the purpose of estimating total harvest levels, harvest by First Nation hunters is estimated to be equal to reported harvest by licenced hunters. A total annual harvest of about 52 moose is the recommended maximum allowable harvest.

### **Other Sightings of Wildlife**

In addition to the moose that we counted in the blocks during our census, we also saw another 47 moose elsewhere in the survey area—14 of these were adult bulls, 17 were adult cows, 5 were calves, and the ages and sexes of the other 11 were not recorded.

We saw 4 caribou on the ridges northeast of Ethel Lake, and another 2 groups of 18 and 25-30 on the forested ridges south of the lake. There were numerous tracks and cratering of caribou along North Crooked Creek and near the mountain block between this creek and Crooked Creek locally called Big Sheep Mountain (north of the main McArthur mountain block). We also saw caribou tracks in the wetland to the northwest of Woodburn Lake. All of these observations are within the range of the Ethel Lake caribou herd.

There were tracks of sheep on Big Sheep Mountain, and also on the south end of the McArthur Range.

We saw the tracks of one pack of at least 7-8 wolves between Parallel and Reverse Creeks, north of Ferry Hill, and another of about 7 animals near Grayling Lakes. Tracks of smaller groups of wolves were also seen at Reid Lakes, at the east end of Ethel Lake, and along the Macmillan River.

Other wildlife sightings included numerous muskrat pushups on Reid Lakes and Grayling Lakes, otter tracks in the wetlands northwest of Woodburn Lake and at Grayling Lakes, a red fox at the Mayo airport, and numerous ptarmigan.

### **CONCLUSIONS AND RECOMMENDATIONS**

- ❖ We estimate that there are about 850 moose in the survey area in the Upper Klondike Highway Moose Management Area. The estimated density is about 147 per 1,000 km<sup>2</sup>, which is about average for the Yukon. This may be slightly underestimated because these estimates are not corrected for moose missed by the survey crews.
- ❖ There was good survival of calves in this area during the summer and fall of 2002. Survival of calves born in 2001 (yearlings in this survey) does not appear to have been as good.
- ❖ The number of bulls in the survey area, compared to the number of cows, appears to be healthy.
- ❖ Harvest of moose in the Upper Klondike Moose Management Area, and in several Game Management Subzones within it, likely now exceeds the maximum recommended allowable rates. Our estimates of present harvest rates may not be accurate because of incomplete information on harvest by First Nation hunters.
- ❖ We should commence discussions with affected First Nations and Renewable Resources Councils about getting information on harvest by First Nations hunters in this area. We should also discuss what management actions to take to bring harvest levels down to more sustainable levels.
- ❖ We should continue to closely monitor the status and harvest of the moose population in the Upper Klondike Moose Management Unit.

## **Acknowledgments**

The Selkirk First Nation and the Yukon Fish & Wildlife Branch, Government of Yukon, funded this survey. Dave Young, of Big Salmon Air, flew the stratification survey, with Pat Van Bibber, Sr., and Stewart Moses as observers. We also thank Cam Drinnan, Derek Drinnan, and Richard Rodger of Blacksheep Aviation for safe, efficient flying, their keen eyesight, and good humour.

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