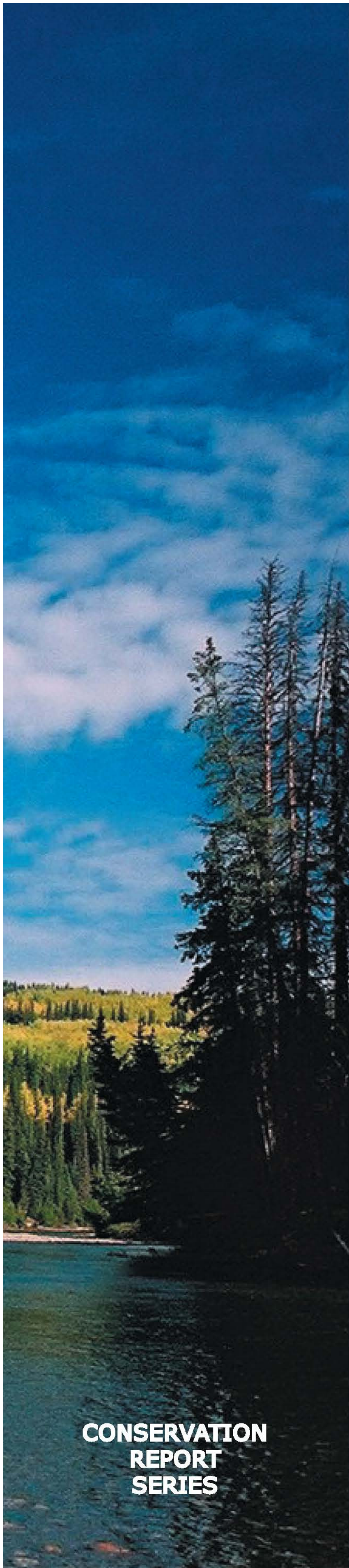

Delegated Aerial Ungulate Surveys 2009/2010 Survey Season

Alberta Conservation Association

Conserving Alberta's Wild Side

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Delegated Aerial Ungulate Surveys, 2009/2010 Survey Season

Edited by:
Mike Ranger and Shevenell Webb
Alberta Conservation Association
#101, 9 Chippewa Road
Sherwood Park, Alberta, Canada
T8A 6J7

Alberta Conservation Association

Conserving Alberta's Wild Side

Executive Editors
DOUG MANZER
Alberta Conservation Association
Box 1139, Provincial Building
Blairmore AB T0K 0E0

GLENDA SAMUELSON
R.R. #2
Craven SK S0G 0W0

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Alberta Conservation Association
#101, 9 Chippewa Rd
Sherwood Park AB T8A 6J7
Toll Free: 1-877-969-9091
Tel: (780) 410-1998
Fax: (780) 464-0990
Email: info@ab-conservation.com
Website: www.ab-conservation.com

EXECUTIVE SUMMARY

Alberta Conservation Association (ACA) uses levies on hunting and fishing licenses to collect and analyze population inventory data that can be used by Alberta Sustainable Resource Development (ASRD) in setting hunting and fishing seasons and regulations. Aerial ungulate surveys (AUS) are the primary method used to determine the population status and trends for ungulates in Alberta, and therefore are an integral component for setting hunting guidelines. Beginning in 2007, ACA became an active partner in delivering the AUS program, and now works collaboratively with ASRD to plan and conduct surveys and to summarize survey data. ASRD continues to set provincial priorities for survey locations and rotations, and uses these data in the management of ungulate populations. A portion of the overall survey plan is delegated to ACA for delivery (D-AUS) in collaboration with ASRD. During the 2009/2010 fiscal year, ACA funded and delivered 24[1] AUS across Alberta. These surveys included summer range trend surveys for pronghorn antelope (*Antilocapra americana*) and mountain goats (*Oreamnos americanus*), winter range trend surveys for bighorn sheep (*Ovis canadensis*) and bison (*Bison bison*), and random stratified block surveys for elk (*Cervus elaphus*), moose (*Alces alces*), white-tailed deer (*Odocoileus virginianus*) and mule deer (*Odocoileus hemionus*). This document summarizes the methods used to conduct these surveys as well as the survey results.

Key words: Alberta, aerial survey, ungulates, pronghorn antelope, mountain goats, bighorn sheep, bison, elk, moose, white-tailed deer, mule deer, population estimates.

---

[1] All Antelope Management Areas (AMAs) are counted as individual surveys.

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1.0 INTRODUCTION

Alberta Conservation Association (ACA) is a non-profit, non-governmental organization that has been designated as a Delegated Administrative Organization by Alberta Sustainable Resource Development (ASRD) to assist with the responsibilities of conserving Alberta's fish and wildlife resources. A component of this partnership is the use of hunting and fishing levies to collect and analyze inventory data to better understand population trends, composition and status, which can then be used by ASRD to set hunting and fishing regulations. Aerial ungulate surveys (AUS) are an important method for estimating population data that is used both to set hunting allocations, and to keep the general public, and hunters in particular, informed of population trends.

Prior to 2007, ACA's role in the AUS program was limited primarily to funding survey flights, while ASRD determined the species and areas to be surveyed, conducted the surveys, and analyzed data to estimate populations, trends and demographic parameters. In 2007, ACA became an active partner in the AUS program, and now works collaboratively with ARSD to plan and conduct surveys and to analyze and report on survey results. ASRD continues to set provincial priorities for survey locations and rotations, and uses these data to manage ungulate populations. A portion of the overall survey plan is delegated to ACA for delivery (D-AUS) in collaboration with ASRD.

ACA is committed to providing detailed annual reports to describe the outcome of these surveys. Annual reports condense and combine all delegated survey information into one document, streamlining access to ungulate population estimates for the general public, hunters, ASRD, and ACA staff. The following annual report summarizes the surveys conducted by ACA from 1 April 2009 to 31 March 2010.

During the 2009/2010 survey cycle, the Wildlife Management Branch of ASRD delegated 24 aerial ungulate surveys to ACA. Additional surveys were conducted by ASRD as part of their internal survey activities. In some cases, ACA staff participated in the delivery of these additional surveys. ACA conducted at least one survey for every harvestable ungulate within the province, including moose (*Alces alces*), elk (*Cervus elaphus*), white-tailed deer (*Odocoileus virginianus*), mule deer (*Odocoileus hemionus*), bighorn sheep (*Ovis canadensis*), mountain goats (*Oreamnos americanus*), pronghorn antelope (A*ntilocapra americana*), and bison (*Bison bison*). Details for each individual survey[2] are described in the following sections.

2.0 SELECTING SURVEY PRIORITIES

As the government agency responsible for managing ungulates within Alberta, ASRD sets the long-term AUS priorities for ungulates. In many cases, wildlife management units (WMUs) are surveyed on a three to five year rotational basis to enhance management decisions. Surveys may also be prioritized in order to assess the effectiveness of specific management actions, determine the effects of harsh winters, or in response to unique information requirements for a specific species or area of the province. ACA works collaboratively with ASRD to develop short-term (three year) plans for the implementation of surveys to ensure that they fall within budget constraints. In addition, because of the rarity of good survey conditions (complete snow cover coupled with low winds and high visibility) in some areas of the province, several condition-dependent surveys are identified each year that are given priority if weather conditions are favourable.

3.0 SURVEY METHODS

The techniques used to survey Alberta's ungulate herds vary across the province according to the habits and habitats of the species of interest, weather conditions that may affect animal movement or sightability, and the safety features of various aircraft. In general, three main approaches are used, each with its own advantages and limitations.

3.1 Summer range trend surveys

For some species, including mountain goats and pronghorn antelope, the contrast between their coat colour and vegetation, coupled with the openness of their habitats,

[2] Some related surveys have been grouped into a single report section to facilitate comparison (e.g., all antelope management area surveys are in section 4.1).

allows population surveys to be conducted during summer months. Summer surveys are ideal from a harvest management perspective because they allow the population status to be assessed immediately prior to the hunting season and inherently incorporate over-winter mortality, unlike traditional winter surveys. While useful for monitoring long-term changes in ungulate populations, summer range surveys do not necessarily allow the complete enumeration of population numbers, and therefore are most useful when compared to results from previous years.

Mountain goat summer ranges are intensively searched by rotary-winged aircraft (helicopter) during the cool parts of the day when goats are most active and visible. In addition to recording the total number of goats seen on each mountain range complex, surveyors enumerate the number of adults, yearlings and kids, whenever possible.

Pronghorn antelope surveys are conducted by surveying 1-mi wide transects within long-term census blocks that have been established across pronghorn range. Counts of pronghorn observed in these blocks are extrapolated across the antelope management area (AMA) to estimate the total population within the AMA. In addition, classification by sex and age allows for estimation of buck/doe/kid ratios for each herd. In 2008 and 2009, ACA and ASRD staff tested a distance sampling survey approach for pronghorn antelope (Webb et al. 2008, Grue and Morton 2010, unpublished ACA reports).

3.2 Winter range trend surveys

For some species, including elk, bighorn sheep and bison, the presence of distinct winter ranges that are predictably occupied year-after-year provides the opportunity to conduct annual minimum population counts. These counts are used to estimate the population trend (increasing, decreasing or stable) and key demographic information, including male/female/young ratios and the per cent of males in various size categories. As with summer range surveys, winter range surveys are useful for monitoring long-term changes in ungulate populations, but do not necessarily allow the complete enumeration of population numbers, and therefore are most useful when compared to results from previous years.

Trend surveys are typically conducted by helicopter during ideal weather conditions, such as after a recent snowfall when winds are low. In some cases, fixed-wing aircraft may be used to locate groups of animals for subsequent counting by helicopter. The navigator directs the pilot to known traditional winter ranges, where the area is searched intensively to determine if animals or tracks are present. When animals are seen, the pilot maneuvers the aircraft so that surveyors can estimate a total count and enumerate the numbers of males, females and offspring. These classifications may not be possible for all species, especially during late winter when many male ungulates have dropped their antlers. On ranges with large herds, the survey team may take photographs to allow for more precise counts.

3.3 Random stratified block surveys

When possible, ACA and ASRD strive to implement aerial survey approaches that provide statistically rigorous estimates of ungulate population numbers and densities within each WMU. In most cases, this is facilitated by using the 'Gasaway Method' (Gasaway et al. 1986) to design and implement counts in a random selection of survey blocks. This approach has widespread application for moose and deer in areas where the forest cover is sparse enough to allow good sightability. In addition to providing accurate population estimates, this approach often allows estimates of male/female/young ratios, as well as the relative number of small-, medium-, and large-antlered males, if surveys are conducted prior to antler drop.

The Gasaway Method divides a WMU or group of adjacent WMUs into smaller survey blocks that are approximately equal in size, and then classifies each block into a stratum that describes the relative number of animals that are expected to be present within that block. Stratification can be based on counts from fixed-wing aircraft immediately prior to the intensive portion of the survey, previous knowledge of ungulate distribution within the WMU, or habitat features within each survey block. Following stratification, a portion of the blocks within each stratum are randomly selected for intensive searching via helicopter. During surveys, each block is thoroughly searched and surveyors classify each animal observed as an adult male, adult female or young, whenever possible. A series of calculations allow the number of animals observed in the survey blocks to be converted to a population estimate for the entire WMU, and the error associated with the estimate is determined. Additional blocks are surveyed until the error is deemed acceptable (typically error is below 20% for a 90% confidence interval).

3.4 Population recruitment surveys

Total population estimates are used in conjunction with estimates of reproduction and mortality to model how a population of ungulates may be changing throughout the year or during intervening periods between population surveys. These models can be used to track the population's rate of change, to identify appropriate harvest levels, or to predict how changes in harvest level might influence the overall population in the short and long-term. The D-AUS program contributes information to these modeling exercises by providing information on the number of offspring recruited into a population in a given year. These data may be collected by three general means. The first method involves intensively searching areas of known ungulate distribution and good sightability to find females. The number of offspring observed with these females is used to calculate a reproductive rate. The second method involves locating radio-collared females and recording the number of offspring observed with the associated group. This method provides more reliable data, but is less common as it is generally only associated with larger studies that have deployed radio collars for other purposes. The third method records the number of offspring observed during random stratified block or trend surveys. Although this method provides an efficient use of resources, it is usually only a secondary objective of the survey and may not provide an adequate level of data collection in all cases.

3.5 Classification

Beginning in 2008/2009, ACA and ASRD survey crews across the province began using a standardized classification system for adult male ungulates (Table 1). This system allows comparisons among WMUs of the relative number of small-, medium-, and large-antlered ungulates of various species. However, because of variability in the timing of antler drop by age class across years, comparisons of the percentage of large, medium, and small males may not be possible for surveys that are conducted during mid to late winter.

Table 1. Standardized classification system used to determine antler size classes of male ungulates in Alberta.

Size Class	Moose	Deer	Elk
Small	Antler pole type, usually a spike or fork, if palmated, does not extend beyond ear tip.	Spike or 2 points on one or both antlers.	Spike antlers or with light 1 to 2 point antlers.
Medium	Antlers palmated, with spread < ½ of body length.	Small to medium size antlers with 3 or more points/antler; antlers inside ears.	Small antlers with 3 to 5 points/antler.
Large	Antlers palmated, with spread > ½ of body length.	Large antlers with 4 or > 4 points/antler; antlers outside of ears.	Large antlers with 6 to 7 points/antler, massive.

4.0 SUMMER RANGE TREND SURVEYS

4.1 Pronghorn antelope

Section Authors: Mike Grue and Kim Morton

Aerial surveys for pronghorn antelope are conducted annually to provide information on population density, distribution and composition within a series of long-term trend survey blocks. This information is used by ASRD to extrapolate an estimate of population size for each antelope management area (AMA), which in turn influences harvest objectives for the upcoming fall hunting seasons. Recreational hunting opportunity for pronghorn antelope in Alberta is highly sought after, making the information collected during the annual aerial survey an important component of the decision process. This summary describes data collected during the 2009 survey conducted in AMAs A to H, and Area Suffield (S) (Figure 1).

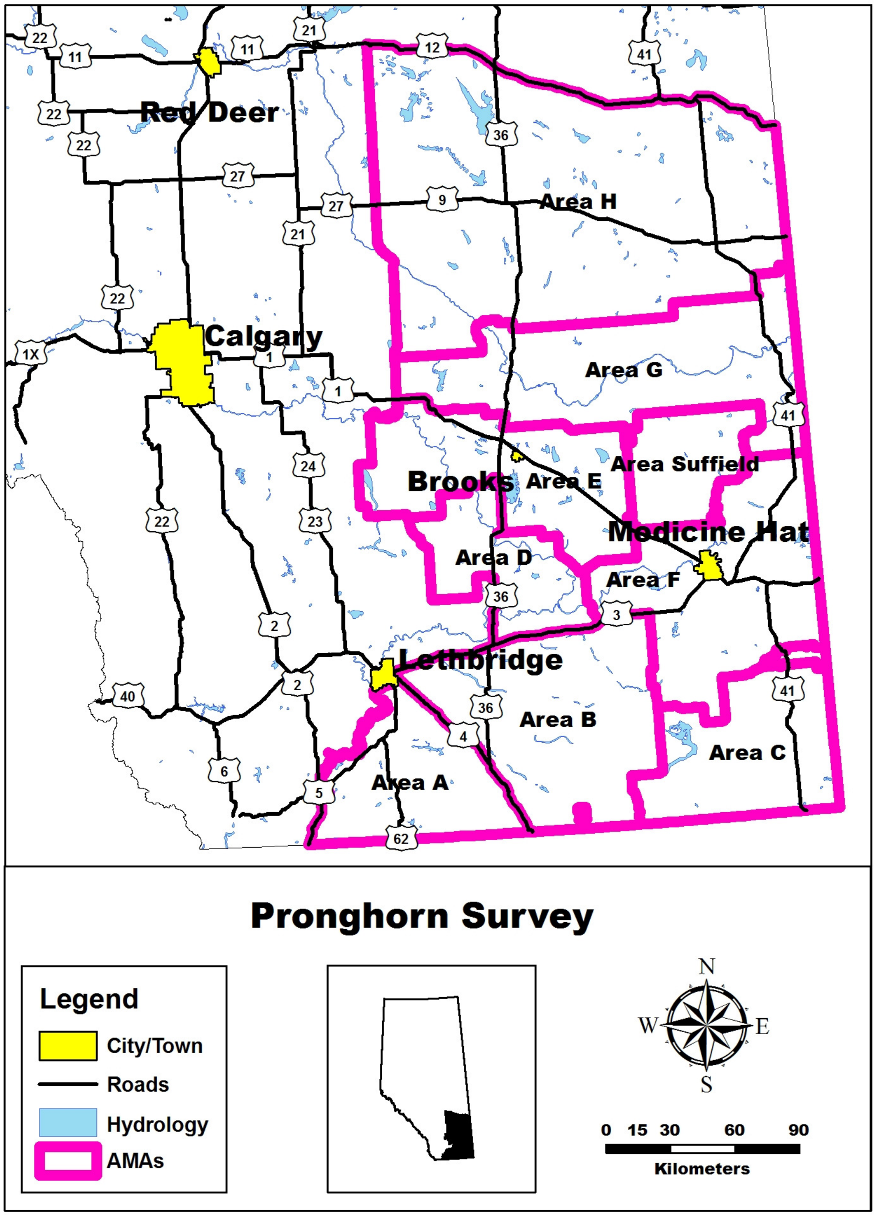


Figure 1. Location of pronghorn antelope management areas (AMA) in Alberta.

4.1.1 Survey methods

Following standard census procedures, we conducted pronghorn antelope surveys from 15 – 25 July 2009. Each AMA contains designated survey blocks with fixed strip transects, which we surveyed from rotary-winged aircraft. To reduce survey costs, we conducted non-stop, 3 hour flights with the support of strategic fuel cache locations. We divided each survey day into two periods, with the first flight commencing at approximately 0800 h and the second flight beginning toward evening, after the heat of the day. The survey crew consisted of the pilot, navigator, and two rear seat observers in a Bell 206L helicopter. Primary observers maintained constant observation of the ground for a distance of 0.8 km perpendicular to the flight line on each side of the aircraft. The navigator kept the aircraft on course, recorded observations, and assisted with ground observation and herd classification, whenever possible. Observers counted all pronghorn on the transect, and enumerated the number of bucks, does and kids, whenever possible.

4.1.2 Observed pronghorn density

We calculated a minimum estimate of pronghorn density (# animals/km^2) for the survey blocks in each AMA by dividing the number of animals observed by the total area (km^2) of the strip transects that were flown. We did not correct for sightability, assuming 100% detection across the 1600 m strip width. We acknowledge that animals were likely missed within this area, and are testing a distance sampling approach for surveying pronghorn that incorporates a sightability correction (Webb et al. 2008, Grue and Morton 2010). Until that preliminary work has been completed, overall counts will continue to be considered as minimum estimates and direct comparisons of survey results among years may be difficult.

4.1.3 Results

During the survey, we recorded 1,083 bucks, 2,268 does and 823 kids on the transects. This resulted in an overall minimum density estimate of 0.58 pronghorn/km^2 across all AMAs surveyed (Table 2).

Table 2. Comparison of pronghorn antelope survey results from 2007 – 2009.

	Antelope Management Area									*Overall Density Estimate
	A	B	C	D	E	F	G	H	S	
2009 Survey										
Observed pronghorn density (pronghorn/km^2)	0.63	0.39	0.93	0.62	0.89	0.50	0.44	0.27	0.95	0.58
Bucks/100 Does	38	66	43	60	39	35	62	35	66	-
Kids/100 Does	39	58	22	42	42	35	34	29	47	-
2008 Survey										
Observed pronghorn density (pronghorn/km^2)	0.50	0.43	0.98	0.95	0.90	0.38	0.50	0.25	-	0.61
Bucks/100 Does	40	47	59	44	50	32	52	65	-	-
Kids/100 Does	21	42	28	30	27	43	47	31	-	-
2007 Survey										
Observed pronghorn density (pronghorn/km^2)	0.48	0.44	0.96	0.93	0.65	0.53	0.37	0.19	-	0.57
Bucks/100 Does	24	46	42	24	48	30	45	68	-	-
Kids/100 Does	30	67	30	52	37	37	50	39	-	-

*Overall density does not include AMA Suffield (S)

4.2 Wildlife Management Unit 402 mountain goats

Section Authors: Mike Jokinen and Greg Hale

Counts to estimate the trends for mountain goat populations in WMU 402 have been sporadically carried out since the late 1960s, and in some cases done in conjunction with surveys for bighorn sheep. The most recent mountain goat counts include surveys in 1994, 1997, and 2006. Many mountain complexes in WMU 402 overlap the boundary of Alberta and British Columbia, and as a result contain a trans-boundary population which is best assessed by surveying on both sides of the continental divide. Surveys encompassing an area from Tecumseh Mountain following the Divide north to Mt. O'Rourke at the headwaters of the Oldman River, including Crowsnest Mountain and the Livingstone Range (Figure 2) were surveyed in 2006 and 2009.

The 2009 survey will re-establish baseline data to monitor population trends, as well as to refine Goat Population Areas within Goat Management Area A of WMU 402. Currently there is no established Goat Hunting Area or hunting season for mountain goats in WMU 402. Our survey objectives were to obtain a minimum count of goats to determine population status and trend, classify all goats by age to assess herd structure and recruitment, and to map sightings that describe regional distribution.

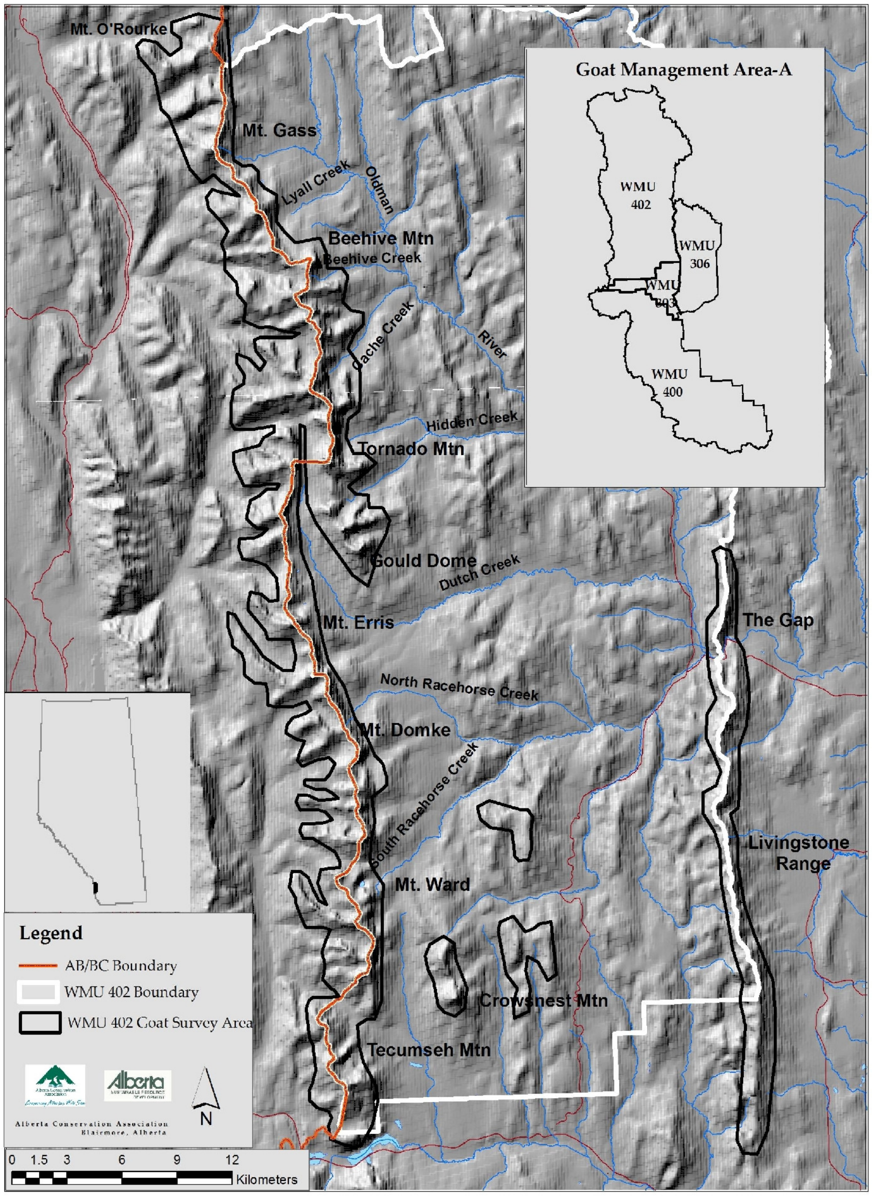


Figure 2. Location of the Wildlife Management Unit 402 mountain goat survey area in Alberta and British Columbia.

4.2.1 *Survey methods*

We searched mountain complexes in WMU 402 (Figure 2) over a 3-day period from 11 – 15 July 2009. All surveys occurred during the morning hours to take advantage of peak animal activity, using a Bell 206B helicopter flown at air speeds ranging from 80 to 100 km/h. In some instances, coverage of the goat range was accomplished by conducting a single flight above timberline, but a large portion of the survey area required a second flight at a higher elevation to provide complete coverage of extensive mountain faces, particularly in high goat density areas.

The left front passenger (navigator) maintained the proper flight course and assisted with classification of goats to age categories. Two observers occupying the rear seat provided continuous side observation, with the right passenger recording wildlife numbers and Global Positioning System (GPS) locations. We classified all goats observed into standard age categories of adult, yearling or kid. We did not correct for sightability; therefore, overall counts are minimum estimates and direct comparisons of survey results among years may be difficult. Weather conditions for the survey were good with an average temperature of 11 degrees Celsius, cloud cover ranging from 0 - 30% and wind speeds averaging 18 km/h.

4.2.2 *Results*

We observed 186 mountain goats during the survey, including 119 adults, 44 kids, 23 yearlings, and no unclassified goats (Table 3). Classification of age classes resulted in reproduction and recruitment rates of 37 kids/100 adults and 19 yearlings/100 adults.

The 2009 survey count of 186 goats was 24% greater than the survey conducted in 2006; however, some areas may have been flown in less detail due to high winds in 2006 (Table 4). The 2009 reproduction estimate of 37 kids/100 adults was almost identical to 2006, when 36 kids/100 adults were recorded. The number of yearlings per adults recorded during the 2009 survey (19 yearlings/100 adults) was much greater than in 2006 (9 yearlings/100 adults).

Table 3. Mountain goat population trend counts within each mountain complex of Wildlife Management Unit 402 in 2009.

Complex	Adult	Yearling	Kid	Total
Crowsnest	39	6	20	65
Divide- AB	43	9	17	69
Divide- BC	31	4	6	41
Livingstone	6	4	1	11
Total	**119**	**23**	**44**	**186**

Table 4. Total mountain goat population trend counts for all mountain complexes in Wildlife Management Unit 402, 2006 versus 2009.

	Number of Mountain Goats			
Year	Adults	Yearling	Kid	Total
2009	119	23	44	186
2006	98	9	35	142

4.3 Wildlife Management Unit 439 – 446 mountain goats

Section authors: Jeff Kneteman and Shevenell Webb

Extensive annual surveys for mountain goats have been conducted in Willmore Wilderness Park and adjacent areas since 1974. With permission from the Superintendent of Jasper National Park, the survey area was expanded (beginning in 1979) to include mountain complexes straddling the Jasper Park boundary. The objectives of annual goat surveys in WMU 439 – 446 (Figure 3) are to collect data on population trends, distribution and herd composition, and to monitor the status of these mountain goat herds.

4.3.1 Survey methods

The survey area is comprised of seventeen mountain complexes and one canyon complex in the forested foothills of WMU 439 - 446 (Figure 3). We surveyed 11 complexes from 2 – 3, 15 – 17, and 27 July 2009 using a Bell 206B helicopter flown counter-clockwise around each mountain complex between timberline and ridge top. Air speed ranged from 120 – 150 km/h. The left front passenger navigated, observed

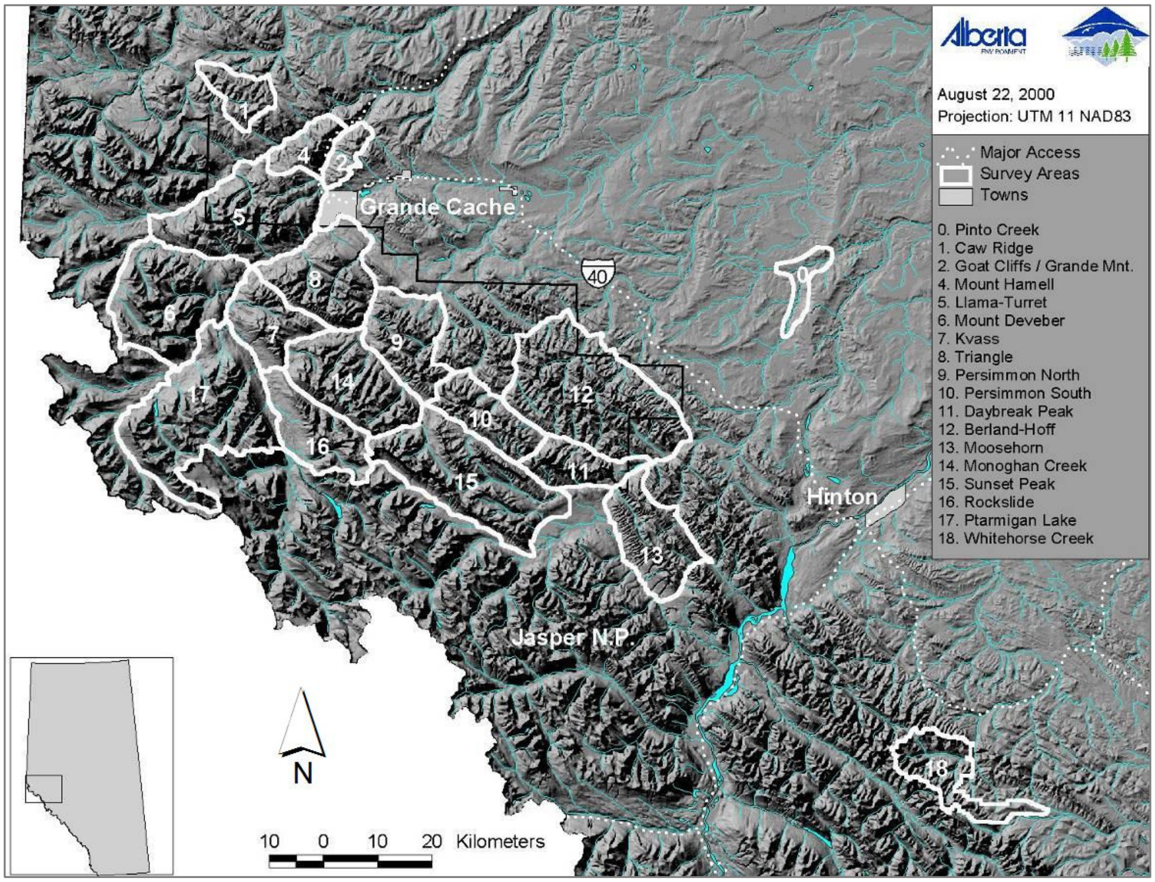


Figure 3. Location of the Wildlife Management Units 439 – 446 mountain goat survey in Alberta.

and plotted checkpoints on a 1:250,000 scale topographic map. GPS locations were recorded for each group of goats. The two rear passengers observed and recorded species classification and numbers onto field data sheets. When herd size and/or location made classification difficult for observers or dangerous for mountain goats, the helicopter landed at a distance of approximately 0.8 km and we classified goats using a 20 – 45X variable spotting scope. Flights typically occurred between 0600 – 1100 h and 1600 – 2200 h during the goats' most active periods. Exact survey flight paths vary from year to year; thus, comparison of overall counts between years is cautioned and should only be considered as a long term trend. We did not correct for sightability; therefore, overall counts should be considered as minimum population estimates.

4.3.2 Results

We observed a total of 492 goats (328 adults, 23 yearlings, 60 kids, and 81 unclassified) with ratios of 18 kids/100 adults and 7 yearlings/100 adults (Table 5). Kid to adult ratios were less than the average and yearling to adult ratios were equal to the average for the six mountain complexes surveyed most frequently between 2001 and 2009 (Table 6).

Total counts of goats on individual complexes in 2009 exceeded long-term averages in 3 of 11 complexes surveyed (Berland-Hoff, Caw Ridge and Llama-Turret); were less than long term averages on 7 complexes (Daybreak, Deveber, Goat Cliffs, Monaghan, Moosehorn, Mt. Hamel and Rockslide); and approximated the long-term average on 1 complex (North Persimmon).

In 2009, six complexes (Berland-Hoff, Caw Ridge, Deveber, Goat Cliffs, Moosehorn and Mt. Hamel) exceeded total goats counted in 2008, while total goats were less than the most recent survey on 4 complexes (Daybreak, Llama-Turret, Monaghan, and Rockslide) and approximated the most recent survey on 1 complex (North Persimmon).

Table 5. Mountain goat population counts within each mountain complex of Wildlife Management Unit 439 - 446 in 2009.

Complex	Adult	Yearling	Kid	Unclassified	Total
Berland-Hoff	14	2	2	0	18
Caw Ridge	15	0	1	81	97
Daybreak	14	1	4	0	19
Deveber	38	3	5	0	46
Goat Cliffs	35	1	6	0	42
Llama-Turret	77	7	16	0	100
Monaghan	25	1	5	0	31
Moosehorn	6	2	2	0	10
Mt. Hamel	45	2	7	0	54
North Persimmon	39	4	8	0	51
Rockslide	20	0	4	0	24
Total	**328**	**23**	**60**	**81**	**492**

Table 6. Total mountain goat population counts for six mountain complexes (Caw Ridge, Daybreak, Goat Cliffs, Llama-Turret, Moosehorn and Mt. Hamel) flown on a consistent basis in Wildlife Management Unit 439 - 446, 2001 - 2009.

	Number of Mountain Goats				
Year	Adults	Yearling	Kid	Unclassified	Total
Jul. 2009	192	13	36	81	322
Jul. 2008	221	11	51	0	283
Jul. 2007	236	21	40	9	306
Jul. 2006	-	-	-	-	-
Jul. 2005	269	31	63	5	368
Jul. 2004	299	17	63	5	384
Jul. 2003	-	-	-	-	-
Jul. 2002	302	15	75	9	401
Jul. 2001	223	20	70	43	356

"-" = all six mountain complexes were not surveyed during this year, so combined trend counts are not comparable.

5.0 WINTER RANGE TREND SURVEYS

5.1 Hay-Zama bison

Section Authors: Ryan Hermanutz and Lyle Fullerton

The Hay-Zama wood bison population was established in 1983 and has been surveyed three times in the past (Morton 2003; Moyles 2007, 2008). A hunting season was initiated in the fall of 2008 (1 September 2008 to 31 March 2009), and a second season ran from 1 September 2009 to 31 March 2010. The hunting season was initiated to reduce bison numbers and distribution due to growing concerns over disease issues associated with bison moving west from Wood Buffalo National Park and public safety concerns related to conflicts in communities and on roads. ACA monitors the Hay-Zama bison population and distribution by conducting aerial surveys in late winter. The purpose of this survey is to determine bison numbers and their distribution in the Hay-Zama area in late winter 2010.

5.1.1 Study area

The Hay-Zama wood bison herd has established itself in the area west of High Level, east of Rainbow Lake and north to Zama City as reported by Moyles (2008). The limits of this distribution are roughly North 58 degrees 30 minutes in the south, North 59 degrees 30 minutes in the north, West 117 degrees 30 minutes to the east and West 119 degrees 30 minutes to the west (Figure 4). The distribution of this bison herd has changed in recent years, expanding to the south along Highway 58 and easterly along the Zama Highway. Expansion to the more northerly and westerly areas appears to be more seasonal (i.e. summer range). Six townships (Township 112, 113 and 114, Range 2 and 3) have been established as a "No Hunting Area" to provide a refuge for bison in critical winter habitat.

5.1.2 Survey methods

On 19 March 2010 a two-person crew in a Cessna 206 airplane surveyed an area beginning immediately south of Highway 58 working north to the community of Habay. East-west transects were flown from approximately 11 kilometers east of the Chinchaga River to approximately 8 kilometers west of Rainbow Lake. Bison sightings and areas of bison tracks were recorded, and a GPS waypoint was taken using a handheld unit.

Poor weather conditions for flying (snow and winds) prevented flights on 20 - 21 March. On 22 March, a two-person crew in an EC 120 helicopter began surveying areas where bison had been observed during the fixed wing flight of 19 March. Additional survey lines were flown at 1 minute of latitude intervals from longitude West 118 degrees 10 minutes to the municipal road running north of Highway 58, into the oilfield road network on the west. All bison observed were counted and calves/adults delineated. Photos were taken of herds to confirm the number of calves. Calves were identified by their smaller body size and absence of horns. Yearlings were included in the adult age class because of the difficulty in distinguishing between these two age categories in an aerial survey.

On 23 March, a two-person crew in a Cessna 206 resumed surveying using 1 minute of latitude survey lines to the west and north of the survey conducted the previous day.

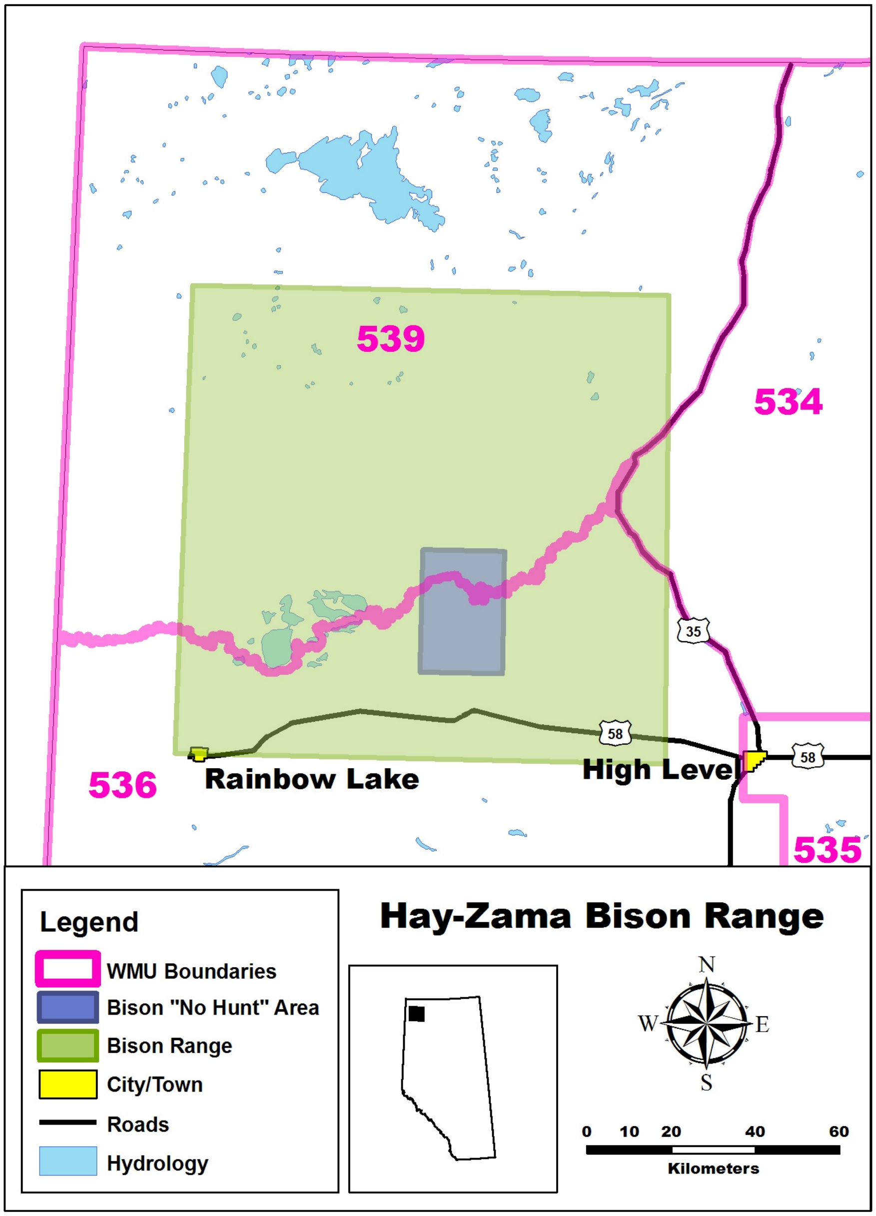


Figure 4. Location of the Hay-Zama bison herd range in Alberta.

Again, bison sightings and areas of bison tracks were recorded and a GPS waypoint was taken. On 24 March, a two-person crew in an EC 120 helicopter located bison observed during the fixed wing flight of 23 March. All bison observed were counted and calves/adults delineated. Photos were taken of herds to confirm the number of calves. We did not correct correct for sightability; therefore, overall counts should be considered as minimum population estimates and direct comparisons of survey results among years may be difficult.

In general, survey conditions were excellent. Fresh snow covered much of the survey area and skies were clear on all days except for 24 March, which was 100% overcast. Daily temperatures ranged from -23 to -18 degrees Celsius and wind speeds ranged from 0 – 20 km/h.

5.1.3 Results

A total of 527 bison (452 adults and 75 calves) were found at 39 sites throughout the area surveyed (Table 7). The vast majority of the bison were located along the Chinchaga and Hay River confluence, in or near an area set aside as a "No Hunting" protection area. A total of 4 bison were located in the Shekilie oilfield area (Township 118 Range 8) and only 1 bison was located north of Zama City. No bison were located near Highway 58 in the southern portion of their former range.

Table 7. Comparison of aerial survey results for bison in the Hay-Zama area from 1994 – 2010.

Year	# of Groups	Number of Bison			%Calves[b]
		Adults[a]	Calves	Total	
Mar. 2010	39	452	75	527	14
Feb. 2009	59	547	50	597	8
Mar. 2008	63	593	59	652	9
Mar. 2007	41	499	66	565	12
Feb. 2006	41	499	23[c]	522	4
Mar. 2005	33	365	59	424	14
Mar. 2004	30	267	53	320	17
Feb. 2003	23	236	26	262	10
Feb. 2002	21	200	33	233	14
Mar. 2001	12	158	27	185	15
Mar. 2000	12	132	21	153	14
Mar. 1999	14	81	16	97	17
Feb. 1998	12	106	6[d]	112	5
Mar. 1997	7	75	14	89	16
Mar. 1996	7	61	15	76	20
Nov. 1995	4	62	12	74	16
Mar. 1995	4	48	15	63	24
Dec. 1994	3	41	17	58	29

[a] Adults includes yearlings.
[b] % Calves = calves/total population x 100.
[c] This is a minimum count due to difficulties distinguishing calves from yearlings.
[d] This is a minimum count.

5.2 Wildlife Management Units 136 and 140 deer

Section Authors: Kim Morton and Mike Grue

Wildlife Management Units 136 and 140 were flown only once previously (Morton 2005), when it was determined that a baseline population estimate should be established. These two WMUs have little quality deer habitat and generally have low densities of deer (i.e. WMU 136 had a mule deer density of approximately 0.27 deer/km^2 in 2005). As well, neither WMU has a special management regime in place, such as Trophy buck management.

Hunting permit numbers for both WMUs have increased over the last 5 years. Population estimates used for permit calculations each year were derived from the 2005 survey results and adjusted for harvest and recruitment estimates based on the provincial management plan for both mule deer (F&WD 1989) and white-tailed deer (F&WD 1995) and annual game harvest surveys. The increase in permits each year led to stakeholder concerns that the populations, particularly mule deer, were being pushed well below their management goal (ASRD unpublished data, 2005 - 2009). In order to properly address the concerns, WMUs 136 and 140 were placed at the top of the aerial survey priority list for the winter of 2009/2010.

The results of these surveys will be used by ASRD to calculate permit allocations for the upcoming hunting seasons. As well, they will provide the starting point for calculations to determine population estimates in future years, as both WMUs will now be considered a low priority for aerial surveys for the next 5 years.

5.2.1 Study area

WMU 136 and 140 are located in the mixedgrass and dry mixedgrass natural subregions of Alberta (Natural Regions Committee 2006) (Figure 5). WMU 136 is mostly cultivated farmland, with some areas of native grassland in the center of the unit and along the northern edge, where it includes portions of the Siksika Indian Reserve #146 that lie ssouth of the Bow River. Since recreational hunters typically do not gain access to hunt on Reserve lands, only the portions of WMU 136 that are outside Reserve boundaries were included in the study area. Population estimates and associated densities derived from survey results will only apply to these same lands. WMU 140 is also predominantly cultivated agricultural land, with native grassland covering about 20% of the unit in the northeast portion, south of Bow City.

5.2.2 Survey methods

Based on a request by ASRD, this survey was flown as a trend survey and not the typical random stratified block survey. The survey attempted to fly 100% coverage of the area to provide a minimum population count for the WMUs. Survey flight lines were spaced 1.6 km apart, covering the entire area of both WMU 136 and WMU 140. Where vegetation cover and topography reduced sightability to less than 1.6 km between flight lines, distance between lines was reduced. As well, in areas with deep coulees and/or heavy tree cover, lines were meandering rather than straight, to effectively obtain complete coverage of the area. Height and speed of the rotary-winged aircraft varied depending on wind speed and direction and amount of cover and topography of the area, but was typically 500 m above ground with a forward air speed averaging 195 km/h. Observers were able to see up to 800 m in open areas and 400 - 500 m in other areas. The crew was comprised of one navigator, who also recorded and

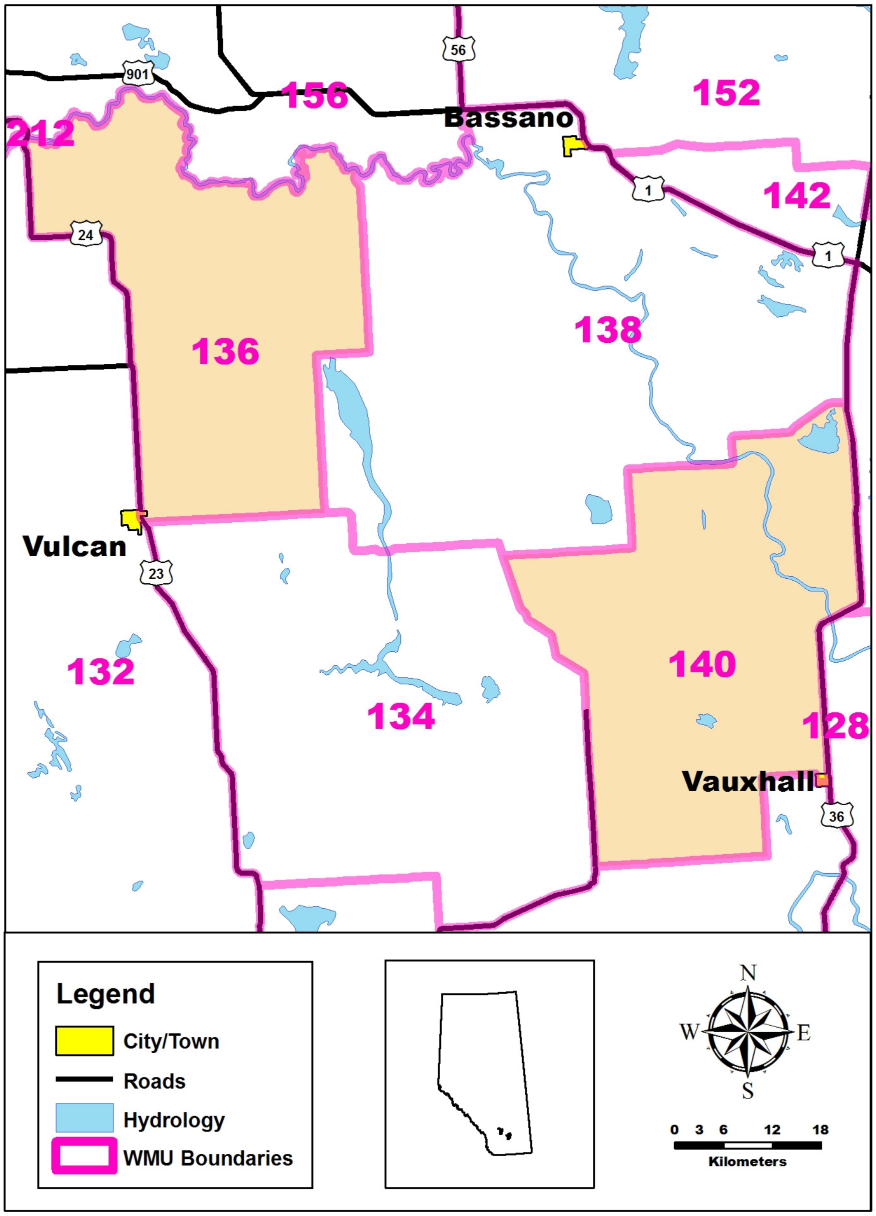


Figure 5. Location of Wildlife Management Units 136 and 140 in Alberta.

observed, in the front seat beside the pilot, and two observers in the back seat, one on each side of the helicopter.

For population composition, sex was determined by the presence of antlers, as early in December, bucks would not typically begin dropping antlers. To determine age, body size and length of face provides an accurate means to classify fawns from adults.

Snow cover was very good throughout all three days of the survey, 9 – 11 December 2009. Cloud cover varied from 70 - 100% over the three days providing 'Good' to 'Excellent' visibility. We did not correct for sightability; therefore, overall counts should be considered as minimum population estimates.

5.2.3 Results

In WMU 136, a total of 381 mule deer and 276 white-tailed deer were observed (Table 8). The density of mule deer in WMU 136 is at least 0.28/km^2, assuming 100% sightability. Herd composition data indicate 67 bucks per 100 does and 65 fawns per 100 does. The density of white-tailed deer in WMU 136 is at least 0.21/km^2. Herd composition data indicate 25 bucks per 100 does and 73 fawns per 100 does.

In WMU 140, a total of 137 mule deer and 308 white-tailed deer were observed (Table 8). The density of mule deer in WMU 140 is at least 0.09/km^2. Herd composition data indicate 60 bucks per 100 does and 76 fawns per 100 does. The density of white-tailed deer in WMU 140 is at least 0.20/km^2. Herd composition data indicate 21 bucks per 100 does and 46 fawns per 100 does.

Table 8. Mule deer and white-tailed deer aerial survey results for Wildlife Management Units 136 and 140 in 2009.

	Bucks	Does	Juveniles	Unclassified	Total Deer	Deer/ km^2	Ratio to 100 Females	
							Males	Juveniles
WMU 136								
Mule Deer	109	164	107	1	381	0.28	67	65
White-tailed Deer	35	139	102	0	276	0.21	25	73
WMU 140								
Mule Deer	35	58	44	0	137	0.09	60	76
White-tailed Deer	38	185	85	0	308	0.20	21	46

5.3 Wildlife Management Unit 445 bighorn sheep

Section Authors: Dave Stepnisky, Conrad Thiessen and Robb Stavne

In order to effectively manage bighorn sheep populations throughout Alberta, periodic surveys are used to monitor populations and ensure that present harvest levels are sustainable. Bighorn sheep have been surveyed in WMU 445 since 1972, with subsequent surveys in 1975, 1978, 1980, 1982, 1988, 1995, and 1999. Traditionally only mountains and ridges on the Alberta side of the border have been surveyed. In December of 2009, WMU 445 was surveyed, along with a newly expanded area that included adjacent mountain ranges in British Columbia (Figure 6). Many mountain ridges in this area overlap Alberta and British Columbia, and as a result likely contain a continuous sheep population. Survey methodology was consistent for all survey years, resulting in minimum counts, population trends and changes in demographics that can be compared over time.

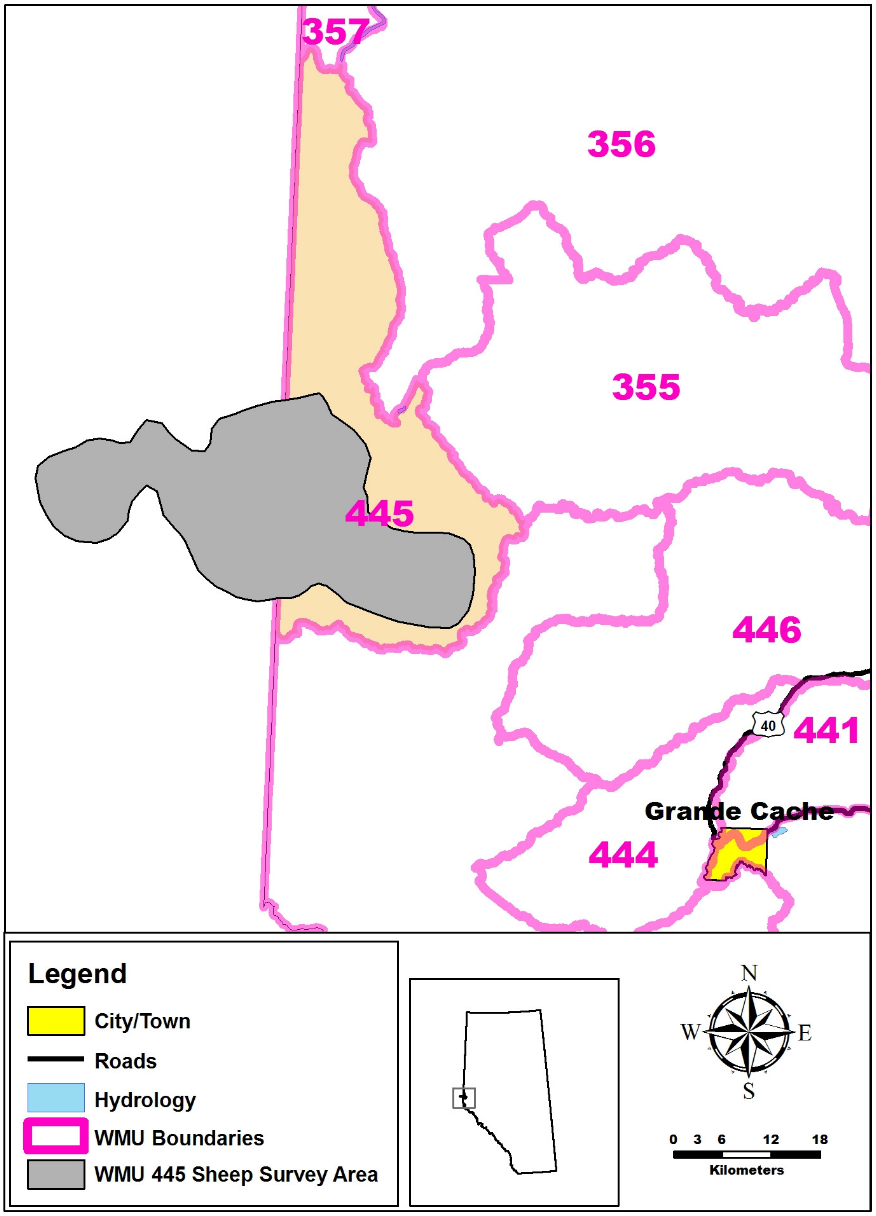


Figure 6. Location of the bighorn sheep survey area in British Columbia and Wildlife Management Unit 445 in Alberta.

5.3.1 Study area

All probable bighorn sheep winter range within WMU 445 and the adjacent ridges in British Columbia were surveyed. Prominent ridges and mountains that were searched during the survey include: Mount Torrens (AB), Torrens Ridge (AB), Dinosaur Ridge (AB/BC), Mount Gorman (AB/BC), Coal Ridge (AB), Sulfur Ridge (AB), Mount Minnes (BC), Hannington Pass (BC), Saxon Ridge (BC), Nekik Mountain (BC), Picture Mountain (BC), Mokasis Mountian (BC), Meosin Mountain (BC), and Manitou Mountain (BC). This area includes portions of the alpine and subalpine natural subregions of Alberta (Natural Regions Committee 2006). The area is dominated by non-treed alpine landscapes, with alpine shrubs and grasses being the predominant vegetation. Moderate levels of recreational activities (notably snowmobile use in the winter months) are visible with little to no industrial activity present. A portion of the survey area overlaps the Kakwa Wildland Provincial Park in Alberta and Kakwa Provincial Park in British Columbia.

5.3.2 Survey methods

All mountain complexes and known sheep habitat were surveyed from 14 – 15 December 2009 using a Bell 206B helicopter. Mountain contours were flown counter-clockwise at a height to ensure visibility of open slopes on all ridges. The crew consisted of a pilot, a navigator/observer, an observer and a recorder/observer. The navigator was seated in the left front seat of the helicopter and was responsible for directing the pilot on the survey as well as assisting in obtaining a total count and classification of the sheep. The observer was seated directly behind the navigator and was responsible for obtaining a total count and classification of sheep. If a discrepancy between the numbers counted by the navigator and the observer seated behind the navigator occurred, the herd was re-counted and re-classified. The recorder (seated behind the pilot) was responsible for recording all observations, for using a GPS unit to obtain precise locations of animals, and for scanning down to tree line below the helicopter for sheep. All sheep were classified by sex (ewes and rams) and age (adults and lambs). Rams were further classified into horn size categories of ¼ curl, ½ curl, ¾ curl, 4/5 curl (legal) and larger. Other sheep classifications include unclassified rams (horn size not determined); ewes and lambs (lambs not distinguished from ewes and rams with less than ¼ curl); and unclassified sheep (ewes and lambs with noticeable rams mixed in the group but an exact classification could not be obtained).

Conditions for the surveys were generally good with an estimated 95% of the ridges snow covered. Temperatures averaged -20 degrees Celsius. Although winds were generally calm, gusty winds on 15 December resulted in marginally difficult flying conditions. As a result, several high alpine ridges in the Mokasis, Picture and Manitou Mountain areas (in British Columbia) were partially surveyed. We did not correct for sightability; therefore, overall counts should be considered as minimum population estimates and direct comparisons of survey results among years may show only broad trends.

5.3.3 Results

A total of 177 bighorn sheep were counted during the survey (Table 9). Greater numbers of sheep were counted in the Alberta portion of the survey (123 sheep) than the British Columbia portion of the survey (54 sheep). The age/sex composition for the entire survey area (Alberta and British Columbia combined) was 24% rams, 53% ewes, and 23% lambs, or 43 lambs/100 ewes and 45 rams/100 ewes. Comparisons within the Alberta portion of the survey (Table 9) were possible over time, due to repeat surveys that have been conducted for sheep since 1972. Although the total number of sheep counted was slightly greater than previous surveys, the proportion of rams was down, with an age/sex classification on the Alberta winter range of 21% rams, 53% ewes and 26% lambs.

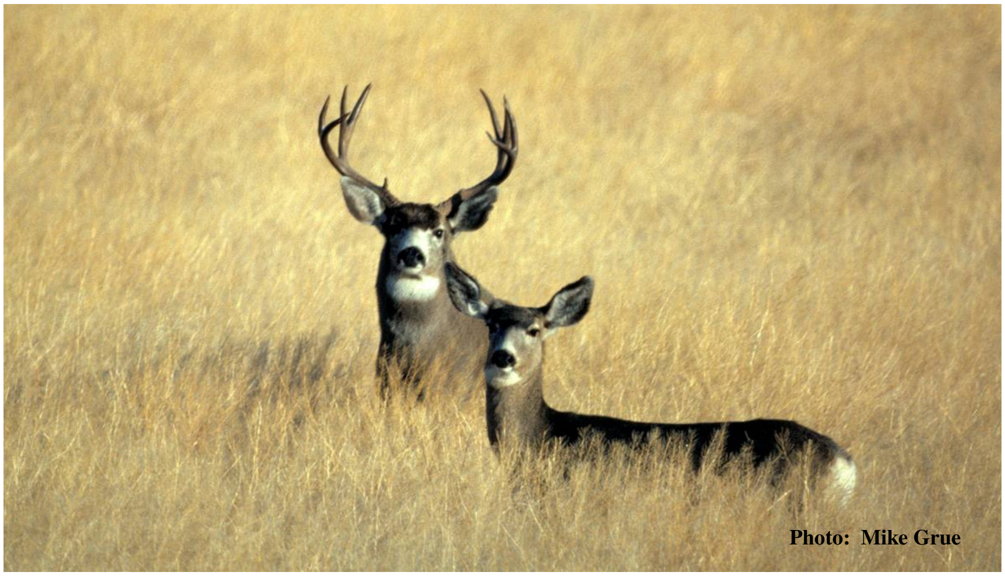
Table 9. Total counts and age/sex classification of bighorn sheep in Wildlife Management Unit 445 and adjacent mountain ranges in British Columbia during aerial surveys from 1972 - 2009.

Province	Year	Rams	Ewes	Lambs	Unclassified	Total Sheep
Alberta	2009	26	65	32	0	123
B.C.	2009	16	28	8	2	54
Alberta	1999*	4	8	6	28	46
Alberta	1994/1995	28	50	21	0	99
Alberta	1988	29	53	26	11	119
Alberta	1982	42	51	17	0	110
Alberta	1980	23	57	26	6	112
Alberta	1978	26	48	17	0	91
Alberta	1975	9	23	8	0	40
Alberta	1972	15	21	7	0	43

* 1999 totals were an underestimate, as weather did not allow for surveying part of the Dinosaur/Torrens Ridge complex.

6.0 RANDOM STRATIFIED BLOCK SURVEYS

6.1 Wildlife Management Unit 119 mule deer



Section Author: Mike Grue

Wildlife Management Unit 119 was last surveyed in 2003. Budget and time constraints led to the decision to stratify WMU 119 only for mule deer during this survey. Survey results will be used to estimate changes in population numbers and herd composition over time. These data will also be used by ASRD to allocate harvest targets.

6.1.1 Study area

WMU 119 is located in the mixedgrass and dry mixedgrass natural subregions of Alberta (Natural Regions Committee 2006). It is a small unit located southeast of Medicine Hat (Figure 7). A legal description of the area is found in Schedule 9, Part 1 of the Wildlife Act – Wildlife Regulation (Province of Alberta 1999). The unit is bordered by the Cypress Hills Provincial Park to the south and several drainages originate in the Cypress Hills and extend northward through the WMU to its northern boundary at Highway 1. Most of the mule deer habitat in the unit is associated with the shrub cover found in these drainages. The primary industry in WMU 119 is agriculture with approximately 70% of the unit consisting of grassland utilized for grazing and the

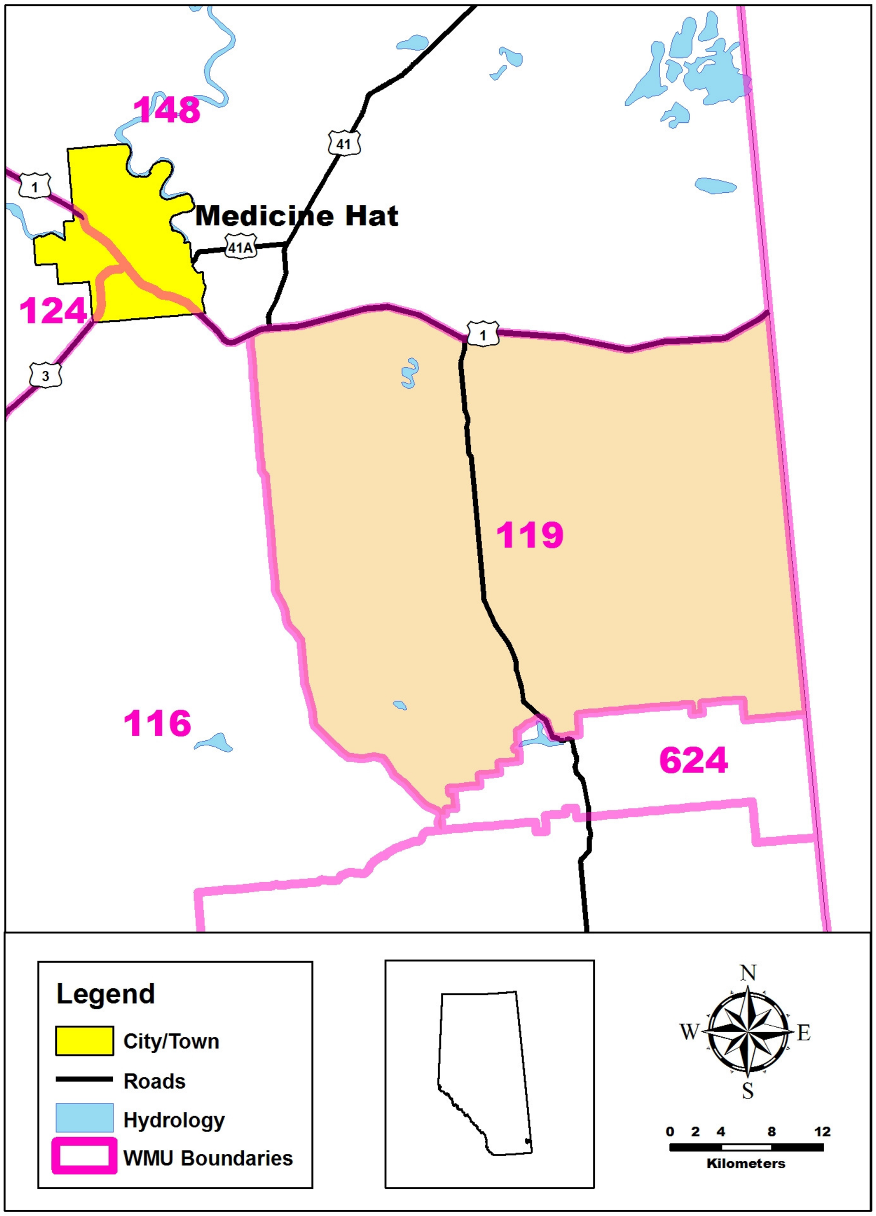


Figure 7. Location of Wildlife Management Unit 119 in Alberta.

remaining 30% is cropland. There is very little oil and gas activity in this unit. A few wind turbines are located in this area with a strong possibility of more in the future.

6.1.2 Survey methods

The study area was stratified for mule deer (Gasaway et al. 1986; ASRD 2010), using a Bell 206B helicopter on 28 – 29 January 2010. Air speed during the survey stratification was approximately 180 km/h and altitude above ground was approximately 100 m. Height and speed of the aircraft varied depending on wind speed and direction, amount of cover and topography of the area. Stratification flight lines followed drainages containing shrub and tree cover in a general north/south orientation. Observers were expected to search for deer primarily in the drainages close to the aircraft while also detecting deer on the uplands at greater distances. Survey crews were comprised of one navigator/recorder/observer in the front seat beside the pilot and two observers in the back seat, one on each side of the aircraft.

While the entire study area was flown for stratification purposes, not all animals in the WMU were observed. Mule deer observed during the pre-survey flight provided a representation of distribution within the unit and allowed for stratifying of survey blocks (3 min latitude x 3 min longitude) as per Shumaker (2001a). The assignment of blocks was based on the number of deer seen within the survey block. The usual method of assigning survey blocks to the appropriate strata is to have approximately 60% in the middle stratum and the remaining 40% split between the high and low stratum (Shumaker 2001b). A large percentage of survey blocks (54%) had 0 deer observed; these survey blocks made up the low stratum for mule deer. The remaining survey blocks were stratified with 23% being medium, 16% high and 7% very high.

Twelve survey blocks (3 blocks x 4 strata) were randomly selected, using the RAND function in Microsoft Excel (Shumaker 2001c). Each survey block was searched intensively (100% coverage) with a Bell 206B helicopter. Results were incorporated into the Quadrat Survey Method Program developed for WMU 119 as per Lynch (1997). Strata were evaluated based on variance associated with deer density and those strata with high variance had additional units randomly selected and flown. This process continued until confidence intervals were at target levels. We did not correct for sightability; therefore, overall counts should be considered as minimum population estimates and direct comparisons of survey results among years may be difficult.

6.1.3 Results

We observed 961 mule deer during stratification flights and 395 mule deer while intensively flying 12 survey blocks. From this, a population estimate of 1,023 +/- 73 was calculated (Table 10).

During intensive survey block flights, a total of 228 white-tailed deer were observed. However, because WMU 119 was not stratified for white-tail deer, a population estimate was not calculated. Herd composition data was not collected for white-tailed deer.

Table 10. Comparison of aerial mule deer survey results from 2003 and 2010 in Wildlife Management Unit 119.

Year	Population Estimate (90% confidence limits)	Mule deer/km^2	Ratio to 100 Females	
			Males	Juveniles
2010	1,023 (±7.1%)	0.79	20	33
2003	1,440 (±22.0%)	1.11	--	--

6.2 Wildlife Management Unit 305 mule deer

Section Author: Mike Jokinen

The primary goal of the 2010 mule deer survey in Wildlife Management Unit 305 (south Porcupine Hills) was to obtain a current population estimate. There have been two previous surveys, in 1996 and 2000 (Quinlan 1996; Quinlan, pers. comm.). Until 1996, population estimates used for hunting license allocations were based on male harvest trends. It was assumed that under a general season and high level of hunter access, long term harvests would be approximately equal to recruitment rates in the populations (Bergman 2004).

Quinlan (1996) and Bergman (2004) suggest that concerns from stakeholders arose in the early 1990s, regarding the lack of a sound population estimate. Some members of the public claimed mule deer numbers were higher than those estimated, whereas others felt numbers were actually lower. Due to public perception and the lack of a true inventory, license allocations were reduced in the early 1990s, and it was decided that an inventory system would be needed in southern foothill units, WMUs 300 to 308 (Bergman 2004).

In 1999, hunting regulations were changed to a limited entry hunt for antlered mule deer. This change removed the opportunity to use male harvest trends as indicators for population trends; thus, periodic aerial surveys are now applied to obtain a population estimate (Bergman 2004). This report provides the most current population estimate for mule deer in WMU 305.

6.2.1 Study area

WMU 305 is located in the South Porcupine Hills, north of Pincher Creek. It is a large WMU that is bordered by highways 3, 22, 2 and secondary road 520 (Figure 8). Portions of the unit lie within the montane, foothills fescue and mixedgrass natural subregions of Alberta (Natural Regions Committee 2006). The Oldman River creates coulee habitat along the southern portion of the WMU. Once amongst the Porcupine Hills, rocky ridges and forest form a bulk of the western half of the WMU while patchy Douglas fir, poplar and shrub communities located within rough fescue grassland shape the east. Coulee draws and varying aspects along the eastern edge of the WMU, where the hills convene with open grassland, create ideal mule deer habitat.

6.2.2 Survey methods

The survey method employed was based on density stratified random sampling. This method applies the principles of random sampling within previously defined strata, to increase precision in the resulting population estimate (Krebs 1989). Density stratification is based on mule deer numbers recorded during a pre-survey flight done rapidly through an entire area.

In 1996, WMU 305 was divided into 63 survey units, each averaging 33 km^2 in size. Survey unit boundaries were created by considering winter mule deer densities and combining those with recognizable land features (roads, fences, vegetation boundaries, etc.). These relatively large survey units allowed for detailed flying of fewer survey units and less sampling variance (Gasaway et al. 1986; ASRD 2010).

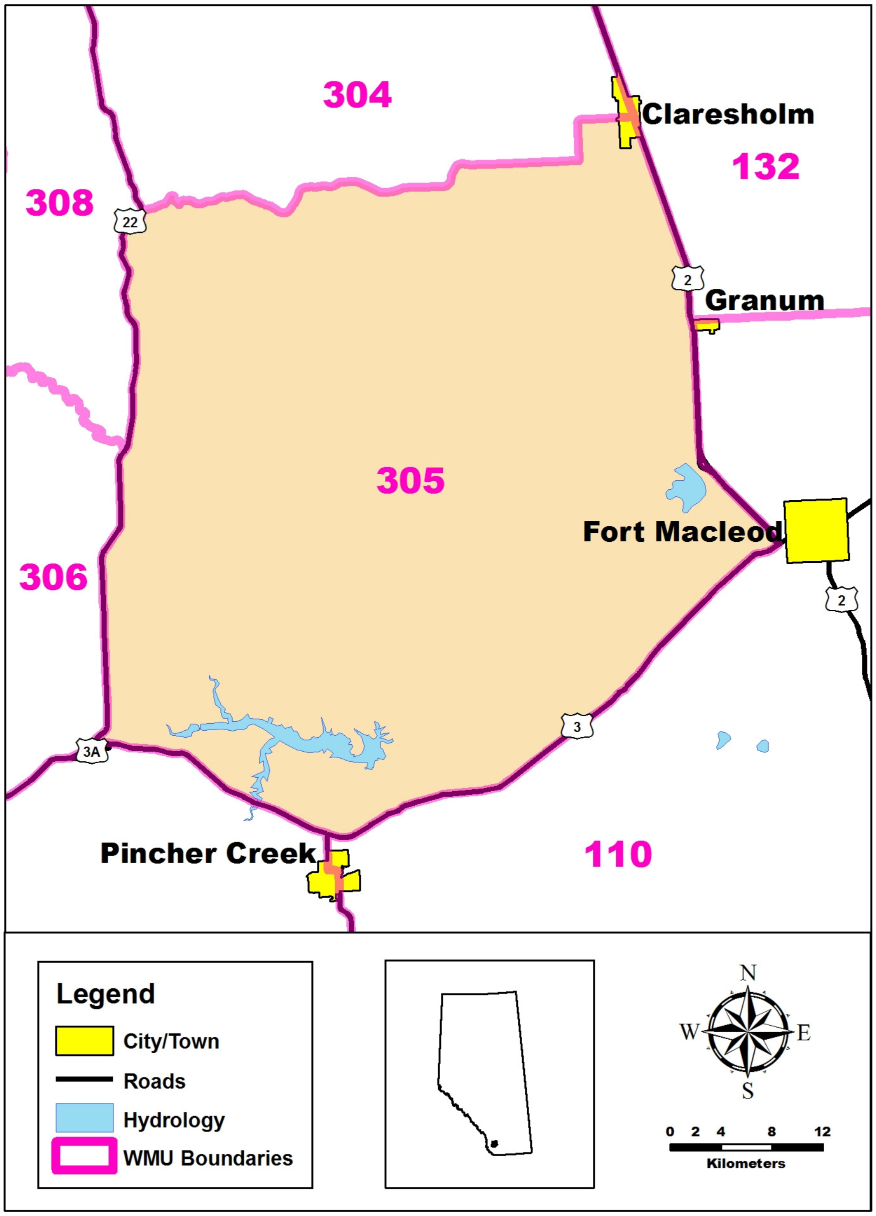


Figure 8. Location of Wildlife Management Unit 305 in Alberta.

A stratification flight briefly surveying each of the 63 units throughout the entire WMU was conducted first. The navigator operated a laptop computer with mapping software and a GPS unit in real time which allowed for efficient and accurate navigation of survey unit boundaries. The navigator and two rear seat observers provided continuous observation, with the right rear observer recording time "on and off survey unit" and total deer numbers, while the left rear observer marked deer locations and the survey track on a handheld GPS. During the 2010 survey, Canon 10 X 42 image stabilizing binoculars were used by the navigator to accurately identify deer to species and to aid with total count. In addition to the number of deer observed, each unit was subjectively rated as high, medium or low in regards to habitat quality and wildlife sign (Gasaway et al. 1986; ASRD 2010).

Following the categorization of survey units, 5 units in each stratum were randomly selected for detailed survey flights. Selected survey units were flown at speeds and heights required to provide thorough coverage. This varied from high and fast (>100 m above ground level (AGL), >120 km/h) in open cropland units, to low and slow (<50 m AGL and as slow as 20 km/h) in areas of dense mixed forest.

The navigator was responsible for all deer classifications, as well as maintaining the proper flight course and ensuring detailed coverage of each survey unit. Two observers occupied the rear seats, with the right observer recording all survey information and the left observer marking waypoints of animal observations and providing a total count of all deer.

All observed mule deer were classified into standard sex and age categories by the navigator using Canon 10 X 42 image stabilizing binoculars (often from a distance to prevent the animals from moving or running). Mule deer were classified as antlered, antlerless adult, and juvenile. Juvenile deer were distinguished from adults by body size. Mule deer that were considered male but to have dropped their antlers and mule deer with one antler were noted. To prevent observer confusion and increase total count and classification accuracy, when a large group of animals was encountered it was best if they were herded into separate groups and/or prevented from running/mixing together during classification. We did not correct for sightability; therefore, overall counts should be considered as minimum population estimates and direct comparisons of survey results among years may be difficult.

Survey conditions over the three day period, 27 – 29 January 2010, were good; however snow cover was quite variable within the WMU. Snow cover conditions deteriorated in certain sections of the WMU, particularly around tree bases on south facing slopes.

6.2.3 Results

During the 2010 stratification flight, a total of 2,085 mule deer were observed within WMU 305. The stratification survey data resulted in 32 units being classified as low density, 18 as medium density, and 13 as high density. In total, 5 low density units, 4 medium density units, and 4 high density units were flown in the detailed survey to ensure a variance near 20% of the estimate.

The total estimated winter population of mule deer in WMU 305 was calculated to be between 3,662 and 5,835 mule deer (Table 11). The 2010 population estimate of 4,748 represents a 13% increase from the 2000 estimate of 4132; however, because confidence limits overlap, it is difficult to know whether this is a real increase or the result of sampling variability. As the previous survey was flown after nearly all antlers had dropped, we are not able to compare buck:doe ratios.

Table 11. Comparison of aerial mule deer survey results from 1996, 2000 and 2010 in Wildlife Management Unit 305.

			Ratio to 100 Females	
Year	Population Estimate (90% confidence limits)	Mule deer/km^2	Males	Juveniles
2010	4,748 (±22.9%)	2.26	43	35
2000*	4,132 (±12.5%)	1.99	0	35
1996	3,789 (±15.8%)	1.82	10	56

*2000 mule deer surveys were flown in March after many males had dropped their antlers.

6.3 Wildlife Management Unit 326 elk and moose

Section Authors: Anne Hubbs and Maria Didkowsky

WMU 326 is a desirable unit for both moose and elk hunters. There are approximately 400 elk hunters annually in this unit, with demand for licenses during the 'Calling Season' exceeding the supply for the past few years. Moreover, antlered and antlerless moose and elk are harvested year-round by aboriginal people in this area.

In 2008, hunting of only antlered moose was permitted, with a season from 24 September – 30 November. The season was divided into two seasons: a 'Calling Season' from 24 September – 31 October, and a 'Late Season' from 1 – 30 November. The harvest goal for moose is presently 4% of the estimated pre-season population. Moose hunter success according to hunter harvest questionnaires has averaged 56% in the

Calling Season and 61% in the Late Season over the last five years (ASRD unpublished data, 2004 - 2008).

The harvest goal for bull elk is 6% of the estimated pre-season population (or 37% of antlered males). A general hunting season with a 3-point antler minimum is in place to protect the majority (~80%) of yearling bulls and to increase bull:cow ratios. The bow season (general license) is from 25 August – 16 September and the rifle season from 17 September – 30 November. Bull elk hunter success from hunter harvest questionnaires has averaged 1.2% over the last five years (ASRD unpublished data, 2004 - 2008). There is no season for antlerless elk in this unit.

Regular population inventories are required in this unit to assist in managing losses due to hunter harvest, predation, and severe winters. The objectives of this survey were to estimate the total moose and elk population sizes in this unit, and to determine herd composition for moose.

6.3.1 Study area

WMU 326 is located south of the North Saskatchewan River, west of the Clearwater River, and east of the Ram River (Figure 9). The southern area borders Seven Mile Flats, and Rocky Mountain House is located northeast of the WMU. The unit is 1,046 km^2 in size and elevation varies between 800 m and 2000 m, with terrain consisting of moderate to steep rolling hills, with increasing ruggedness towards the Rocky Mountains (Allen 2005). The unit straddles the lower and upper foothills natural subregions (Natural Regions Committee 2006), and has three traditional elk wintering ranges comprising 5% of the WMU. The dominant land-cover from the Alberta Vegetation Inventory (AVI) is conifer (76%), followed by non-forest (19%; e.g. shrub, rocks, anthropogenic features), mixedwood (3%), and deciduous (2%). Cut blocks comprise approximately 36% (~34,800 ha) of the WMU. In general, the industrial footprint is widespread with oil and gas, and forestry as the dominant disturbances. Road density was greater than 0.56 km/km^2 (> 555 km) within the WMU.

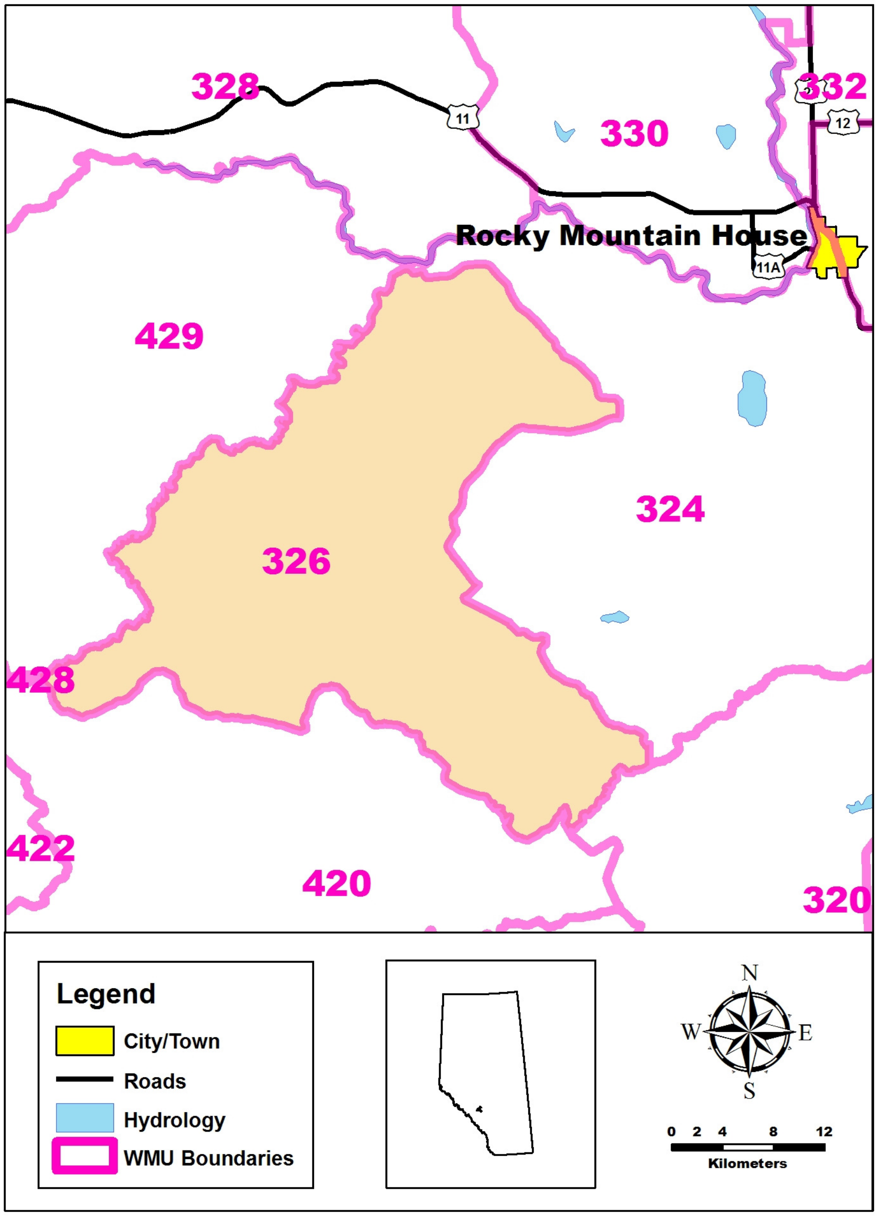


Figure 9. Location of Wildlife Management Unit 326 in Alberta.

6.3.2 Survey methods

Prior to the survey, we used a geographic information system (GIS) to delineate survey blocks by creating a 2 minute latitude by 2 minute longitude grid overlaid on a map of WMU 326. This method of delineating survey blocks is consistent with previous surveys of this unit.

Moose Stratification – We classified 2 X 2 blocks into three strata (low, medium and high probability of moose occurrence) using the Alberta Vegetation Inventory. These methods were generally consistent with those used previously for this WMU.

First, varying weights were assigned to each of the six dominant land cover types, according to their expected probability of moose occurrence. Deciduous and deciduous-dominated mixedwood were assumed to have the highest likelihood of moose, followed by cut blocks less than 30 years old, then coniferous-dominated mixedwood and lastly, conifer stands. Non-forest, which included anthropogenic features, was assumed to have no probability of moose occurrence. Because non-forest also included shrub habitat, the likelihood of moose occurrence may have been underestimated in this case. Also, in the future, greater weight should be assigned to cover within river valleys or flats.

Second, an overall weighting was generated for each block based on the combined weight from each land cover type. Blocks with the highest and lowest 20% weights were assigned to the 'high' and 'low' strata, respectively. The remaining blocks were assigned to the 'medium' strata. Generally, conifer blocks with >85% conifer coverage consist of relatively low quality habitat and have issues related to low sightability due to dense cover. As a result, blocks with >85% conifer coverage were not assigned to strata and were not used in deriving a moose population estimate for the WMU. This method is consistent with previous surveys in WMU 326 (Allen, pers. comm.).

Overall, 18 blocks were classified as low, 42 as medium and 20 were classified as high. We then randomly selected survey blocks for inclusion in the intensive survey using the random number generator in Excel.

Elk Stratification - The relative probability of elk occurrence across the WMU was calculated for winter habitat using the Elk Habitat Planning Tool (Webb and Anderson 2009). The elk tool uses resource selection function (RSF) models developed by Frair et al. (2007) to predict habitat quality and risk for elk across the landscape. Updated habitat cover variables and industrial disturbance (post-2003) could not be incorporated into the Elk Habitat Planning Tool, and thus were not considered in the stratification process.

We calculated the average RSF value in each sample unit to determine relative probability of elk occurrence. We used Jenks Natural Breaks to divide the sample units into 3 strata, creating low, medium, and high strata. We then randomly selected survey blocks for inclusion in the intensive survey using the random number generator in Excel.

We surveyed sample blocks with a Bell 206B helicopter from 4 – 6 February 2010 (Gasaway et al. 1986; ASRD 2010). We surveyed a total of 27 blocks: 8 low, 11 medium and 8 high for moose; 5 low, 14 medium and 8 high for elk. We flew approximately 120 km/h, 30 - 50 m above the ground at 400 m intervals to ensure that each block was completely covered. A navigator sat next to the pilot and observed and recorded animal locations, while two observers in the back seat of the aircraft were responsible for scanning out to approximately 200 m from each side of the aircraft.

We counted and recorded locations of moose and elk. We circled all moose to determine age, sex, total number of individuals, and condition. Most bulls at this time had shed their antlers but the white vulva patch below the tail indicated a cow moose. Light brown patches, typically occurring on the shoulders and back, indicated tick infestation. Sex and age composition data of elk was collected using the presence of antlers and body size to differentiate bulls and calves from cows. We did not correct for sightability; therefore, overall counts should be considered as minimum population estimates and direct comparisons of survey results among years may be difficult.

Moose and elk counts per block were each summed and entered into separate Quadrat Survey Method Program files to determine population estimates (Gasaway et al. 1986; ASRD 2010).

In general, the visibility and snow cover during the survey was good. Daily temperatures ranged from -20 to -10 degrees Celsius. Snow conditions deteriorated slightly as the survey progressed, exposing some parts of south facing slopes and black stumps in open areas.

6.3.3 Results

Moose — During the survey, 94 moose were counted in 19 survey blocks. The total moose population was estimated at 316 to 518 moose (90% confidence limit) as compared to the 2005 population estimate of approximately 300 moose (confidence limits unknown) (Table 12). Ticks were not prevalent; only one moose had slight hair-loss.

Elk — We were unable to calculate a population estimate for elk due to very low densities, but did document a minimum count of 44 elk throughout the WMU. Of the 44 elk, only one group of 38 elk (including 6 calves) was observed within the 27 survey blocks. An additional group of 6 bull elk was observed outside of the assigned survey blocks.

Elk populations have declined over the last four or more years. In 2005, there were an estimated 200 elk (confidence limits unknown) in WMU 326 (Table 12). In 2001, this estimate was 327 +/- 15% elk (Table 12) when the Jenk's classification system was used for stratification (as per our survey) and approximately 250 elk when trend surveys were used (Allen 2005). An average of 11 elk, ranging from a low of 4 to a high of 26, have been seen on 3 wintering ranges within this unit from 2002 - 2008. During the 2010 survey the one group of 38 elk observed was located on one of the wintering ranges.

Table 12. Comparison of aerial moose and elk survey results from 2001, 2005 and 2010 in Wildlife Management Unit 326.

Species	Year	Population Estimate (90% confidence limits)	Animals/km²	Ratio to 100 Females	
				Males	Juveniles
Moose	2010	417 (±24.1%)	0.40	80	13
	2005	300 (--)	0.29	--	--
	2001	--	--	--	--
Elk	2010	--	--	--	--
	2005	200 (--)	0.19	--	--
	2001	327 (±15.0%)	0.31	--	--

6.4 Wildlife Management Unit 340 moose

Section Authors: Dave Hobson, Kirby Smith, and Shevenell Webb

Obtaining accurate moose population estimates is important for ensuring healthy moose populations and hunting opportunities. WMU 340 is surveyed on a rotational basis, approximately every three years. WMU 340 was surveyed using the modified Gasaway method in 1994, 1996 and 2004 (Gasaway et al. 1986; Lynch and Schumaker 1995; Lynch 1997). Our objective for this year's aerial survey was to estimate moose population size, density, condition and composition (i.e., ratio of bulls:cows:calves).

6.4.1 Study area

WMU 340 is located south of the Town of Edson and is bounded by Highway 16 on the north, the Wolf Lake road and Wolf Creek on the east, the Pembina River on the southeast, Highway 40 on the southwest and Highway 47 on the northwest (Figure 10). This 2,585 km^2 unit is characterized by moderate to high levels of oil and gas development (roads, wellsites, large and small gas plants and pipelines), a coal mine, and an extensive, moderate density, all-weather road network. Forest cut blocks in

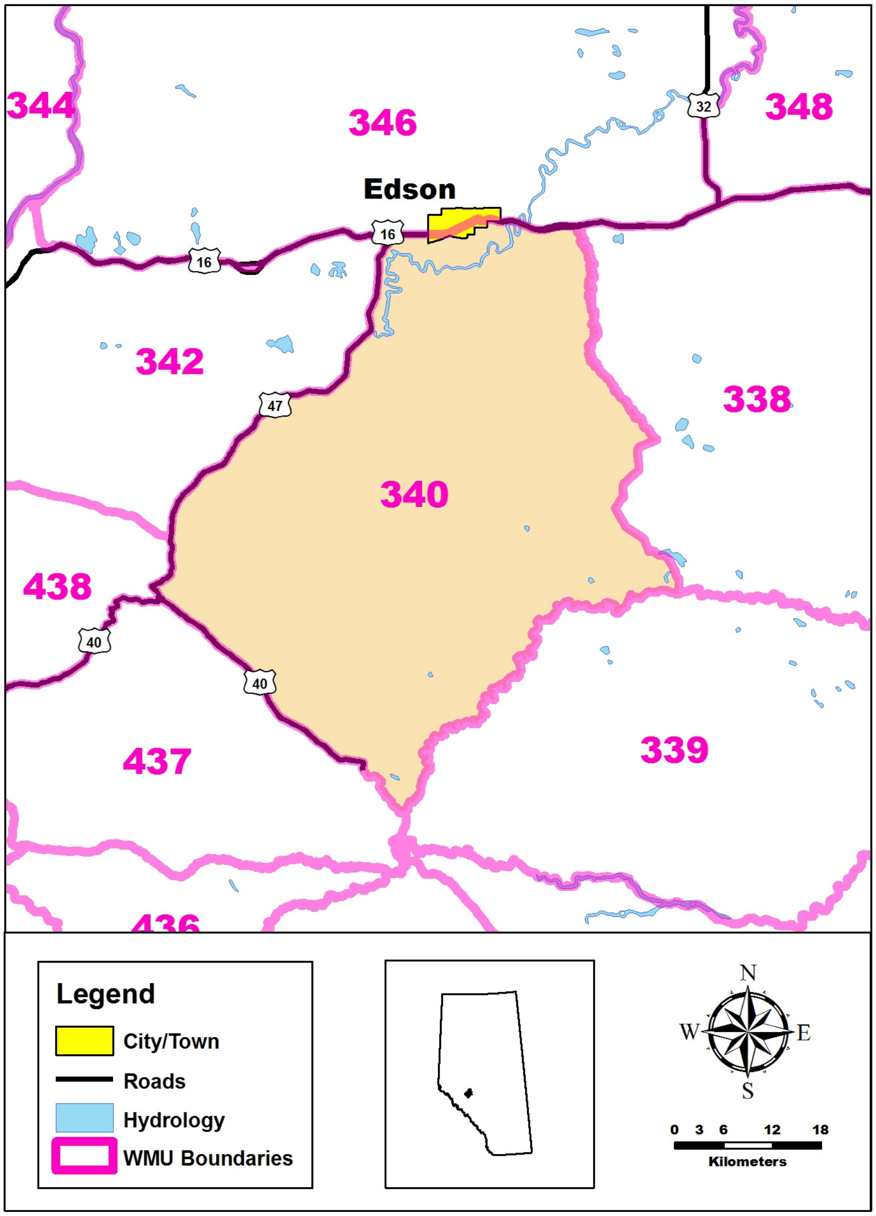


Figure 10. Location of Wildlife Management Unit 340 in Alberta.

various stages of activity and regeneration are dispersed throughout the WMU. The unit is located in the lower and upper foothills natural subregions of Alberta (Natural Regions Committee 2006). The habitat is largely coniferous forest (predominately lodgepole pine), black spruce and tamarack muskegs, and dwarf shrub bogs. Mixedwood and pure deciduous stands are mainly in the northern portion of the WMU and on the Robb Highlands. There are a few scattered small lakes.

6.4.2 Survey methods

WMU 340 was surveyed for moose using the modified Gasaway method (Lynch and Schumaker 1995; Lynch 1997; ASRD 2010). Fixed-wing aerial stratification of the WMU was flown on 11 – 12 January 2010. Detailed rotary-wing aerial surveys were conducted on 13 – 15 January 2010. This WMU was divided into 51 survey units (5 minute longitude by 5 minute latitude) and classified into high, medium and low strata by the fixed-wing stratification flights. Strata were determined by the number of moose observed in each unit during the fixed-wing flights and calculated as a density. Direction and distance of each moose from the airplane were also estimated and recorded. Fixed-wing stratification flights were followed by more detailed surveys of randomly selected survey units using rotary-wing aircraft. Initially 5 of each stratum were flown and data analyzed to determine confidence limits for the population estimate. The goal was to produce a population estimate with a 90% confidence interval of +/- 20% or less. If after flying 5 of each stratum the confidence limits are >20%, additional survey units are flown of those strata with high variance. We did not correct for sightability; therefore, overall counts should be considered as minimum population estimates and direct comparisons of survey results among years may be difficult.

Survey conditions were good, with complete snow cover (though not complete coverage of root balls and dead fall) and sunny or partially cloudy skies. During the fixed-wing flights, high wind and some turbulence was experienced in the western portion of the WMU.

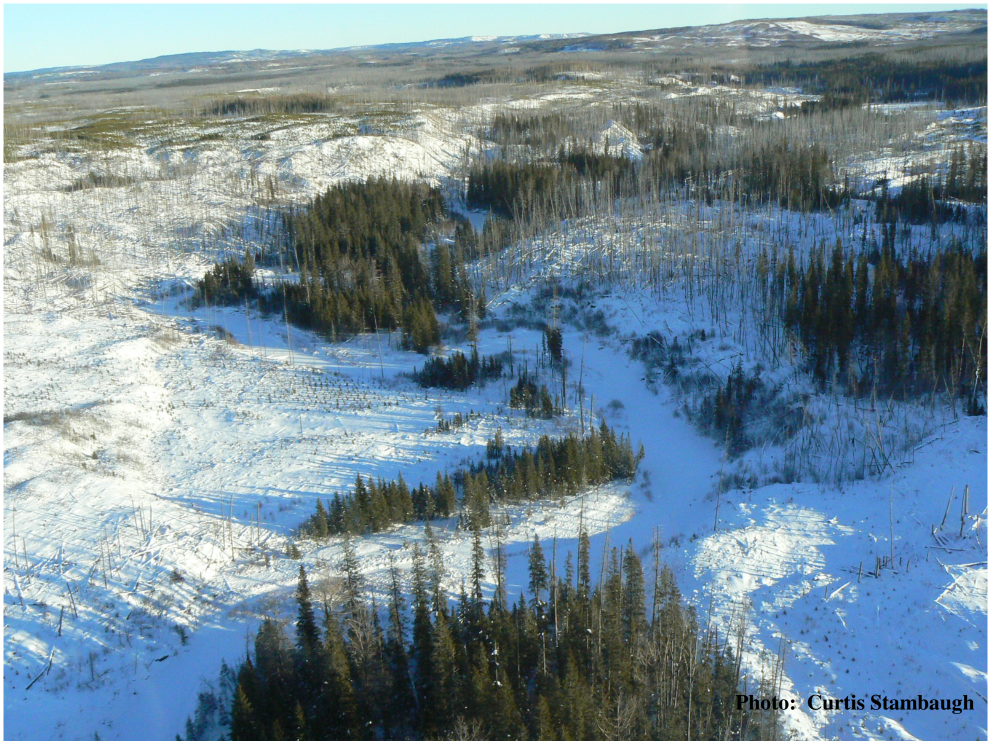
6.4.3 Results

A total of 239 moose were observed during the detailed survey (47 bulls, 134 cows, 57 calves, and 1 unclassified). The population estimate for moose in WMU 340 was calculated to be between 685 and 833 (Table 13). The bull:cow ratio was the highest recorded in the past four surveys, while the calf:cow ratio was within the previous range (Table 13).

Table 13. Comparison of aerial survey results for moose in Wildlife Management Unit 340 from 1994 – 2010.

	Population Estimate		Ratio to 100 Females	
Year	(90% confidence limits)	Moose/km^2	Males	Juveniles
2010	759 (±9.8%)	0.29	35	43
2004	640 (±14.5%)	0.26	26	50
1996	1,247 (--)	0.48	15	46
1994	1,463 (±17.8%)	0.63	19	39

6.5 Wildlife Management Unit 347 moose



Section Authors: Curtis Stambaugh and Corey Rasmussen

Wildlife Management Unit 347 has seen an abundance of landscape change over the last 20 to 30 years. The forest industry is very active within the WMU and the energy sector has been steadily increasing. Along with resource extraction activities comes road infrastructure and currently very few places in the WMU are inaccessible by vehicle or ATV, which increases hunting pressure on game species.

WMU 347 has been surveyed three times since its delineation in 1993. The unit was surveyed in 1994 and 1998 as part of the Northern Moose Program (Lynch 1997) and again in 2002. The objective for this survey was to produce a moose population estimate with a 90% confidence interval of +/- 20% or less. Elk, mule deer and white-tailed deer are also found within the WMU; however, forest vegetation means the accuracy of population estimates for these species is low and thus not a priority for this WMU.

6.5.1 Study area

WMU 347 is a relatively small unit, totaling 1,579 km^2, located to the west of Whitecourt and south of Fox Creek (Figure 11). It is bounded in the north by Highway 43, to the west by the Bigstone Road and other smaller resource roads, and to the south by the Athabasca River. WMU 347 lies primarily within the lower foothills natural subregion of Alberta (Natural Regions Committee 2006) and is predominately comprised of coniferous and mixedwood forest. The Athabasca and Little Smoky rivers are the predominant watersheds, although numerous tributaries to the Athabasca are present.

6.5.2 Survey methods

Aerial stratification was completed on 26 January followed by detailed block surveys from 27 – 29 January 2010. Survey methodology followed the Alberta Fish and Wildlife modified Gasaway technique or stratified random block design (Gasaway et al. 1986; Lynch 1997; ASRD 2010). The WMU was divided into a 3 minute latitude by 5 minute longitude grid, resulting in 55 survey blocks (some blocks varied in size due to WMU boundary). Block stratification was conducted using a Cessna 185 and a crew of three plus a pilot. The crew consisted of a navigator/observer and two full time observers. Transects were flown every one minute latitude, with the exception of block boundaries (every fifth minute), and all observations of moose on either side of the aircraft were recorded. All moose locations were recorded with a Garmin GPSMap 76CSx. Pilots attempted to maintain a consistent altitude of 100 m above ground level (AGL) so an approximate distance to the animal could be consistently recorded. Aircraft speed was maintained at approximately 150 km/h. Survey blocks were then assigned a value of low, medium, or high based on moose densities from stratification flights.

Five blocks for detailed surveys were chosen randomly for each of the low, medium and high strata. Detailed surveys were conducted by 2 crews of 3 observers, plus a pilot, using 2 Bell 206B helicopters. Crews consisted of at least two experienced observers; one in the front left seat (navigator/observer) and the other behind the pilot. A third observer was also present behind the navigator/observer. North/south lines were flown 400 m apart and approximately 30 m above the trees at a speed of 100 km/h, depending on cover type. All moose locations were recorded with a handheld global positioning system (GPS). Every attempt was made to sex and age the animals unless forest cover

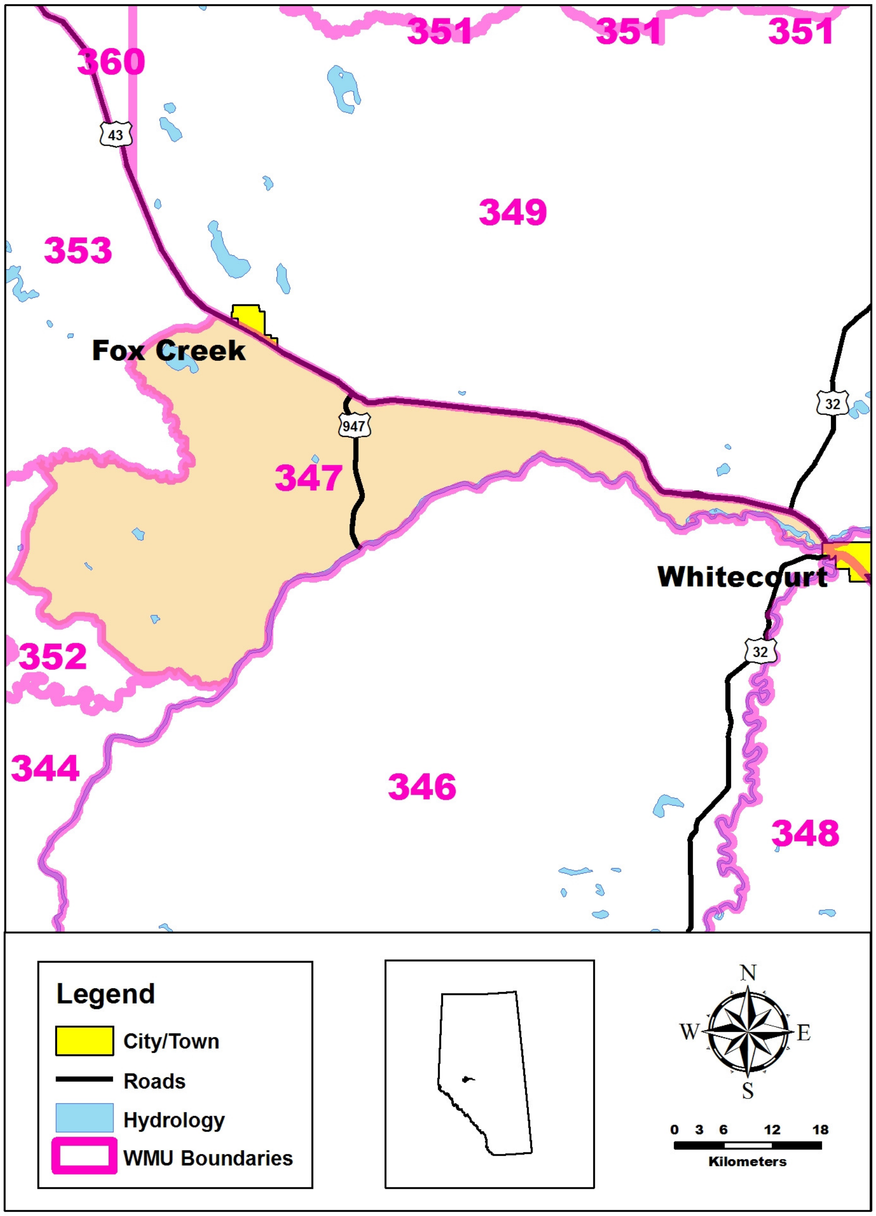


Figure 11. Location of Wildlife Management Unit 347 in Alberta.

and/or wind prevented safe or confident identification. All moose were classified as adults or calves based on body size and length of nose; all yearlings were classified as adults. All adult moose were classified as cows if a white vulva patch was present. All adult bulls that still possessed antlers were classified by their size. We did not correct for sightability; therefore, overall counts should be considered as minimum population estimates and direct comparisons of survey results among years may be difficult.

Conditions were adequate throughout the duration of the survey. Temperatures ranged from -15 degrees Celsius in the mornings to -5 degrees Celsius in the afternoons. Winds were calm and turbulence was negligible. Snow cover varied between the forest and cut blocks and from east to west but overall was adequate with a skiff of fresh snow. Heavy frost on the trees in the mornings, particularly along the Athabasca River, did make sightability difficult but was largely avoided by changing which blocks were surveyed in the afternoons when the frost had melted.

6.5.3 Results

The estimated moose population was between 566 and 776 (Table 14). This represents a slight drop in estimate (approximately 16%) from 2002, though confidence intervals for these two most-recent surveys overlap. The bull:cow ratio was the highest observed in the past four surveys. Calf:cow ratios fell within the range of past surveys with an observed twin rate of 24%. A total of 42 bulls were observed with 83% having already shed their antlers. Of those still carrying antlers, four were yearlings and three were classified as medium. Table 14 shows population and demographic estimates for WMU 347 among survey years.

Table 14. Comparison of aerial survey results for moose in Wildlife Management Unit 347 from 1994 – 2010.

Year	Population Estimate (90% confidence limits)	Moose/km^2	Ratio to 100 Females	
			Males	Juveniles
2010	671 (±15.7%)	0.42	42	43
2002	800 (±19.3%)	0.52	15	46
1998*	194 (--)	0.21	13	26
1994	613 (±19.9%)	0.42	15	39

*Data presented was split from the total survey which also included WMU 352.

6.6 Wildlife Management Unit 351 moose

Section Authors: Alain J. Fontaine and Ryan Hermanutz

Historically, moose populations in WMU 351 were surveyed following Alberta's Northern Moose Management Program protocol (Lynch 1997) in the winters of 1993/94, 1997/98, and 2001/02. Alberta Fish and Wildlife strives to complete surveys in each WMU at a minimum of every 3 years or when land and wildlife management issues necessitate increased monitoring and assessment of populations and their distribution. WMU 351 receives substantial hunting pressure from First Nations and Metis communities and is also a highly desirable unit for recreational hunters given historical moose populations in the unit, ease of access, and relative proximity to major urban centres. Therefore, regular moose surveys in WMU 351 are important to assess moose population status and trends, in order to properly manage the resource. This report contains the results of the moose survey conducted in WMU 351 in the winter of 2009/10.

6.6.1 Study area

WMU 351 is delimited to the north by the southern boundaries of townships 71 and 72; to the west by the western boundaries of range 18 and 19 and the northern boundary of township 69; to the south by the main tributary of the Goose River and the Goose Forestry Tower Road; and to the east by Highway 33 (Figure 12).

This WMU has few small lakes and ponds, however, it is characterized by an abundance of creeks and rivers. The Goose and Swan rivers and their tributaries are the major flowing waters in the WMU. The land base in WMU 351 is composed of the lower and upper foothills natural subregions at higher elevations, with portions of the central mixedwood natural subregion at lower elevations (Natural Regions Committee 2006). Much of the WMU is highly fragmented with logging cut blocks and hauling roads. This is especially true of the western half of the WMU and the region northwest of Swan Hills. Footprint from the oil and gas industry is omnipresent on the landscape and is especially prevalent around the headwaters of the Swan, Moosehorn, and Inverness rivers northwest of Swan Hills, as well as in the southwest corner of the unit north of the Goose River.

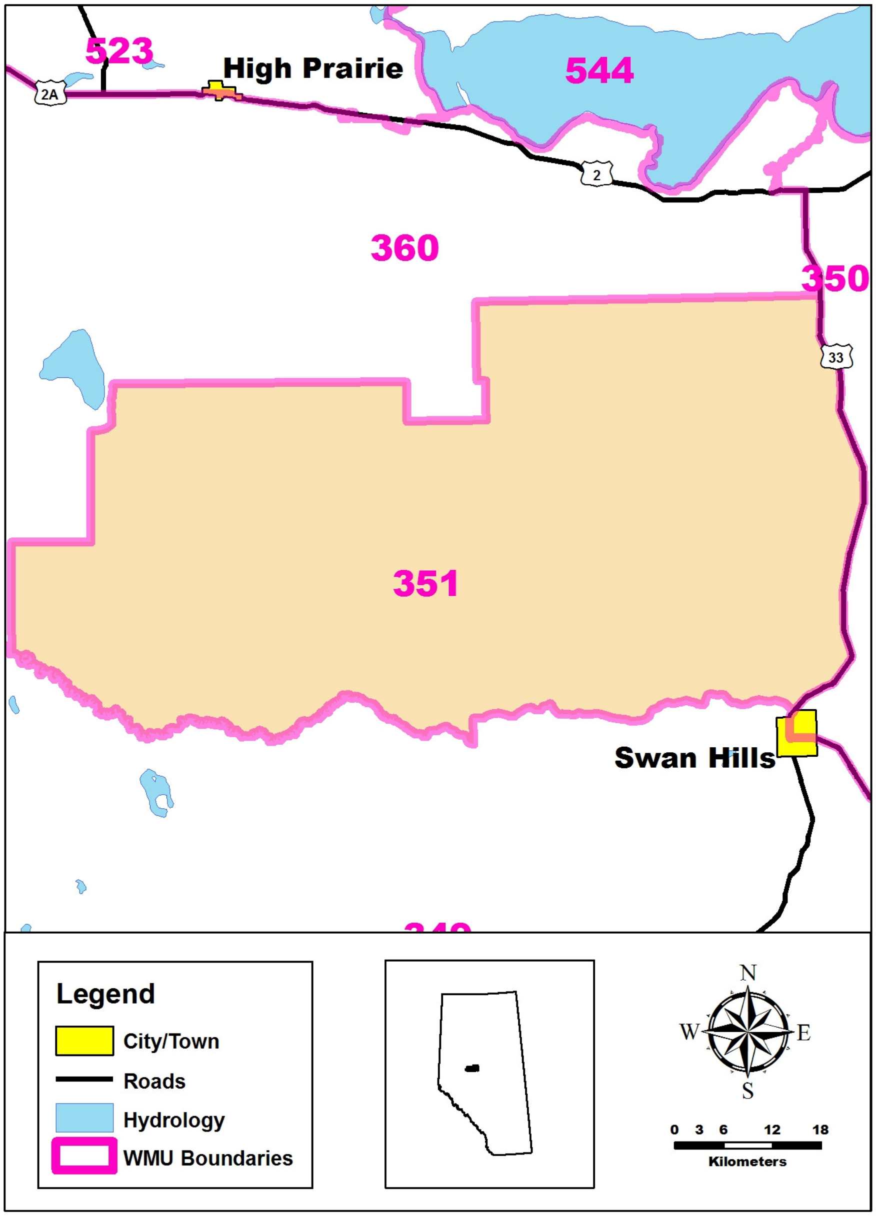


Figure 12. Location of Wildlife Management Unit 351 in Alberta.

6.6.2 Survey methods

An aerial ungulate survey following methodology adapted from the Gasaway survey technique (Gasaway et al. 1986), as described in the Northern Moose Management Program Moose Survey Field Manual (Lynch 1997) and the ASRD-AUS protocol manual (ASRD 2010), was conducted in February, 2010. A Cessna 185 and Cessna 206 fixed-wing aircraft, each with a crew consisting of a pilot and three observers, were used for the stratification flights on 1 - 2 February 2010. Stratification crews in each aircraft flew east-west transects across the WMU at one minute of latitude intervals skipping latitude lines at 5 minute intervals. Air speed during stratification flights was approximately 150 km/h, and flight altitude was maintained between 60 - 90 m above ground level (AGL). Locations of moose were marked using a Garmin GPSmap 60CSx.

The WMU was then divided into low, medium and high density blocks (measuring 5 minutes longitude x 5 minutes latitude) based on moose densities observed during the fixed-wing stratification flights. As a result, 20 blocks were classified as low, 53 as medium, and 19 as high, for a total of 92 blocks. A random sample of five blocks from each stratum was initially selected for intensive moose surveys. Two Bell 206B helicopters were used to assess the number of moose within each of the intensive survey blocks on 3 - 8 February 2010. Each block was flown east to west on flight lines spaced approximately 400 m apart at speeds of 80 - 110 km/h and an altitude of 45 - 75 m. Flight crews consisted of one pilot and three observers on all flights. Based on the analysis of the results when all initial blocks had been flown, an additional four medium and one high block were randomly selected and surveyed to reach our precision target of less than +/- 20% for a 90% confidence limit.

All moose were classified as bulls, adult cows with or without calves, lone calves, or unclassified. Bull moose still retaining their antlers were further classified into size classes based on antler development (Table 1). We did not correct for sightability; therefore, overall counts should be considered as minimum population estimates and direct comparisons of survey results among years may be difficult.

A fresh snowfall of 2 - 5 cm on top of older snow was initially judged to be adequate for aerial survey purposes, but was not ideal. Snow depths were less than 30 cm over much of the unit, with the exception of higher elevation low density pine stands where snow depth was approximately 50 cm. Flying conditions throughout the stratification were excellent with no turbulence, flat light, and good visibility. Winds were generally calm (0 - 10 km/h) and skies were 100% overcast. Snow condition deteriorated progressively throughout the intensive surveys such that south facing slopes and benches, as well as the base of conifers at lower elevations were often bare of snow. Low ground fog on 3 – 4 February and on the morning of 5 February prevented crews from flying. However, flying conditions for the reminder of the survey were excellent with little to no turbulence, good visibility, generally calms winds (0 - 10 km/h) and clear skies.

6.6.3 Results

After intensively flying 18 sample units, the Quadrat Survey Method Program generated a moose population estimate of between 1,803 and 2,411 (Table 15). Of the cows and calves observed during detailed block surveys, 55.7% were single cows, 43.3% were cows with a single calf, and 1.0% were cows with twins, for an observed twin rate of 2.2%. Of the observed bulls, 93% had already shed their antlers (80 out of 86 observed bulls). Therefore no inferences regarding the distribution of bulls by antler class can be made. Two medium stratum blocks were removed from the analyses due to discrepancies between stratification and intensive survey observations. Localized movements of moose that were concentrated near survey unit boundaries may have caused such discrepancies. With consideration of these factors, we present results both with and without the two additionally survey blocks. Based on results from 20 sampled units, the Quadrat Survey Method Program estimated a moose population of between 1,535 and 2,199 (Table 15).

Table 15. Comparison of aerial survey results for moose in Wildlife Management Unit 351 from 1994 – 2010.

Year	Population Estimate (90% confidence limits)	Moose/km^2	Ratio to 100 Females	
			Males	Juveniles
2010 – 18 units	2,107 (±14.5%)	0.48	41	46
2010 – 20 units	1,867 (±17.8%)	0.43	42	45
2002	2,457 (±10.5%)	0.56	32	45
1998	2,451 (±19.2%)	0.56	42	28
1994	2,152 (±16.5%)	0.52	19	53

6.7 Wildlife Management Unit 358 moose

Section Authors: Dave Stepnisky and Robb Stavne

Aerial ungulate surveys are valuable for setting license numbers for resident and non-resident hunters, for ungulate depredation discussions and for habitat protection efforts. Moose populations in WMU 358 were last surveyed in 1998. Since the last survey, a great deal of industrial development has occurred within the Saddle Hills. With increased industrial activity, there has been an increase in accessibility of moose to hunters (with more road access). A detailed survey was required to determine the effect of landuse change on moose populations and to ensure that harvest levels remain sustainable in this area. This report contains the results of analysis of moose surveys conducted in WMU 358 in 2010.

6.7.1 Study area

WMU 358 lies entirely within the Saddle Hills County and includes a mix of predominantly farmland to the east, and forested Crown land in the west. The unit is bordered by Highway 49 to the north, Highway 2 to the east, the British Columbia border to the West, and by the Saddle Hills County border to the south (Figure 13). This area is comprised primarily of the lower foothills natural subregion, but also includes portions of the dry mixedwood and central mixedwood natural subregions (Natural Regions Committee 2006). Considerable fragmentation within the forested area has resulted from substantial forestry and oil and gas activity. The increase in forestry activity at the green/white zone interface has generated substantial amounts of additional forage for moose.

6.7.2 Survey methods

Wildlife staff from ACA and ASRD flew transects across WMU 358 by fixed-wing aircraft on 25 January 2010 to stratify the distribution of moose across 61 sampling units, in preparation for detailed surveys of ungulates using rotary-wing aircraft. Fixed-wing (Cessna 185 and 206) flights were flown along lines of 1 degree of latitude (except for every fifth line, which fell on sample unit borders) within the WMU. Air speed during stratification flights was approximately 150 km/h, and flight altitude was maintained between 60 - 90 m. Cloud cover was 100% for the duration of the stratification, providing observers with flat light conditions and intermittent light snow flurries. Temperatures averaged -14 degrees Celsius. Snow conditions were good, with an average of 60 cm of old snow and 2 cm of fresh snow. Sightability was generally good throughout the farmland and mixed conifer/deciduous forest, however, heavy frost accumulations on dense conifer and aspen/willow stands resulted in isolated patches of very poor sightability in the western half of the unit. Locations of moose were recorded using a Garmin 60CSx Global Positioning System (GPS).

Sample units were classified according to the number of moose observed during fixed-wing stratification flights following a modified Gasaway technique (Gasaway et al. 1986; Lynch 1997; ASRD 2010). Based on relative densities from stratification flights, survey units were stratified for moose into low, medium, and high classifications. Sample units were 5 minutes latitude x 5 minutes longitude in size. Fifteen sample units (5 low, 5 medium and 5 high) were randomly selected for intensive search by helicopter.

A Bell 206B helicopter was used to determine the number of moose within each of the 15 randomly selected blocks on 26 – 29 January 2010. Each block was flown in an east to west orientation on flight lines spaced approximately 400 m apart, at 100 - 140 km/h,

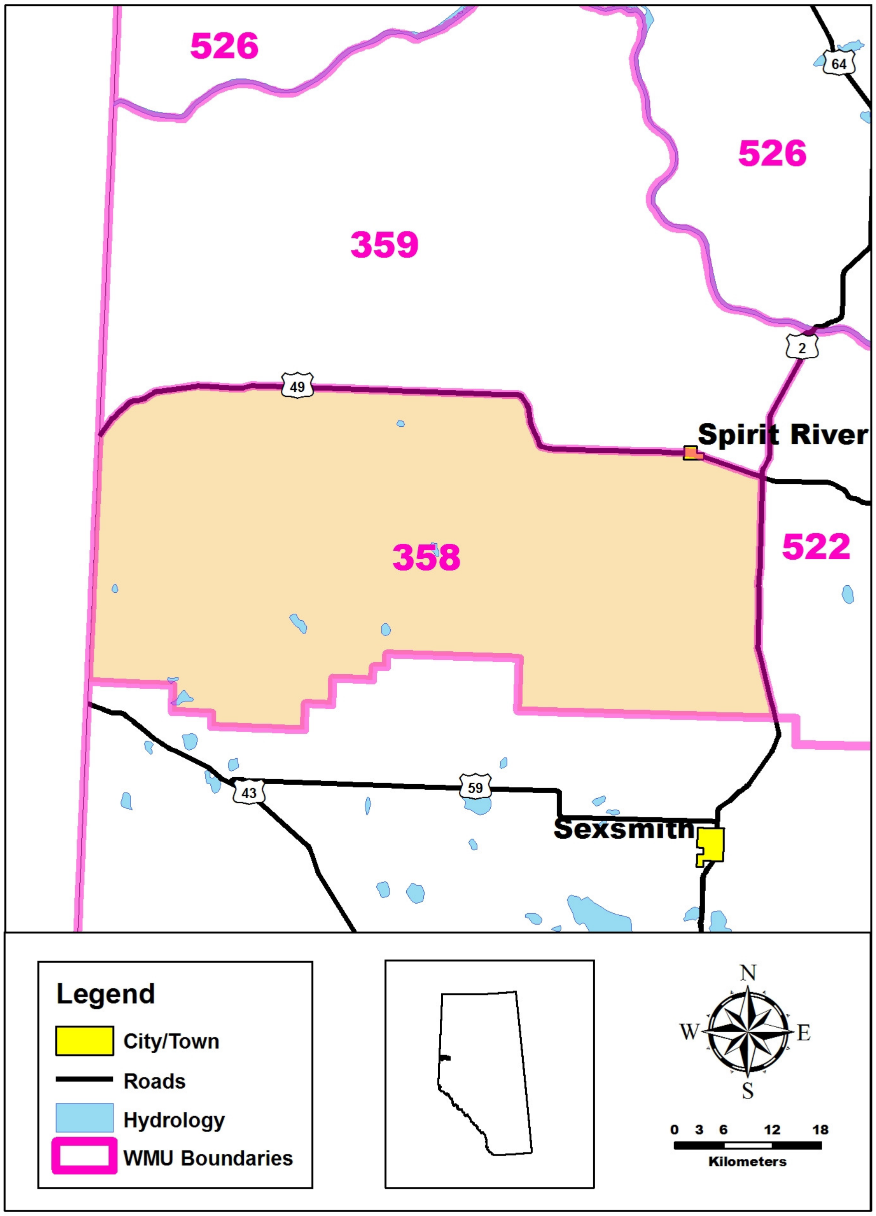


Figure 13. Location of Wildlife Management Unit 358 in Alberta.

and at an altitude of approximately 30 m. Because of very poor sightability conditions in a few blocks (owing to heavy frost and dense forest cover), some of the flight lines were narrowed considerably, to 150 - 200 m spacing, and helicopter altitudes were elevated to reduce the chance of observers missing moose.

Each flight crew consisted of three surveyors: a navigator/recorder/observer up front, and two observers in the back seat of the aircraft. Observers on each side of the helicopter were responsible for a field of view approximately 200 m wide. All ungulates were identified by sex and age using physical characteristics that were easily observed from the air (e.g. presence of white vulva patch on cow moose, or antlers on males). Although most bulls had already dropped their antlers, those that still retained their antlers were classed appropriately into either the small, medium or large antler size category (Table 1). We did not correct for sightability; therefore, overall counts should be considered as minimum population estimates and direct comparisons of survey results among years may be difficult.

Conditions for rotary-wing surveys were generally good with excellent snow coverage. Ground temperatures varied from -12 to -25 degrees Celsius, however some inversions were noted where air temperatures were measured to be -2 degrees Celsius. Winds were generally calm, providing us with excellent observation conditions throughout all portions of the rotary-wing survey.

6.7.3 Results

The total moose population estimate for WMU 358 was calculated to be between 2,056 and 2,448 (Table 16). The bull:cow ratio was higher than the previous survey, while the calf:cow ratio was lower than the previous survey (Table 16). The observed twin rate was 8.4%. Of the bulls that were observed, 29.3% had already shed their antlers. Of those bulls with antlers, 52.8% were small, 43.4% were medium and 3.8% were large. Note that proportions of large bulls may be underestimated, due to higher probability of early antler drop.

Table 16. Comparison of aerial survey results for moose in Wildlife Management Unit 358 in 1998 and 2010.

Year	Population Estimate (90% confidence limits)	Moose/km^2	Ratio to 100 Females	
			Males	Juveniles
2010	2,252 (±8.7%)	0.79	31	51
1998	2,552 (±10.5%)	0.89	24	56

6.8 Wildlife Management Unit 501 moose and deer

Section Authors: Barb Maile and Velma Hudson

Moose and white-tailed deer are the primary big game species in WMU 501, providing recreational hunting opportunities and subsistence for many residents. Mule deer are also harvested within the WMU but occur at low densities. The objective of this survey was to obtain a moose population estimate for WMU 501 and compare the result with past estimates and surrounding WMUs. Aerial ungulate surveys provide population and density estimates, distribution patterns, and habitat-use data implemented in determining hunting license allocations. When conducted at regular intervals of every 3 years (ASRD 2010), surveys also offer valuable data for assessing ungulate and other wildlife population trends, in addition to providing an aerial appraisal of natural and anthropogenic changes occurring on the landscape. Although the purpose of the survey was to inventory moose, the timing of the survey allowed for collection of valuable information on distribution and population levels for white-tailed deer and mule deer.

6.8.1 Study area

WMU 501 lies within the dry mixedwood subregion of the boreal forest natural region (Natural Regions Committee 2006). It has an area just over 2,100 km^2, it lies southwest of Cold Lake and is bordered by Saskatchewan to the east (Figure 14). Agriculture is predominant throughout much of the unit, however, several tracts of mixedwood stands occur north of Highway 55 and along the Saskatchewan border. Substantial water bodies within the WMU include Cold and Muriel lakes and several medium-sized lakes in the northern portion attract recreationalists. Quality riparian areas occur along the Beaver River and provide key summer and winter ungulate habitat. Urban centres include Bonnyville and Cold Lake, as well as several small communities and summer villages, which are dispersed throughout the unit. Portions of the WMU held under federal jurisdiction include Cold Lake First Nations and Kehewin First Nations Reserves, and Department of National Defence 4 Wing Cold Lake. Oil and gas extraction activities are common with abundant oilfield and related traffic through much of the area.

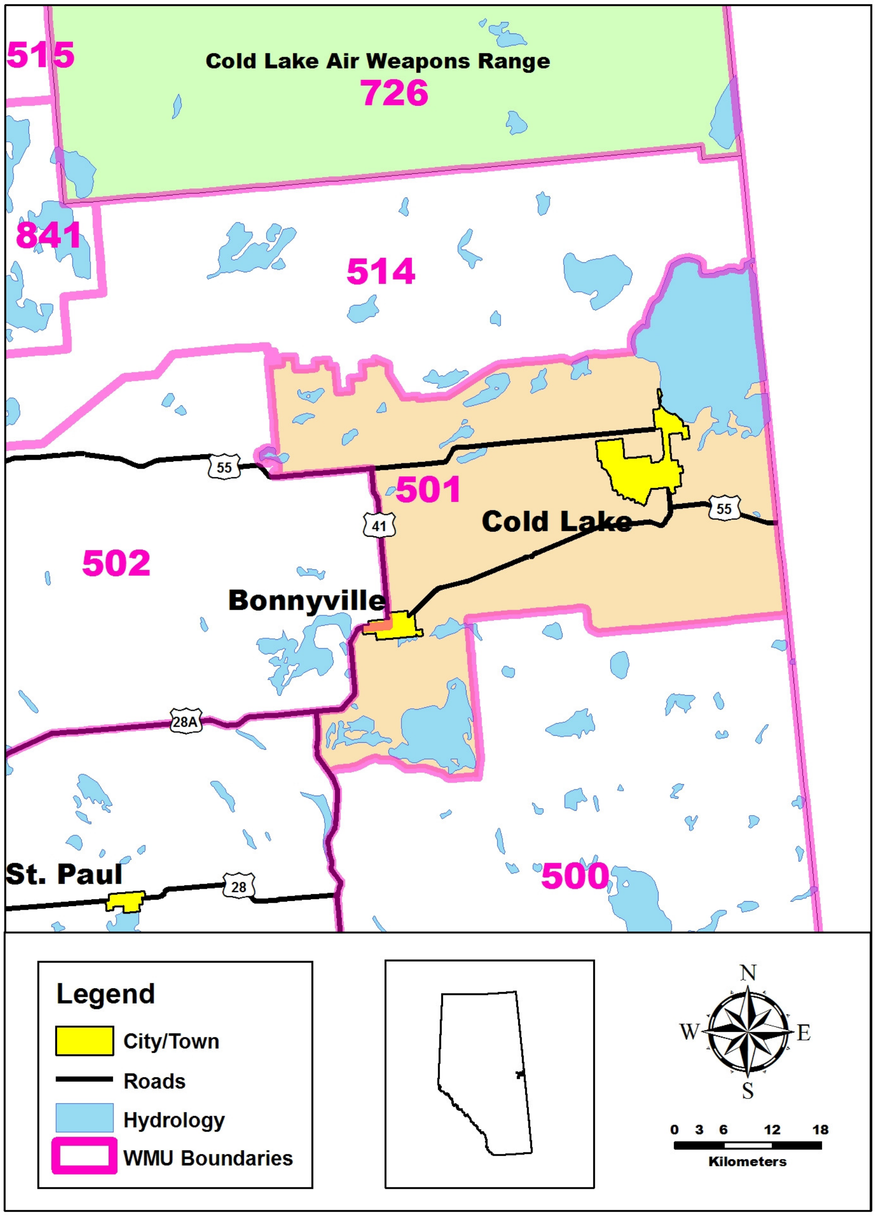


Figure 14. Location of Wildlife Management Unit 501 in Alberta.

6.8.2 *Survey methods*

WMU 501 was stratified for moose densities (Gasaway et al. 1986; ASRD 2010) using a Cessna 206 fixed-wing aircraft on 5 – 6 January 2010. Flight maps to aid in navigation were prepared using ArcGIS 9. A one minute latitudinal grid was overlaid on the WMU. Stratification lines were flown on the half-minute such that observations along a flight line would not straddle two sampling units. Approximate altitude and ground speed during the flights were 100 - 150 m above ground level (AGL) and 180 km/h respectively, allowing observers to detect animals within 200 m on either side of the aircraft. Height and speed of the aircraft varied slightly depending on the amount and type of tree cover. Species and number of animals were recorded; observation waypoints were taken using a Garmin 60Cx GPS unit.

Stratification information was used to determine stratum for each sampling unit based on moose density. Due to white-tailed deer population concerns, deer information was collected during the flights and a separate stratum was assigned based on white-tailed deer density. A sampling unit grid was established using ArcGIS 9 by dividing the WMU into units measuring 5 minutes longitude by 3 minutes latitude. Areas that were less than half of a full unit were combined or joined to adjacent units to ensure sampling units of fairly uniform size, resulting in 66 units. Units that overlapped Cold Lake and were comprised entirely of water were excluded from the survey and analysis.

Sampling units were ranked according to indices of moose and white-tailed deer density, calculated as the number of individuals observed per km^2 within each unit. Sampling units were then categorized into strata. Normally, approximately 20% of the blocks are classed as low, 60% as medium, and 20% as high. However, because moose density ranged from 0 to 0.75 moose/km^2 and 32 units out of 66 had no moose, only two strata were used, low and high. Sampling units based on white-tailed deer density were categorized into 3 strata (low, medium and high).

Sixteen sampling units were randomly selected from the moose stratified units to be intensively searched. These units were used to select four units within each white-tailed deer strata. Using a Bell 206B helicopter, twelve units were surveyed from 9 – 11 January 2010. Due to a less than adequate targeted precision estimate, two additional units were flown on 12 January. Navigation was aided by computer generated maps and a GPS unit. Units were flown in an east-west direction with a flight line separation of 400 m. Observations were recorded within 200 m of either side of the helicopter, allowing for total coverage of the area. Altitude was approximately 60 m AGL and air speed was approximately 80 km/h, reaching 100 km/h in open areas. Moose were classified using four criteria: presence of antlers or pedicel scars, presence of vulva patch, face and body shape and pigmentation, and behaviour. White-tailed deer and mule deer were classified by the presence of antlers, body size, and behaviour. All antlered moose and deer were classified as small, medium or large under the standardized antler classification system (Table 1). Where adults lacked antlers and sex was undeterminable, animals were recorded as unclassified. All wildlife observations were recorded on forms with locations recorded using a Garmin 60Cx GPS. We did not correct for sightability; therefore, overall counts should be considered as minimum population estimates and direct comparisons of survey results among years may be difficult.

Survey conditions during the stratification portion were fair with a small amount (< 6 cm) of recent snow and temperatures between -20 and -30 degrees Celsius. During the detailed block portion, temperatures rose steadily from -20 degrees Celsius on 8 January to -2 degrees Celsius on the last two days of surveying (11 – 12 January). Due to a freezing rain forecast between Lac La Biche, and Bonnyville, flights were cancelled for 9 January.

6.8.3 Results

The intensive search of fourteen sampling units resulted in observations of 49 moose (8 bulls, 29 cows, 12 calves), 758 white-tailed deer, and 48 mule deer. Of the 8 bulls observed, 1 was a juvenile, 4 had shed their antlers, and based on antler classification, 2 were classed as small, and 1 was classed as medium. Ten cow-calf pairs were observed, 18 cows were without calves, and one cow had twins. The Quadrat Survey Method Program generated a moose population estimate of between 145 and 265 (Table 17). Because of deteriorating survey conditions, especially on the last day, results excluding data from the last day (i.e. 2 blocks flown on 12 January) are also presented. Based on results from 12 sampled units, the Quadrat Survey Method Program generated a moose population estimate of between 182 and 304 (Table 17).

Of the white-tailed deer observed within 14 sampling units, 173 were does, 159 were fawns, and 346 were unclassified adults. The white-tailed deer population was estimated to be between 2,881 and 3,883 (Table 17). An age-sex ratio was not estimated for white-tailed deer due to the advanced antler drop; adult deer lacking antlers and obviously not accompanied by a fawn remained unclassified. Antler size classification for the 74 bucks that had retained their antlers is as follows: 25 small, 30 medium, 19 large. Does with single fawns or twins could be accurately determined in small groups; in large groups when adult sex and doe-fawn associations could not accurately be determined, it was assumed 1 fawn per doe. The population estimate, where counts during the last survey day are excluded (i.e. 12 sampling units), was calculated to be between 2,798 and 4,184 (Table 17). A population estimate was not generated for mule deer.

Table 17. Comparison of aerial survey results for moose and white-tailed deer in Wildlife Management Unit 501 in 2000 and 2010.

Species	Year	Population Estimate (90% confidence limits)	Animals/km²	Ratio to 100 Females	
				Males	Juveniles
Moose	2010 - 14 units	205 (±29.1%)	0.10	28	41
	2010 - 12 units	243 (±25.0%)	0.12	23	42
	2000	89 (±47.5%)*	0.06	--	--
White-tailed deer	2010 - 14 units	3,382 (±14.8%)	1.73	--	--
	2010 - 12 units	3,491 (±18.3%)	1.78	--	--
	2000	2,260 (±27.7%)	1.47	--	--

*Incomplete survey performed under poor conditions contributed to high precision of error (Saker 2000).

6.9 Wildlife Management Unit 510 moose

Section Authors: Kristina Norstrom and Shevenell Webb

Moose, a highly sought after ungulate species from both a hunter and "watchable wildlife" perspective, are one of the primary game species in Alberta. They are found throughout most of the boreal forest, and in agricultural areas along the boreal/parkland "fringe" (Rippin 2000). Ecologically, moose can exert a significant impact on wildlife habitat and are an important component of predator-prey systems (Arsenault 2000). Their range may overlap with other ungulate species including white-tailed deer, mule deer, elk, and woodland caribou. Provided food and cover are available, moose are well-adapted to boreal climate patterns (Franzmann and Schwartz 2007), although moose in northeast Alberta typically occur in low population densities (Lynch 1999). This, combined with hunting pressure, predator pressure and habitat change make understanding their population dynamics and distribution important for managing population levels.

Wildlife surveys for moose in the boreal are generally conducted a minimum of every 3 years or when land and wildlife management issues necessitate increased monitoring and assessment of populations and their distribution (ASRD 2010). These surveys are specifically designed to gather population data on the density, distribution, and age/sex classification of game species (ASRD 2010). General information on ungulate habitat use, the distribution and abundance of predator populations, and the occurrence of species-at-risk (e.g. woodland caribou) or less-encountered ungulate species (e.g. mule deer) are also gathered during the surveys. In turn, the data is used for wildlife management purposes including calculating allowable hunter harvest and license allocations, monitoring population trends, and tracking habitat change across the landscape. These surveys provide a reliable means of delivering information to concerned stakeholders including hunters, trappers, outfitters, landowners, and the general public.

The purpose of this report is to present the results of the 2009/10 wildlife survey of WMU 510. The current status of moose and other wildlife species in this area will be discussed, and compared to the results of the 2001/02 survey.

6.9.1 Study area

Situated on the transition zone between agricultural lands and the northern boreal mixedwood forest, WMU 510 covers 4,415 km^2 of diverse habitat and landforms (Figure 15). It is bordered by the Athabasca River in the northern and western portions, Highway 2 in the south-eastern portion and Highway 661 to the south. Much of the area south of Highway 663 and portions along Highway 2 and 44 is farmland, with additional residential and recreational development surrounding Baptiste and Island lakes. The remaining area is boreal mixedwood forest with scattered patches of muskeg, including many lakes and a portion of the Pembina River. In addition, approximately 300 km^2 of the forested area around Chisholm was burned by a wildfire in the spring of 2001 (Hubbs 2002).

6.9.2 Survey methods

Provincial aerial ungulate survey protocols (ASRD 2010) were followed for both the stratification and detailed block portions of the survey. Deviations from, or additional details to this protocol, will be outlined in the following paragraphs.

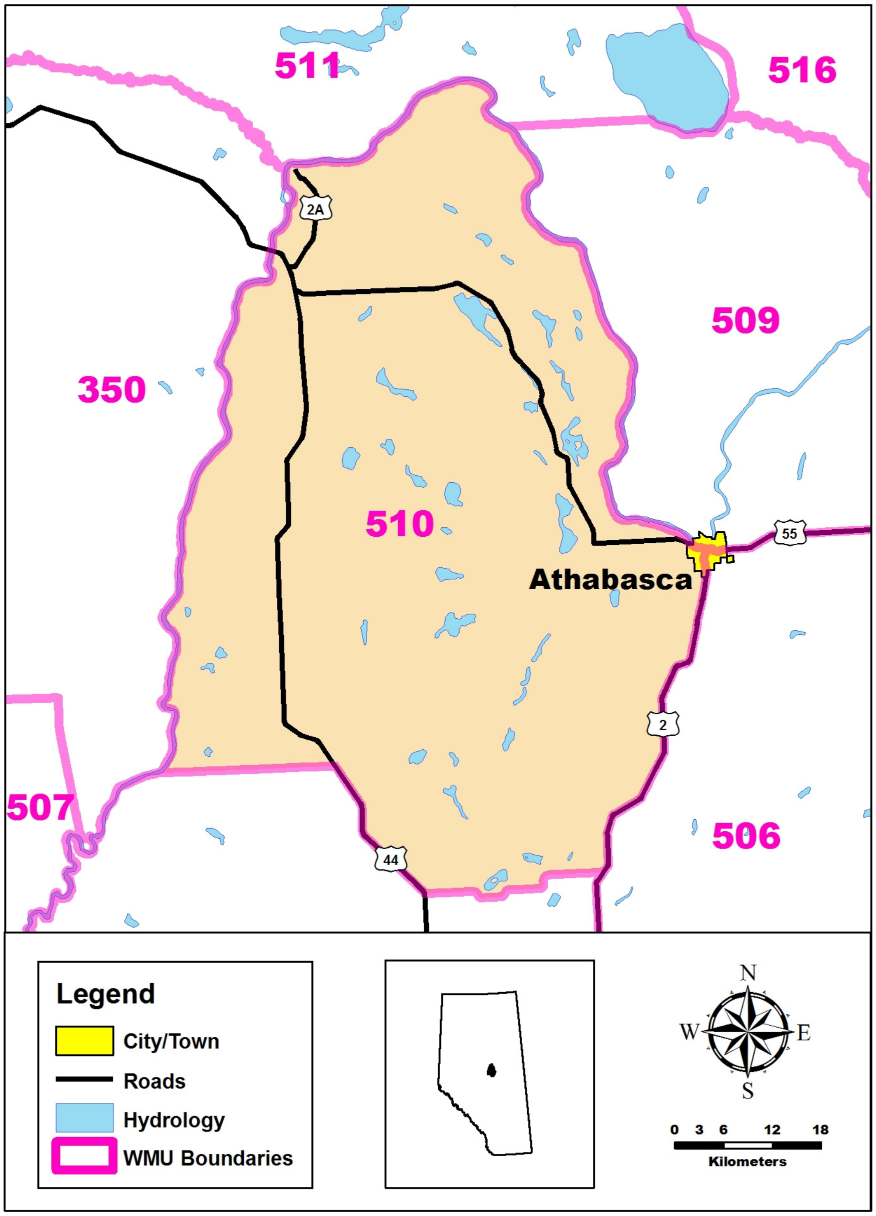


Figure 15. Location of Wildlife Management Unit 510 in Alberta.

The area was stratified with a Cessna 206 fixed-wing aircraft for moose and deer on 7 – 10 December 2009 and detailed blocks were flown 11, 14 - 15 December 2009 in a Bell 206B helicopter. Flights were grounded 12 – 13 December due to extreme cold weather and wind chill conditions. Additional detailed block information was obtained from flights flown on a concurrent deer survey 14 – 16 December. All flights employed three observers, including a navigator in the front passenger seat, and were flown in an east to west orientation.

Data from the stratification flights were used to categorize the WMU into sampling units (5 degrees latitude x 5 degrees longitude) of low, medium, or high strata. This categorization was done based on moose density, with water features omitted from the land area. The assignment of the strata was based on natural breaks in the data, using roughly 20% of the blocks in each of the low and high categories as a guide. This resulted in 21 high blocks, 50 medium blocks and 20 low blocks. Nine of these sampling units were randomly selected for the detailed block portion of the survey. Information from an additional 6 blocks was obtained from the survey crew flying the concurrent deer survey. This resulted in the collection of moose information from a total of fifteen blocks, 5 from each stratum. Following the helicopter survey, the data was compiled for moose, entered in the Quadrat Survey Method Program, developed as per the Gasaway population model (Gasaway et al. 1986), and a population estimate and confidence interval determined.

Age (juvenile vs. adult) and sex classification were obtained wherever possible for all moose encountered. To save time, deer were only classified where the blocks overlapped those of the concurrent deer survey. Bulls and bucks were identified by the presence of antlers; cows were confirmed by the presence of a white vulva patch or calf at foot; while does and fawns were assumed to be those animals without antlers and classified according to their size. This classification is likely accurate, due to the timing of the survey (early winter), before significant antler drop occurs. Antler classification (Table 1) was recorded only for male moose. All other wildlife sightings were also recorded during the survey and a GPS waypoint taken. We did not correct for sightability; therefore, overall counts should be considered as minimum population estimates and direct comparisons of survey results among years may be difficult.

Snow conditions were fair, with approximately 20 cm of fresh snow in the 3 day period prior to the survey, although some features (i.e. stumps, tree wells, tall grass, etc.) were not completely snow covered. Temperatures ranged from -30 to -20 degrees Celsius during the stratification survey and -34 to -20 degrees Celsius during the detailed block portion of the survey. Wind speeds were generally calm, ranging from 15 - 30 km/h and 5 - 25 km/h for the stratification and detailed block portions of the survey, respectively.

6.9.3 Results

A total of 633 moose were observed during the stratification portion of the survey, while 467 moose were observed during the detailed block portion of the survey. The resultant population was estimated to be between 2,541 and 3,531 moose (Table 18).

In the detailed block portion of this survey, there were 93 bull, 246 cow and 120 calf moose observed. The observed twin rate was 3%. Where antler class of moose was noted, 8% of bulls had dropped their antlers (confirmed by absence of vulva patch and other characteristics), 34% were classified as small (one was a yearling), 56% as medium and 2% as large. The incidence of ticks amongst moose in this WMU appeared to be low with only 20 individuals (~4%) appearing to be infested. This may be an underestimate of tick infestation as the prevalence of ticks often becomes more noticeable later in the winter.

Ninety-one elk were observed in six different locations during the stratification; no information on age/sex was obtained. Additional observations from the 9 blocks surveyed include 26 mule deer. White-tailed deer will be discussed in a future report (Powell and Morgan, in progress).

Table 18. Comparison of aerial survey results for moose in Wildlife Management Unit 510 in 1996/97, 2001/02 and 2009/10.

Year	Population Estimate (90% confidence limits)	Moose/km^2	Ratio to 100 Females	
			Males	Juveniles
2009/10	3,036 (±16.3%)	0.72	38	49
2001/02	1,245 (±24.0%)	0.35	17	53
1996/97	1,399 (--)	0.37	65	55

6.10 Wildlife Management Unit 536 moose

Section Author: Dave Moyles

WMU 536 is an important unit for providing moose hunting opportunities to hunters living in northwestern Alberta. Aboriginal moose hunters routinely hunt within this WMU throughout the year. During the recreational hunt, demand for the 'Calling Season' (1 September to 31 October) has exceeded the supply of licenses for the past few years. The moose hunting outfitting industry is also active in this WMU.

6.10.1 Study area

WMU 536 is within the County of McKenzie No. 23 (Figure 16). In the south, the unit is bordered by the 27th Baseline while the western boundary is the Alberta/B.C. border. The Hay River forms the northern boundary while the eastern boundary shifts from the eastern side of range 19 and 20, and then becomes Highway 35 to its intersection with Hay River. WMU 536 is completely Crown land. The three main communities are High Level, Rainbow Lake and Chateh (Assumption). The western portion and the area around Mt. Watt are classified as lower boreal highlands, the central portion is central

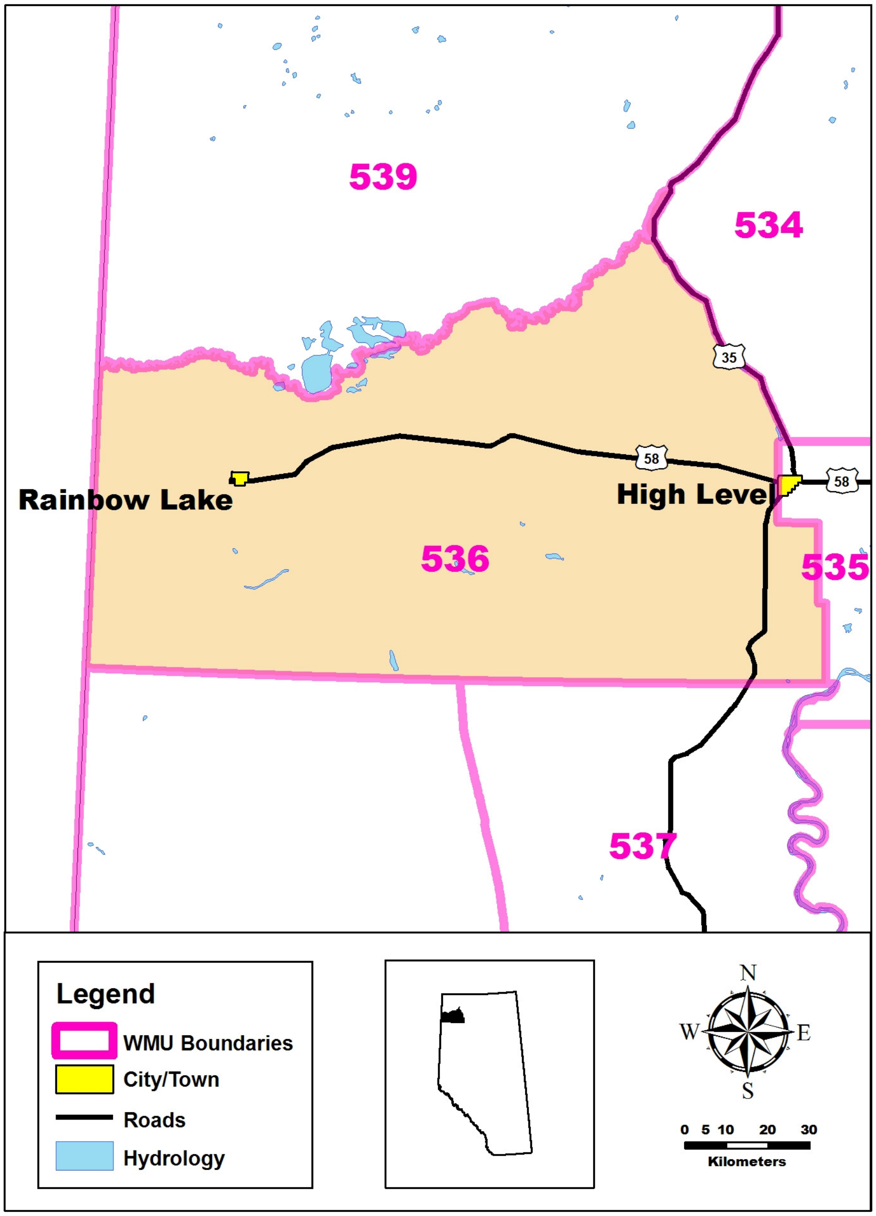


Figure 16. Location of Wildlife Management Unit 536 in Alberta.

mixedwood, and the southeastern portion is classified as dry mixedwood (Natural Regions Committee 2006). Mixedwood forests of aspen and spruce dominate much of this unit, although peatlands are common in the west. Industrial development has been extensive in this unit during the past several decades and has intensified in recent years. Forestry activity has been intensive in past years with large cut blocks in the central and southern areas of this unit. Industrial development has increased both quantity and quality of access in recent years. Much of this unit is accessible in frozen ground conditions. Attempts to regulate access have not been effective.

6.10.2 Survey methods

All surveys for moose were conducted as per Lynch (1997), and ASRD (2010). We used three fixed-wing aircraft (one Cessna 210 and two Cessna 206) and flew transects 1.6 km apart, orientated in an east-west direction on the four minutes of latitude between the survey unit boundaries. One crew worked from Rainbow Lake while the two other crews were based at the High Level airport to reduce dead-heading. The long transects in the southern and central portion of the WMU were split at 118 degrees 30 minutes longitude so that the lines would not be too long and thus reduce observer fatigue. Each crew consisted of two observers, one in the front and one sitting behind the pilot. For each wildlife sighting, the front observer took a waypoint using a hand held Garmin 76Cx and recorded the sighting. Data from the stratification flights was used to categorize the WMU into sampling units of low, medium, or high strata. However, cold temperatures forced the cancellation of stratification flights with only 65% of the unit surveyed. In order to stratify the remaining 35% of the unit we used a combination of past survey results, local knowledge and current (2008) spot imagery to identify new access and impacts of intensive timber harvest on moose numbers.

For the intensive surveys we used three two-person crews in Bell 206B helicopters from 16 – 19 December 2009 to conduct intensive searches of 33 survey blocks. One crew worked from High Level, concentrating on the eastern, southern and central portions of the WMU, while two crews were based in Rainbow Lake and worked the northern, western and southern part of the unit. One crew shuttled from Rainbow Lake on the evening of 18 December to concentrate on the eastern portion of the unit on the last day of surveys.

Crews flew transects orientated east-west that were spaced to ensure full coverage of the survey unit. All moose observed were classified as either adults or calves, based on body size and length of the nose; all yearling moose were considered as adults. All adult moose were classified as cows if a vulva patch was present. Ninety-four bulls (91%) still had antlers while nine other bulls were classified as males because of the absence of a vulva patch. Antlered bulls were classified as small, medium or large in accordance with the Alberta standardized classification system for male ungulates (Table 1). We did not correct for sightability; therefore, overall counts should be considered as minimum population estimates and direct comparisons of survey results among years may be difficult.

6.10.3 Results

Moose populations in WMU 536 are estimated to be between 1,454 and 1,964 (Table 19). Of a total of 103 bulls, 40 bulls were classified as small, 34 as medium and 20 as large, while 9 bulls had already dropped their antlers. A ratio of 38 calves to 100 cows is to be expected for northern WMUs with adverse weather and a large number of predators.

Table 19. Comparison of aerial survey results for moose in Wildlife Management Unit 536 in 1996/97 and 2009/10.

Year	Population Estimate (90% confidence limits)	Moose/km^2	Ratio to 100 Females	
			Males	Juveniles
2009/10	1,709 (±14.9%)	0.12	69	38
1996/97	3,226 (±25.0%)	0.23	51	43

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