

**LOWER MACMILLAN RIVER MOOSE
MANAGEMENT UNIT**

**SUMMARY OF EARLY-WINTER 2008
MOOSE SURVEY**

19-24 November 2008



Prepared by:
Mark O'Donoghue & Rick Ward



October 2009

**LOWER MACMILLAN RIVER MOOSE MANAGEMENT UNIT
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NOVEMBER 2008**

**Fish and Wildlife Branch
SR-09-07
Yukon Department of Environment**

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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

Suggested citation:

O'DONOGHUE, M., AND R. WARD. 2009. Lower Macmillan River Moose Management Unit
Summary of Early-Winter 2008 Moose Survey . Yukon Fish and Wildlife Branch Report
SR-09-07, Whitehorse, Yukon, Canada.

SUMMARY

- ❖ We conducted an early-winter survey of moose along the lower Macmillan River on 19-24 November 2008, using fixed-wing aircraft. The main purposes of this survey were to map the distribution and early-winter habitats of moose in this area and to get an indication of abundance of moose.
- ❖ We flew over the entire survey area and spent about 0.5 minutes per km² searching for moose. We found a total of 368 moose, of which 154 were adult bulls, 173 were adult and yearling cows, 5 were yearling bulls, 25 were calves, and 11 were unclassified adults.
- ❖ Most moose seen were in 14-19-year old burned areas in hilly terrain; we found aggregations of moose in burned areas in the hills to the southeast of the Hess River, south of Big Kalzas Lake, and north of Earn Lake. Some moose, mostly cows, remained in willow-rich habitats in lowlands in the main river valleys and associated ponds and sloughs.
- ❖ We saw about 0.20 moose for every minute searched in the survey area. Previous moose surveys have shown that this rate of sighting moose corresponds to a density of about $185 \pm 39\%$ moose per 1,000 km² over the whole area. This density estimate is close to the estimate of 210 moose per km² that we had previously estimated for the area from our last survey in 2000. The 2008 estimate is only a rough indication of moose abundance though, which would need to be verified with a census
- ❖ Harvest of moose in this area appears to be sustainable at present levels.

INTRODUCTION

This report summarises the results of the early-winter survey of moose in a part of the Lower Macmillan River Moose Management Unit (see Map 1), conducted on November 19-24, 2008. The main purposes of the survey were to map the distribution and early winter habitats of moose in this area and to get an indication of abundance of moose.

Previous Surveys

The Yukon Fish and Wildlife Branch has previously participated in or conducted three other surveys of moose along the Macmillan River in early winter (see Map 2), and one in late winter. The first was conducted by contractors in 1982 to evaluate moose numbers and habitat use in an area of active mining exploration; the 1982 survey area overlapped the entire 2008 survey area between the Macmillan and Pelly Rivers (see Map 2; results in Johnston & McLeod 1983). The second early-winter survey was conducted in 1995 to census the moose population in the Pelly Crossing area, in a survey area that overlapped with the 2008 area only in the western section between the Macmillan and Pelly Rivers (results in Ward, McLean, Westover, Florkiewicz, & Withers 1998). In November and December 2000, the Yukon Fish and Wildlife Branch and Selkirk First Nation conducted an early-winter census of moose over a very large area that completely overlapped the 2008 survey area in addition to covering areas to the southeast in the Lower Macmillan River Moose Management Unit (see Map 2), and to the north and south of the MMU (results in Ward 2001). The 2008 survey area was again covered in a survey funded by Selkirk First Nation, with Yukon Fish & Wildlife Branch support, to map late-winter habitat in March 2001 (results in O'Donoghue 2005).

Community Involvement

Residents of the Pelly Crossing area have consistently placed a high priority on monitoring the health of local moose populations. Concerns about high hunting pressure and fewer moose seen along the Macmillan River, which is an important hunting area for the Selkirk First Nation, led to recommendations at Northern Tutchone May Gatherings that we conduct this survey. Selkirk First Nation co-funded the survey, and both the Selkirk First Nation and the First Nation of Na-Cho Nyäk Dun provided staff to help conduct it.

STUDY AREA

The Lower Macmillan River survey area was delineated in 2001 to cover the areas most accessible and used by hunters, and to conform to the boundaries of Yukon moose management units. Moose management units were developed to help us more consistently monitor and manage moose in all areas throughout the Yukon. We plan to monitor the health of moose populations in priority moose management units using both aerial and ground-based surveys.

The Lower Macmillan River Moose Management Unit is about 7,825 km², and includes Game Management Sub-zones 410, 411, 417, 418, and 419 (see Map 1). The survey area within this Moose Management Unit is about 3,515 km². The border of the survey area follows the Macmillan, Kalzas, and the Hess Rivers in the north, and the Pelly River and Earn Lake in the south; the eastern boundary extends roughly from Earn Lake in the south to Moose Lake in the north.

Most (about 3,385 km²) of the study area is considered suitable moose habitat, except for approximately 4% of the area, which includes large water bodies (0.5 km² or greater in size) and land over 1,524 m (5,000 feet) in altitude. The study area consists mostly of rolling hills and plateaus, dissected by numerous creeks, in the drainages of the Macmillan, Pelly and Hess Rivers. Much of the area is forest-covered with black and white spruce, aspen, and lesser amounts of lodgepole pine and paper birch; balsam poplar also grows along the Macmillan and Pelly Rivers. Forest cover varies from dense mature white spruce and poplar in the main river valleys, to dense black spruce in many lowlands, to more open mixed spruce and aspen or birch on slopes. Willow and dwarf birch shrub habitats, alpine tundra, and unvegetated rocky areas typify the higher plateaus scattered throughout the study area, especially in the mountainous areas in the Wilkinson Range and east of Little Kalzas Lake. Forest cover in much of the survey area has burned during the past 60 years (see Map 3). The most recent forest fires have occurred in the northeastern part of the study area in 1989, several fires between Big Kalzas Lake and Earn Lake in 1994, 1998, and 1999, and a number of scattered fires in 2004.

The survey area has little access other than along the rivers; old mining roads in the Wilkinson Range are mostly overgrown and impassable. The Macmillan and Pelly Rivers are regularly used, especially in the fall, for hunting moose.

METHODS

We used a survey method called “intensive stratification”, which gives us good information about the distribution and areas of concentration of moose over the whole survey area. It also allows us to calculate an “index” or indirect indication of abundance of moose. The technique involves the following steps:

1. The survey area is divided into uniform rectangular blocks 15-16 km² in size. We used the same survey blocks as those used in the overlap area in the 2000 survey.
2. Observers in fixed-wing aircraft fly over all the blocks, making about 4 passes through each block and classifying (or “stratifying”) 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 the same as the “stratification” part of a full census survey, except that we cover the area at about four times the intensity to get more complete information.
3. We count and get a GPS location of each moose or group of moose we see. We classify all moose seen by age (adult, yearling, or calf) and sex when possible, but we do not put as much effort into this as we do in censuses when we are making estimates of population composition.
4. We estimate an index of the total number of moose in the entire survey area based on the numbers of moose we see and the amount of time we spend looking for them. An analysis of data from previous surveys showed that the number of moose seen per minute on these stratification surveys could be used to predict the actual densities of moose in the survey areas (details in Ward, Gasaway & Dehn 2000). Predicted densities are not as precise as those estimated from full censuses though, so they should only be taken as rough estimates of abundance that need to be verified with censuses in situations where close monitoring of moose populations is required.

WEATHER AND SNOW CONDITIONS

Overall, the weather and snow conditions were fair for this survey. Temperatures ranged from -34°C to -14°C. Skies were mostly clear on three of the six survey days and cloudy on the others; on two days, low clouds and snow caused us to fly only partial days. We encountered moderate to strong winds on three days, which made flying in mountainous terrain difficult. We were able to fly some hours on all six consecutive days of the survey. Light conditions ranged from flat to bright and snow coverage was complete with fresh snowfalls on the 19th and 23rd of November, so visibility was generally good for spotting moose.

RESULTS AND DISCUSSION

Coverage

It took us about 30.8 hours to count moose in the 224 blocks in our survey area, for a search intensity of 0.53 minutes per km². This matched well with our target search intensity of 0.5 minutes per km², and corresponded with flying through each block about four times and circling at animal observations when needed to verify them. We needed an additional 18.7 hours to ferry to and from the survey area and fuel supplies in Mayo and Pelly Crossing. The time devoted to ferrying (about 38% of total flight time) was high compared to other surveys because of the survey area's remote location. Survey costs are summarised in the Appendix.

Observations of Moose

We counted a total of 368 moose, 154 of them adult bulls, 173 adult and yearling cows, 5 yearling bulls, 25 calves, and 11 unclassified adults (see Table 1). We spent 1846 minutes searching the survey blocks for moose, so we saw an average of 0.20 moose per minute of survey time.

Table 1. Observations of moose during the November 2008 survey in the Lower Macmillan River Moose Management Unit.

	Number Observed	Percentage of Moose Observed
Adult Bulls	154	42
Adult and Yearling Cows*	173	47
Yearling Bulls	5	1
Calves	25	7
Unclassified Adults	11	3

* 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.

Distribution of Moose

Moose were widely distributed in the survey area, but most observations were concentrated in 14-19-year old burned areas (see Map 4). The biggest aggregation of moose—42% of all moose seen—was in the northeast corner of the study area in hills south of the Hess River that had been burned in a 1989 fire. Another concentration with 17% of all moose seen was in the Clarke Hills in the 1994 burn extending south and east from the western end of Big Kalzas Lake. The third major aggregation, with 12% of all moose seen, was in the 1994-burned hills north of Earn Lake. We did see moose in a variety of other habitats as well, mostly associated with subalpine willow habitats and in riparian habitats with abundant willows near the major rivers. We saw few moose in forested lowlands and slopes that had little shrub cover.

The Lower Macmillan River survey area does not have extensive subalpine willow habitats typical of some other areas of the central Yukon. The Clarke Hills are mostly heavily forested with black spruce, except in areas with recent fires. The transitions between forested lower slopes and alpine habitats in the higher peaks of the Wilkinson Range and the mountains east of Little Kalzas Lake are fairly abrupt, especially on south-facing slopes. The most extensive areas of subalpine willows are on the north-facing slopes of the Wilkinson Range, and we likely missed seeing some moose in these habitats because strong winds forced us to fly at higher altitudes over some of these areas.

We saw scattered moose, mostly cows, in lowland habitats associated with willow flats along the Macmillan River and near open ponds and sloughs in the river valley. Because of the heavy forest cover, we undoubtedly missed more moose in these lowland habitats than we did in open burned and subalpine areas, which would bias our results towards the open habitats. However, we saw no indication from our observations of moose tracks that we were missing large aggregations of moose in forested cover. Our general conclusion that most moose were in burned habitats in uplands while some cows stayed in lower-altitude riparian areas holds, despite differences in sightability among habitats.

Several aggregations of moose were noted in the 1982 survey of moose within the 2008 survey area—two in subalpine habitats in the Wilkinson Range, one in the same burned hills north of Earn Lake (which were also burned in 1951 and 1972) where we saw a concentration in 2008, one in riparian willow habitats along the Macmillan River, and one in sloughs and open forest about 5 km south of the Macmillan River, north of the Tummel River's confluence with the Pelly River (see Johnston & McLeod 1983). More cows, and especially cows with calves, were seen in lowland habitats than were bulls. So, the

general pattern of early-winter distribution that we observed in 2008 is consistent with observations 26 years previously.

Abundance of Moose

We can use the number of moose we saw per minute of search time to calculate an index of abundance of moose over the whole survey area. The equation used to calculate this index is:

$$\text{Estimated Density} = 39.5 + (725.5 \times (\# \text{ Moose seen per minute}))$$

Substituting in our results of 0.20 moose seen per minute, and using the formulas for estimating precision in Ward, Gasaway & Dehn (2000), the calculated estimated density for the survey area is $185 \pm 39\%$ moose per 1,000 km² (the “ $\pm 39\%$ ” is a 90% “confidence interval”, which says that, because of the variability in different factors affecting these sorts of counts, we’re 90% certain that if we went out and counted the area again that we’d end up with an estimate within 39% of 185 moose per 1,000 km²).

At a density of 185 moose per 1,000 km², the total estimated population for the survey area would be 626 moose, with a 90% confidence interval of 382-870 moose. Based on previous surveys, our estimate of the moose population in the survey area was 711 moose (estimated average density of 210 moose per 1,000 km²). So, the 2008 survey results do not suggest any large decrease or increase in moose numbers in the survey area. Even though the estimate of abundance in 2008 is a bit less than we had previously estimated, these stratification surveys only give us rough indices of abundance, and so they can only detect large changes in numbers. Repeated low-intensity surveys or a high-intensity census would be necessary to more closely monitor the trend in moose numbers in this area.

Ages and Sexes of Moose

We classified almost all of the moose we saw by age and sex, but we cannot translate these directly into estimates of the composition of the moose population in the study area. Stratification surveys such as this are aimed mostly at determining the distribution of moose in the survey area. The data are valuable for mapping important habitats and also for dividing up the survey blocks covering the area into “strata” or categories of high and low expected densities of moose for future censuses.

The observed proportions of moose of different ages and sexes that we saw were likely biased compared to those of the actual population.

Previous surveys have shown that cow moose, particularly cows with calves, tend to space themselves away from other moose more than bulls do, so that there is a higher proportion of cows in low-density survey blocks than there is in high-density blocks. Early-winter low-density blocks also typically have lower sightability, because forest canopies are, on average, denser. This is consistent with our observations of more cows in the lowland habitats in the 2008 survey. As a result of these differences in sightability of bulls and cows, we likely miss seeing more cows than we do bulls when we search over all habitats with the same intensity, so our observations will be biased towards bulls. Census surveys, in which survey blocks are searched very intensively and counts are corrected for sightability, are more appropriate for estimating population composition than are intensive stratification surveys.

The age and sex classifications observed in this survey can be compared directly with the results from similar surveys in the future though so, for that purpose, our observed composition indices were 92 bulls per 100 cows, 15 calves per 100 cows, and 6 yearlings per 100 cows.

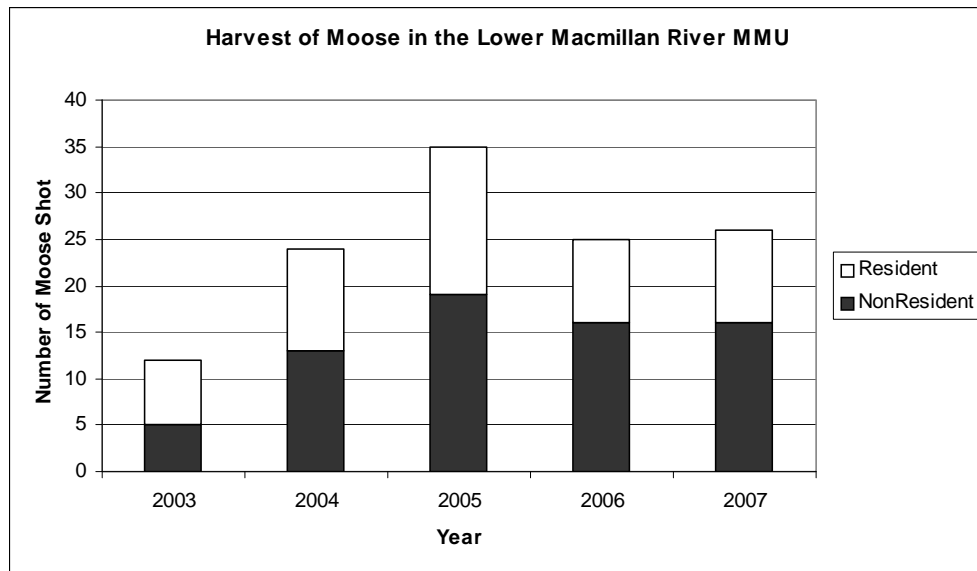
Identification of High and Low-Density Blocks

We divided the survey blocks into four categories of expected moose density, for use in future censuses of the survey area. We classified 40 (18%) of the 224 survey blocks as high, 28 (13%) as medium, 78 (35%) as low, and 78 (35%) as very low expected abundance of moose (see Map 5), based on our observations from the air and from previous surveys. Most of the blocks with higher expected numbers of moose were located in the burns where we observed high numbers of moose in this survey, in subalpine areas in the Wilkinson Range and in the mountains east of Little Kalzas Lake, and in areas with dense willows along the Macmillan River. For the purpose of selecting blocks for future censuses, we can group the blocks classified as expected high and medium numbers of moose into a High stratum with 68 blocks, and consider the 156 blocks with low and very low expected numbers of moose to make up the Low stratum.

Harvest

The reported harvest of moose by licensed hunters in the Lower Macmillan River Moose Management Unit during the last 5 years for which we have complete records (2003 to 2007), averaged about 24 moose per year (see Figure 1). This does not include harvest data from First Nation hunters, which are reported annually at Northern Tutchone

May Gatherings. Using our best estimates of moose density and total harvest by all hunters, we estimate that the annual harvest is presently at about 2.1% of the total moose population in the Lower Macmillan River Moose Management Unit. This is well below the recommended maximum sustainable harvest rate of 4% for this area. The Macmillan River is the most important hunting area for hunters from the Selkirk First Nation who have noticed increased hunting pressure in recent years with more people coming and using jet boats to go up the river. We need to continue to closely monitor both harvest and the moose population in this area to ensure that the population remains healthy.



Other Wildlife Sightings

During the moose survey, we also recorded sightings of other notable observations of wildlife besides moose. We saw three groups of Fannin sheep, totalling 28 animals, on the rocky outcrops north of the Earn River about 5 km upriver of its confluence with the Pelly River (see Map 6). We saw one small group of five caribou on the north slopes of the Wilkinson Range south of the Macmillan River, and three groups of wolves, a pack of nine and a pair along the Macmillan River, and a single animal on Big Kalzas Lake (see Map 6). Flying to Pelly Crossing, we also saw a group of four mule deer on the north bank of the Pelly River, south of Diamain Lake.

CONCLUSIONS AND RECOMMENDATIONS

- ❖ Habitat in hilly terrain that has been burned within the last 15-20 years supports the highest densities of moose in this area in the early winter. Burns south of the Hess River, south of Big Kalzas Lake, and north of Earn Lake presently support the largest concentrations of moose in the area. Some moose, especially cows, remain in the river valleys during early winter in areas where there are abundant willows.
- ❖ The estimated density of moose in this area is close to 200 per 1,000 km² of suitable moose habitat, which is higher than the Yukon-wide average. We have no indication that abundance of moose in this area has changed during the past eight years, but would need to do a full census to verify this.
- ❖ Present levels of harvest of moose in the Lower Macmillan River Moose Management Unit seem sustainable. The Macmillan River is the main hunting area for the Selkirk First Nation, and local hunters have reported increasing levels of harvest pressure.
- ❖ We should continue to monitor moose populations in this area using aerial and ground-based monitoring.

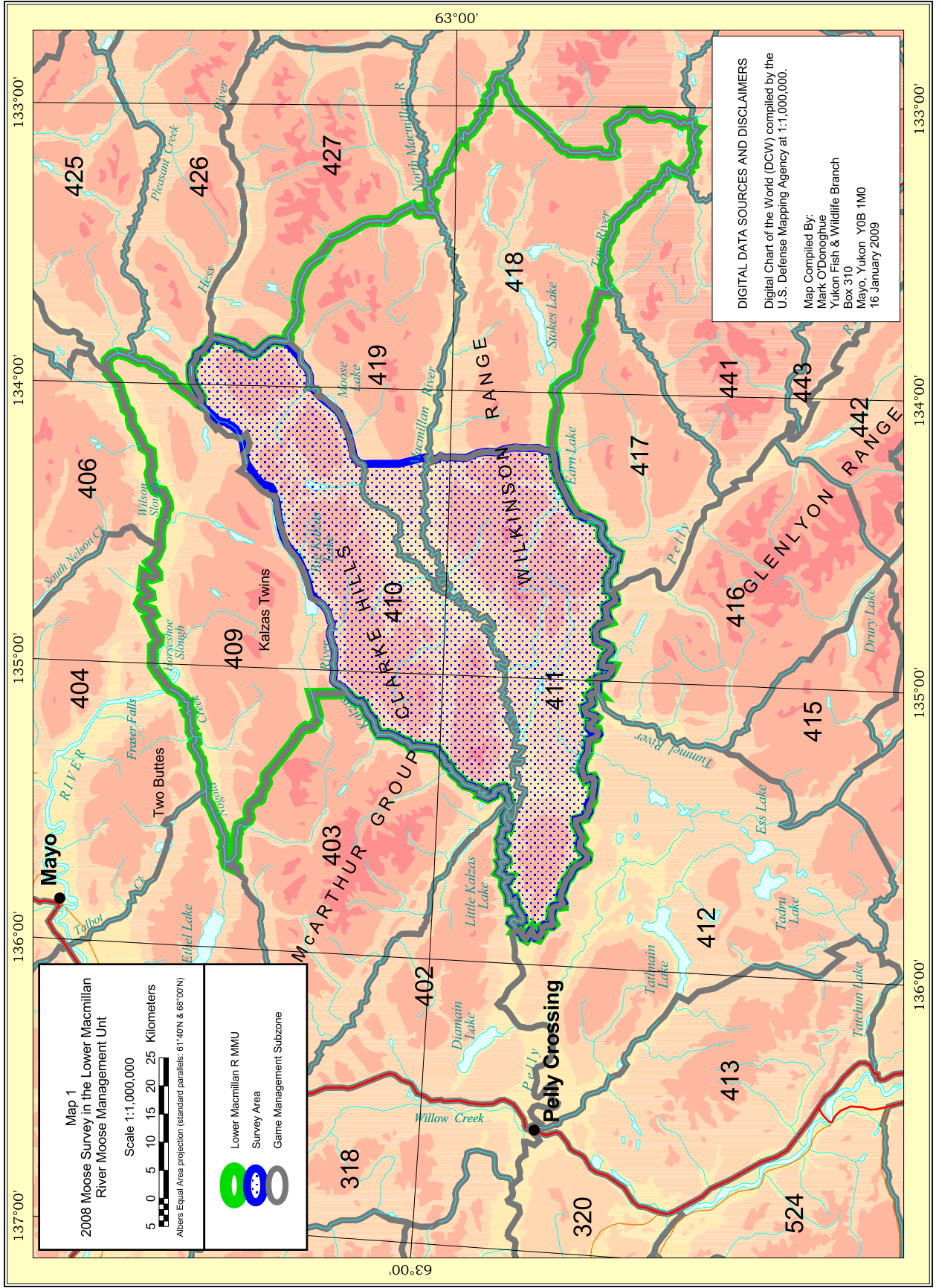
Acknowledgments

The Yukon Fish & Wildlife Branch and Selkirk First Nation provided funding and staff for this survey. The First Nation of Na-Cho Nyäk Dun also provided staff. We thank Jim Healy and Bernie Martin for safe, efficient flying in often difficult conditions. Dawna Hope, Kevin Johnstone, and Rene Rivard acted as additional navigators and did a fine job guiding the survey planes and recording data. We also thank Beverley Brown, Teri Buyck, Gary Hope, Christiana Joe, Styd Klugie, Walter Peter, Erin Profeit, and Barb Shannon for providing their keen eyesight and knowledge of the area as observers on the aerial survey crews.

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Maps



Map 1
 2008 Moose Survey in the Lower Macmillan River Moose Management Unit

Scale 1:1,000,000

5 0 5 10 15 20 25 Kilometers

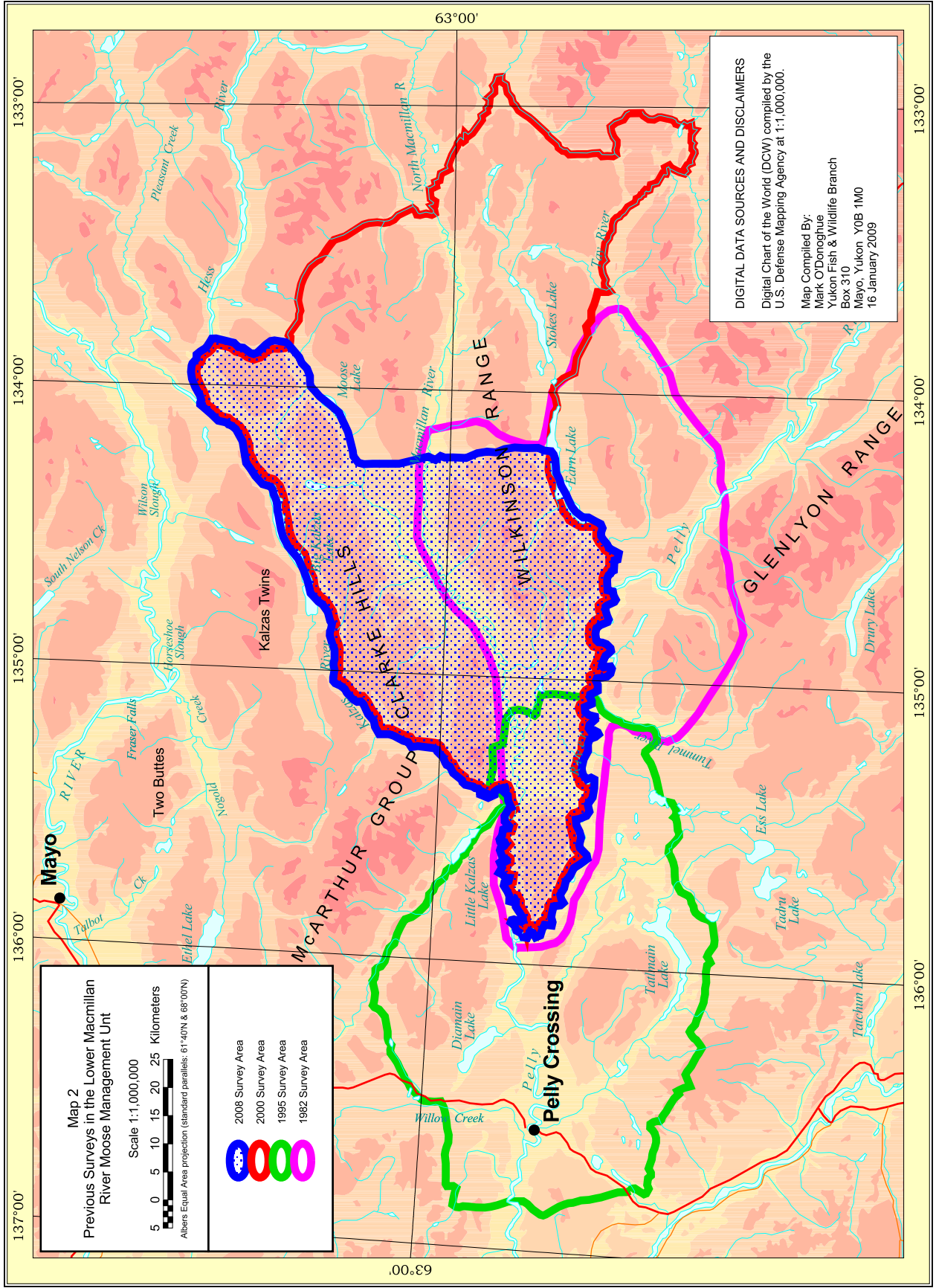
Albers Equal Area projection (standard parallels: 61°40'N & 68°00'N)

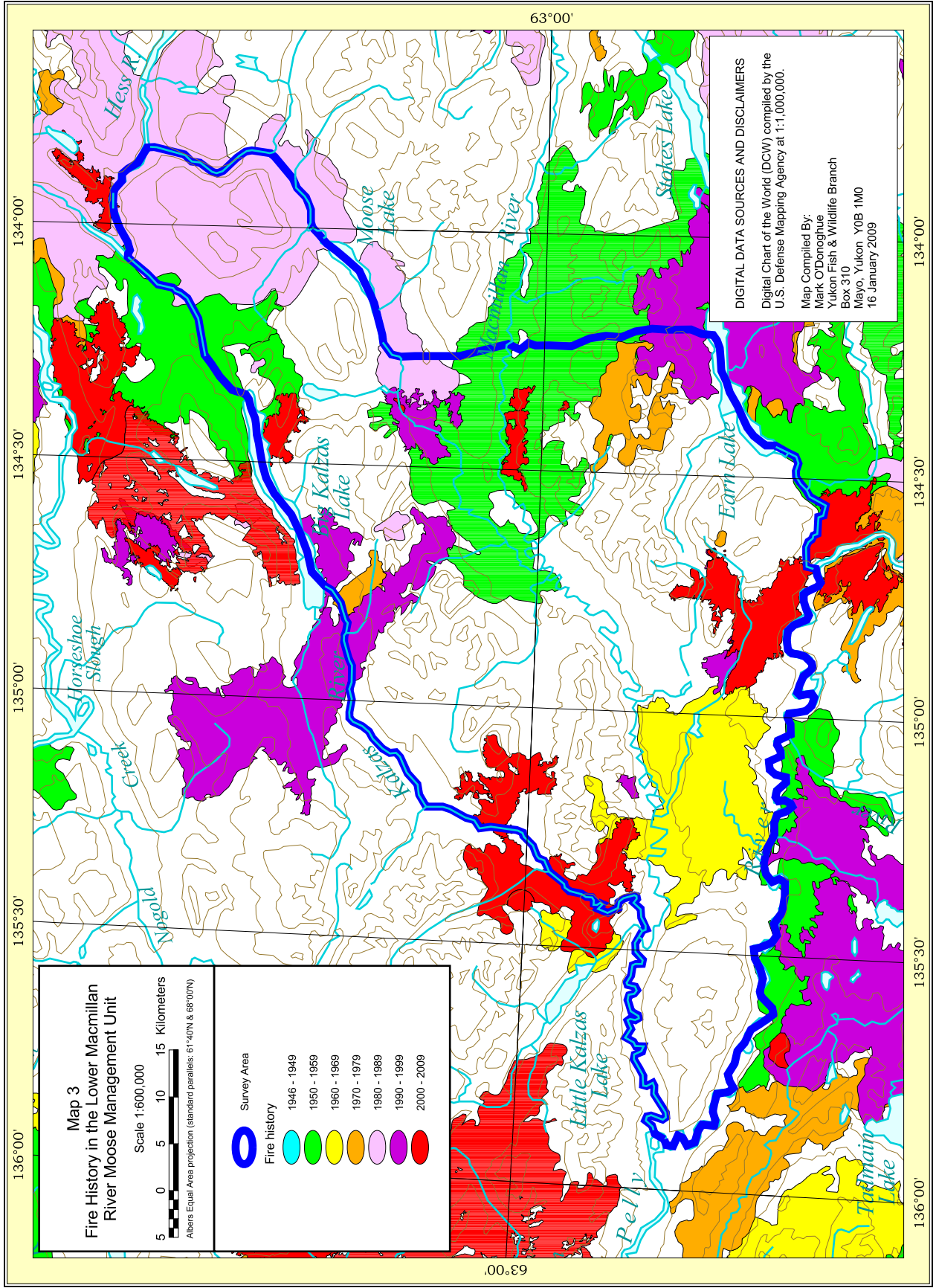
Lower Macmillan R MMU
 Survey Area
 Game Management Subzone

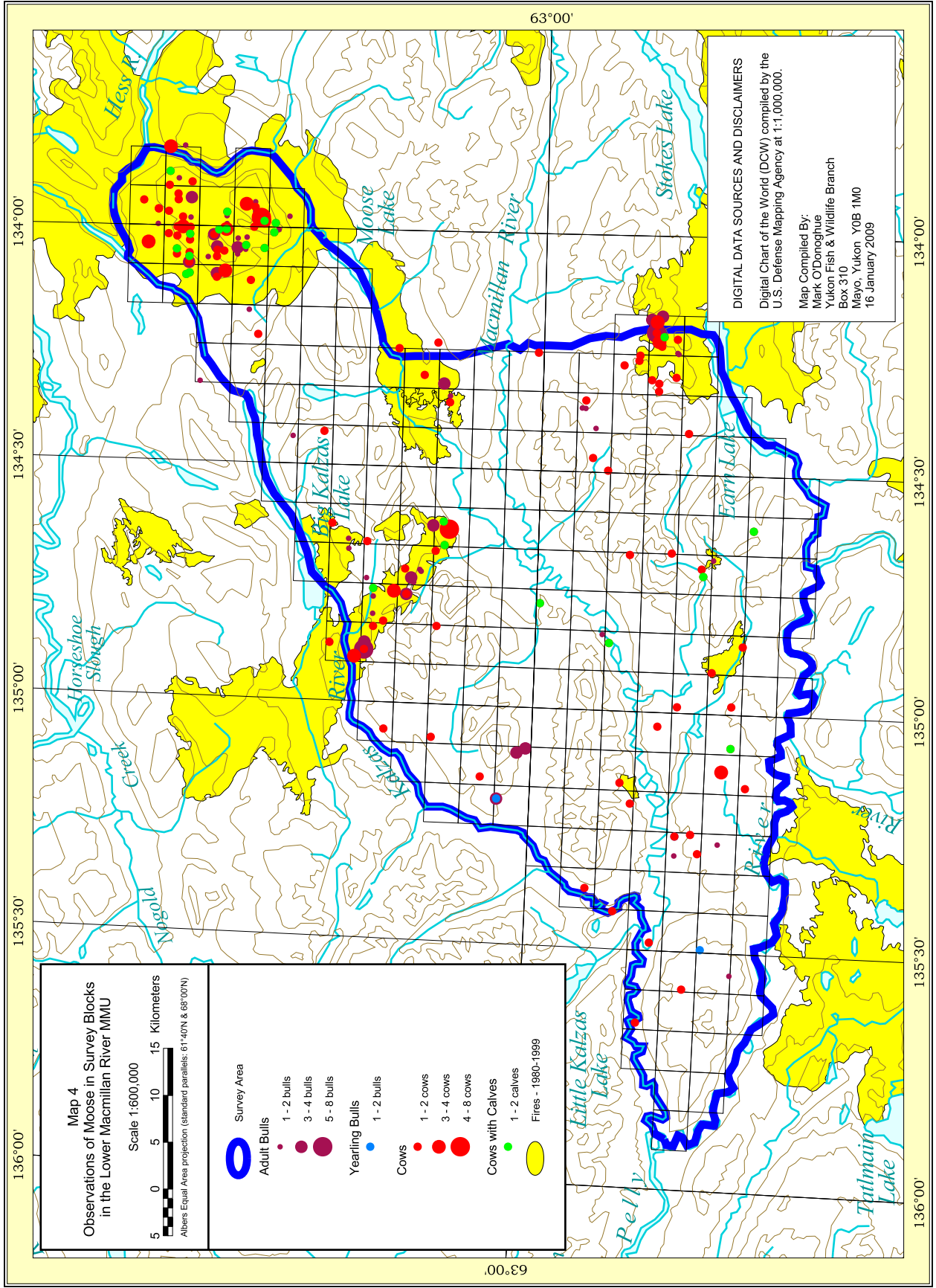
DIGITAL DATA SOURCES AND DISCLAIMERS

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

Map Compiled By:
 Mark O'Donoghue
 Yukon Fish & Wildlife Branch
 Box 310
 Mayo, Yukon Y0B 1M0
 16 January 2009







Map 4
Observations of Moose in Survey Blocks
in the Lower Macmillan River MMU

Scale 1:600,000
 0 5 10 15 Kilometers
 Albers Equal Area projection (standard parallels: 61°40'N & 68°00'N)

Survey Area

Adult Bulls

- 1 - 2 bulls
- 3 - 4 bulls
- 5 - 8 bulls

Yearling Bulls

- 1 - 2 bulls

Cows

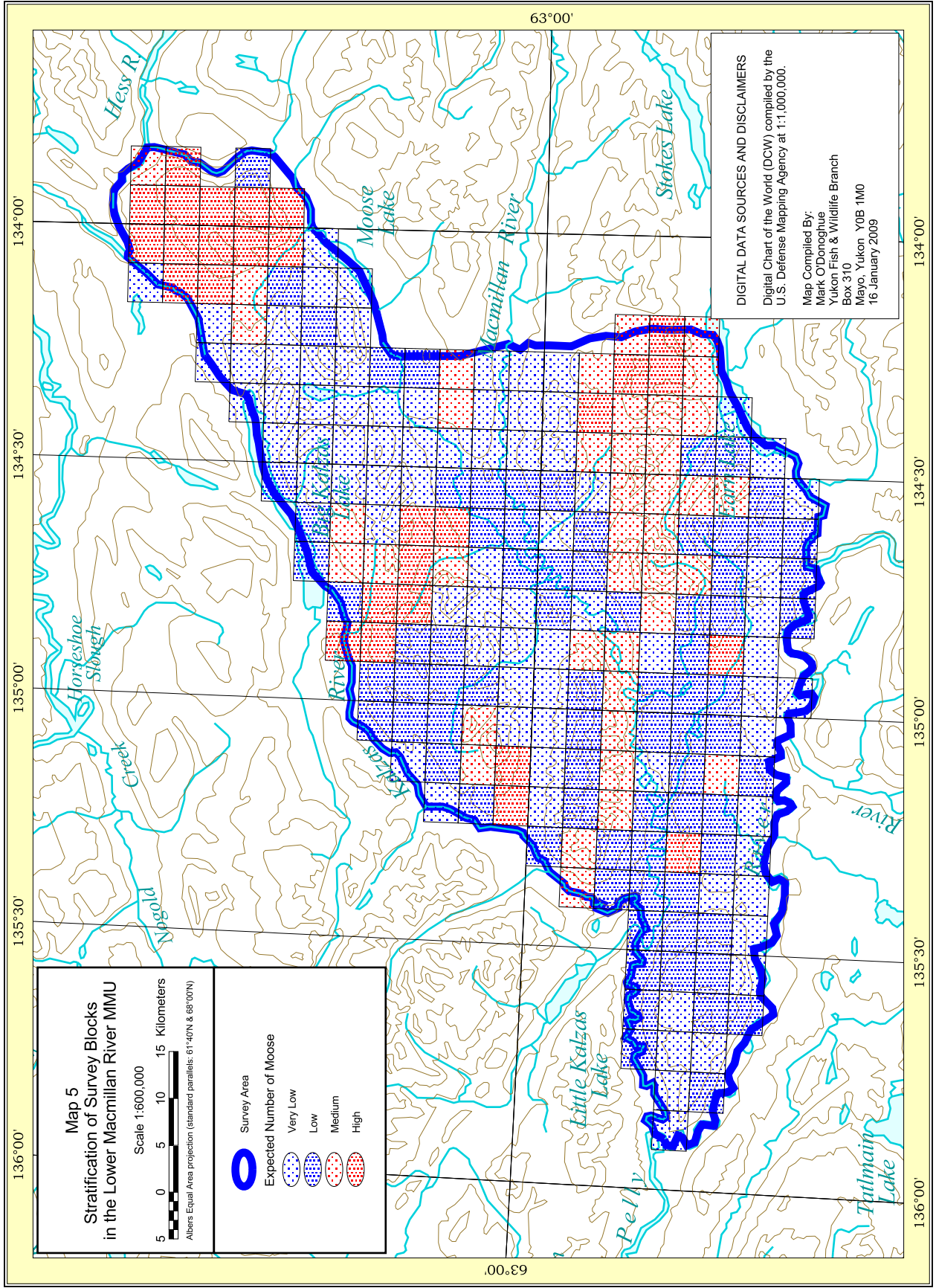
- 1 - 2 cows
- 3 - 4 cows
- 4 - 8 cows

Cows with Calves

- 1 - 2 calves

Fires - 1980-1999

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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 16 January 2009



Map 5
Stratification of Survey Blocks
in the Lower Macmillan River MMU

Scale 1:600,000
 0 5 10 15 Kilometers
 Albers Equal Area projection (standard parallels: 61°40'N & 68°00'N)

Survey Area

Expected Number of Moose

- Very Low
- Low
- Medium
- High

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