Delegated Aerial Ungulate Surveys 2008/2009 Survey Season

Alberta Conservation Association

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Delegated Aerial Ungulate Surveys
2008/2009 Survey Season

Edited by:
Nathan Webb and Robert Anderson
1st Floor Provincial Building
4919 - 51 Street
Rocky Mountain House, Alberta, Canada
T4T 1A3

Alberta Conservation Association

Report Editors

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

KELLEY KISSNER
50 Tuscany Meadows Crescent NW
Calgary, AB T3L 2T9

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Alberta Conservation Association
101 – 9 Chippewa Rd
Sherwood Park, AB T8A 6J7
Toll Free: 1-877-969-9091, Tel: (780) 410-1999
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 population status and trends for ungulates in Alberta, and therefore are an integral component for setting hunting guidelines. Beginning in 2007, ACA became a very active partner in the AUS program, and now works collaboratively with ARSD 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 2008/09 fiscal year, ACA funded and delivered 29 AUS across Alberta. These surveys included summer range trend surveys for pronghorn antelope (A*ntilocapra americana*) and mountain goats (*Oreamnos americanus*), winter range trend surveys for bighorn sheep (*Ovis canadensis*), bison (*Bison bison*) and elk (*Cervus elaphus*), random stratified block surveys for moose (*Alces alces*), white-tailed deer (*Odocoileus virginianus*) and mule deer (*Odocoileus hemionus*), and recruitment surveys for caribou (*Rangifer tarandus*). This report summarizes the methods used to conduct these surveys and the survey results.

ACKNOWLEDGEMENTS

The Alberta Conservation Association (ACA) – Alberta Sustainable Resource Development (ASRD) Wildlife Program Agreement clarifies that ACA is delegated the responsibility to deliver a significant portion of the overall aerial ungulate survey program in Alberta. Toward this end, ACA and ASRD work collaboratively to plan surveys, collect and analyze data, and complete written summaries for the surveys conducted. We thank the following ACA and ASRD staff and volunteers who were involved in the planning and delivery of surveys in 2008/09:

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TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

1.0 INTRODUCTION

Alberta Conservation Association (ACA) is a non-profit, non-governmental organization that has been designated 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 and composition, which can then be used by ASRD to set hunting and fishing seasons and regulations. Aerial ungulate surveys (AUS) are the primary method used to determine population status and trends for ungulates in Alberta, and therefore are an integral component of the decision process for setting hunting guidelines.

Prior to 2006, ACA's role in the AUS program was limited primarily to funding survey flights, while ASRD determined species and areas to be surveyed, conducted the surveys, and analyzed survey data to estimate population numbers, trends, or demographic parameters. In 2007, ACA became a very 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. This annual report condenses and combines all delegated survey information into one document, streamlining access to ungulate population estimates for provincial wildlife managers, ACA staff, hunters, and many other interested stakeholders. This report summarizes the surveys conducted by ACA during the 2008/09 fiscal year.

During the 2008/09 survey cycle, the Wildlife Management Branch of ASRD delegated a total of 29 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*), bison (*Bison bison*) and caribou (*Rangifer tarandus*). Details for each individual survey[1] are described in the following sections.

2.0 SELECTING SURVEY PRIORITIES

As the government agency responsible for managing ungulates within Alberta, ASRD sets long-term survey 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 prioritized 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.

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

3.1 Summer range trend surveys

For some species, such as mountain goats and pronghorn antelope, the contrast between coat colour and vegetation, coupled with the openness of their habitats, allows population surveys to be conducted during summer months. When possible, summer surveys are ideal from a harvest management perspective because they allow the population status to be assessed immediately prior to hunting seasons and inherently incorporate over-winter mortality, unlike traditional winter surveys.

Mountain goat summer ranges are intensively searched by 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 range complex, observers 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. Densities of pronghorn observed in these blocks are extrapolated across the antelope management area (AMA) to estimate total numbers within the unit. In addition, classification of each herd by sex and age allows estimation of buck/doe/kid ratios. In 2008, ACA and ASRD staff tested a distance sampling survey approach for pronghorn antelope (Webb et al., unpublished ACA report).

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 counts to estimate the population trend (increasing, decreasing or stable) and key demographic information, including male/female/young ratios and per cent of males in various size categories. While useful for monitoring long-term changes in ungulate populations, winter range surveys 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 with rotary-winged aircraft 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 aircraft 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 observers can obtain a complete 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 allow for statistically rigorous estimates of ungulate population numbers and density within WMUs. In most cases, this is facilitated using the 'Gasaway Method' (Gasaway et al. 1986) to design and implement counts in a random selection of survey blocks. This approach sees widespread application for moose and deer in areas where the forest cover is sparse enough to allow good sightability. In addition to allowing precise 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 several dozen smaller survey blocks that are approximately equal in size, and then classifies each block into a stratum that describes the relative number of animals of the species of interest that are expected to be present within that block. Stratification can be based on observations from fixed-wing aircraft (small, high-winged airplanes) 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 rotary-winged aircraft (helicopter). During surveys, each block is thoroughly searched and observers 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 sample of survey blocks to be converted to a population estimate for the entire WMU, and the error associated with the estimate to be determined; additional blocks are surveyed until the error is deemed acceptable (typically 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 population 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 only infrequently available as an option because 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 and may not provide an adequate level of data collection in all cases.

3.5 Classification

Beginning in 2008/09, 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 regions 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 many 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 – 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 or 7 points/antler, massive.

4.0 SUMMER RANGE TREND SURVEYS

4.1 Pronghorn

Section Authors: Mike Grue and Kim Morton

Aerial surveys for pronghorn antelope are conducted annually to provide information on population density, distribution, composition, and an estimate of population size. This information is used by ASRD to formulate 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 2008 survey conducted in AMAs A, B, C, D, E ,F ,G and H (Figure 1). AMA S (Suffield area) was not surveyed in 2008.

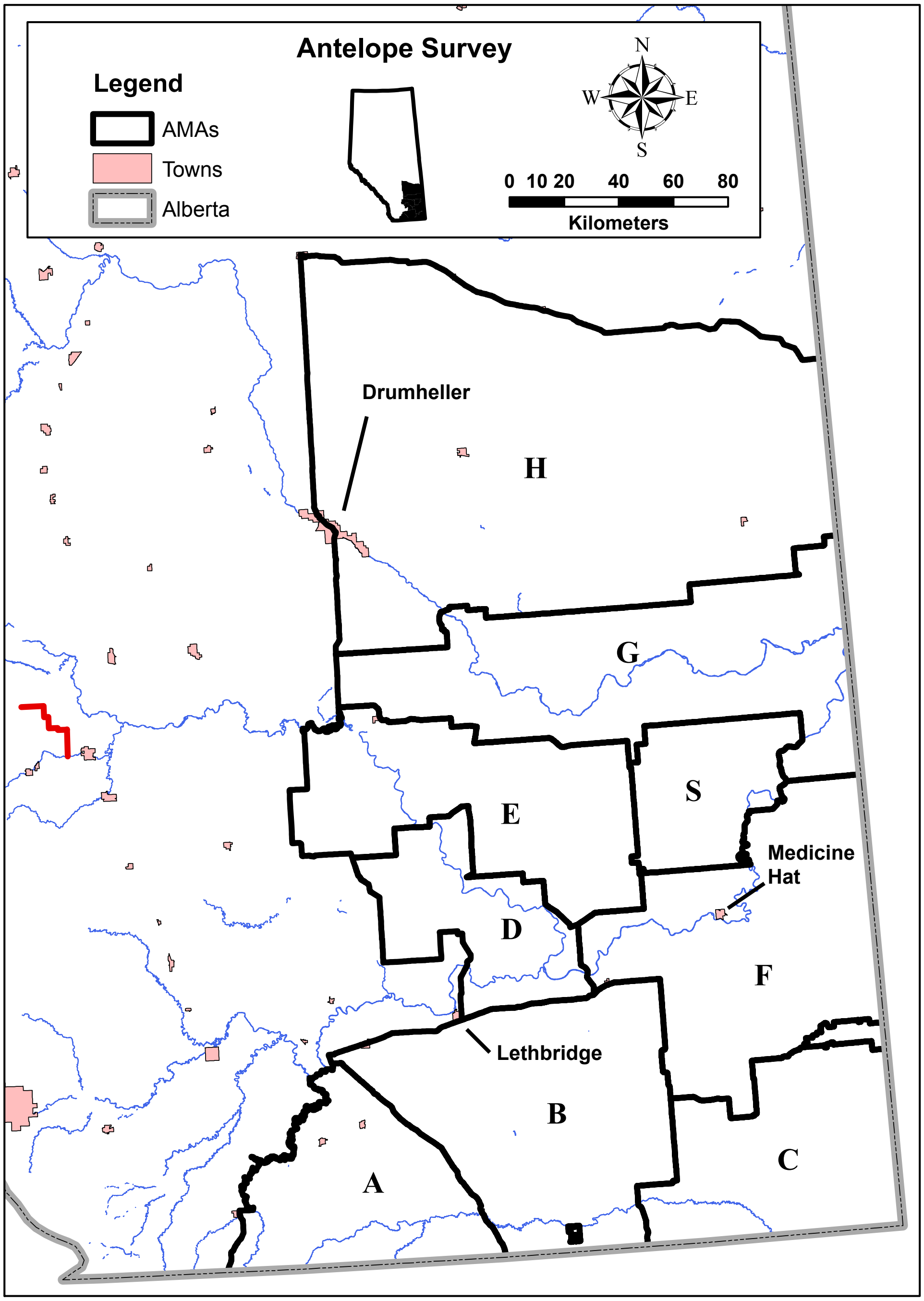


Figure 1. Location of antelope management areas (AMAs) in Alberta.

4.1.1 Survey methods

Following standard census procedures, we conducted antelope surveys on AMAs between 8 – 15 July 2008 (Figure 1). Each AMA contains designated survey blocks with fixed transects that we surveyed from rotary-winged aircraft. In an attempt to reduce survey costs, we conducted non-stop, 3-h 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 0.5 mi (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. We did not correct for sightability; therefore, overall counts should be considered as minimum estimates and direct comparisons of survey results among years may be difficult. However, in 2008, we tested a distance sampling approach for surveying pronghorn that incorporates a sightability correction; results of this continual improvement trial are reported elsewhere (Webb et al., unpublished ACA report).

4.1.2 Population estimate calculations

We calculated a population estimate on an AMA basis by calculating a density (# animals/km^2) from the number of animals observed on transects divided by the area (km^2) of primary antelope range flown along transect lines, and applying that density to the area of the unit. We only surveyed primary antelope range. For AMAs with secondary antelope range, we assumed a density of 0.26 animal/km^2, and multiplied this by the total area of the AMA that consisted of secondary range (km^2). The population estimates for each AMA were summed together to estimate the antelope population in the entire survey region. In years when all AMAs are not flown, an AMA estimate is based on estimates from the last year flown, adjusted to reflect estimates for mortality and recruitment rates (Fish and Wildlife Division 1990) and known events that may have caused unpredictable changes in the population (i.e., severe weather event resulting in high mortality).

4.1.3 Results

During the entire survey, we recorded 974 bucks, 1,978 does and 669 kids on transects. This resulted in a total population estimate (excluding Suffield) of 19,648 antelope, including 5,314 bucks, 10,671 does and 3,663 kids. The population densities, areas in primary and secondary ranges, and resulting population estimates for each AMA are summarized in Table 2.

Table 2. Area surveyed, density, population estimates, and herd composition from the 2008 Alberta pronghorn antelope surveys. Data from the 2007 survey are provided for comparison.

	Antelope Management Area							
	A	B	C	D	E	F	G	H
2008 Survey								
Primary range surveyed (km²)	384	1106	906	438	489	1216	945	1114
Observed antelope density (#/km²)	0.50	0.43	0.98	0.95	0.90	0.38	0.50	0.25
Estimated primary range (km²)	1818	5837	4621	1336	2970	7334	6182	7012
Estimated population in primary range	918	2528	4548	1276	2666	2768	3069	1732
Estimated secondary range (km²)	0	0	0	0	0	0	2097	8993
Estimated population in secondary range	0	0	0	0	0	0	82	351
Total estimated population	918	2528	4548	1276	2666	2768	3151	2083
Bucks/100 Does	39.7	46.5	58.9	43.8	49.8	32.4	52.1	64.5
Kids/100 Does	20.7	42.1	28.0	30.4	26.5	42.7	46.6	30.5
2007 Survey								
Total estimated population	880	2620	4140	1260	2020	3950	2390	1690
Bucks/100 Does	24.0	45.7	41.9	23.8	47.8	30.4	44.8	68.0
Kids/100 Does	29.8	66.7	30.1	51.9	37.2	36.7	50.3	38.8

4.2 Southern mountain goats

Section Authors: Mike Jokinen and Greg Hale

Surveys to determine the status of the Southern Continental Divide (north of Waterton Lakes National Park to the Crowsnest Pass) mountain goat population have been implemented on 22 occasions since the first program in 1979. During the 1979 program, only complexes along the eastern (Alberta) side of the Continental Divide were surveyed. Commencing in 1980 and continuing during all subsequent years, entire mountain complexes on both sides of the Divide have been surveyed (Figure 2). With a growing population, a hunt was initiated in 2001 with a small number of licenses issued in three goat management areas. In 2008, our survey objectives were to obtain a minimum count of goats to determine population status and trend, to classify all goats by sex and age to facilitate population analysis and provide an assessment of herd production and recruitment, and to map goat sightings to provide population status information on a regional basis.

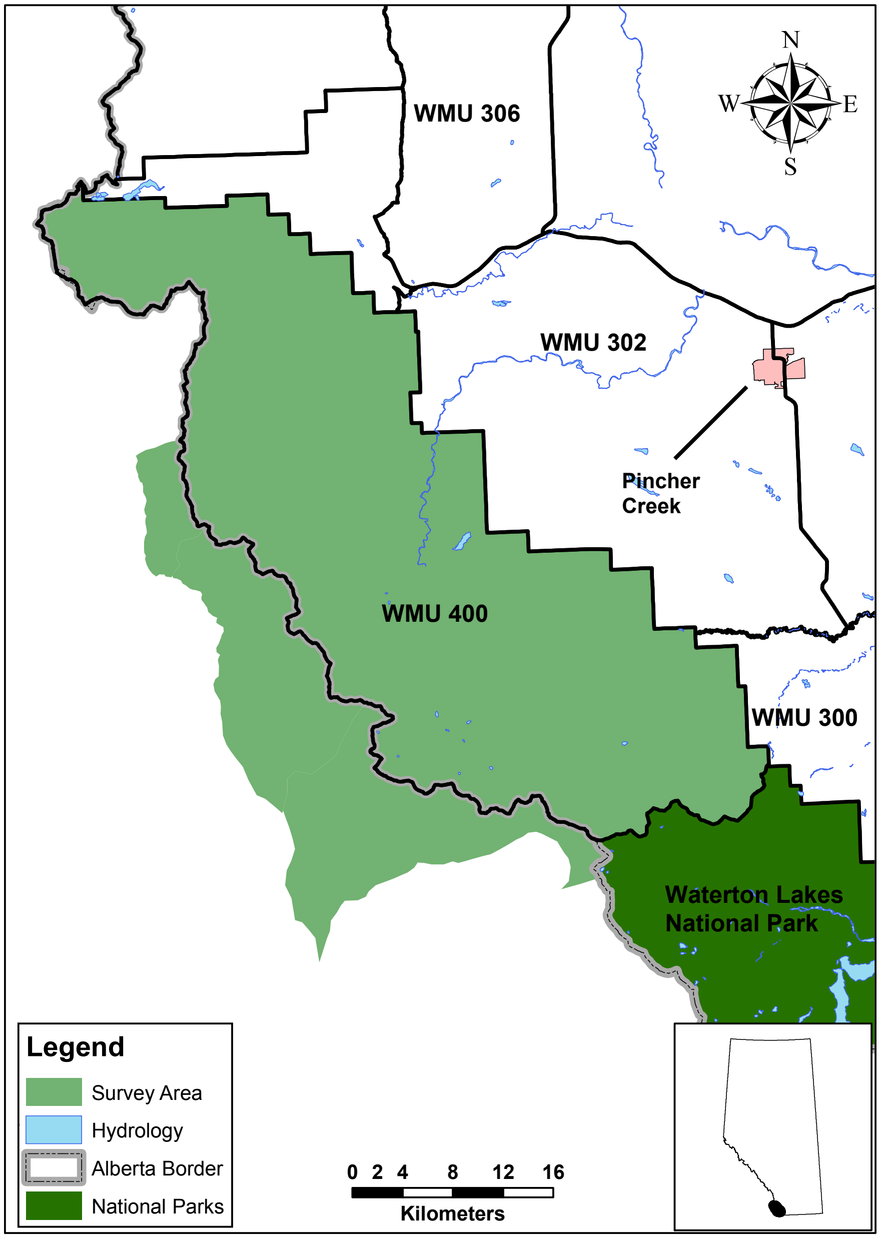


Figure 2. Location of the southern mountain goat survey area in Alberta.

4.2.1 Survey methods

We searched mountain complexes along the Continental Divide over a 4-day period from 26 – 29 June 2008 (Figure 2). All surveys occurred during the morning to take advantage of peak animal activity using a Bell 206 helicopter flown at air speeds ranging from 50 to 100 km/h. In some instances, coverage of the goat range was accomplished by conducting a single flight near 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 sex and 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 should be considered as minimum estimates and direct comparisons of survey results among years may be difficult. Weather conditions for the 4-day survey were excellent.

4.2.2 Results

We observed 218 mountain goats during the survey, including 149 adults, 46 kids, 25 yearlings, and no unclassified goats (Table 3). Classification of age classes resulted in reproduction and recruitment rates of 31 kids/100 adults and 17 yearlings/100 adults.

The 2008 survey count of 218 was 11% greater than the survey conducted in 2007; however, the 2008 count was 12% lower than the all-time high of 248 goats observed during 2005 (Figure 3). Recruitment rates in 2008 were down from the 2007 survey when 37 kids/100 adults were recorded, although 31 kids/100 adults was consistent with the long-term average (1980 – 2007). The number of yearlings per adult during the 2008 survey (17 yearlings/100 adults) decreased from 2007 (27 yearlings/100 adults) and was below the long-term average.

Table 3. Mountain goat observations within each mountain complex in 2008.

Complex	Total	Adult	Yearling	Kid
O-Alberta	29	24	1	4
Upper West Castle	7	4	0	3
B-BC	59	34	9	16
Q-Alberta	33	22	7	4
C-BC	25	20	1	6
R-Alberta	51	38	4	9
D-BC	14	7	3	4
North end of Divide to Crowsnest Pass	0	0	0	0
Overall Total	**218**	**149**	**25**	**46**

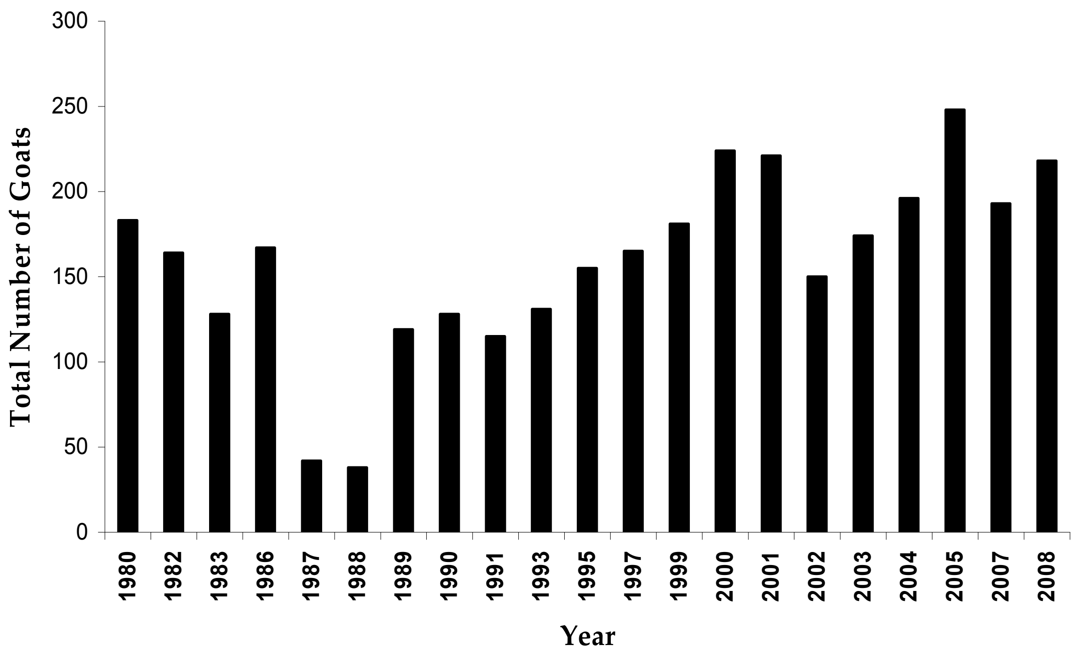


Figure 3. Southern Continental Divide mountain goat minimum population count, 1980 to 2008. Surveys conducted in 1987 and 1988 were incomplete.

4.3 Foothills mountain goats

Section author: Jeff Kneteman

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 surveys 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 (Figure 4). We surveyed 12 complexes from 2 – 6 July 2008 using a Bell 206 Jet Ranger 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 and plotted checkpoints on a 1:250,000 scale topographic map. GPS locations were recorded for each group of goats. The 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. Normally, all flights occurred from 0600 – 1100 h and 1600 – 2200 h during the goats' most active periods. We did not correct for sightability; therefore, overall counts should be considered as minimum estimates and direct comparisons of survey results among years may be difficult.

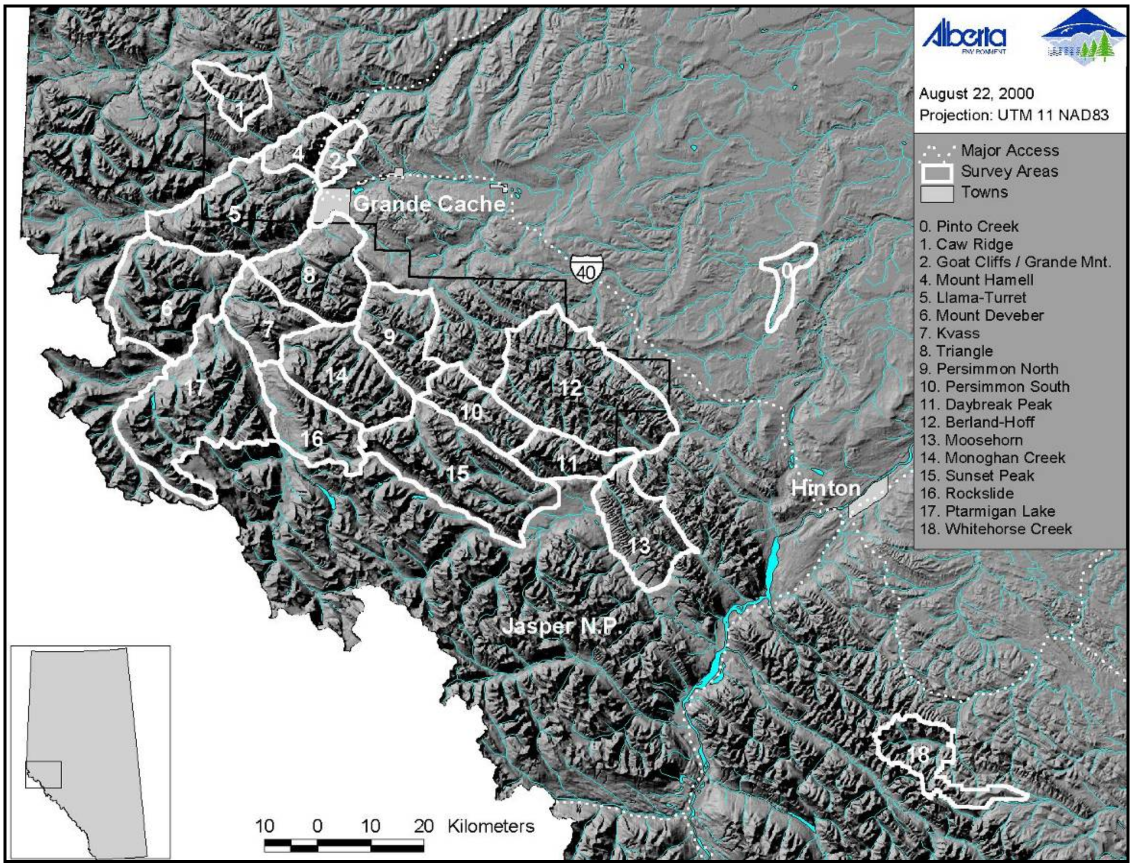


Figure 4. Location of the foothills mountain goat survey in Alberta.

4.3.2 Results

We observed a total of 501 goats (380 adults, 25 yearlings, 96 kids, no unclassified) with ratios of 25 kids/100 adults and 7 yearlings/100 adults (Table 4). Both ratios were less than the long-term indices for six complexes surveyed annually 20 times between 1979 and 2008.

Total counts of goats on individual complexes in 2008 exceeded long-term averages in two of 12 complexes surveyed (Llama-Turret, South Persimmon), was less than long-term averages on seven complexes (Caw Ridge, Goat Cliffs, Mt. Hamel, Deveber, Moosehorn, Monoghan, Sunset Peak), and approximated the long-term average on three complexes (North Persimmon, Daybreak, Rockslide).

Three complexes (Llama-Turret, South Persimmon and Daybreak) exceeded total goats counted in the most recent previous survey, while total goats were less than the most recent survey on seven complexes (Caw Ridge, Mt. Hamel, Deveber, North Persimmon, Moosehorn, Sunset Peak, Rockslide), and approximated the most recent survey on two complexes (South Persimmon, Daybreak).

Table 4. Mountain goat observations within each mountain complex in 2008.

Complex	Total	Adult	Yearling	Kid
Caw Ridge	64	47	2	15
Goat Cliffs	36	27	0	9
Mt. Hamel	42	35	1	6
Llama-Turret	109	85	5	19
Deveber	41	28	1	12
North Persimmon	49	37	4	8
South Persimmon	36	26	3	7
Daybreak	30	26	2	2
Moosehorn	1	1	0	0
Monaghan	49	37	5	7
Sunset Peak	5	4	0	1
Rockslide	39	27	2	10
Total	**501**	**380**	**25**	**96**


Photo: Shevenell Webb

5.0 WINTER RANGE TREND SURVEYS

5.1 Hay-Zama bison

Section Author: Dave Moyles

The Hay-Zama lowlands were selected in the late 1970s and early 1980s as a site suitable for reintroduction of wood bison (Reynolds et al. 1982). An enclosure designed as a temporary holding facility for bison was built and a small herd was brought from Elk Island National Park in 1983. The bison were never released because of concerns about these animals contracting bovine brucellosis and/or tuberculosis from diseased bison wandering out of Wood Buffalo National Park. In 1993, portions of the fence fell down and the small herd escaped into the Hay-Zama area. ASRD has monitored the increase in bison numbers and in their range by conducting aerial surveys in late winter. In March 2008, 652 bison were counted (Moyles 2008).

Bison have spread out in the Hay-Zama area in a predictable pattern, with bulls (either singly or in small groups) moving out from the core area around the confluence of the Chinchaga and Hay rivers into new areas. Cow-calf groups move from the core area as their numbers increase and into areas of suitable habitat located by bulls. This pattern was observed in the Northwest Territories as the Mackenzie wood bison herd expanded their range (C. Gates, pers. comm.).

In the Hay-Zama area, first bulls and lately cow-calf groups have been moving east along the Zama Road, south to Highway 58, and into the Shekilie oil and gas field to the northwest. Small groups of bulls have moved eastward along the Zama Road and crossed Highway 35 in early 2008, thus leaving the Bison Protection Zone. As well, bison have been observed well to the south of Rainbow Lake, yet none of the Hay-Zama bison have been observed south of the ditches along Highway 58.

One objective of this survey was to determine the distribution of wood bison throughout the Hay-Zama Lowlands-Chinchaga River-Negus Meadows-Zama area - Shekilie area as a precursor to conducting the total count survey with a helicopter. The second objective was to investigate bison sightings to the south of Rainbow Lake.

5.1.1 Study area

The Hay-Zama wood bison herd has spread throughout the low-lying areas between Zama Ridge to the south, and the slopes of the Cameron Hills and Bootis Hill to the north (Figure 5). Much of the area in and around the Hay-Zama wetland complex is composed of sedge meadows and wet sedge grass communities, prime foraging areas for bison (Reynolds et al. 1982). Bison also make extensive use of oxbows along the lower reaches of the Chinchaga River to its confluence with the Hay River.

Much of the area surrounding the wetland and river complex is dominated by black spruce muskeg communities, with aspen and white spruce bluffs on better-drained soils. The network of oil patch infrastructure, including well sites, borrow pits, road edges, pipelines, battery sites and airstrips, provides additional habitat for bison because clover has been used extensively for reclamation purposes. Bison have followed this infrastructure into the Shekilie field in 118-8 W6M and close to the Paramount Bistcho Plant in 122-2 W6M. Bison have also followed the Zama Road to its junction with Highway 35, and have been seen along Highway 58 near Rainbow Lake. We also have reports of bison in the Fontas area, well to the south of Rainbow Lake.

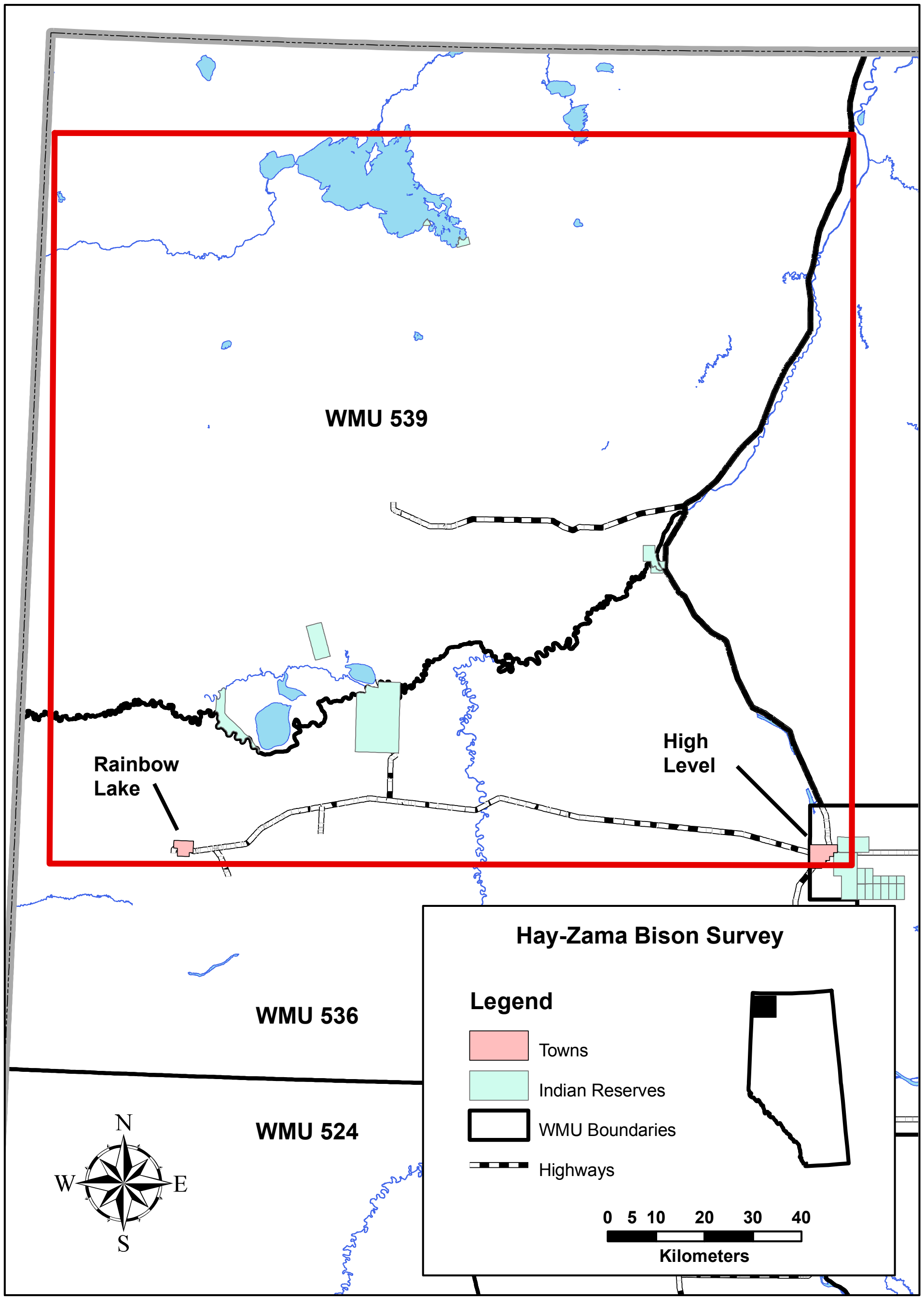


Figure 5. Location of the Hay-Zama bison herd in Alberta.

5.1.2 Survey methods

On 23 February 2009, a two-person crew in a Cessna 206 surveyed areas south of Rainbow Lake where bison had been seen earlier in the winter, plus flew along Highway 58 and the Zama Ridge. Conditions were relatively good with deep snow and bison tracks were easily identified.

On 24 February 2009, the crew continued working east-west transects throughout the Hay-Zama lowlands, including the Hay-Zama Wildland Provincial Park, the Dene Tha' First Nation reserve, the Chinchaga River-Hay River confluence and associated oxbows, the Negus Meadow area, portions of the Zama oil patch, and along Zama Road and Highway 35. Snow showers prevented surveys of the western portion of the Zama oil patch and the Shekilie area to the northwest. We recorded a waypoint on a hand-held GPS for all sightings of bison or tracks and recorded the number of bison. We did not correct for sightability; therefore, overall counts should be considered as minimum estimates and direct comparisons of survey results among years may be difficult.

5.1.3 Results

The only bison we found south of Highway 58 on 23 February 2009 were 15 animals in 104-9 W6M; this group included 12 adults, 1 yearling and 2 calves. We found two bison along the southern portion of the Hay-Zama Wildland Provincial Park (HZWPP). On 24 February 2009, we observed 355 bison in 33 different groups and found an additional 78 sets of bison tracks.

5.2 Clearwater Area sheep

Section Authors: Chiarastella Feder and Shevenell Webb

Bighorn sheep are one of the most prized of Alberta's wild ungulates because of their appearance, size, large horns and social behaviour. With continued growth of the human population and activities, public interest regarding sheep has become numerous and diversified (Fish and Wildlife Division 1993). Bighorn sheep are highly valued for hunting and viewing opportunities.

Sheep populations in Alberta experienced a historically strong decline at the beginning of the 1900s, followed by a successful increase due to management actions, such as more restrictive hunting regulations. The foothill and montane habitats of the Clearwater Area provide moderately productive habitat for bighorn sheep compared with other areas in the province. In 1986, a systematic winter range aerial trend survey for bighorn sheep was initiated in the Clearwater Area. Since this time, surveys have been conducted every two years over the same winter ranges in order to monitor the spatial distribution, post-hunt herd composition, and trends in population size. The purpose of this section is to summarize results, such as minimum count, population trends, herd composition, and spatial distribution, obtained during the 2009 bighorn sheep winter survey.

5.2.1 Study area

Bighorn sheep winter ranges in Southwest Region 2 are located on the west portion of the Clearwater Area, bordered to the west by Banff and Jasper national parks, to the north by the Yellowhead and Brazeau counties, and to the south by the Panther and the Dormer-Sheep forest land use zones (Figure 6). There are 17 sheep winter ranges identified in this area (within WMUs 328, 416, 417, 420, 422, 426, 428, 429, 430, 432 and 434); the 2009 survey covered 16 of these winter ranges with the exception of range 6 (Obstruction Mountain). The area consists predominantly of upper foothills, montane and subalpine habitats (from east to west respectively), with several large river valleys characterized by riparian habitats and meadows. The area includes some unique habitat: fescue grassland (Ya-Ha Tinda) in the most southwestern portion, a plain characterized by mild winters (Kootenay Plains), and an extensive forested area (R11) with no timber allocations. In the R11 Forest Management Unit, several prescribed burn plans have been approved with the intent of using prescribed fires to bring the age classes closer to natural ranges and enhance wildlife habitat, particularly for sheep and elk. There is very little agriculture or human settlement, and forestry and energy extraction activities are limited, although the level of human pressure related to recreational activities in the area is steadily increasing.

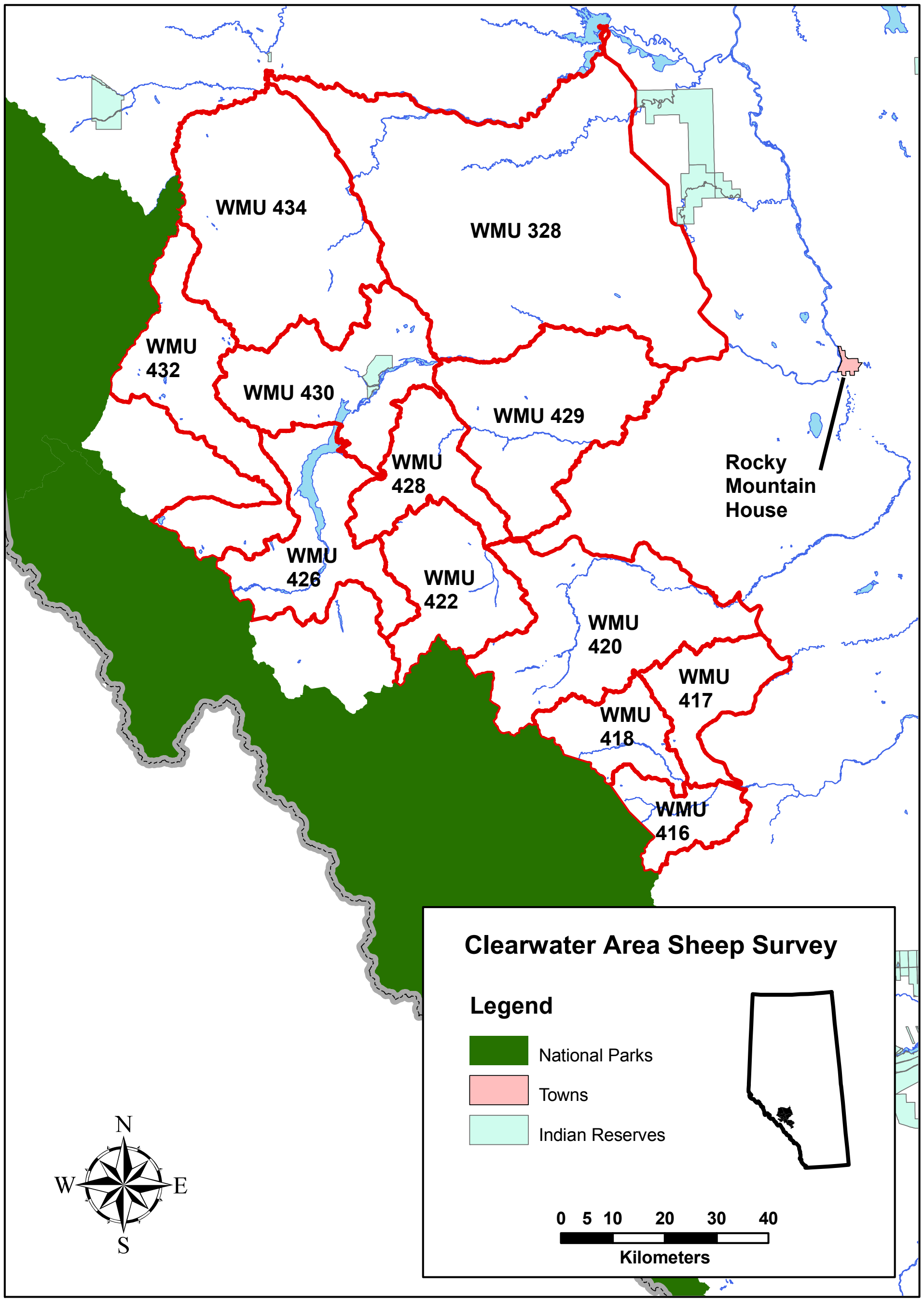


Figure 6. Location of the Clearwater Area sheep survey in Alberta.

5.2.2 Survey methods

We flew surveys in known sheep winter ranges between 19 – 21 January 2009 using a Bell 206 Jet Ranger. We counted all sheep present and searched more intensely in areas where tracks were observed. We recorded the location of each sheep with a GPS and identified males, where possible, following the classification used as the provincial standard: ¼ curl, ½ curl, ¾ curl, ⅘ curl and full curl. Lambs were identified by their smaller size. We identified all encountered ungulates (i.e., elk, moose, deer and feral horses) by a GPS location and classified them by sex and age, wherever possible. Air speed during flights was approximately 80 km/h. The flight crew consisted of a pilot and three passengers: a navigator/observer in front and two experienced observers in the back. We surveyed 16 of the known bighorn sheep winter ranges within the region. We did not survey ranges within Jasper and Banff national parks at this time. During the survey, flying and observing conditions were fair because of bright light and moderate snow coverage; winds were light. We did not correct for sightability; therefore, overall counts should be considered as minimum estimates and direct comparisons of survey results among years may be difficult.

5.2.3 Results

We observed 1,491 sheep on 14 winter ranges (Table 5). No sheep were observed on two winter ranges. Some observations of sheep were outside the known winter ranges (n = 8 groups totaling 156 sheep), particularly in WMUs 414, 420 and 426, suggesting that winter ranges should be re-adjusted over time. The population structure identified during the survey on known winter ranges was 732 ewes, 175 lambs, 339 rams and 245 unclassified sheep. Rams were classified as 107 ¼ curl, 131 ½ curl, 41 ¾ curl, 15 ⅘ curl, 9 full curl and 36 unclassified males. The herd composition was 23.9 lambs/100 ewes and 46.3 rams/100 ewes, with 1.6% of the total sheep that were classified as ⅘ or full curl. Results from this survey are similar to the results from previous surveys: in 2005 a total of 1,482 sheep were counted and the composition was 45 rams/100 ewes/32 lambs. In 2007, a total of 1,072 animals were counted and the ratio was 36 rams/100 ewes/30 lambs.

Table 5. Total numbers and age/sex classification of bighorn sheep by wildlife management unit (WMU) during aerial surveys in January 2009.

WMU	Rams	Ewe/Lamb Herds			Total Sheep
		Ewes	Lambs	Unclassified	
328	3	9	3	0	15
414	24	22	9	0	55
416	0	1	1	0	2
417	0	6	2	0	8
418	28	79	23	27	157
420	97	135	31	22	285
422	78	244	69	165	556
426	18	107	7	2	134
428	7	0	0	0	7
429	0	9	3	19	31
430	17	53	2	0	72
432	21	15	7	0	43
434	41	51	18	10	120
738	5	1	0	0	6
Total	**339**	**732**	**175**	**245**	**1491**

5.3 Wildlife Management Unit 212 elk

Section Author: Pat Young

Local landowner reports suggest that elk began occupying the southwest portion of WMU 212 in the 1960s. Initially, their numbers were quite low and the population seemed relatively stable. In 1974, the WMU was declared an archery-only hunting zone due to safety concerns expressed by some local residents and landowners. A number of landowners petitioned the government to reduce elk numbers in the mid 1980s. Two rifle hunts were conducted in 1986 and 1988 that were considered successful, but were met with some opposition from the anti-hunting community. An additional rifle hunt was conducted in 1996. Again, the hunt was considered successful, but there was considerable opposition expressed by the public.

In an attempt to respond to public concerns, a large, permanent live trap was constructed in the Cross Conservation Area (CCA). This live trap achieved considerable success during the first five years of use. A total of 422 elk (mainly cows and calves) were captured and relocated to other suitable elk range along Alberta's East Slopes and away from agricultural areas to avoid landowner conflicts. When the local elk herd was reduced near the CCA, a new trap was constructed further south in the WMU to try to capture additional elk from a separate and growing elk herd. This new trap has not been very successful, with only 15 elk relocated in the past five years (2003 to present). The local elk population has steadily increased concurrently with the poor capture success and low hunting harvests. Landowner complaints have also risen as crop depredation, fence damage and concern over vehicle collisions increase.

The WMU 212 elk survey has not been flown on a regular basis, mainly due to poor surveying conditions and lack of funding in some years. In 2007, a survey schedule was established to allow a survey to occur if weather conditions became suitable. These conditions were met in winter 2009 and we conducted this survey to better understand population numbers to inform the decision process for determining transplant goals, hunter allocations, and options for population control. Future surveys will provide a mechanism to determine the success of management efforts.

5.3.1 Study area

Elk range in WMU 212 is limited to an area southwest of the City of Calgary (Figure 7). Occasional movements of elk into the area from adjacent WMUs or into normally unoccupied range may occur, but the majority of wintering elk occur within an area south of Highway 22X and west of secondary Highway 552 to the WMU boundary. This area consists of considerable tree cover interspersed amongst farmland, rangeland, acreages and subdivision developments. Only areas offering suitable cover within this landscape were surveyed. Because the area is populated and there are many landowners with horses that can be disturbed by low-flying aircraft, it was necessary to avoid certain areas while trying to maximize area coverage. Most elk occur in large groups during the winter months, and thus are readily observed. Smaller groups of bulls often split from the main herds and move into more remote and isolated locations. We assumed that most of the smaller bull groups would be located during the survey if all suitable forested cover was surveyed. However, we may have missed smaller groups or single individuals, and this may have biased our estimates of bull:cow ratios.

5.3.2 Survey methods

We conducted the WMU 212 elk survey on 25 February 2009 using a Bell 206 helicopter. The survey proceeded to the west, south, and east from the meeting point at Belvedere House on the CCA. Transects were flown in an appropriate orientation to ensure complete coverage of the area. When a large group of elk was observed, we estimated the total count by breaking the herd into smaller sub-groups by terrain, landscape changes, or natural divisions within the herd. We tallied these smaller groups as the pilot circled the group at an altitude that avoided spooking the elk. One person acted as a navigator to ensure that all suitable elk range was covered and to provide direction to the pilot as the survey proceeded. The other crew members took photos, tallied the larger groups of elk, and took GPS locations for each group encountered. When possible, we classified elk as cows, calves and bulls. Many of the larger groups were unclassified. Sex ratios and age classes may be inaccurate if some elk drop antlers prior to the survey. We did not correct for sightability; therefore, overall counts should be considered as minimum estimates and direct comparisons of survey results among years may be difficult.

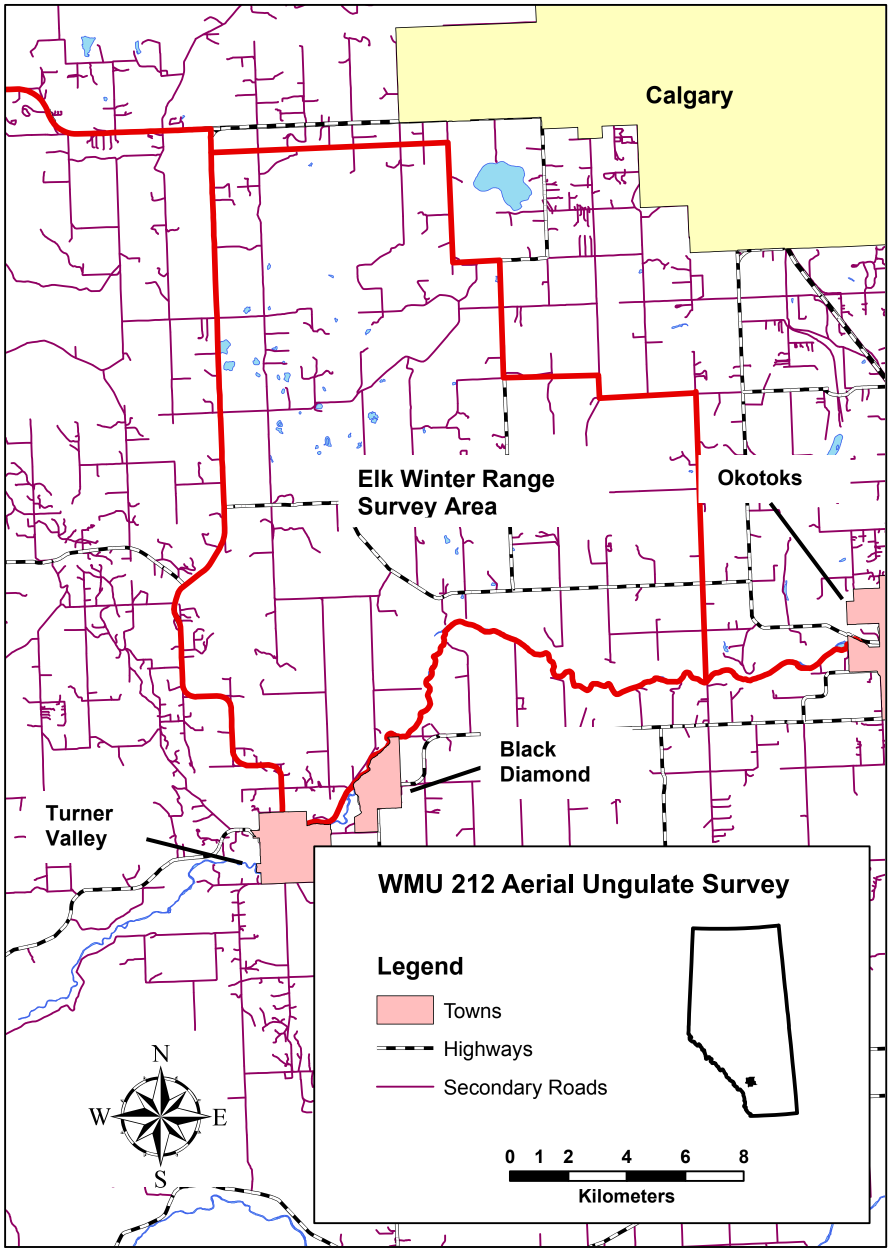


Figure 7. Location of the Wildlife Management Unit 212 elk survey in Alberta.

We also counted the local moose population during the survey. The number of animals observed was not considered to be a complete count of moose within the WMU, but we assumed it to represent a high proportion of the population because the same land base that supports the elk also supports most of the moose known to occur in the WMU.

5.3.3 Results

The survey day was bright and sunny, which created some difficulty with shadows in forested areas. We recorded 22 separate elk observations, ranging from a single cow to a large group of 187 individuals. Interestingly, we only observed four elk on the ridge that runs to the northwest from the town of Black Diamond towards Millarville. In most winters, this ridge is usually occupied by one or more large groups of elk. This ridge has been the location of a number of complaints regarding elk depredation.

We observed a total of 914 elk during the 2009 survey, suggesting a 234% increase in the total count of elk in this area compared to the 2002 survey when 391 elk were counted. We recorded two large groups away from the CCA consisting of 161 and 114 elk, and a number of other moderate groups, small groups, or single elk. We observed elk in smaller groups than commonly found in the 2008, with these groups more widely dispersed through the survey area.

We were interested in elk population numbers on the CCA property because the elk trap has not been active for some time and hunting is not permitted on the property. We observed 209 elk in five separate groups. One of the groups was quite large (187 elk). Because these elk were located in the trees, we were not able to classify young bulls, cows or calves, although we assumed the majority were cows and calves. The other four small groups consisted of cows and calves, with only a single spike bull elk recorded. During the January 2008 survey, we recorded 137 elk within the CCA. It appears that more elk were wintering in this area in February 2009. We observed 705 elk outside the CCA.

We recorded 66 bulls during the survey, although we may have missed some small bull groups. There undoubtedly were bulls in the large, unclassified groups that we encountered during the survey.

During the survey we also counted a total of 73 moose. This number was similar to the 2008 count of 80 animals.

6.0 RANDOM STRATIFIED BLOCK SURVEYS

6.1 Wildlife Management Unit 124 mule deer

Section Author: Mike Grue

Mule deer are an important game animal in Prairie Area WMUs. White-tailed deer can be included with mule deer surveys with a little extra flying and stratification work (Glasgow 2000), although time restraints led us to stratify WMU 124 for mule deer only during this survey. Survey results allow us to estimate changes in population numbers over time and to assess herd composition. These data will also be used by ASRD to calculate allowable hunter harvest and license allocations for future hunting seasons.

6.1.1 Study area

WMU 124 is located in the Grasslands region of Alberta. It is a small WMU located west of the City of Medicine Hat (Figure 8). A legal description of the area is found in Schedule 9, Part 1 of the *Wildlife Act* – Wildlife Regulation (Province of Alberta 1999). The WMU is bisected by the South Saskatchewan River, which is oriented east-west. Approximately 75% of the WMU is cultivated and 25% is native grassland. Most of the known mule deer habitat in the WMU is associated with coulees and draws along the South Saskatchewan River.

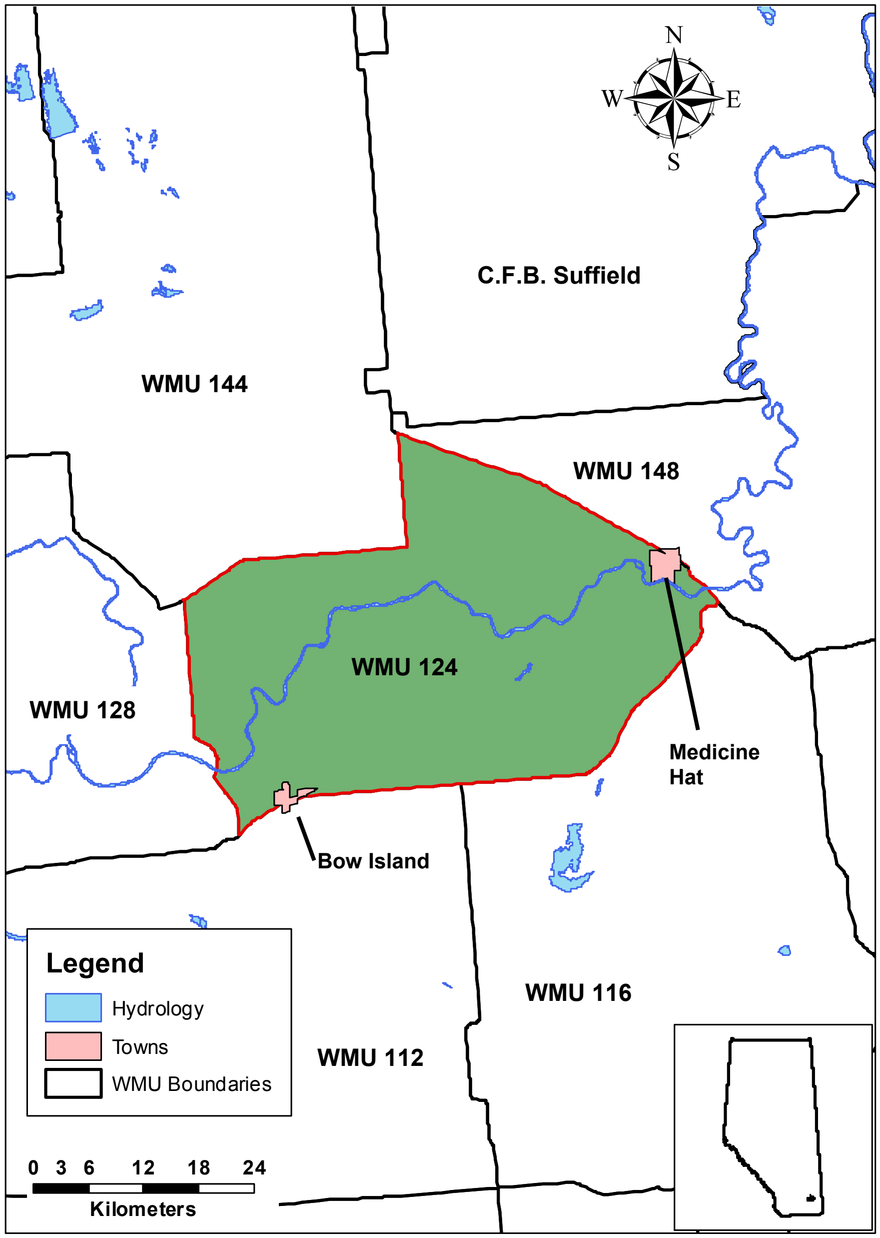


Figure 8. Location of Wildlife Management Unit 124 in Alberta.

6.1.2 Survey methods

We stratified the study area for mule deer densities (Gasaway et al. 1986) using a Bell 206L helicopter on 26 February 2009. During stratification the aircraft travelled at approximately 180 km/h and 100 m above ground. Height and speed of the aircraft varied with wind speed and direction, amount of cover, and topography of the area. Stratification lines occurred approximately 2 km apart. Where cover and topography required, the distance between lines was reduced. In areas with deep coulees and/or heavy tree cover (i.e., South Saskatchewan River), lines were meandering to effectively cover the area for accurate stratification. We assumed observers could locate deer within 800 m in open areas and within 100 m when flying rivers and coulees. Survey crews for both stratification flights and intensive survey block flights included one navigator (who also recorded and observed) in the front seat beside the pilot and two observers in the back, one on each side of the aircraft. The pilot was able to observe intermittently, but was not considered an observer.

Mule deer observed during the stratification flight provided a good representation of distribution within the WMU and allowed us to stratify survey blocks (3 min latitude x 5 min longitude as per (Shumaker 2001a)) into one of three strata (low, medium or high). 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 allocate approximately 60% to the middle stratum and split the remaining 40% between the high and low strata (Shumaker 2001b). In this survey, a large percentage of survey blocks (66%) had zero deer observed. These survey blocks made up the low stratum for mule deer, while the remaining blocks were stratified based on deer numbers observed during stratification.

We randomly selected nine survey blocks (three blocks in each of the three strata) for intensive surveys using Microsoft Excel (Shumaker 2001c). We searched each survey block (100% coverage) using a Bell 206L helicopter. Results were incorporated into a Quad file program developed for WMU 124 as per Gasaway et al. (1986). We evaluated strata based on variance associated with deer density. For strata with high variance, we randomly selected and flew additional blocks until confidence intervals were at acceptable levels (< 25%). We did not collect herd composition data because many males had dropped their antlers before the start of the survey.

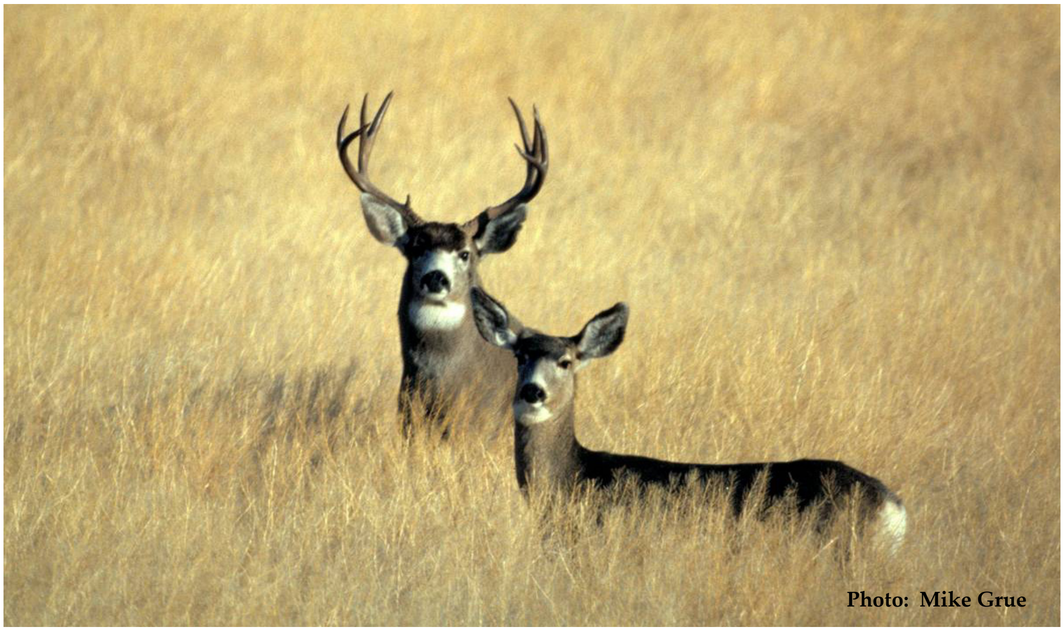
6.1.3 Results

Mule deer —We observed a total of 831 mule deer during stratification flights and 315 mule deer while flying 11 survey blocks in rotary-winged aircraft. From this, we calculated a population estimate for mule deer of 712 ± 152 (90% CL = 21.4%) (Table 6). The density of mule deer in WMU 124 was 0.49/km^2.

White-tailed deer — We observed a total of 319 white-tailed deer during stratification flights. We did not calculate a population estimate because WMU 124 was not stratified for white-tailed deer.

Table 6. Comparison of aerial mule deer survey results from 2004 and 2009 in Wildlife Management Unit 124.

Year	Population Estimate (90% confidence limits)	Mule deer/km^2	Ratio to 100 Females	
			Males	Juveniles
2009	712 (21.4%)	0.49	--	--
2004	994 (25.8%)	0.68	22	24



6.2 Wildlife Management Unit 152 mule deer

Section Author: Mike Grue

Mule deer are an important game animal in Prairie Area WMUs. White-tailed deer can be included with mule deer surveys with a little extra flying and stratification work (Glasgow 2000), although time restraints led us to stratify WMU 152 for mule deer only during this survey. Survey results will allow us to estimate changes in population numbers over time and to assess herd composition. These data will also be used by ASRD to calculate allowable hunter harvest and license allocations for future hunting seasons.

6.2.1 Study area

WMU 152 is located in the Grasslands region of Alberta. It is a large WMU located north of Brooks, Alberta (Figure 9). A legal description of the area is found in Schedule 9, Part 1 of the *Wildlife Act* – Wildlife Regulation (Province of Alberta 1999). The WMU is bisected by the Red Deer River, which is oriented east-west. Approximately 50% of the WMU is cultivated and 50% remains as native grassland. Most mule deer habitat in the WMU is associated with coulees and draws along the Red Deer River.

Figure 9. Location of Wildlife Management Unit 152 in Alberta.

6.2.2 *Survey methods*

We stratified the study area for mule deer densities (Gasaway et al. 1986) using a Bell 206L helicopter on 28 February and 1 – 2 March 2009. During stratification, the aircraft travelled at approximately 180 km/h and 100 m above ground. Height and speed of the aircraft varied with wind speed and direction, amount of cover, and topography of the area. Stratification lines occurred approximately 2 km apart. Where cover and topography required, distance between lines was reduced. In areas with deep coulees and/or heavy tree cover (i.e., Red Deer River), lines were meandering to effectively cover the area for accurate stratification. We expected observers could see deer up to 800 m in open areas. When flying rivers and coulees, we expected observers could see deer up to approximately 100 m. Survey crews for both stratification flights and intensive survey block flights included one navigator (who also recorded and observed) in the front left seat beside the pilot and two observers in the back, one on each side of the aircraft. The pilot was able to observe intermittently, but was not considered an observer.

Mule deer observed during the stratification flights provided a good representation of distribution within the WMU and allowed us to stratify survey blocks (3 min latitude x 5 min longitude as per Shumaker (2001a)) into one of three strata (low, medium or high). We based the assignment of blocks on the number of deer observed 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 strata (Shumaker 2001b). However, during this survey, a large percentage of survey blocks (62%) had zero deer observed. These survey blocks made up the low stratum for mule deer. The remaining blocks were stratified based on deer numbers observed during stratification.

We randomly selected nine survey blocks (three blocks in each of the three strata) for intensive surveys using Microsoft Excel (Shumaker 2001c). We searched each survey block intensively (100% coverage) with a Bell 206L helicopter. Results were incorporated into a Quad file program developed for WMU 152 as per Gasaway et al. (1986). We evaluated strata based on variance associated with deer density. For strata with high variance, we randomly selected and flew additional blocks until confidence intervals were at acceptable levels (< 25%). We did not collect herd composition data because many males had dropped their antlers before the start of the survey.

6.2.3 Results

Mule deer — We observed a total of 1,552 mule deer during stratification flights. During the intensive survey, we observed a total of 415 mule deer while flying nine survey blocks in rotary-winged aircraft. From this, we calculated a population estimate of 3,051 ± 284 (90% CL = 9.3%) (Table 7). The density of mule deer in WMU 152 was 0.78/km^2.

White-tailed deer — During stratification flights, we observed a total of 938 white-tailed deer. We did not calculate a population estimate because WMU 152 was not stratified for white-tailed deer.

Table 7. Comparison of aerial mule deer survey results from 2004 and 2009 in Wildlife Management Unit 152.

Year	Population Estimate (90% confidence limits)	Mule deer/km^2	Ratio to 100 Females	
			Males	**Juveniles**
2009	3051 (9.3%)	0.78	--	--
2004	3336 (20.7%)	0.86	37	47

6.3 Wildlife Management Unit 304 mule deer

Section Author: Greg Hale

Report not received from author for WMU 304 (Figure 10). Please contact the author for information on this survey.

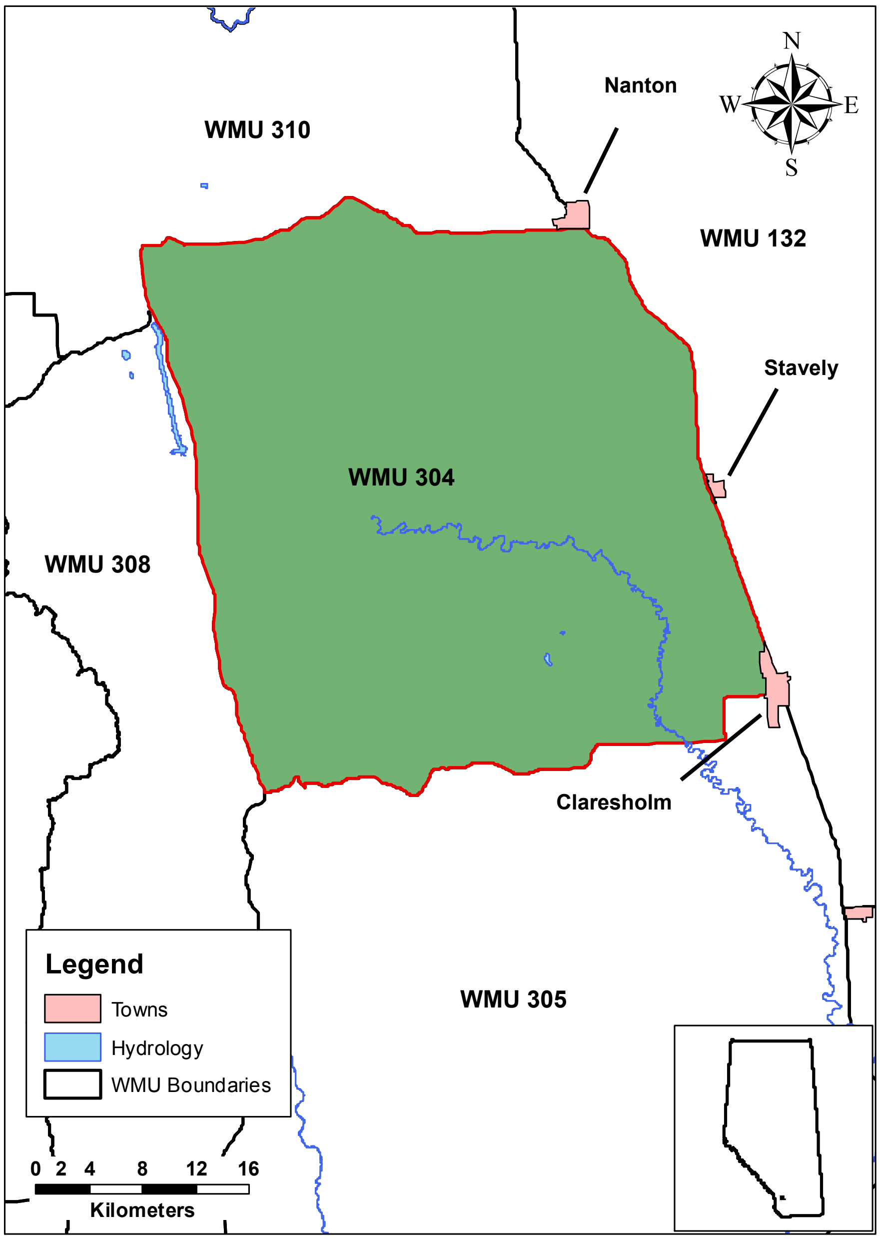


Figure 10. Location of Wildlife Management Unit 304 in Alberta.

6.4 Wildlife Management Unit 328 moose and elk

Section Authors: Anne Hubbs and Shevenell Webb

WMU 328 is a desirable WMU for moose and elk hunters, and receives high pressure from recreational and unregulated hunting. More than 700 hunters pursue elk in this WMU each year, and it consistently has the largest number of elk hunters in the entire Clearwater Area. Regular population inventories are required to balance losses due to hunter harvests, predation and severe winters. The objectives of this survey were to estimate the total moose and elk population sizes in this WMU and to determine herd composition for moose. WMU 328 is surveyed approximately every three or four years on a rotational basis for moose and/or elk.

In 2008, hunting of only antlered moose was permitted, with a season from 24 September to 30 November. The harvest goal for moose is 3% of the estimated pre-season population. According to hunter harvest questionnaires, moose hunter success has averaged 48% over the last five years (ASRD 2003 – 2007). For elk, a general season with 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) occurs from 25 August to 17 September and the rifle season from 17 September to 30 November. Bull elk hunter success from hunter harvest questionnaires has averaged 2.5% over the last four years (ASRD 2003 – 2007). There is no season for antlerless elk.

6.4.1 Study area

WMU 328 is located west of Rocky Mountain House (Figure 11). The North Saskatchewan and Brazeau rivers form the southern and northern boundaries, and Forestry Trunk Road and Sunchild Road form the western and eastern borders. WMU 328 straddles the Lower and Upper Foothills natural subregions (Natural Regions Committee 2006). The dominant land cover type is conifer (71%) and mixedwood forests (4%), followed by wetlands/rivers/lakes (5%), shrub/meadow complexes (4%), and other types (e.g., rock, soils or burn, 3%) (Beyer et al. 2004). Cutblocks comprise 13% of the WMU. The industrial footprint is widespread; petroleum extraction and forestry are the dominant disturbances. Road density is currently 0.42 km/km^2.

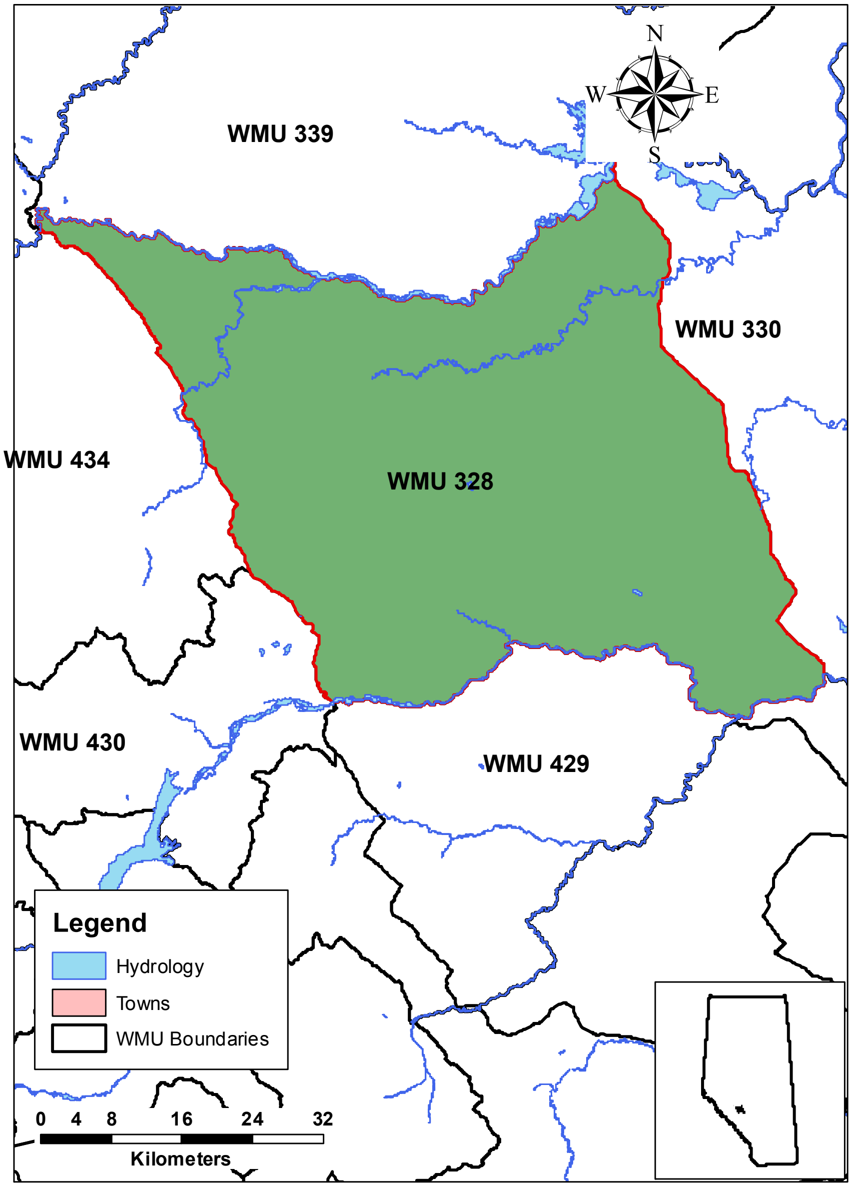


Figure 11. Location of Wildlife Management Unit 328 in Alberta.

6.4.2 *Survey methods*

We stratified the WMU for moose based on numbers counted from a Cessna 185 fixed-wing aircraft on 10 – 11 March 2009 (Gasaway et al. 1986). During the stratification survey, the fixed-wing aircraft flew at approximately 160 km/h and 90 m above ground, depending on land cover and topography (higher in dense forest and greater topography). We flew transects in an east-west direction at 1 min longitude (~1 km) intervals (Lynch and Shumaker 1995; Lynch 1997). Observers scanned 300 – 500 m out from the aircraft and recorded moose locations found along the transect. Temperature during stratification flights ranged from -30 to -10°C, and snow conditions were excellent.

Following the stratification survey, we uploaded moose counts and GPS locations into a geographic information system (GIS) and intersected these with a 3 min latitude x 5 min longitude sampling grid to determine the number and density of moose observed in each block. We observed too few moose during stratification flights to allow accurate classification of sample blocks into three strata (e.g., zero moose were observed in 52/94 = 55% of sample blocks). Therefore, we classified sample blocks into two strata (low or high) using a combination of direct sightings of moose during stratification flights, as well as sightings of moose tracks. We classified sample blocks where no moose were observed as low, with the exception of seven sample blocks with abundant moose tracks, which we classified as high. We classified all sample blocks where ≥ 1 moose was observed as high. Overall, we classified 45 sampling blocks as low and 49 as high. We randomly selected survey blocks for inclusion in the intensive survey using the Excel Seed file methods (Shumaker 2001c).

We stratified the WMU for elk using a winter resource selection function (RSF) originally developed by the Central East Slopes Elk Study (Webb and Anderson 2009). After calculating the average RSF value in each sample block, we used Jenks Natural Breaks to divide the sample blocks into three strata, resulting in 18 sample blocks classified as low, 39 as medium and 37 as high.

We searched sample blocks with a Bell 206 Jet Ranger helicopter from 12 – 14 March 2009 (Gasaway et al. 1986). We surveyed a total of 16 blocks: 8 low and 8 high for moose; 5 low:6 medium:5 high for elk. We flew approximately 120 km/h and 30 – 50 m above 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 sat in the back of the aircraft. Each observer scanned out to approximately 200 m from the aircraft.

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. We also counted elk and determined their sex and age-class using the presence of antlers and body size to differentiate bulls and calves. Some misclassification may have occurred because some bulls may have already shed their antlers and calves may be difficult to distinguish from cows in March.

We summed moose and elk counts per block and entered the data into separate Excel Quad files to determine population estimates (Gasaway et al. 1986). Intensive survey flights occurred during constant weather: partially cloudy, calm days, with average temperatures ranging from -18 to 8°C. Snow conditions deteriorated slightly as the survey progressed, exposing most south-facing slopes and black stumps in open areas.

6.4.3 Results

Moose — During the intensive survey, we counted 57 moose in 16 survey blocks. We estimated the total population to be 335 ± 90 (90% CI = 26.8%), with a density of 0.12 moose/km^2 (Table 8). The composition of moose was 55 bulls/100 cows and 23 calves/100 cows. No twins were observed. We saw four moose with slight evidence of ticks.

Elk — During the intensive survey, we counted 43 elk in 16 survey blocks. We estimated the total population to be 241 ± 213 (90% CI = 88.2%), with a density of 0.08 elk/km^2 (Table 8). The composition of elk was 5 bulls/100 cows (or 5 bulls/100 antlerless) and 3 calves/100 cows. Bull/cow and calf/cow ratios may be underestimated because bull elk generally shed their antlers in March or early April and calves may be difficult to distinguish from cows in March.

Table 8. Comparison of aerial moose and elk survey results from 2002, 2005 and 2009 in Wildlife Management Unit 328.

Species	Year	Population Estimate (90% confidence limits)	Animals/km²	Ratio to 100 Females	
				Males	Juveniles
Moose	2009	335 (26.8%)	0.12	55	23
	2005	503 (--)	--	43	33
Elk	2009*	241 (88.2%)	0.08	5	3
	2002*	899 (46.8%)	0.34	--	--

*2002 survey stratified using per cent tree canopy; 2009 survey stratified using a resource selection function-based approach. A sightability correction was not applied in either year.


Photo: Shevenell Webb

6.5 Wildlife Management Unit 330 moose

Section Authors: Shevenell Webb and Anne Hubbs

WMU 330 is a desirable WMU for moose hunters, and requires regular population inventories to balance losses due to unregulated harvest, predation, and severe winters with recreational hunting. Our objectives for this survey were to estimate the total moose population size and herd composition in the WMU. WMU 330 is surveyed approximately every three to five years on a rotational basis. To improve moose management, ASRD replaced the general season in WMU 330 with a special license draw system in 1996. In 2008, hunting of only antlered moose was permitted, with a season from 24 September to 30 November. In 2007, moose hunter success was estimated at 28% (ASRD 2007).

6.5.1 Study area

WMU 330 is located directly northwest of Rocky Mountain House (Figure 12). The North Saskatchewan and Brazeau rivers form the southern and northern boundaries, and Sunchild Road and Wolf Creek/Highway 22 form the western and eastern borders. The Sunchild/O'Chiese First Nations Reserve is located in the northwest portion of the WMU, but was not surveyed during the intensive portion of the survey. WMU 330 is dominated by the Lower Foothills subregion, with a small amount of Central Mixedwood covering the northeast portion (Natural Regions Committee 2006). Of the WMU's total land area, the dominant land cover type is conifer (41%) and mixedwood/deciduous forest (33%), followed by wetland (16%), shrub (8%), and other (2%; e.g., exposed land, developed). In general, the industrial footprint is widespread; oil and gas development and forestry are the dominant disturbances. Road density in the sampling blocks ranges from 0.11 – 3.5 km/km^2 (mean = 1.29 km/km^2).

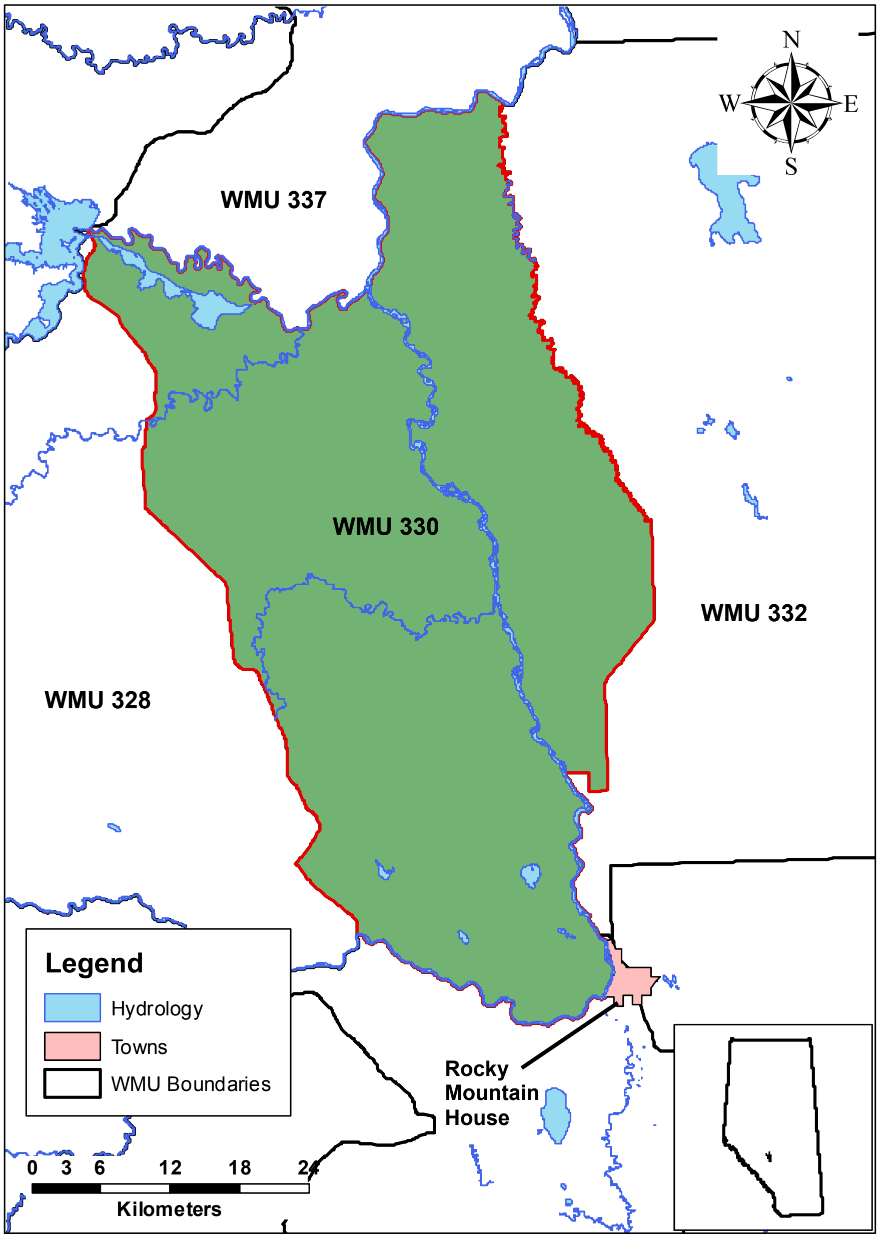


Figure 12. Location of Wildlife Management Unit 330 in Alberta.

6.5.2 *Survey methods*

We stratified the WMU based on moose counted from a Cessna 185 fixed-wing aircraft on 2 – 3 February 2009 (Gasaway et al. 1986). During the stratification survey, the fixed-wing aircraft flew at approximately 160 km/h and 90 m above the ground, depending on land cover and topography (higher in dense forest and greater topography). We flew transects in a north-south direction at 1 min longitude (~1 km) intervals (Lynch and Shumaker 1995; Lynch 1997). Observers scanned 300 – 500 m out from the aircraft and recorded moose locations found along the transect. After the stratification survey, we uploaded moose counts and GPS locations into a GIS and intersected the data with a 3 min latitude x 5 min longitude sampling grid to determine the number and density of moose observed in each block. We classified blocks into strata based on the following moose counts during the stratification flight: 0 (low), 1 – 3 (medium), and ≥ 4 (high), respectively.

We randomly selected five blocks to sample in each of the low, medium and high strata. We also sampled one additional high stratum block to improve confidence intervals, for a total of 16 blocks (5 low:5 medium:6 high). We searched sample blocks with a Bell 206 Jet Ranger helicopter from 4 – 6 February 2009 (Gasaway et al. 1986). We flew approximately 120 km/h and 30 – 50 m above 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 sat in the back of the aircraft. Each observer scanned out to approximately 200 m from the aircraft. We circled all moose to determine age, sex, total number of individuals, and condition. Most bulls had shed their antlers, but the white vulva patch below the tail indicated a cow moose. Light brown or grey patches, typically occurring on the shoulders and back, indicated tick infestation. In addition, we recorded locations and approximate counts of other wildlife species. All deer were simply recorded as “deer” and counts were recorded for each block. We summed moose counts per block and entered these data into an Excel Quad file to determine population estimates (Gasaway et al. 1986).

During the stratification survey, temperatures were mild (-5 to 4°C) and snow conditions were good with moderate snow cover. The intensive surveys flights occured during constant weather: partially cloudy, calm days with average temperatures ranging from -12 to 6°C. Snow conditions deteriorated slightly as the survey progressed, exposing most south-facing slopes and black stumps in open areas. Blowing snow on the final day made visibility poor at times and prevented further surveying.

6.5.3 Results

We estimated the total moose population to be 211 ± 63 (90% CI = 29.9%), for a density of 0.11 moose/km² (Table 9). The composition of moose was 60 bulls/100 cows and 40 calves/100 cows. No twins were observed. We observed 11 moose with slight ticks; approximately one-third of the cow/calf pairs showed evidence of ticks.

Table 9. Comparison of aerial survey results for moose in Wildlife Management Unit 330 from 2001 – 2009.

Species	Year	Population Estimate (90% confidence limits)	Moose/km²	Ratio to 100 Females	
				Males	Juveniles
Moose	2009	211 (29.9%)	0.11	60	40
	2004	499 (19.7%)	0.26	--	--
	2001	494 (28.5%)	0.26	44	38

6.6 Wildlife Management Unit 338 moose

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

Obtaining accurate moose population estimates is important for ensuring healthy moose populations and hunting opportunities. WMU 338 is surveyed on a rotational basis, approximately every three to five years. WMU 338 was surveyed by line transect method in 1980, 1985, 1990 and 1993 and using the modified Gasaway method in 1996, 2003 and 2008. 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). In 2008, antlered moose hunting was permitted via a special license draw from 3 September to 31 October for archery and from 1 to 30 November for firearms. In 2006, moose hunter success was estimated at 17% (ASRD 2007).

6.6.1 Study area

WMU 338 is located east of Edson and south of Highway 16 between Wolf Lake Road/Wolf Creek to the west, Cynthia Road to the east, and the Pembina River to the south (Figure 13). This 2,536 km^2 WMU is characterized by heavy oil and gas development and extensive all-weather access in its southern third, large areas of cleared farmland in its northern third, and some forestry clearcuts in various stages of activity and regeneration in its centre. The WMU is located in the Lower Foothills natural subregion and the forest cover largely consists of mixed conifer and deciduous stands on the uplands and black spruce and tamarack bogs in the lowlands. There are a number of small- and medium-sized lakes in the WMU (e.g., Wolf Lake).

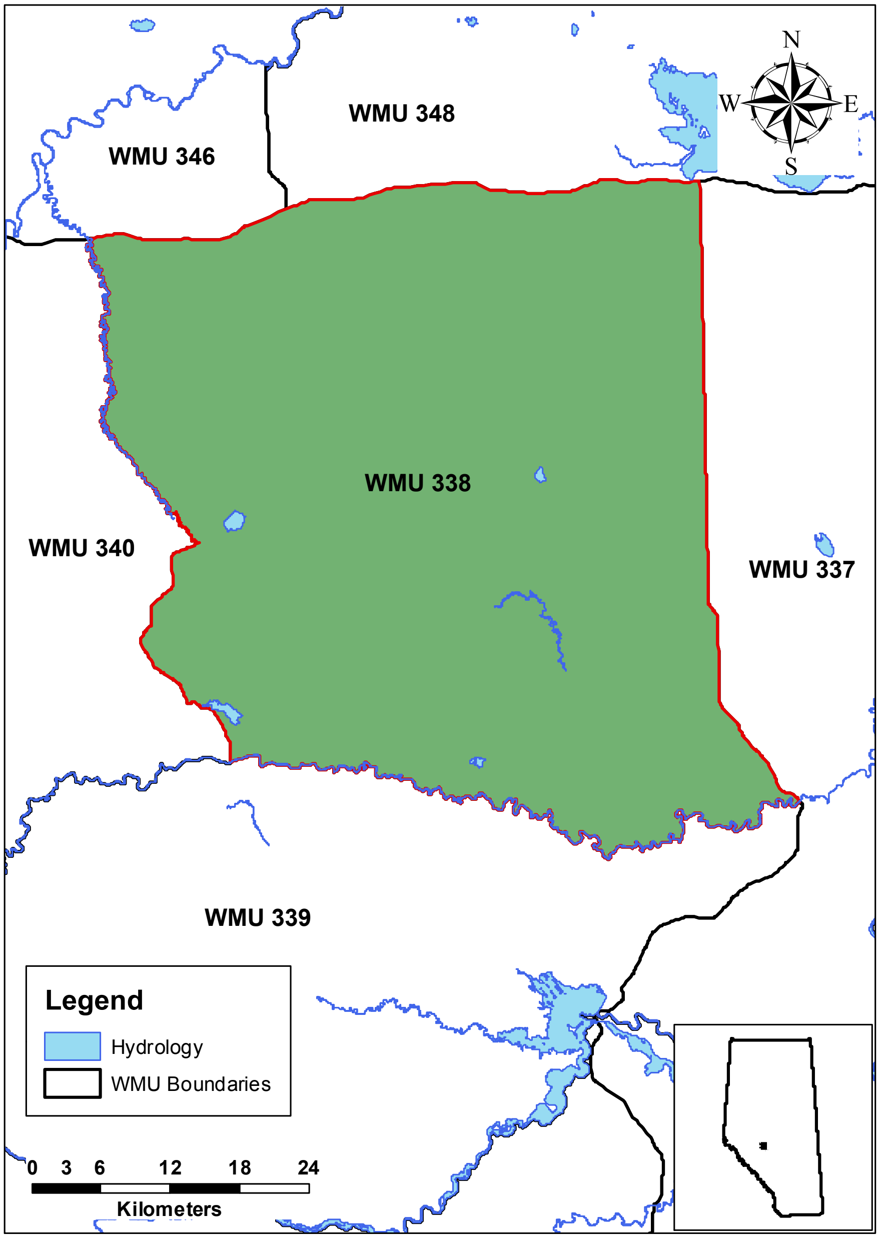


Figure 13. Location of Wildlife Management Unit 338 in Alberta.

6.6.2 *Survey methods*

We stratified the WMU based on moose observed from a Cessna 185 fixed-wing aircraft on 9 – 10 February 2009 (Gasaway et al. 1986). The aircraft flew at approximately 160 km/h and 90 m above the ground, depending on land cover and topography (higher in dense forest and greater topography). We flew transects with the same three experienced observers in an east-west direction at 1 min latitude (~1.9 km) intervals using a hand-held GPS unit (Lynch and Shumaker 1995; Lynch 1997). Observers scanned 300 - 500 m out from the aircraft and recorded moose locations found along the transect. After the stratification survey, we uploaded moose counts and GPS locations into a GIS and intersected the data with a 5 min latitude x 5 min longitude sampling grid to determine the density of moose observed in each block. We determined strata based on moose density (i.e., low, medium, high) and randomly selected survey blocks using the Excel Seed file methods (Shumaker 2001c).

We searched for moose in 15 sample blocks (five each from the low, medium and high strata) from 11 – 12 February 2009 using a Bell 206 JetRanger helicopter (Gasaway et al. 1986). During intensive surveys, we flew approximately 80 – 120 km/h and 50 – 100 m above ground at 400 m intervals to ensure that each block was sampled completely. A navigator sat next to pilot and observed and recorded animal locations, while two observers sat in the back of the aircraft. Each observer scanned 200 m out from the aircraft. We circled all moose to determine age, sex, total number of individuals, and condition. The white vulva patch below the tail indicated a cow moose and light brown-grey patches, typically occurring on the shoulders and back, indicated tick infestation. In addition, we recorded locations and counts of other wildlife species. We summed moose counts per block and entered these data into an Excel Quad file to determine population estimates (Gasaway et al. 1986).

During stratification flights, daytime high temperatures were cool (-1 to 5°C) and snow conditions were good with moderate to complete snow cover. Intensive survey flights occurred during constant weather: clear to partially cloudy, calm days, with average high temperatures ranging from -7 to -2°C. At the time of the survey, the last snow had occurred one day prior, adding a few inches of fresh snow.

6.6.3 Results

We estimated the total moose population at 927 ± 167 (90% CI = 18.1%), for an overall density of 0.37 moose/km² (Table 10). Moose density was lowest in the low stratum (0.23 moose/km²); similar moose densities were found in the medium and high strata (0.41 moose/km²). The composition of moose was 40 bulls/100 cows and 39 calves/100 cows. We did not observe twins. Evidence of ticks on moose was minimal (< 5%).

The density of moose appears to have declined since 1993; however, the bull:cow ratio has increased over that period (Table 10). The calf:cow ratio has declined since 1990, but has been variable over the past four aerial surveys (Table 10).

Table 10. Comparison of moose population parameters from seven surveys in Wildlife Management Unit 338 from 1980 – 2009.

Year	Survey Type	Population Estimate (90% confidence limits)	Moose/km²	Ratio to 100 Females	
				Males	Juveniles
2009	RSB[1]	927 (18.0%)	0.37	40	39
2003	RSB	884 (15.2%)	0.35	36	49
1996	RSB	1119 (17.9%)	0.44	25	46
1993	Transect	1413	0.55	30	38
1990	Transect	1390	054	23	67
1985	Transect	--	0.56	24	60
1980	Transect	--	0.50	--	--

[1]RSB - Random stratified block.

6.7 Wildlife Management Unit 342 moose

Section Authors: Robert Anderson, Dave Hobson and Jeff Kneteman

WMU 342 is one of the many WMUs in the province in which demand for moose licenses exceeds the number available. In 2008, 124 hunters applied for 48 available licenses. In general, applicants wait four or five years before getting an early-season draw for this WMU. Aerial ungulate surveys are invaluable for setting license numbers for resident and non-resident hunters. Moose in WMU 342 were last surveyed in 1996. The long period between surveys, combined with anecdotal suggestions of reduced moose numbers in recent years, gave this WMU a high priority for surveying during the winter of 2008/09. The primary purpose of this survey was to determine a moose population estimate and bull:cow:calf ratio. Information on deer and elk populations was considered secondary and is not presented.

6.7.1 Study area

WMU 342 stretches from Hinton to Edson, primarily south of Highway 16 (Figure 14). A description of the official boundaries of this WMU can be found in Schedule 9, Part 1 of the *Wildlife Act* – Wildlife Regulation (Province of Alberta 1999). The WMU contains portions of the McLeod River drainage and the town of Hinton. The area is dominated by the Lower Foothills natural subregion, as described by the Natural Regions Committee (2006), with the western portion transitioning into Upper Foothills. Conifer forests, dominated by pine, are common in the western portion of the WMU. Mixedwood forest becomes more common moving from west to east. The forest industry is prevalent throughout the WMU. Oil and gas activity is also common. Some agricultural use occurs along the Highway 16 corridor.

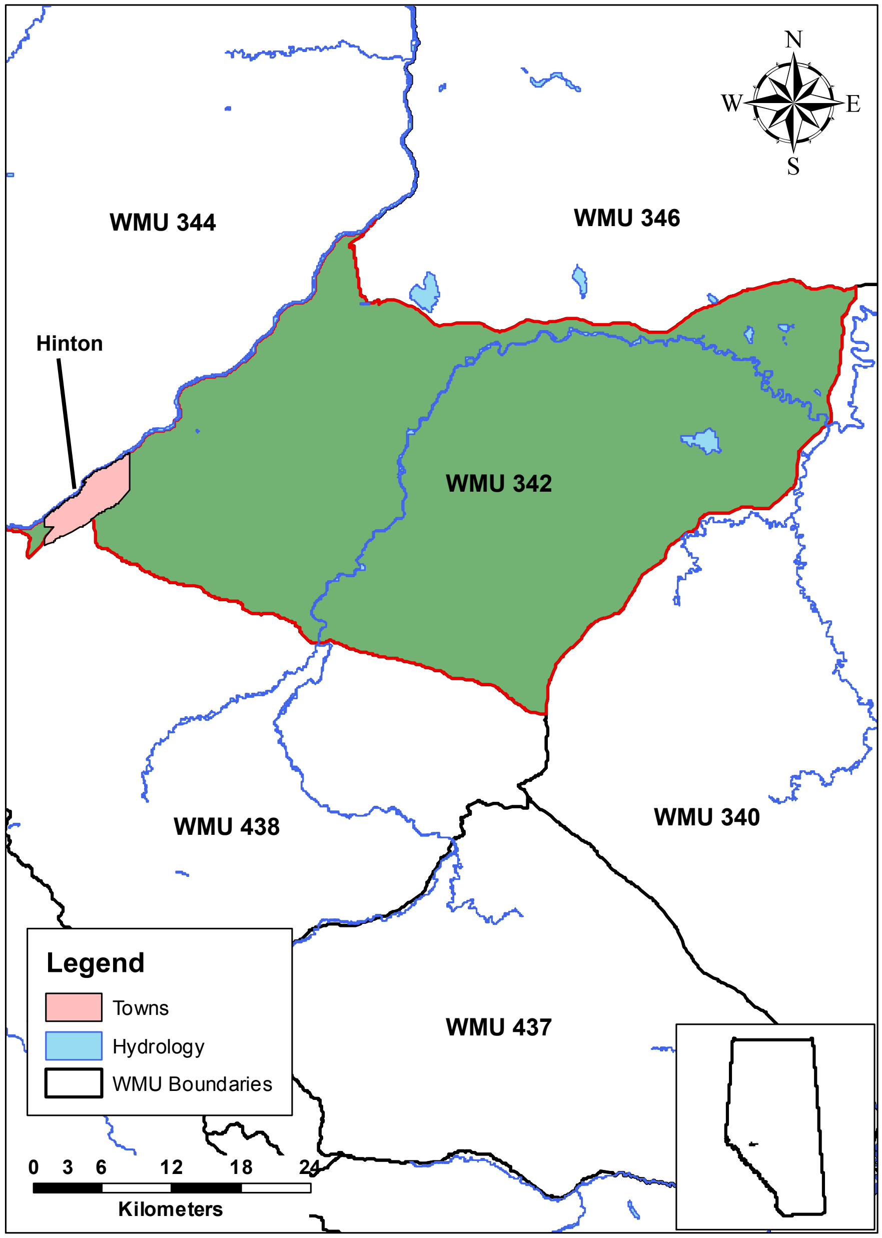


Figure 14. Location of Wildlife Management Unit 342 in Alberta.

6.7.2 Survey methods

We used a random stratified block study design (Gasaway et al. 1986; Lynch 1997) to produce a population estimate for moose in WMU 342. On 12 – 13 January 2009, wildlife staff from ACA and ASRD flew fixed-wing (Cessna 210) transects across WMU 342 to stratify the study area based on moose distribution observed across 56 sampling blocks (3 min latitude x 5 min longitude). Flights occurred along lines of 1 min latitude (except for every third line, which fell on sample block borders). Winds varied across the WMU, with more turbulence experienced near the western boundary. Snow cover had been complete during the previous week; however, warm weather (above freezing) caused melting, which exposed stumps and some bare ground. Visibility was generally excellent throughout the survey. Night-time low temperatures were -8°C and 1°C during the stratification survey, while day-time highs reached 8°C and 9°C. During the stratification survey, crews recorded locations of moose, deer, incidentally encountered elk, and other pertinent wildlife with a GPS.

We classified sample blocks according to the number of moose observed during fixed-wing stratification flights. Because the number of moose observed during these flights was low, we used a simplified stratification method. We classed all blocks in which moose were observed during the stratification flight into one stratum, and all other blocks as a second stratum.

We randomly selected 19 sample blocks for intensive search by helicopter (13 in stratum 1 and six in stratum 2) between 14 – 16 January 2009. Bell 206B helicopters were used to determine the number of moose within each of the randomly selected blocks. A single crew conducted the surveys on 14 and 16 January, and three crews conducted the surveys on 15 January. Blocks were flown in a north-south orientation at 100 – 130 km/h and at approximately 100 – 150 m above ground on flight lines spaced approximately 400 m apart. Each flight crew consisted of three passengers: a navigator/recorder/observer up front, observer left-behind, and observer right-behind. Observers on each side of the helicopter scanned a field of view approximately 200 m wide. Crews identified all ungulates 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). Crews also recorded incidental observations of other wildlife (deer, elk, sharp-tailed grouse and wolves). Conditions for rotary-wing surveys were moderate. Approximately 15 cm of snow covered the ground during the detailed survey, although some bare ground and stumps were exposed. Night-time low temperatures ranged from -4 to 2°C, with day-time highs ranging from 3 to 7°C. Winds were generally light during rotary-wing surveys.

We entered data into a Gasaway population estimate spreadsheet ("Quad6.xls"), producing a moose population estimate, male:female:juvenile ratio, and population density.

6.7.3 Results

We observed a total of 55 moose during the survey. Of these, 10 were bulls (6 antlerless, 1 yearling, 3 medium) and 39 were cows (33 solitary cows, 6 cows with a single calf). We did not observe any cows with twins. Estimates for the bull:cow:calf ratio (Table 11) should be interpreted with caution because the total number of moose observed was considered lower than desired for estimating this population parameter. We estimated the population was between 107 and 171 moose (90% confidence interval; see Table 11 for a comparison to previous years).

Sightability during the survey may have been influenced by weather conditions, thereby biasing the results toward a lower population estimate. Temperatures were above normal during the survey, and well above what is considered ideal surveying conditions. It is possible that moose may have spent more time under cover during this survey than would otherwise be the case, although we have no data to confirm or reject this. Incomplete snow cover may have affected sightability as well, particularly during the stratification flight. These transects were flown faster than typically desired, but was unavoidable given the aircraft available. This may not have been as concerning under ideal survey conditions, but likely affected our ability to identify moose on 12 – 13 January. During future surveys, we recommend using a Cessna 185 aircraft for this WMU, as opposed to a Cessna 210.

Table 11. Comparison of moose population and demographic estimates for Wildlife Management Unit 342.

Year	Population Estimate (90% confidence limits)	Moose/km²	Ratio to 100 Females	
			Males	Juveniles
2009	139 (22.7%)	0.09	26	15
1996	327 (19.8%)	0.22	20	40
1991	422 (31.5%)	0.28	17	59

6.8 Wildlife Management Unit 349 moose

Section Authors: Curtis Stambaugh and Nathan Webb

WMU 349 has traditionally been a popular area for moose hunters. This WMU receives above-average hunting pressure due to its relatively close proximity to Edmonton, an abundance of public land, varying terrain and remote ruggedness, and Sunday hunting opportunities. However, in 2008, Sunday hunting was expanded to most of the province. WMU 349 has also experienced an enormous amount of landscape change over the last 20 to 30 years. A total of three Forest Management Agreements, with a handful of embedded quota holders, overlap with numerous oil and gas companies, all competing for resources within the boundaries of the WMU. Along with extraction activities comes road infrastructure, and currently most places in the WMU are accessible by truck or all-terrain vehicle. In fact, some areas of the WMU experience some of the highest road densities in Alberta (e.g., southwest of Swan Hills, Judy Creek oil field).

WMU 349 has been surveyed three times since its separation from WMU 350 in 1993. The WMU was surveyed in 1994 and 1997 as part of the Northern Moose Program (Lynch 1997), and again in 2000. Elk, mule deer and white-tailed deer are also found within the WMU; however, their numbers are considered low and are not observed consistently enough to warrant special attention during surveys.

6.8.1 Study area

WMU 349 is a relatively large WMU totaling 6,488 km^2. It is located between the towns of Whitecourt to the south, Fox Creek to the west, and Swan Hills and Fort Assiniboine to the north and east (Figure 15). It is formally bounded in the north by the Goose River and Goose Tower Road, Highway 33 and Highway 658 in the east, and the Athabasca River and Highway 43 in the south and west.

WMU 349 is rolling Upper and Lower Foothills terrain, predominately comprised of deciduous mixedwood on the western and southern edges changing to lodgepole pine forest, with a gain in elevation in the central and northeastern portions of the WMU. Streams and creeks flowing out of the Swan Hills form deeply incised valleys through the WMU. In the summer of 1998, the Virginia Hills forest fire burned approximately one-third of the WMU.

6.8.2 Survey methods

Survey methodology followed the modified Gasaway technique as per Lynch (1997) and Gasaway et al. (1986). We divided the WMU into a 5 min latitude by 5 min longitude grid, resulting in 139 survey blocks (some blocks varied in size along the WMU boundary). Two crews of three plus a pilot conducted sample block stratification in a Cessna 185 and Cessna 206 fixed-wing aircraft on 15 – 16 January 2009. Crews consisted of at least two experienced observers; one in the front seat and the other behind the pilot. Crews flew every 1 min latitude, with the exception of block boundaries (every fifth minute), and counted all moose on either side of the aircraft. Crews also recorded elk and deer, if observed. Pilots attempted to maintain a consistent altitude of 100 m above the trees. Aircraft speed was maintained at approximately 160 km/h. We assigned survey blocks a value of low, medium or high based on moose densities from stratification flights.

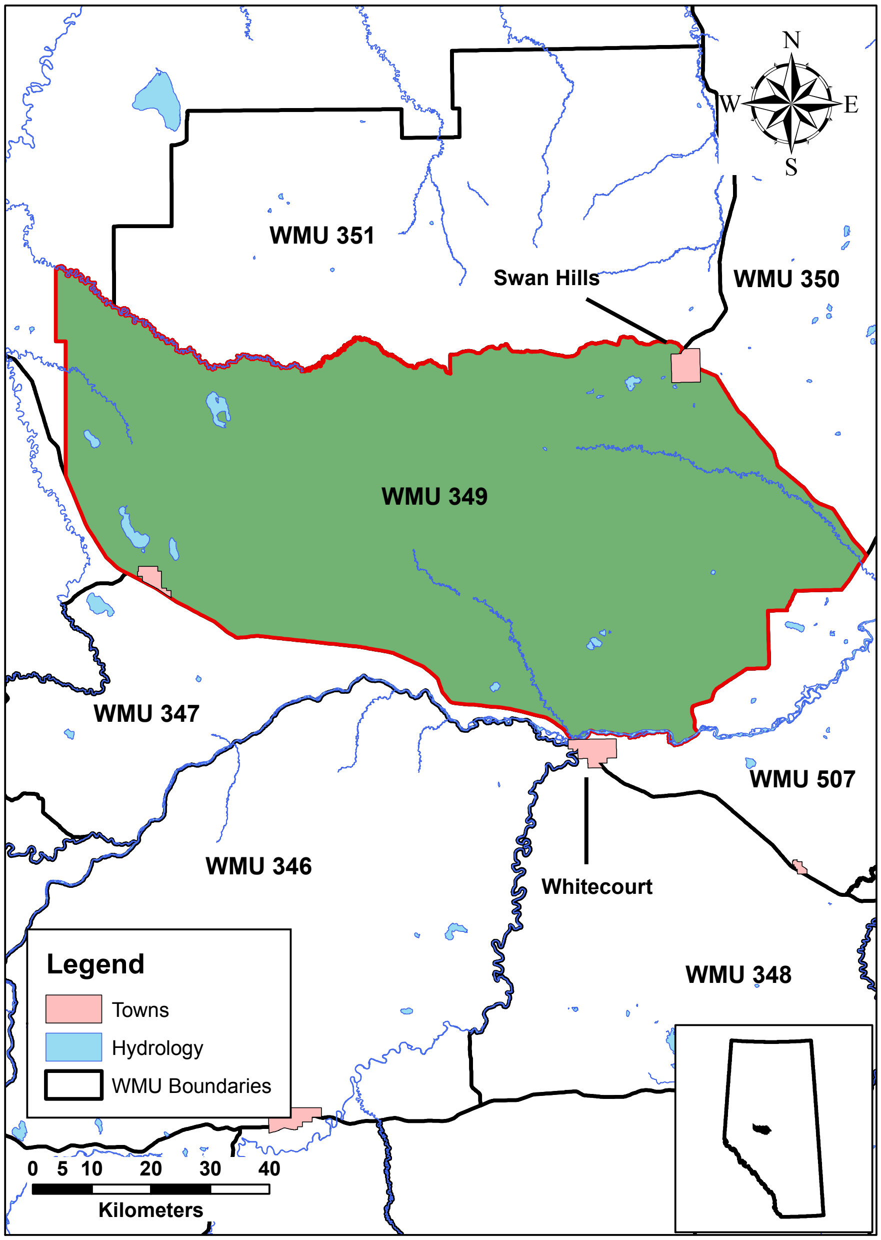


Figure 15. Location of Wildlife Management Unit 349 in Alberta.

We randomly chose five blocks for detailed surveys for each of the low, medium and high strata. Two crews of three plus a pilot conducted detailed surveys using two Bell 206 Jet Ranger helicopters between 17 – 20 January 2009. Crews consisted of at least two experienced observers; one in the front seat and the other behind the pilot. North-south lines were flown 400 m apart within each sample block. Pilots flew approximately 30 – 40 m above ground at a speed of 80 – 130 km/h, depending on cover type. We recorded all moose locations with a hand-held GPS. We made every attempt to sex and age animals unless forest cover and/or wind prevented safe or confident identification. We classified all moose 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 according to Table 1. Because of variability in the timing of antler drop and survey dates, comparisons of the percentage of large, medium, and small bulls across years was difficult. Observations of other ungulates (i.e., deer) were classified to species; gender was only confirmed if antlers were present. We recorded wolves and other species of interest, if observed.

During stratification flights, snow conditions were good and the sky was clear for both days with the temperature hovering around 0°C; however, winds from the northwest made it very turbulent. Conditions during intensive surveys were clear, with temperatures rising throughout the week, reaching approximately 5°C. Snow conditions deteriorated as the week progressed and were classified as marginal by the end of the survey, with bare stumps and exposed hilltops.

6.8.3 Results

We estimated the moose population was 1,969 ± 375 (90% CI = 19.1%), for a density of 0.30 moose/km^2, indicating a 40% decline in population since 2000 (Table 12). Demographic ratios were 24 bulls/100 cows and 37 calves/100 cows with a twinning rate of 1.4%. We observed eight bulls with antlers, of which seven were classified as yearlings and one as medium.

Table 12. Comparison of moose population and demographic estimates for Wildlife Management Unit 349.

Year	Population Estimate (90% confidence limits)	Moose/km^2	Ratio to 100 Females		Twinning Rate
			Males	Juveniles	
2009	1969 (19.1%)	0.30	24	37	1.4%
2000	3277 (18.5%)	0.51	29	37	3.3%
1997	2976 (19.7%)	0.46	22	33	4.5%
1993	3911 (18.7%)	0.65	15	48	--

Photo: Dave Jackson

6.9 Wildlife Management Unit 350 moose

Section Authors: Al Fontaine and Robb Stavne

Historically, WMU 350 was part of Alberta's Northern Moose Management Program and was surveyed annually over the winters of 1993/94 to 1997/98 (Lynch 1997). The WMU was again surveyed during the winter of 2001/02. Attempts were made to survey the WMU during the winter of 2005/06, but poor weather and snow conditions forced the cancellation of the survey in its early stages.

WMU 350 receives substantial hunting pressure by hunters from First Nations and Métis communities, and it is also a highly desirable WMU for recreational hunters given historical moose populations in the WMU, ease of access, and relative proximity to major urban centres. Therefore, regular moose surveys in WMU 350 are important to assess moose population status and trends in order to properly manage the resource. Current information on moose populations and distribution is also required for proper habitat and land use management.

6.9.1 Study area

WMU 350 is delimited to the north by the shorelines of Lesser Slave Lake and the Lesser Slave River from Kinuso to Smith, to the west and southwest by Highway 33 from Kinuso to the Peace Pipeline west of Fort Assiniboine, and to the east and southeast by the Athabasca River from Smith to the ferry on the Athabasca River west of Vega (Figure 16).

The town of Slave Lake and parts of the town of Swan Hills are found within the boundaries of the WMU. The only major lake present within the WMU is Mitsue Lake, which is surrounded by the Mitsue Lake Industrial Park. The waters of the Lesser Slave River from Smith to Slave Lake, and the Athabasca River from the southern end of the WMU to Smith, fall within the boundaries of the WMU. Two other major river systems found within the WMU are the Otauwau and Saulteaux rivers and their tributaries. These river systems are all buffered by habitats important to ungulates, especially moose.

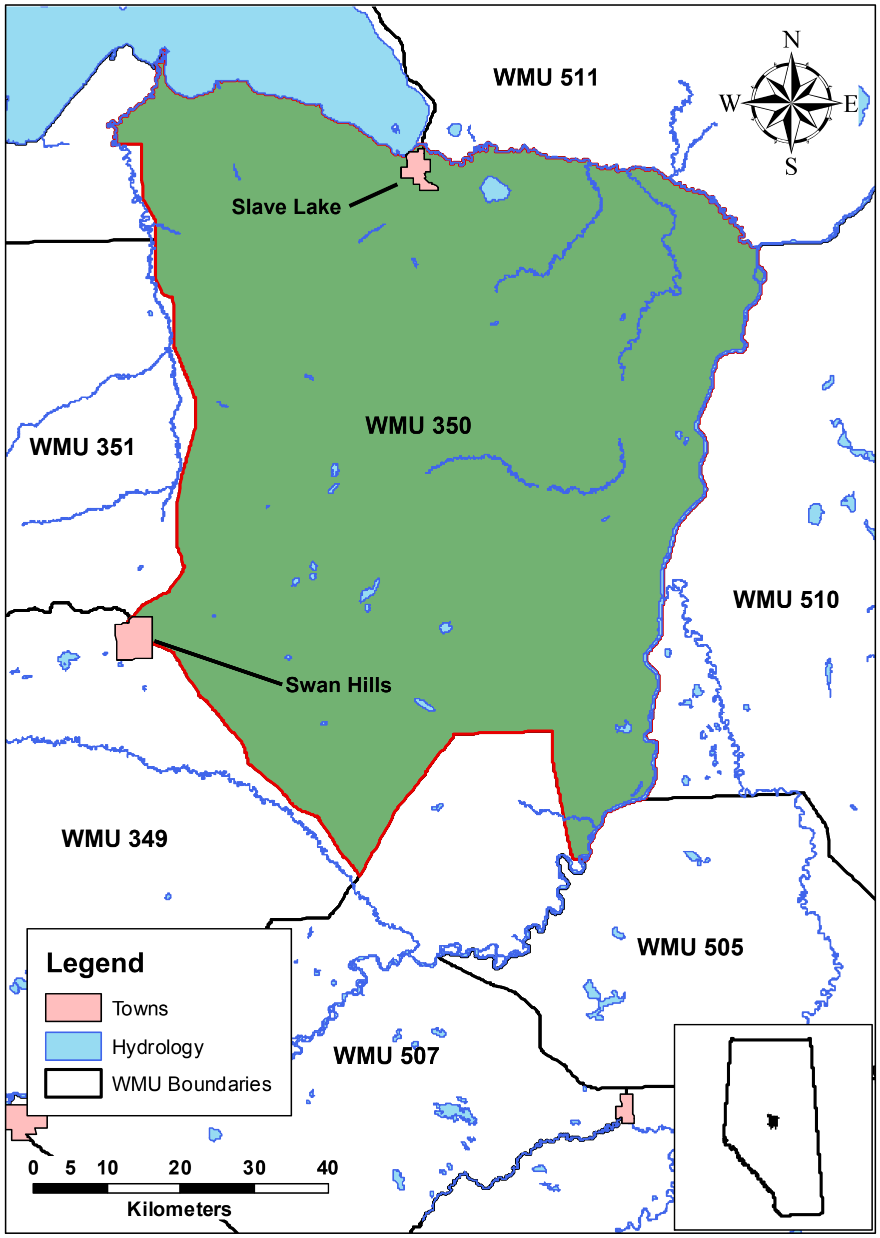


Figure 16. Location of Wildlife Management Unit 350 in Alberta.

The landbase in WMU 350 includes portions of the Central Mixedwood, Upper Foothills and Lower Foothills subregions, as described by the Natural Regions Committee (2006). Mixedwood forests of aspen and white spruce dominate the landscape. These are interspersed with stands of jack and lodgepole pine as well as black spruce and tamarack muskeg. Only two small portions of the WMU are under cultivation for agricultural purposes, the southeast tip and the northwest tip. The farmland in these two areas is dominated by tame hay and pasture lands, with some grazed mixedwood forest. The western half of the WMU is highly fragmented with logging cutblocks; however, cutblocks can be found throughout the WMU. Footprint from the oil and gas industry is pervasive on the landscape, but not to the extent observed in neighbouring WMU 351 to the west.

6.9.2 Survey methods

To assess moose populations in WMU 350, we conducted an AUS 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), in February 2009. We used two C-185 fixed-wing aircrafts equipped with wheels and a crew comprised of a pilot and three observers (ASRD and ACA) for the stratification flights. Stratification crews in each aircraft flew east-west transects across the WMU at 1 min latitude intervals between 10 – 12 February 2009.

We marked locations of moose and other wildlife using a GPS. We recorded waypoint numbers, numbers of moose observed, distance to animals, and side of the line (north or south) on stratification datasheets. Weather and observer information was also recorded on the datasheets at the start of the survey and afterwards, whenever these changed.

We divided the WMU into detailed survey blocks of common size (5 min latitude x 5 min longitude). We stratified detailed survey blocks according to the number of moose observed within each block during the stratification flights. Based on relative moose counts, we stratified survey blocks into low (0 – 1 moose), medium (2 – 5 moose), and high (> 5 moose) strata. As a result, 41 blocks were classified as low, 65 as medium, and 25 as high (131 blocks total).

We used two Bell 206 JetRanger helicopters to determine the number of moose within each of the randomly selected blocks on 13 – 15 February 2009. We flew each block east-west on flight lines spaced every 0.25 min of latitude (approximately 400 m) apart. On 13 February, both flight crews consisted of one pilot and three observers. On 14 and 15 February, one of the flight crews had only two observers in an effort to maximize flight times due to weight restrictions imposed by the charter company.

We classified all moose as antlered bulls, unantlered bulls, adult cows, unknown adults and calves. In addition to observations of moose, we recorded other wildlife sightings. We further classified bull moose into size classes based on antler development as outlined in Table 1. We recorded locations and numbers of moose observed on survey datasheets.

We judged snow cover and condition to be adequate for survey purposes, but these were not ideal. Snow depth averaged approximately 50 cm with very little fresh snow present. Some melt was present around trees and bushes, as well as on south-facing slopes and benches. Stumps and deadfalls were generally not covered by snow. Flying conditions throughout the survey were excellent, with little turbulence and good visibility.

We entered block survey results into a population estimate spreadsheet ("Quad6.xls") and calculated population parameters (e.g., population estimate, male:female:juvenile ratios, density, twinning rates).

6.9.3 Results

We calculated a population estimate for moose in WMU 350 of 2,999 ± 525 (90% CI = 17.5%) (Table 13). The overall density was 0.48 moose/km^2. Ratios of bulls and calves to 100 cows were 22 and 31, respectively. Of cows and calves we observed during detailed block surveys, 70.6% were single cows, 27.7% were cows with a single calf, and 1.7% were cows with twins for a twinning rate of 5.9%. Of observed bulls, 98% had already shed their antlers (50 of 51 observed bulls). Therefore, we could not make inferences regarding the distribution of bulls by antler class.

Table 13. Comparison of moose population and demographic estimates for Wildlife Management Unit 350.

Year	Population Estimate (90% confidence limits)	Moose/km^2	Ratio to 100 Females	
			Males	Juveniles
2009	2999 (17.5%)	0.48	22	31
2002	4561 (14.1%)	0.73	35	49
1998	3204 (14.0%)	0.51	29	32
1997	3593 (18.9%)	0.57	28	35
1996	3557 (19.5%)	0.57	25	39
1995	2701 (15.7%)	0.45	10	32
1994	2952 (18.9%)	0.51	23	45

6.10 Wildlife Management Unit 357 moose, mule deer, white-tailed deer and elk

Section Authors: Dave Stepnisky, Robb Stavne and Nathan Webb

Ungulates in WMU 357 were surveyed previously in 2000, 2003 and 2007. High moose numbers were observed during the 2007 survey, which led to increased numbers of antlerless moose tags being issued by ASRD in 2007. A detailed survey was required to determine the effect of the increased harvest on moose, deer and elk populations. Additionally, the relatively high use of this area by hunters and the high level of human-wildlife issues in this WMU also necessitated an updated inventory of moose and deer populations. This section summarizes the results and analysis of moose, deer and elk surveys conducted in WMU 357 in 2009.

6.10.1 Study area

WMU 357 contains all of the County of Grande Prairie No. 1, plus the Crown land portion north of the Wapiti River and the farmland in the Grovedale area (Figure 17). The WMU is bordered by the Saddle Hills to the north, the Smoky River to the east, and portions of the Wapiti River to the south. This area includes portions of the Peace River Parkland, Dry Mixedwood, Central Mixedwood, and Lower Foothills subregions, as described by the Natural Regions Committee (2006). Mixedwood forests of aspen and white spruce dominate the non-agricultural portions of the WMU, and are interspersed with peatlands and lotic river systems. Agriculture is prevalent in the Peace Parkland region in the central portions of the WMU, and is dominated by annual cereal and perennial forage crops, interspersed with small aspen stands, and ephemeral and permanent wetlands. Increased forestry activity at the Green/White Zone interface has generated a substantial amount of additional forage for moose.

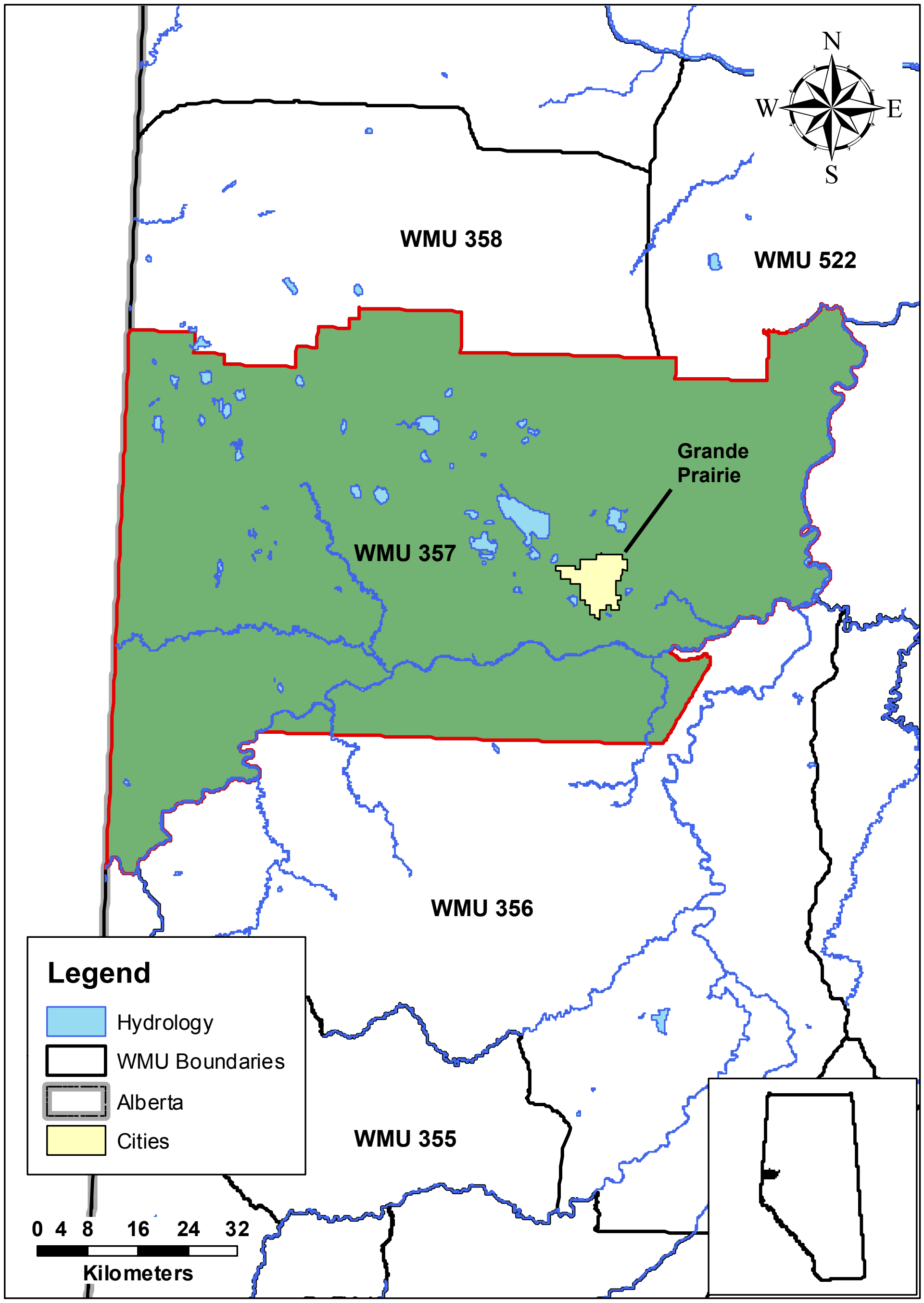


Figure 17. Location of Wildlife Management Unit 357 in Alberta.

6.10.2 Survey methods

Wildlife staff (ACA and ASRD) flew transects across WMU 357 using fixed-wing aircraft on 5 – 6 January 2009 to stratify the distribution of moose and deer across 146 sampling blocks. Air speed during stratification flights was approximately 150 km/h, and flight altitude was maintained between 60 and 90 m. Winds were calm and snow cover was complete. Visibility was generally excellent throughout the survey; however, light fog during the afternoon of 6 January prevented the completion of the western portion of one stratification line. Mean ground temperature was -26°C. We recorded locations of moose, deer, incidentally encountered elk, and other pertinent wildlife using a GPS.

We classified sample blocks according to the number of moose and deer observed during stratification flights following a modified Gasaway technique (Gasaway et al. 1986; Lynch 1997). Based on relative densities from stratification flights, we stratified survey blocks for moose into low (< 0.06/km^2), medium (0.06 – 0.185/km^2), and high (> 0.185/km^2) strata. For white-tailed and mule deer, we stratified survey blocks using a combination of information derived from transect surveys, as well as through application of local knowledge of animal concentrations, food sources, cover availability, and animal movement patterns in winter. In particular, deer are known to concentrate in areas with food sources such as non-harvested cereal grain swaths, or unprotected grain piles and livestock forage. Sample blocks were 5 min latitude x 5 min longitude (approximately 49 km^2). We randomly selected 19 sample blocks for intensive search by helicopter. The classification distribution of these blocks differed by species. For moose, seven of the sample blocks were classed as low, six as medium and six as high. For mule deer, the classification of survey blocks was broken down as 13 low and six medium. White-tailed deer classifications included 11 low survey blocks, seven medium and one high.

We used a Bell 206 helicopter to determine the number of moose and deer within each of the randomly selected blocks on 8 – 11 January 2009. We flew each block in an east-west orientation on flight lines spaced approximately 400 m apart, at 100 – 140 km/h, and at an altitude of approximately 30 m. Each flight crew consisted of three passengers: a navigator/recorder/observer up front, observer left-behind, and observer right-behind. Observers on each side of the helicopter scanned a lateral view approximately spanning 200 m from the flight line. We identified ungulates 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). In addition to observations of moose and deer, we also recorded sightings of elk, wolves or kill sites.

On 13 and 14 January, we used one helicopter to conduct complete counts of elk herds that were observed during both the stratification and intensive portions of the moose and deer survey, as well as those known to exist based on agricultural depredation complaints.

Adult males of all ungulate species were classed into one of three categories, as outlined in Table 1.

Conditions for rotary-wing surveys were generally good with excellent snow coverage. Temperatures varied from -4 to -18° C. Although winds were generally calm, heavy winds on 10 January resulted in marginally difficult flying conditions. Despite the wind on one day, observation conditions were excellent throughout all portions of the rotary-wing survey.

We entered data into a Gasaway population estimate spreadsheet ("Quad6.xls") and calculated population estimates, male:female:juvenile ratios, and population densities.

6.10.3 Results

Moose — We estimated the population to be 3,087 ± 367 moose (90% CL = 11.9 %) (Table 14). There were 35 bulls/100 cows and 60 calves/100 cows. Twinning rate was 11.1%, and the overall density was 0.45 moose/km^2. Of bulls that were observed during detailed surveys, 29.3% had already shed their antlers. Of bulls still 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.

Mule Deer — We estimated the population to be 3,550 ± 689 mule deer (90% CL = 19.4%) (Table 14), for a density of 0.51 mule deer/km^2. There were 46 adult bucks and

111 fawns/100 does, with a twinning rate of 17.2%. The proportion of large-antlered bucks was lower than past surveys (Table 15), but may be underestimated due to the variation in timing of antler drop among survey years.

White-tailed deer —We estimated the population to be 4,883 ± 1,753 white-tailed deer (90% CL = 35.9%) (Table 14). There were 33 bucks and 114 fawns/100 does, and a twinning rate of 21.1%. We observed an additional 386 white-tailed deer in the single high strata sampling block, for a total population estimate of 5,269 white-tailed deer.

Elk — We observed a total of 1,605 elk, with 13 bulls/100 cows and 44 calves/100 cows. This was a minimum count of elk; since we did not use a randomized design, we could not estimate confidence intervals.

Table 14. Comparison of 2009 aerial survey results in Wildlife Management Unit 357 with previous surveys.

Species	Year	Population Estimate (90% confidence limits)	Animals/km²	Ratio to 100 Females	
				Males	Juveniles
Moose	2009	3087 (11.9%)	0.38	35	60
	2007	4720 (11.3%)	0.68	29	43
	2003	4268 (13.5%)	0.62	30	54
	2000	2636 (16.3%)	0.38	23	60
Mule deer	2009	3550 (19.4%)	0.51	46	111
	2007	3861 (25.4%)	0.56	37	53
	2003	4235 (16.1%)	0.61	41	85
	1998	3924 (20.7%)	0.57	31	100
White-tailed deer	2009	4883 (35.9%)	0.70	33	114
	2007	3518 (23.0%)	0.51	21	43
	2003	3143 (19.7%)	0.46	26	117
	1998	2372 (32.3%)	0.34	47	103

Table 15. Comparison of age structure of male ungulates in Wildlife Management Unit 357.

Species	Year	Antler Classification		
		Small	Medium	Large
Moose	2009 (n = 75)	53%	43%	4%
Mule deer	1998 (n = 78)	56%	21%	23%
	2003 (n = 80)	43%	36%	21%
	2007 n = 124	43%	46%	11%
	2009 (n = 73)	45%	52%	3%
White-tailed deer	1998 (n = 69)	35%	45%	20%
	2003 (n = 52)	48%	38%	14%
	2007 (n = 74)	51%	31%	18%
	2009 (n = 98)	40%	46%	10%
Elk	2009 (n = 91)	71%	29%	0%

6.11 Wildlife Management Unit 509 moose

Section Author: Christine Found

Moose are an important ungulate found throughout most of the northern boreal forest, as well as in agricultural areas along the boreal/parkland "fringe" where there are few predators and abundant food sources (Arsenault 2000; Rippin 2001). They are well-adapted to areas with cold winter temperatures and heavy snowfall, although moose in northeastern Alberta typically occur at low population densities (Lynch 1999) and sympatrically exist with other ungulates including white-tailed deer, mule deer, elk and woodland caribou. Moose are a key biological component of boreal ecosystems (Rippin 2001), are an important prey species for generalist predators such as wolf and black bear, and are highly valued as a big game species by aboriginal, resident and non-resident hunters. They are also aesthetically appealing to the public as "watchable wildlife", although vehicle-animal collisions may be frequent where human and moose densities are high. Moose are one of the main species of ungulates managed by wildlife biologists in Alberta, and a thorough understanding of their population dynamics, distribution and movements is required. This section presents results of the 2009 survey of WMU 509. Specifically, this survey was designed to obtain population information on local moose populations.

6.11.1 Study area

WMU 509 is relatively diverse in its habitat and landforms, being situated on the transition zone between agricultural lands and northern boreal mixedwood forest (Figure 18). It is bordered by Calling Lake in the north and the Town of Athabasca in the south. The Athabasca River traverses the west side of the WMU and turns northward to divide the area into two halves; numerous drainages and watercourses from this main river system branch throughout the WMU. In the northern portion of the WMU, large expanses of mixedwood forest are interspersed with treed and open fens. In the south, much of the forested area has been cleared for agriculture. Agriculture is the main human activity in WMU 509, including a number of hybrid aspen tree farms. Timber harvest and oil and gas activities also occur throughout the forested Crown lands.

Figure 18. Location of Wildlife Management Unit 509 in Alberta.

6.11.2 Survey methods

We stratified the study area for moose densities (Gasaway et al. 1986) using a fixed-wing aircraft (Cessna 206) from 10 – 13 December 2008. We used three observers, including a crew leader/navigator in the front passenger seat. During stratification, the pilot flew the aircraft at approximately 150 km/h and approximately 100 m above ground. Height and speed of the aircraft varied slightly with the amount of tree cover and sighting conditions. The stratification lines occurred 1 min of latitude (1.6 km) apart and observers recorded individuals seen within 250 m of each side of the aircraft. Although the stratification lines were flown across the entire WMU, we probably missed some individuals due to the distance between lines. However, the intent of the stratification was to determine whether moose numbers were low, medium or high within each sampling block (5 min latitude x 5 min longitude in size) situated in a grid across the entire WMU (Glasgow 2000). Approximately 20% of the blocks were classified into each of the low and high categories.

We randomly selected nine sampling blocks (three per stratum) from the grid and intensively searched these by helicopter (Bell 206L) on 15 and 17 – 19 December. During surveys of sampling blocks, the aircraft flew at 100 km/h and approximately 60 m above ground level. Three observers conducted the survey, including the crew leader/navigator in the front passenger seat. Flight lines occurred 15 sec of latitude (400 m) apart and were flown east-west, allowing a full census of moose and other wildlife within each sampling block. All encountered moose, white-tailed deer and elk were counted and classified to age (juvenile vs. adult) and sex. Male cervids were identified by the presence of antlers, although moose cows were confirmed by the presence of a white vulva patch or if an adult was seen in the company of a calf. Due to the timing of the survey (early winter), we were fairly confident that antler drop had not yet occurred for most male moose, elk and deer. Therefore, the classification for these species is probably accurate. We discontinued the classification of white-tailed deer on the final survey day due to time constraints; however, we were still able to determine a buck:doe:fawn classification for at least 100 does from the sample obtained. All other wildlife sightings were also recorded during the survey and a GPS waypoint taken.

Because the sample variance for the medium strata was still quite high after nine blocks (there was very little variability in the moose counts for the low and high blocks), we flew two additional medium blocks for a total of 11 sampling blocks.

Following the helicopter survey, we compiled the data for moose, entered them in the "Quad6.xls" program developed as per the Gasaway population model (Gasaway et al. 1986), and calculated a population estimate and confidence interval. We did not calculate deer population estimates for the WMU because we based stratification on moose alone. Survey conditions during this period were extremely cold (< -20°C), and varied with some scattered snow flurries, hazy skies and winds, but visibility of the animals was very good with complete ground cover.

6.11.3 Results

We observed a total of 213 moose during the intensive helicopter survey of the 11 sampling blocks. This translated to a population estimate of 921 ± 220 (90% CL= 23.9%) and a density estimate of 0.32 moose/km^2 for WMU 509 (Table 16). We were able to classify all the individuals observed, for a ratio of 22 bulls:100 cows:58 calves. The prevalence of ticks appeared very low, with only three calves showing minor infestations.

We did not calculate a population estimate for white-tailed deer. However, we observed 561 deer during the survey including 75 bucks, 323 does and 132 fawns, for a ratio of 23 bucks:100 does:41 fawns. We were unable to classify 31 deer. In addition, we classified five herds of elk during the rotary-wing surveys, including one group of 19 (10 cows, 7 bulls, 2 calves), 14 (10 cows, 1 bull, 3 calves), 8 (7 cows, 1 calf), 4 (all bulls), and a group of two bulls. Only three bull elk from these herds were large enough to be described as "6-point elk". We observed another large (50+) herd of elk in one of the medium stratum blocks, but this was thought to belong to an elk farming operation.

Table 16. Moose population statistics for wildlife management units (WMU) adjacent to and including Wildlife Management Unit 509.

WMU	Year	Population Estimate (90% confidence limits)	Moose/km²	Ratio to 100 Females	
				Males	Juveniles
509	2008	921 (23.9%)	0.32	22	58
509	2001	720 (25.3%)	0.28	83	72
503	2007	--	--	39	51
506	2003	--	--	33	58
510	2001	1245 (24.3%)	0.35	17	53
512	2004	1461 (31.8%)	0.19	40	53
516	2002	751 (15.5%)	0.19	86	76

6.12 Wildlife Management Unit 525 moose

Section Authors: Nathan Carruthers and Dave Moyles

Aerial ungulate surveys are invaluable for setting license numbers for resident and non-resident hunters, for ungulate depredation discussions, and for habitat protection efforts. Moose in WMU 525 were surveyed previously in 1995 and 2002. The winter of 2006/07 was particularly severe in WMU 525, with deep snow persisting through late winter and a high prevalence of ticks documented in many of the neighbouring WMUs. WMU 525 is a destination for aboriginal and recreational moose hunters. Oil and gas development has increased both quantity and quality of access in recent years, and moose hunters have taken advantage of this increased access resulting in relatively high hunting pressure on moose in WMU 525. This combination of factors necessitated an updated population estimate with age and sex ratios for moose in WMU 525. This report contains the results and analysis of the moose survey conducted in WMU 525 in 2009.

6.12.1 Study area

WMU 525 falls primarily within the Municipal District of Clear Hills. In the south, the WMU is bordered by the Canfor east-west road, which runs along the southern edge of the Clear Hills (Figure 19). The western boundary is the Alberta-British Columbia border and portions of the Notikewin River-Square River and Doig River form the northern boundary of the WMU. WMU 525 is almost completely Crown land and includes portions of the Lower Foothills, Lower Boreal Highlands and Upper Boreal Highlands natural subregions, as described by the Natural Regions Committee (2006). Mixedwood forests of aspen, pine and spruce dominate the southern hills of the WMU. Central and northern portions of the zone combine spruce and pine-dominated forest with peatlands and several lotic systems. Forestry activity in the eastern and southwestern portions of the zone has created additional forage for moose. Increased oil and gas development has increased both quantity and quality of access in recent years. Attempts to limit access have not been effective. Portions of the central and northern portions of the zone remain relatively remote.

6.12.2 Survey methods

Wildlife staff from ACA and ASRD flew transects across WMU 525 using fixed-wing aircraft (Cessna 206) on 15 – 16 February 2009 to stratify the distribution of moose across 127 sampling blocks, in preparation for detailed surveys of moose using rotary-wing aircraft. We flew along every minute of latitude within the WMU, as opposed to the common practice of not flying on the boundary lines of latitude between survey blocks. We recorded the location of moose and other incidentally encountered wildlife as being north or south of the line. We plotted GPS locations of animals and aircraft flight tracks to ensure that all sightings were recorded in the proper survey block. Although the additional flying did add to the overall cost, the additional data were useful for an effective stratification. Air speed during stratification flights was approximately 150 km/h, and flight altitude was maintained between 60 – 90 m. Winds were calm and snow cover was complete, although some melting had occurred. Visibility was generally excellent throughout the survey.

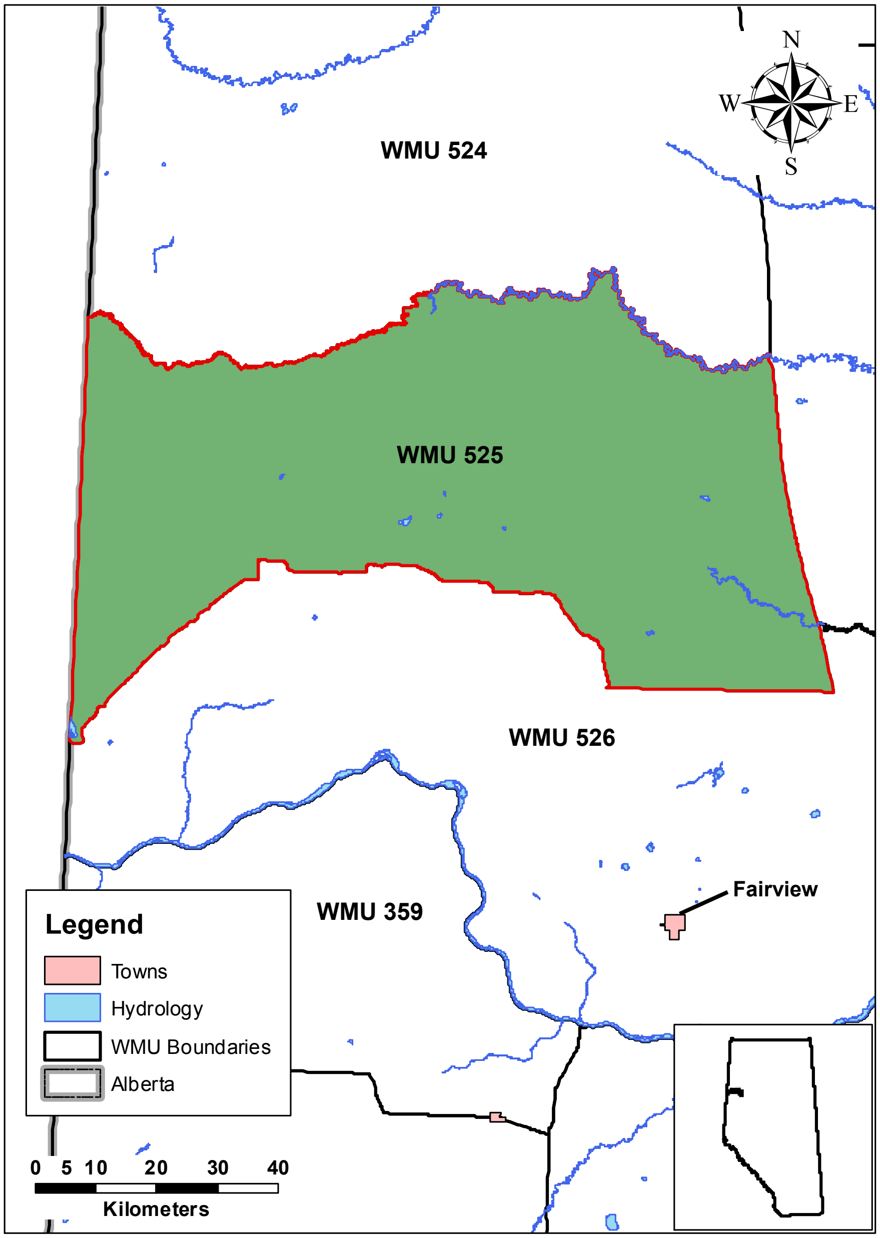


Figure 19. Location of Wildlife Management Unit 525 in Alberta.

We classified sample blocks according to the number of moose observed during fixed-wing stratification flights following a modified Gasaway technique (Gasaway et al. 1986; Lynch 1997). Based on counts, we classified survey blocks for moose as low (0 or 1 moose observed), medium (2 – 4 moose observed), and high (≥ 5 moose observed). Following this initial classification, we re-examined blocks based on relative densities from stratification flights, as well as application of local knowledge of animal concentrations, food sources, cover availability, and animal movement patterns in winter. After this second iteration, we reclassified several blocks to better reflect their true size and/or historic high and low density pockets. We randomly selected 19 sample blocks for intensive search by helicopter. Of sample blocks flown, five were classed as low, 10 as medium, and four as high.

We used Bell 206 helicopters to count and classify moose within each of the randomly selected blocks on 18 – 20 February 2009. We flew blocks in an east-west orientation on flight lines spaced approximately 400 m apart, at 100 – 140 km/h, and at an altitude of approximately 30 m. Each flight crew consisted of three passengers: a navigator/recorder/observer up front, observer left-behind, and observer right-behind. Observers on each side of the helicopter scanned a field of view approximately 200 m wide. We identified all moose 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). In addition to observations of moose, we also recorded sightings of elk, deer, wolves or kill sites.

Conditions for rotary-wing surveys were generally favourable with good snow coverage. Daytime temperatures varied from -20°C on 18 February to 0°C on 20 February. The warm weather on 20 February generated some concern that moose were seeking shelter in the cooler spruce stands, specifically in the sample blocks with more mixedwood and cutblocks. Winds were generally calm, providing excellent flying conditions.

6.12.3 Results

We estimated 1,349 ± 241 moose (90% CI = 17.9%) (Table 17). There were 24 bulls/100 cows and 17 calves/100 cows. Twinning rate was 3.6%, and the overall density was 0.23

moose/km². No comparison of age structure of adult male moose could be completed in 2009, because all bulls observed had shed their antlers.

Table 17. Comparison of 2009 results with those from the previous survey of moose in Wildlife Management Unit 525.

Year	Population Estimate (90% confidence limits)	Moose/km²	Ratio to 100 Females: Males	Ratio to 100 Females: Juveniles
2009	1349 (17.9%)	0.23	23	17
2002	1964 (18.1%)	0.34	17	43

6.13 Wildlife Management Unit 527 moose, mule deer and white-tailed deer

Section Author: Dave Moyles

Ungulate populations increased throughout the Peace Country agricultural areas during the period of seven consecutive mild to average winters from the winter of 1998/99 to 2005/06 (ASRD – Fish and Wildlife Division, unpublished data). These increases created both excitement from hunters and naturalists, and concerns and complaints from residents dealing with increases in crop and haystack depredation and with increases in ungulate-vehicle collisions. ASRD attempted to reduce ungulate populations by increasing hunting pressure and harvests through several different initiatives, including increasing season lengths, allowing hunting on Sundays in White Zone areas in the Peace Country, increasing numbers of hunting licenses and, for antlerless mule deer, having three tags per hunting license in WMU 527. In past years, elk herds were located and the varying amounts of depredation in these locales was determined. Given the intensive management effort, ASRD needed to determine current populations to assess impacts of the increased hunting pressure and effects of the past winter.

6.13.1 Study area

WMU 527 is bordered by the 25th base line (northern boundary of Township 96) to the north, the Peace River to the east, Highway 684 and Highway 35 to the southwest, and bordered on the west by the TransCanada Peace Pipeline from its intersection with the Whitemud River to its intersection with the 25th base line (Figure 20). This WMU is relatively large at 6,767 km^2 and dominated by settlement and agriculture, with only 37% in the Green Zone. There are two main communities (Manning and Peace River), several smaller communities (including Dixonville, North Star, Notikewin and Deadwood), acreage developments near Peace River, and farms throughout this WMU. This WMU is dissected by tributaries to the Peace River, including the Whitemud, Notikewin, Buchanan, Hotchkiss and Meikle rivers. These river valley complexes provide escape and wintering habitat for all ungulate species, while the agricultural areas provide feeding areas.

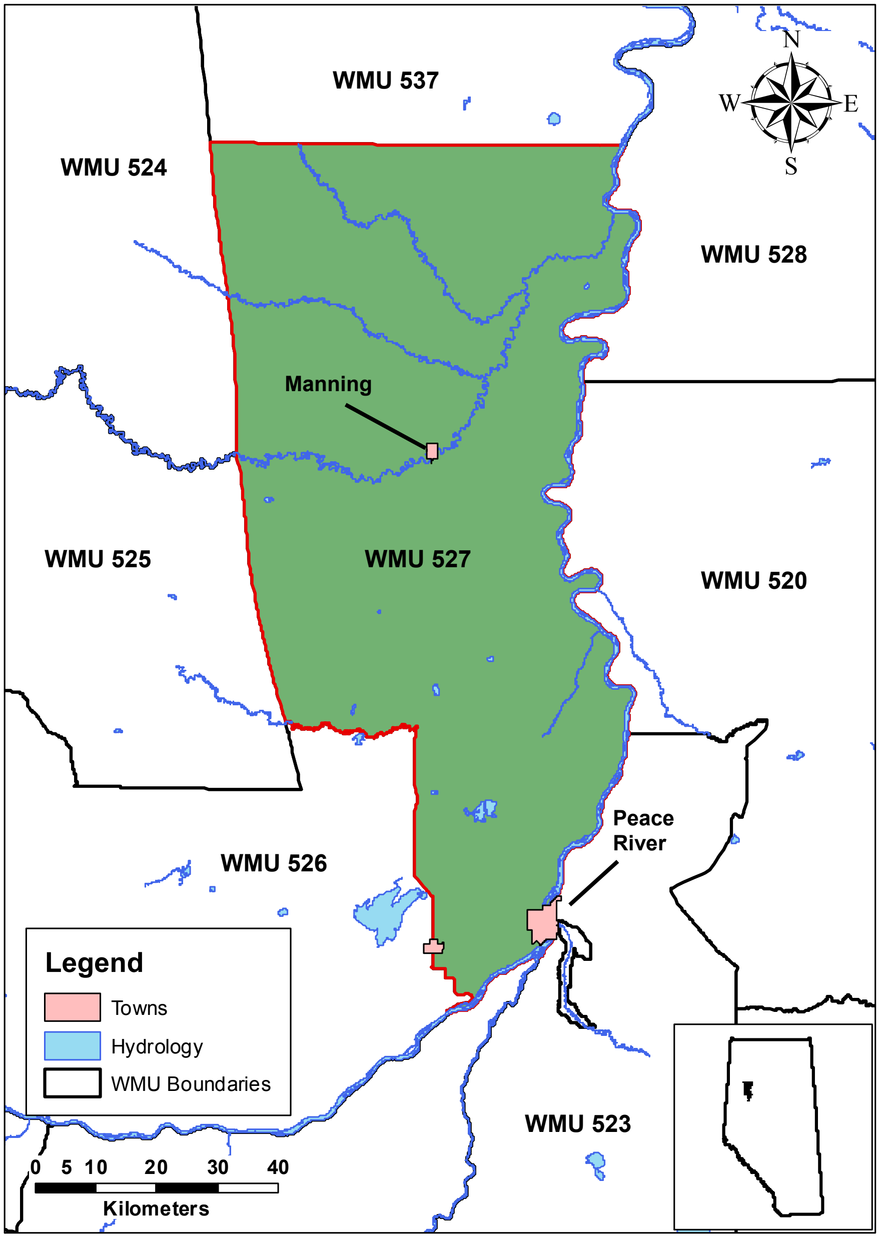


Figure 20. Location of Wildlife Management Unit 527 in Alberta.

6.13.2 Survey methods

We conducted surveys for moose, mule deer and white-tailed deer as per Lynch (1997). We used two Cessna 206 aircraft on 22 and 23 January 2009 to complete the stratification flights of four transects through each survey block. Transects were spaced 1 min of latitude apart (~1.6 km), and lines were flown in an east-west direction. Each crew consisted of two observers, one in the front and one sitting behind the pilot. For each sighting of wildlife, the front observer took a waypoint using a hand-held GPS and recorded the sighting. Crews circled deer to obtain a complete count, if the observers believed that more deer were present. Observers made no attempt to classify any ungulates to age or sex during stratification flights. Conditions were generally favourable, with good depths of relatively fresh snow and little wind and turbulence. We lost approximately 1.5 d of the survey to excessive cold, with temperatures to -37°C.

We initially classified survey blocks into low, medium or high strata for each species (moose, white-tailed deer and mule deer) separately, based on the number of each ungulate species observed. We adjusted up to the next stratum blocks with significant areas of river valley, a high occurrence of depredation complaints, or with local knowledge that indicated a high density of ungulates.

We used two crews in Bell Jet Ranger 206B helicopters on 24 – 27 January, and one crew on 28 January to conduct intensive searches of survey blocks. In total, we searched 24 survey blocks with varying classifications for the three species. We flew transects orientated east-west that were spaced to ensure full coverage of the survey block; in this WMU usually a separation of 0.25 min of latitude was sufficient. We made every attempt to classify all ungulates observed, unless the animals were in close proximity to farmyards or domestic livestock. We classified all moose observed as either adults or calves based on body size and length of the nose; we considered all yearling moose as adults. We classified all adult moose as cows if a vulva patch was present. Twenty four bulls (22%) still had antlers, while all other bulls were classified as males because of the absence of a vulva patch. We classified deer to species, and then to age based on body size and length of the muzzle. We classified male adult deer with antlers according to Table 1.

We recorded waypoints for all elk observed during fixed-wing surveys, but made no effort to classify elk. During the rotary-wing intensive counts, we classified elk as either adults or calves based on body size and length of the muzzle. We classified male elk according to Table 1.

6.13.3 Results

We estimated the moose population to be 3,983 ± 665 (90% CI = 16.7%), with density of 0.59 moose/km^2 (Table 18). Ratios of bull and calves to 100 cows were 27 and 38, respectively. Only one moose showed evidence of winter ticks; an adult cow was approximately 30% 'rubbed' on both flanks. We estimated the mule deer population to be 3,174 ± 555 (90% CI = 17.5%), with a density of 0.47 deer/km^2 (Table 18). The ratio of bucks and fawns to 100 does was 56 and 110, respectively. The white-tailed deer population has increased to 3,210 ± 713 (90% CI = 22.2%), with a density of 0.47 deer/km^2 (Table 18). The ratio of bucks and fawns to 100 does was 35 and 117, respectively.

We recorded 36 different observations of elk during the survey, for a minimum count of 488 elk. We observed 25 bulls/100 cows and 25 calves/100 cows. We summarized the size of antlered mule deer and elk in WMU 527 (Table 19).

Table 18. Population estimates and herd composition of moose, mule deer and white-tailed deer in Wildlife Management Unit 527.

Species	Year	Population Estimate (90% confidence limits)	Animals/km^2	Ratio to 100 Females	
				Males	**Juveniles**
Moose	2009	3938 (16.7%)	0.59	27	38
	2000	2039 (--)	0.30	25	49
Mule deer	2009	3174 (17.5%)	0.47	56	111
	2000	1941 (--)	0.29	15	150
White-tailed deer	2009	3210 (22.2%)	0.47	35	117
	2000	642 (--)	0.10	6	170

Table 19. Antler classifications of mule deer and elk in Wildlife Management Unit 527.

Species	Year	Antler Classification		
		Small	Medium	Large
Mule deer	2009	45%	46%	9%
	2000	77%	17%	6%
Elk	2009	57%	40%	3%

6.14 Wildlife Management Unit 529 moose

Section Authors: Todd Powell and Ashley Blackwood

Moose are the primary big game species in WMU 529, providing recreational hunting opportunities and subsistence for many residents. Our objectives for this survey were to obtain a moose population estimate for WMU 529 and compare this to surrounding WMUs and with past estimates. Aerial game surveys provide population and density estimates, as well as habitat use and distribution patterns. These data enable ASRD to determine hunting license allocations and discuss population condition. When conducted at regular intervals (ideally every five to seven years in northeast Alberta), surveys also offer valuable data for assessing ungulate and other wildlife population trends. Coincidental data was also gathered for other species, particularly white-tailed deer and woodland caribou. These data provide valuable information on distribution and population levels for these species.

6.14.1 Study area

WMU 529 is located southeast of Fort McMurray. It is bordered by the Clearwater River to the north, a combination of the Christina River, a tributary and the CNR railroad to the west, the Winifred River to the south, and the Saskatchewan border to the east (Figure 21). It has an area of just over 4,400 km^2 and is comprised primarily of northern boreal mixedwood forest, with some areas of disturbance due to forest harvest and oil and gas exploration, mostly in the southern area of the WMU. Substantial waterbodies within the WMU include Gordon, Gypsy, Birch, Garson, North Watchusk and South Watchusk lakes. Key summer and winter ungulate habitat occurs throughout the Clearwater and Christina river corridors and the Bohn caribou range is found in the southern half of the WMU. Gypsy Lake Wildland Provincial Park is also included within the WMU boundaries.

6.14.2 Survey methods

We stratified WMU 529 for moose densities using a Cessna 206 fixed-wing aircraft on 10 – 15 February 2009. We prepared flight maps to aid in navigation using ArcGIS 9 and we displayed these during flights using Arcpad installed in a Go Book. We overlaid a 30-sec latitudinal grid, which is equivalent to a 0.9 km separation between lines, on the WMU and it was flown in sequence. During flights, the aircraft travelled at approximately 100 m above ground and 140 km/h. This allowed observers to detect animals within 250 – 300 m on either side of the aircraft, for approximately 50% coverage of the WMU. Three observers, including the navigator in the front, were required for the survey. We recorded species, number of animals, and distance from plane (distance class) with a waypoint taken using a GPS unit. In addition to the standard stratification process, we used a system of calibrated strut and window marks, along with precise altitude measurement, to determine the distance of each animal from the aircraft's line of travel and to place animals into one of five perpendicular distance classes. The results of this additional census method will be reported elsewhere.

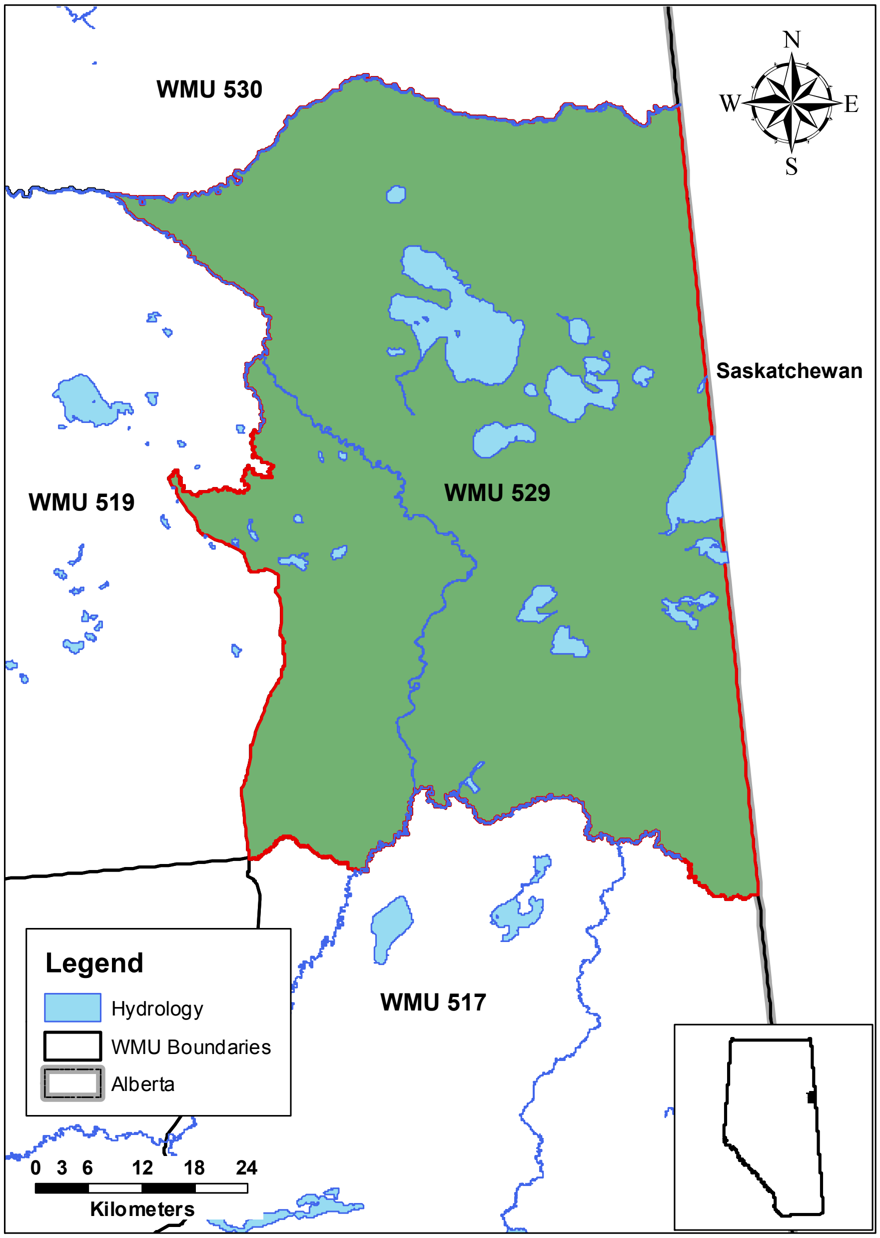


Figure 21. Location of Wildlife Management Unit 529 in Alberta.

We used stratification information to determine the stratum for each sampling block based on moose density. We established a sampling block grid using ArcGIS 9.1 by dividing the WMU into blocks measuring 5 min longitude by 5 min latitude, resulting in blocks of about 48 km^2. Stratification observations were digitally rendered onto the sampling block grid. Given air speed and waypoint record time, a lag may occur between when an animal was observed and the location digitally recorded. To ensure accurate stratification, we assessed waypoints that occurred near a sampling block boundary based on direction of air travel. We re-assigned waypoints to the appropriate block if they fell within 100 m of the block boundary and conditions warranted. We then ranked sampling blocks according to indices of moose density, calculated as the number of individuals observed per km^2 within each block. We categorized sample blocks into one of three strata: low, medium or high. We classed approximately 12% of the blocks as high, 30% as medium, and 58% as low.

We randomly selected 15 sampling blocks (five per stratum) based on moose density, 14 of which were intensively searched using a Bell 206 helicopter between 17 – 19 February. Navigation was aided by ArcPad displayed on an Itronix Go Book, with position indicated on screen, plus a GPS in view of the pilot. We flew blocks in an east-west direction with a flight line separation of 400 m (0.25 min or 15 sec of latitude). We recorded observations within 200 m of either side of the aircraft, allowing for total coverage of the area. Altitude was approximately 90 m above ground and air speed was approximately 80 km/h, reaching 100 km/h in more open areas. We classified moose using four criteria: presence of antlers or pedicel scars, presence of vulva patch, face, body shape and pigmentation, and behaviour. We recorded all wildlife observations on forms with locations digitally recorded. Three observers conducted the survey, including the navigator in the front. Overall, survey conditions were good, with complete snow cover, overcast or clear skies, and light winds.

6.14.3 Results

The stratification portion yielded observations of 97 moose, 15 white-tailed deer, five woodland caribou, one grey wolf and five sharp-tailed grouse. During the intensive search of 14 sampling blocks, 37 moose (9 bulls, 15 cows, 13 calves), four white-tailed deer, and 39 sharp-tailed grouse were observed. The Quadrat Survey Method program generated a moose population estimate of 157 ± 42 (90% CI = 26.8%), with a density of 0.04 moose/km^2 (Table 20). We estimated the sex ratio at 60 bulls/100 cows/87 calves based on observed moose within and adjacent to surveyed blocks (Table 20).

Table 20. Results of the 2009 random stratified block survey and previous surveys in Wildlife Management Unit 529.

Year	Population Estimate (90% confidence limits)	Moose/km^2	Ratio to 100 Females	
			Males	Juveniles
2009	157 (26.8%)	0.04	60	87
2006[1]	259 (--)	0.06	--	--
1998[2]	665 (--)	0.15	65	44
1993	477 (22.9%)	0.11	87	53

[1]stratification flight only; estimate without confidence interval or limits.

[2]only blocks flown; stratification achieved by Reconnaissance Vegetation Index assessment.

6.15 Southern Rockies moose

Section Author: Greg Hale

Report not received from author. Please contact author for information on this survey.

7.0 POPULATION RECRUITMENT SURVEYS

7.1 Caribou demographics

Section Author: Dave Hervieux

Report not received from author. Please contact author for information on this survey.

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