2004 Faro Area Moose Survey Results, Population Status, and Harvest

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2004 FARO AREA MOOSE SURVEY RESULTS, POPULATION STATUS, AND HARVEST

Fish and Wildlife Branch
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Copies available from:
Yukon Department of Environment
Fish and Wildlife Branch, V-5A
Box 2703, Whitehorse, Yukon Y1A 2C6
Phone (867) 667-5721, Fax (867) 393-6263
E-mail: environmentyukon@gov.yk.ca

Also available online at www.env.gov.yk.ca

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Summary

We conducted an early-winter survey of moose in the Faro area from 6-12 November 2004. The main purpose of this survey was to estimate moose abundance, distribution, and population composition. We used this information in conjunction with available harvest data to assess population trend in Game Management Subzone 4-45 since the previous survey of this area in 1997. We also summarize results to date from an ongoing satellite-telemetry study of moose movement patterns in the area.

As in 1997, the extensive sub-alpine plateau north of Faro was found to be an important rut and post-rut area for moose during the 2004 survey. Moose rut and post-rut concentration areas were also observed in sub-alpine/willow and older post-burn habitats in the central and eastern portions of the 2004 survey area.

Compared to other regions of the Yukon, Game Management Subzone 4-45 and the larger 2004 Faro survey area have healthy moose numbers. We estimate there were 2462 ± 27% moose in the entire 2004 Faro survey area. This represents an average density of 405 moose per 1000 km^2. Although our moose population estimates for the Game Management Subzone 4-45 portion of the 2004 survey area declined from about 566 moose in 1997 to 485 moose in 2004, our data were not precise enough to state with certainty that a change in moose abundance had occurred.

If harvest remains within the normal range of 3% to 4% of the estimated moose population specified in our Moose Management Guidelines, recruitment rates and the bull to cow ratio (36 calves, 17 yearlings, and 54 mature bulls for every 100 mature cows) observed in 2004 should be sufficient to maintain a stable moose population.
The average annual reported harvest is about 2% of the total moose estimated for Game Management Subzones in the 2004 entire Faro survey area. Harvest, however, is at or over 5% of the estimated moose population in some accessible Game Management Subzones north and west of Faro, which is above the recommended maximum allowable rate. These harvest levels do not include moose taken by First Nations' members, although First Nation harvest is considered relatively low in this area. If the current voluntary harvest reporting approach is not found to be effective, legislated harvest restrictions may need to be implemented to ensure the long-term welfare of the local moose population.

Introduction

We surveyed moose abundance, distribution and population composition over an extensive area in the Faro region in 2003-2004. The survey area extended from the South Macmillan and Riddell rivers south to the Robert Campbell Highway; and from Drury Lake eastward to Blind and Dragon lakes (see attached Map 1). It includes Game Management Subzones (GMSs) 4-38, 4-40, 4-42 through 4-48, and 4-51. It covers a total area of about 6,470 square kilometers (km^2); of which 6,084 km^2 (2,349 square miles) is habitable moose range (see Table 1). Areas excluded

as non-habitat include alpine habitats 5,500 ft. or more above sea level (ASL) and large water bodies at or greater than 0.5 km^2 in size. The survey was initiated in November 2003, but we could not finish it that year due to bad weather and deteriorating survey conditions. We completed the survey November 6-12, 2004.

This survey was part of the Yukon Government's ongoing monitoring of high priority moose populations throughout the Yukon (i.e. those experiencing relatively high harvest and/or threats to habitat). The mountain blocks to the north and east of Faro, particularly in the GMS 4-45 area, are recognized as important rutting and post-rutting areas for moose. The GMS 4-45 area is also an important hunting area for Faro residents. Concentrations of moose, particularly in accessible sub-alpine regions during the rut make them vulnerable to over-harvest, and an intensive population survey was conducted in GMS 4-45 in 1997 to determine moose abundance, distribution and population composition (Yukon Renewable Resources 1997; Map 1). A less intensive trend survey of the sub-alpine plateau in GMS 4-45 was done in 1999 (Yukon Renewable Resources 1999), and two low intensity early-winter composition surveys were flown in 1998 (Yukon Renewable Resources 1998) and 1999 (Yukon Renewable Resources 1999), to monitor population composition and trend (see Map 2). The 2004 survey encompassed a larger area to address local questions about moose abundance, distribution, and age/sex characteristics in areas adjacent to GMS 4-45 (Map 1).

In this report we use reported harvest data to help assess the trend and impact of harvest in this region. We also summarize results from an ongoing satellite-telemetry study of moose movement patterns in the area.

Survey Methods

Our current survey technique involves a series of four steps. First, the survey area is subdivided into blocks called sample units based on a latitude and longitude grid. The 2004 Faro survey area contains 405 sample units, each unit measuring about 15-16 km^2 in size (see Map 3).

The second step is to "stratify" or assign the sample units into two categories; those that are expected to contain relatively high numbers of moose (high stratum) or few moose (low

stratum). This is accomplished by flying quickly over each unit and evaluating the expected moose abundance on the basis of local knowledge, habitat and moose sign observed. This was done in the Faro area in 2003 with the help of First Nation observers provided by the Ross River Dena Council and by local observers from Faro. Map 3 shows the distribution of sample units expected to have relatively high and low moose abundance. A quick re-stratification to assess some sample units that had burned over the 2004 summer was done immediately prior to the start of the third phase of the survey in early-winter 2004. Otherwise, we assumed that relative moose abundance in the sample units did not change significantly between 2003 and 2004.

Because we can not afford to count moose in every unit, the third step is to select a sample of the units where we expect to see relatively high numbers of moose, and a sample of those where we expect to see few moose. Most units are selected randomly, but about 10% are arbitrarily selected to fill in geographic holes in our sampling. During the 2004 Faro survey we selected and counted moose in 69 of the 405 blocks in the entire survey area. We used small maneuverable aircraft (Piper PA 18 Super-Cub or similar) with a 2-person team (pilot and observer) to search selected units. A Global Positioning System (GPS) receiver is used to identify sample unit boundaries and to determine whether moose seen are in or outside the selected sample units. On average we use about 30 to 35 minutes to search each unit and we attempt to count every moose present. Whenever possible, moose observed are classified as calves, yearlings, mature cows, or mature bulls. From these sample counts we develop an initial estimate of the total number of moose in the entire survey area. We do this by assuming that, within each stratum, the sample units we do not search have on average the same number of moose as the units we search.

During the final step of the technique, we re-survey portions of some of the sample units already searched, but at a higher search intensity (i.e. about 4 minutes per square kilometer instead of the 2 minutes per square kilometer used during the initial search) to see if we missed any moose. If we find, for example, that on average we missed 10% of the moose in the areas we searched, we add 10% to our initial estimate to come up with a corrected final estimate of the total number of moose in the area. This is called developing and applying a sightability correction factor (SCF).

Specialized statistical tests[1] are then used to determine whether we can reliably conclude that moose population abundance and/or composition have changed since the previous survey.

Population Abundance, Composition and Distribution

We counted 391 moose in the 69 sample units that were searched during the survey and estimated that there were about 2462 moose (90% C.I. = 1791-3133 moose)[2] in the entire 2004 Faro study area (Table 1). This population estimate incorporates a 1.11 (or 11%) sightability correction factor for moose missed during the survey. It represents an average density of approximately 405 moose for every 1000 km^2 of habitable moose range (381 moose per 1000 km^2 over the total survey area). This is above the current Yukon-wide average moose density of about 156 moose per 1000 km^2, and the average 191 moose per 1000 km^2 of moose habitat from the most recent data available for previously surveyed areas.

There were an estimated 640 mature bulls (26% of the total population), 1195 mature cows (48%), 199 yearlings (8%), and 428 calves (17%) in the 2004 Faro study area. We saw five cows with twins during the survey for an estimated twinning rate of 8% (Table 1).

Overall recruitment in the Faro survey area (36 calves and 17 yearlings per 100 mature cows) was within the range of 25 to 30 calves and yearlings per 100 mature cows we generally consider sufficient to maintain a stable moose population. The bull ratio (54 mature bulls for every 100 mature cows) was also above the minimum of 30 bulls per 100 mature cows set out in our Yukon Moose Management guidelines to ensure that all cows are bred during the rut (Yukon Renewable Resources 1996).

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[1] A two-tailed, standard normal or "Z" test is used to check for statistically significant changes in estimated moose population abundance. Chi-square contingency tables with Yates correction were used to test for significant changes in estimated population composition. In all cases Alpha was set at 0.1.

[2] While not technically correct, for explanation purposes the 90% C.I. (Confidence Interval) may be interpreted as the range of values that is 90% certain to encompass the actual number of moose in the survey area.

As in 1997, the extensive sub-alpine plateau north of Faro was found to be an important rut and post-rut area for moose during the 2004 survey. Moose early-winter concentration areas were also observed in sub-alpine/willow and older post-burn habitats in the central and eastern portions of the survey area.

Additional data on seasonal movement patterns of moose were collected as part of an ongoing satellite-telemetry study initiated in the Faro area in 2002 (Ward 2003a). Data from this project indicated that most moose are relatively sedentary, remaining with 15 to 20 kilometers of their initial capture site. Daily movement distances and home range sizes of collared moose tended to increase throughout the late winter and spring/summer periods. As the winter progressed, travel off the higher plateaus and down onto the adjacent lowland forest became more common. By spring and early summer the collared moose were spending most of their time in the lowland areas. As summer progressed, they frequently moved between the plateau and lowlands. Data for the fall rut period are limited but moose appeared to range widely, using both sub-alpine and lowland habitats. All moose returned to the same post-rut area in the year following their initial capture and collaring.

Population Trend: 1997 and 2004

Although the 2004 Faro survey area is much larger than the area surveyed in 1997, we were able to compare results for the GMS 4-45 portion which was surveyed in both years (Map 1, Table 1).

The mean estimated moose population in GMS 4-45 declined from about 566 moose in 1997 to 485 moose in 2004. The 2004 estimate for this area was relatively imprecise however, and we cannot say with certainty that any change in moose abundance has occurred in the area (i.e. not statistically significant: 2-tailed Z test, Z=0.74, P=0.46). If our 1997 and 2004 estimates are relatively accurate, however, it would represent a 14% decline in abundance and a reduction in moose density from 586 moose per 1000 km^2 observed in 1997, to 492 moose per 1000 km^2 in 2004. The 2004 moose density is, however, still relatively high for the Yukon.

The calf to cow ratio was higher in 2004 (45 calves per 100 mature cows) than in 1997 (35 calves per 100 mature cows). While the proportion of yearlings in the population was lower

during the 2004 survey (29 per 100 mature cows in 1997 versus 16 in 2004), overall recruitment rates remained very strong. These recruitment rates are within the range normally associated with stable to increasing moose populations. The estimated twinning rate also remained healthy in GMS 4-45, increasing from 7% in 1997 to 11% in 2004.

The estimated proportion of mature bulls in GMS 4-45 increased significantly (Chi square, $P<0.005$) from 30 per 100 mature cows in 1997 to 52 mature bulls per 100 mature cows in 2004. Although this is slightly lower than the current Yukon-wide average of 69 mature bulls per 100 mature cows, it is above the minimum acceptable ratio of 30 mature bulls per 100 mature cows set out in our Yukon Moose Management guidelines to ensure that all cows are bred during the rut (Yukon Renewable Resources 1996).

Harvest

Between 2000 and 2004, an average of 50 moose per year were reported harvested in Game Management Subzones that lie within or overlap the 2004 Faro survey area (GMS 4-38, 4-40, 4-42 to 4-48, 4-51; see Map 1 and Figure 1). This does not include harvest by First Nations' members, but local knowledge indicates that the harvest by First Nations is relatively low in this area, probably less than 6 moose per year (Kirby Meister, Faro District Conservation Officer, Pers. Comm.).

The average annual reported harvest represents a rate of 2.1% of the 2453 moose estimated for these GMSs (Table 2). The harvest rate in individual GMSs (excluding GMS 4-51 which is closed to all big game hunting) ranged from 0.7% in remote GMS 4-38, to 5.0% and 5.9% respectively in the very accessible GMSs 4-44 and 4-43, northwest of Faro. Annual allowable harvest rates for stable moose populations of average density are generally set at 3% to 4% of the total estimated moose population (Yukon Renewable Resources 1996). Harvest rates in excess of 4% to 5% are generally considered to carry an unacceptably high risk of precipitating a population decline. In addition to the high harvest rates recorded in GMS 4-43 and 4-44, several other accessible GMSs adjacent to Faro also experience annual harvest rates at or near the normal 3% to 4% allowable limit (Table 2).

In response to the high harvest rate and the low bull to cow ratio observed during the 1997 survey of GMS 4-45, an experimental voluntary harvest reporting and restriction program was implemented for GMS 4-45 in 1999 (Ward 2003b). Between 1999 and 2002 the reported harvest by all hunters ranged between 10 and 23 moose, but did not exceed the maximum allowable harvest of 25 moose per year set for this area. In 2003, the voluntary program was expanded to include GMS 4-42 through 4-46 because the harvest in the entire area appeared to be high and increasing. The allowable harvest for this larger area was set at 37 moose per year. Annual harvests of 38 and 35 moose were reported by all hunters in these GMSs in 2003-2004 respectively, indicating the level of harvest has been close to or exceeded the maximum allowable target level set for this region.

Management Concerns and Recommendations

Although population composition indicators for the Faro area are good, the decline in estimated moose abundance and the high harvest rates observed in accessible portions of the area raise conservation concerns about the long term welfare of the regional moose population. Relatively easy access through a network of mining and exploration roads makes it a popular hunting area for local residents and other Yukon hunters. The relatively low proportion of mature bulls seen in the GMS 4-45 area in 1997 and somewhat below average mature bull to cow ratio in the 2004 survey are probably linked to the high harvest in the area. If current recruitment rates continue and the total harvest are held to less than 4% of the estimated moose population, moose abundance should remain stable. The current reported and total estimated harvest, however, exceeds the 4% annual allowable harvest limit in some accessible areas north of Faro. If this trend continues and becomes more widespread, the local moose population may decline. The Yukon Fish and Wildlife Branch will continue to monitor the situation through the mandatory territory-wide harvest reporting system and the voluntary harvest management program initiated in the Faro area in 1999. If the voluntary harvest approach is not found to be effective, legislated harvest restrictions may need to be implemented to ensure the long-term welfare of the local moose population.

Other Wildlife Sightings

In addition to the 391 moose we counted during the 2004 survey, we also observed 64 moose outside of the sample units that were surveyed, but still within the survey boundary. The total number observed during the entire survey period was 455 moose. We also noted numbers or sign of several other species during the study. A total of 273 caribou were observed, primarily in low elevation pond complexes in the Laforce Lake area; along the Tay River in the eastern portion of the survey; and between Mt. Mye and Mt. Kulan. A large group of 15 sheep were seen southeast of Rose Mountain. Six sheep were spotted along the cliffs near Faro, and one sheep was seen on the west edge of the survey boundary northeast of Mount Aho. Various flocks of 13-50 ptarmigan were also observed in the northern portion of the survey region. Although no wolves were seen during the survey period, some tracking was identified about five km northeast of Barwell Lake.

Acknowledgements

We would like to thank Testloa Smith, Yukon Environmental Socio-economic Assessment Act Coordinator for the Ross River Dena Council and Kirby Meister, Yukon Government Conservation Officer in Faro, for their assistance in setting up local observers to participate in the Faro moose stratification survey in 2003. We sincerely appreciate the help and patience of all of the observers that took part during the extended 2003 survey season: Kathlene Suza and Henry Dick of the Ross River First Nation, and Danny Granberg, Kerry Rees and Kerry Wagantall from Faro. In 2004, Yukon Environment staff that generously provided their time and technical support during the census survey included Shannon Barker, Todd Powell, and Dave Sembsmoen. A final thanks to Big Salmon Air and pilot Dave Young for providing fixed-wing aircraft support during the 2003 season; and to Black Sheep Aviation and pilots Cam Drinnan, Derek Drinnan and Richard Rodger for their expertise during the 2004 survey period.

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Table 1. Summary of the 2004 Faro Moose Survey Results, and Results from the 1997 and 2004 Game Management Subzone (GMS) 4-45 Comparison Area

	Entire Faro Area	GMS 4-45 Comparison Area	
POPULATION CHARACTERISTICS	**2004[1]**	**1997[2]**	**2004[2]**
Estimated Abundance			
Total Moose (90% Confidence Interval) [3]	2462 ±27% (1791-3133)	566 ±20% (452-681)	485 ±30% (338-632)
Density (moose per 1000 km^2 of habitat)	405	586	492
Estimated Composition (90% Confidence Interval)[3]			
Mature Bulls (≥ 30 months)	640 ±31% (440-839)	88 ±31% (61-115)	122 ±38% (76-168)
Mature Cows (≥ 30 months)	1195 ±28% (855-1535)	291 ±24% (220-361)	235 ±31% (162-308)
Yearlings (Approx. 18 months) [4]	199 ±68% (64-335)	84 ±39% (51-117)	38 ±86% (5-71)
Calves (≤ 12 months)	428 ±35% (278-578)	101 ±39% (62-141)	106 ±40% (63-148)
Unknown	-	2 ±162% (0-6)	-
Estimated Population Ratios (90% Conf. Interval) [3]			
Mature Bulls per 100 Mature Cows	54 ±27% (39-68)	30 ±26% (22-38)	52 ±36% (33-70)
Yearlings per 100 Mature Cows	17 ±61% (6-27)	29 ±51% (14-43)	16 ±82% (3-30)
Calves per 100 Mature Cows	36 ±19% (29-42)	35 ±28% (25-45)	45 ±50% (22-68)
Mature Bulls: Percent of Total Population	26 ±19% (21-31)	16 ±23% (12-19)	25 ±26% (18-31)
Mature Cows: Percent of Total Population	48 ±10% (43-54)	51 ±11% (46-57)	48 ±13% (42-55)
Yearlings: Percent of Total Population	8 ±54% (4-12)	15 ±41% (9-21)	8 ±73% (2-14)
Calves: Percent of Total Population	17 ±19% (14-21)	18 ±27% (13-23)	22 ±50% (11-33)
Unknown	-	<1 ±167% (0-1)	-
Twinning Rate (%)[5]	8 ±92% (1-15)	7 ±100% (0-13)	11 ±92% (1-20)
SURVEY CHARACTERISTICS			
Stratification			
Survey Dates	Nov. 20–26, 2003[6]	Dec. 8-11, 1997	Nov. 21–25, 2003[6]
Total Survey Area (Km^2)	6470	1034	1053
Habitable Moose Range in Survey Area (Km^2)	6084	967	986
Total Flight Time used during Stratification (min.)	1020	679	Not avail.
Survey Time used during Stratification (min.)	614	451	Not avail.
Search Intensity (min. per Km^2 of habitat)	0.101	0.466	Not avail.
Number of Moose Seen	409	236	87
Moose Seen per Minute	0.67	0.52	Not avail.

Table 1. Continued

	Entire Faro Area	Faro Comparison Area (GMS 4-45)	
SURVEY CHARACTERISTICS Cont.	**2004[1]**	**1997[2]**	**2004[2]**
Census			
Survey Dates	Nov. 6-12, 2004	Dec. 9-13, 1997	Nov. 7-12, 2004
Number of Sample Blocks Searched	69	16	10
Area Searched (Km^2)	1102	283	159
Percentage of Habitable Moose Range Searched	18%	29%	16%
Total Flight Time used during Census (min.)	4625	1024	Not avail.
Survey Time used during Census (min.)	2304	580	346
Search Intensity (min. per Km^2)	2.09	2.05	2.17
Number of Moose Seen	391	232	91
Moose Seen per Minute	0.170	0.403	0.263
Sightability Correction Factor (SCF)			
Survey Dates	Nov. 6-12, 2004	Dec. 10, 1997[7]	-
Number of Sample Blocks Searched	15	-	-
Area Searched (Km^2)	60	-	-
Survey Time used during SCF (min.)	260	-	-
Search Intensity (min. per Km^2)	4.34	-	-
Number of Moose Seen	46	-	-
Moose Seen per Minute	0.177	-	-

[1] Population estimate in entire 2004 survey area incorporates a pooled sightability correction factor of 1.108.

[2] To allow for comparison across years, no sightability correction factor for moose missed during the survey is included in estimates provided. Any differences between the total estimated moose abundance and the sum of the estimated composition numbers for the 2004 subset results is due to the population estimation methods used.

[3] While not technically correct, for explanation purposes the 90% C.I. (Confidence Interval) may be interpreted as the range of values that is 90% certain to encompass the actual number of moose in the survey area.

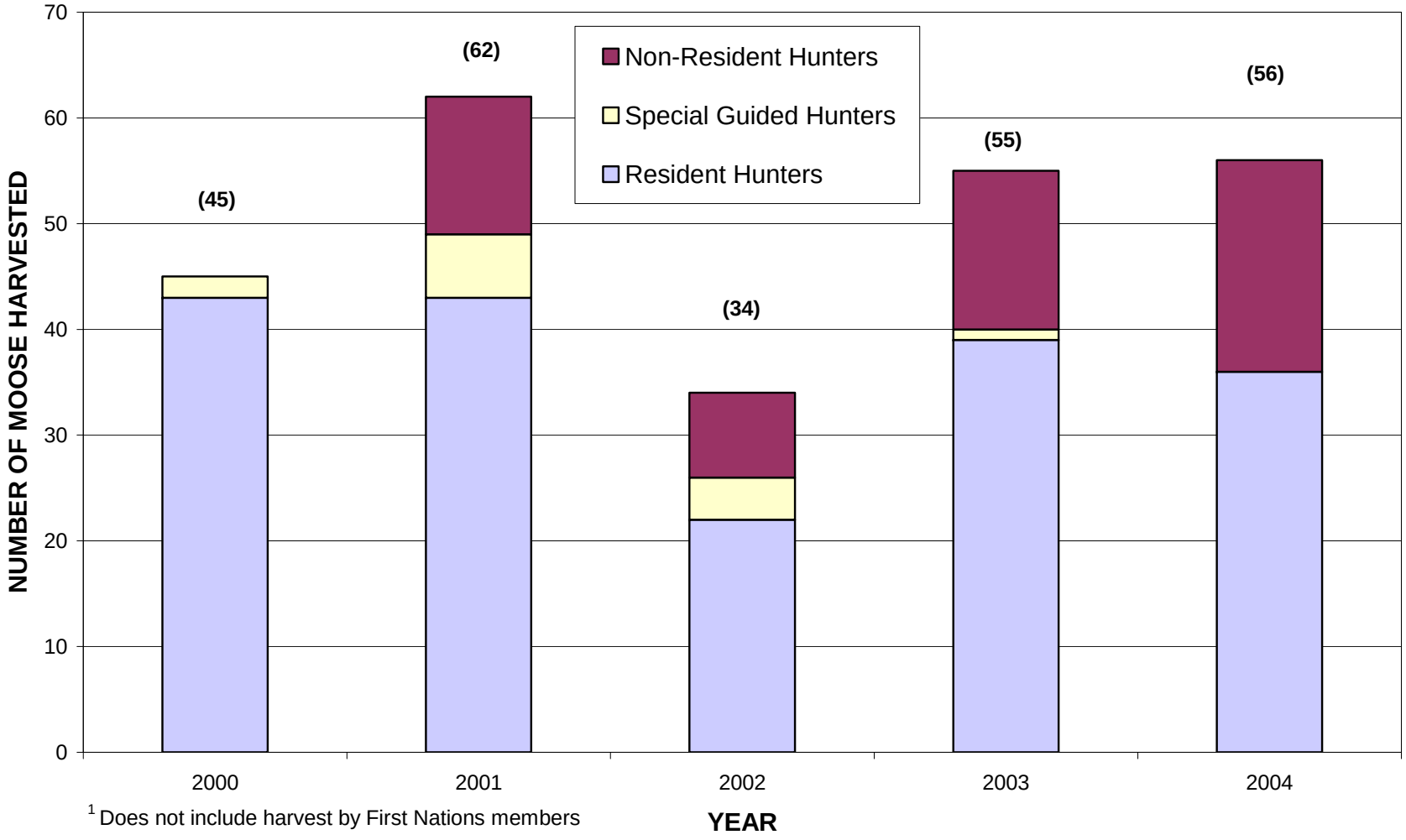
[4] To account for yearling cows that cannot be identified from the air, the total number of yearlings is assumed to equal 2x estimated number of yearling bulls in the population.

[5] Twinning Rate = the number of cows with 2 calves divided by the total number of cows with calves.

[6] The Faro stratification survey was conducted in 2003. As we could not complete the survey in 2003 due to poor weather, the census portion of the survey was conducted and completed in 2004.

[7] Only two SCF areas were flown during the 1997 Faro census due to poor weather. Data was insufficient for analysis.

Figure 1: Annual Reported Moose Harvest (2000-2004) in the Faro Moose Survey Area[1]
(Game Management Subzones: 4-38, 4-40, 4-42 to 4-48, 4-51)

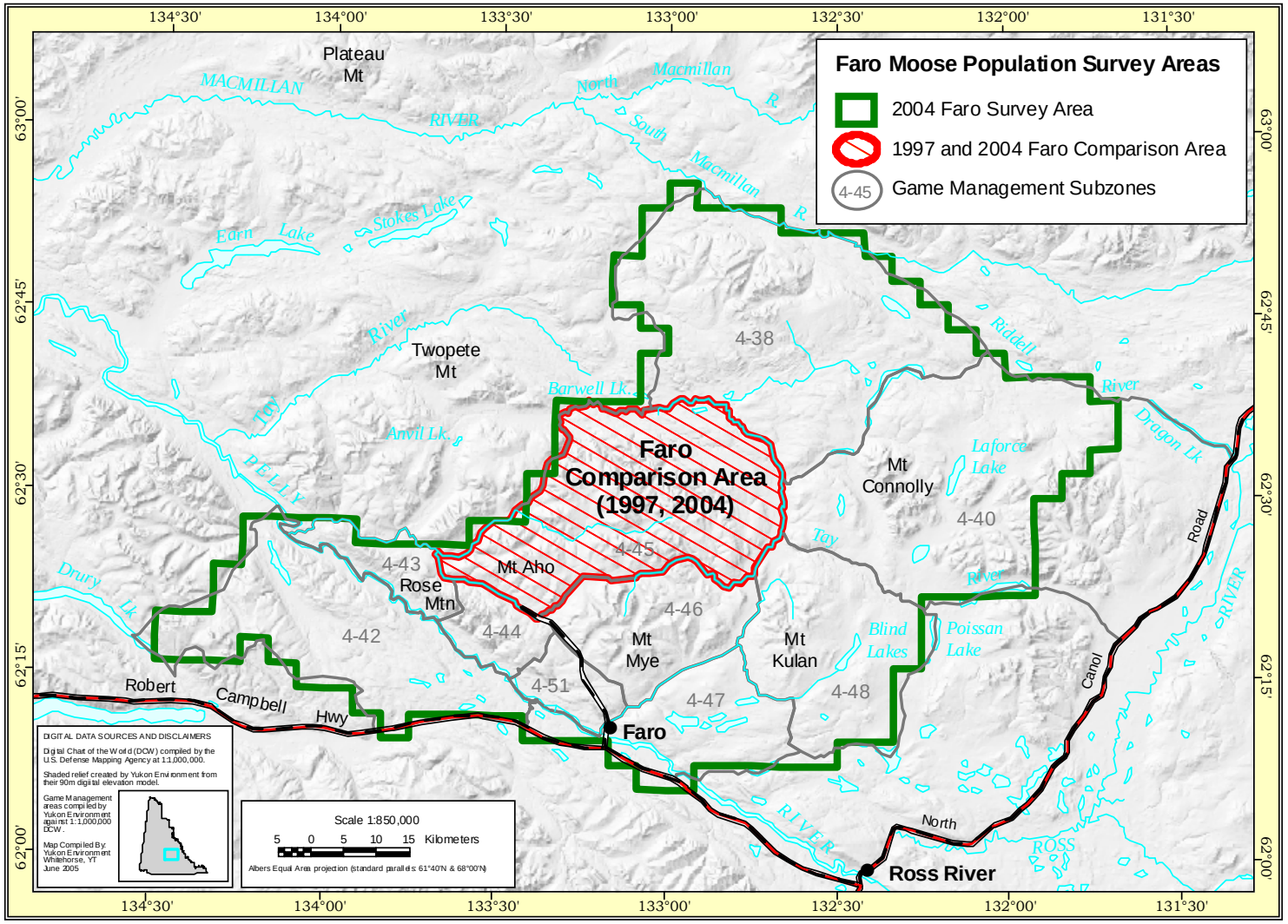


[1] Does not include harvest by First Nations members

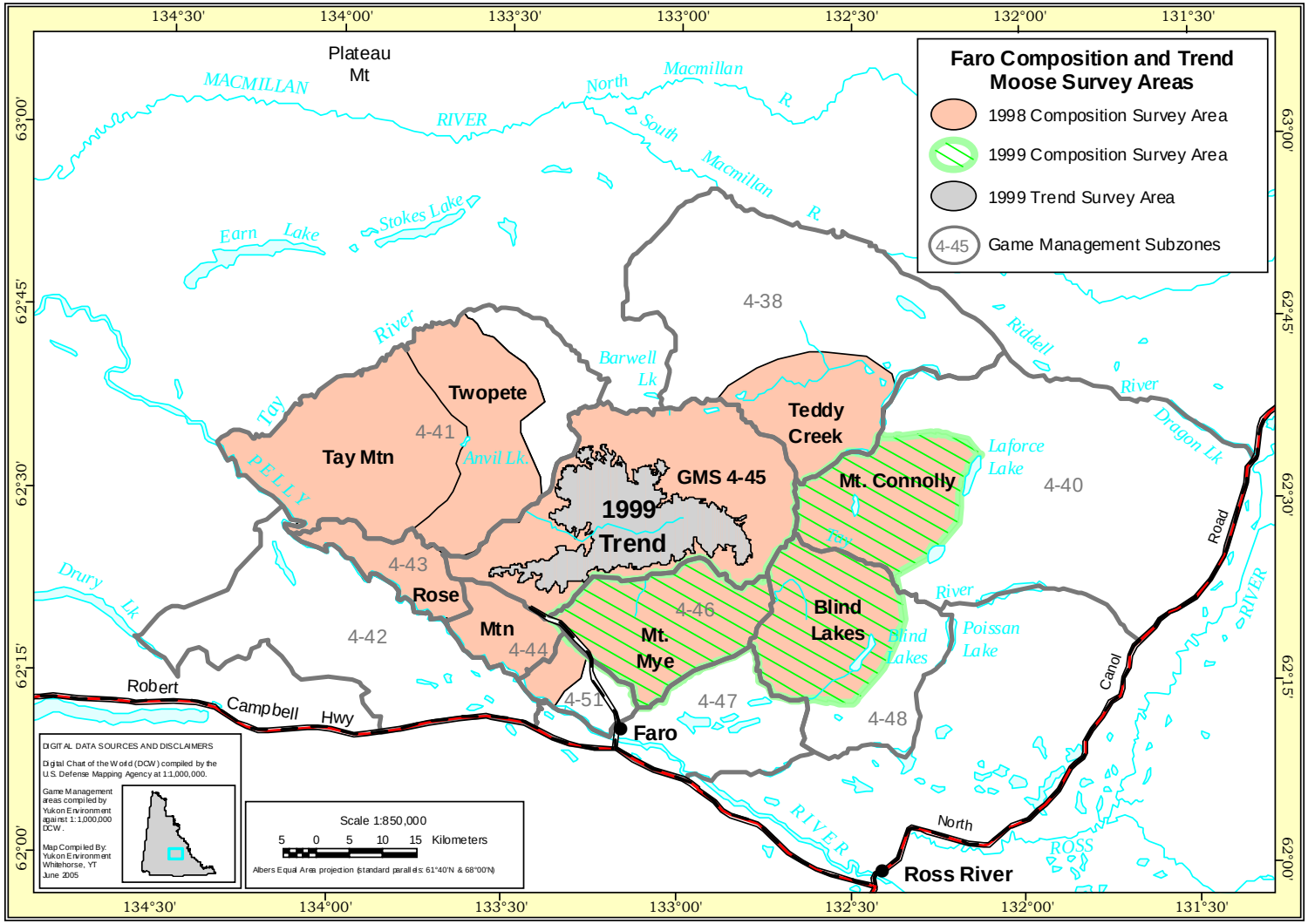
Table 2. Average Annual (2000-2004) Reported Moose Harvest and Allowable Harvest Summary for the 2004 Faro Moose Survey Area Game Management Subzone (GMS) 4-38, a portion of 4-40, 4-42 to 4-48, 4-51[1]

GMS	GMS Area (km^2)	Estimated Density[2] (moose/ 1000 km^2)	Total Estimated number of Moose	Average Resident Harvest	Average Non-Resident Harvest	Average (Special Guided) Harvest	Average Reported Harvest[3] (2000-2004)	Current Harvest Rate (% of total population)	2% Allowable Annual Harvest	3% Allowable Annual Harvest	4% Allowable Annual Harvest	5% Allowable Annual Harvest
4-38	1368.7	400	547.5	1.0	2.8	0.2	4.0	0.7	10.9	16.4	21.9	27.4
4-40	1907.6	325	620.0	4.4	5.4	0.6	10.4	1.7	12.4	18.6	24.8	31.0
4-42	825.5	250	206.4	2.8	1.8	0.0	4.6	2.2	4.1	6.2	8.3	10.3
4-43	170.3	200	34.1	2.0	0.0	0.0	2.0	5.9	0.7	1.0	1.4	1.7
4-44	147.9	325	48.1	2.4	0.0	0.0	2.4	5.0	1.0	1.4	1.9	2.4
4-45	1035.8	450	466.1	15.6	0.8	1.0	17.4	3.7	9.3	14.0	18.6	23.3
4-46	422.5	425	179.6	4.4	0.0	0.4	4.8	2.7	3.6	5.4	7.2	9.0
4-47	420.8	150	63.1	1.8	0.0	0.2	2.0	3.2	1.3	1.9	2.5	3.2
4-48	670.5	400	268.2	2.2	0.4	0.2	2.8	1.0	5.4	8.0	10.7	13.4
4-51	132.0	150	19.8	0.0	0.0	0.0	0.0	0.0	0.4	0.6	0.8	1.0
Total[4]	**7101.6**	**307.5**	**2452.7**	**36.6**	**11.2**	**2.6**	**50.4**	**2.1**	**49.1**	**73.6**	**98.1**	**122.6**

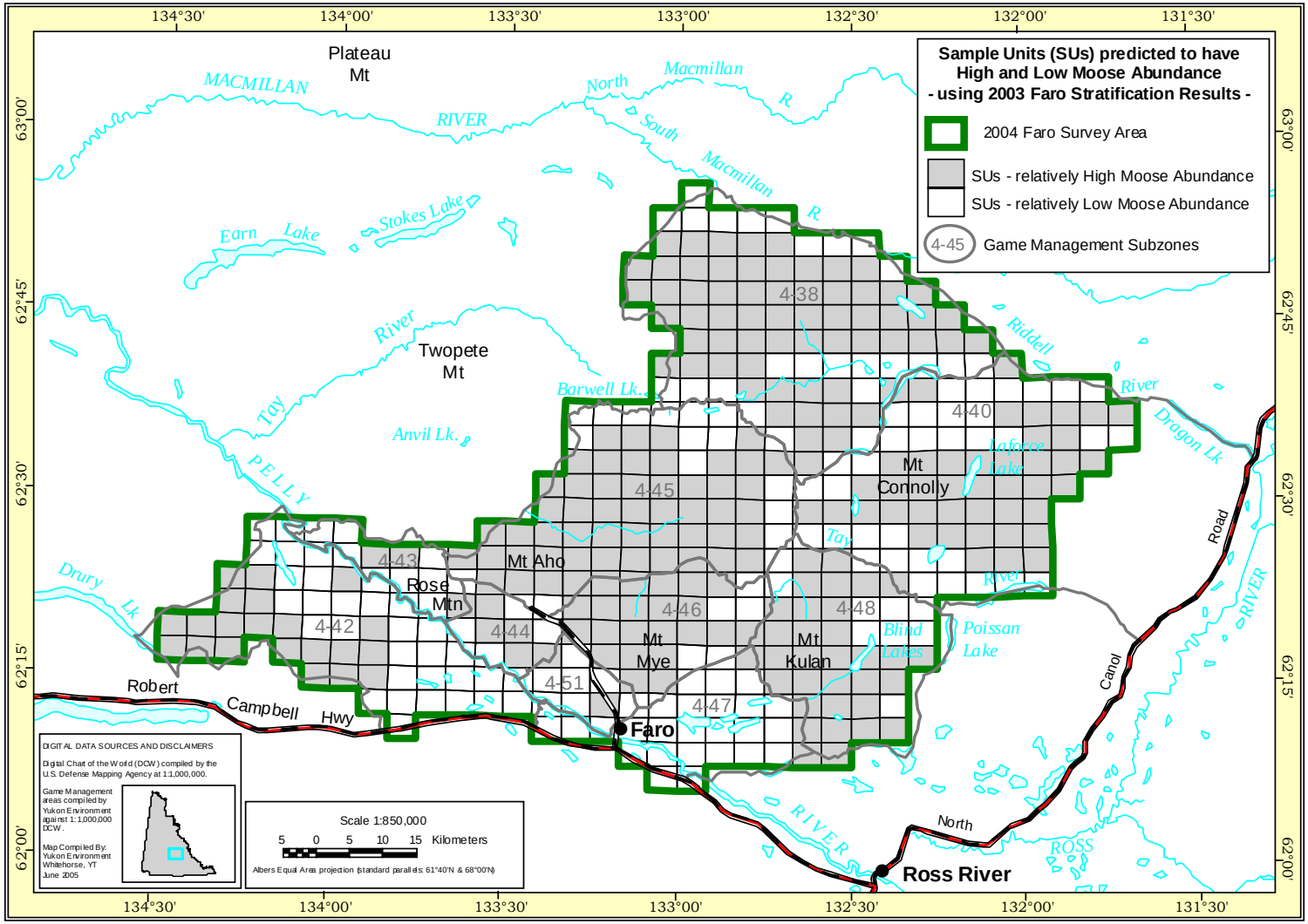
[1] Does not include harvest by First Nations' members.
[2] Based on 2004 Faro moose survey results.
[3] Includes only reported harvest. Does not include harvest by First Nations' members.
[4] Small differences in total area, average moose density, and total number of moose presented in Tables 1 and 2 are due to slight differences in game management subzone and survey area boundaries (see map 1).



Map 1. 2004 Faro Moose Survey Area and the 1997 and 2004 Game Management Subzone 4-45 Comparison Area



Map 2. Faro Moose Composition (1998-1999) and Trend (1999) Survey Areas



Map 3. Relative Moose Abundance and Distribution in the Faro Area based on 2003 Stratification Survey Results