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**AERIAL SURVEY OF THE OLDMAN
RESERVOIR,
SOUTHWESTERN ALBERTA,
28 February to 1 March 1994**

Prepared for

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EXECUTIVE SUMMARY

A linear transect aerial survey with 100% ground coverage was conducted over a core area of the Oldman Reservoir basin and environs during 28 February and 1 March 1994. The survey was incomplete for a small portion of the study area, the South Castle River valley above full supply level. Nine regional control blocks were also surveyed with the same linear transect technique. Comparable information obtained from earlier aerial surveys of the reservoir study area and control blocks are presented.

Within the core reservoir study area (the surrounding area up to full supply level), a total of 739 mule deer were observed among 57 groups. Seventeen of 23 radio-collared deer in the surveyed area were observed, providing a visibility factor of 74%. Using this empirical information we estimate that the mule deer population around the reservoir was at least 740 deer but possibly as large as 930 deer. The current population estimate continues the increasing trend that was evident in earlier aerial survey results.

Mule deer were classified with the aid of binoculars into adult male, adult female and fawn classes. Only groups with complete classifications were summarized for the winter age/ sex profile. The adult male and fawn classes are considered to be underrepresented because antler drop had begun by the end of February, and fawns are difficult to distinguish with the aerial technique under the best conditions. We had limited opportunity to classify deer by landing the helicopter. The age/ sex information suggests high recruitment and survival of fawns in the population with a fawn:female ratio of 58:100. Fawns comprised 36% of the population. The ratio of males to females was 4:100. Age/sex ratios from classification counts of fawns and males are comparable to previous surveys.

The majority of mule deer were observed in large groups on agricultural uplands or in shrubland habitat associated with coulee formations along the edge of the reservoir. Compared to pre-reservoir filling, in general mule deer habitat use has changed from coulee shrublands to agricultural uplands.

In terms of regional population trends, results of the control block surveys (six surveys conducted since 1978) suggest that the mule deer population in surrounding foothills habitats are declining. Changes in the number of other ungulates show fluctuations not seen in the mule deer counts. Overall, the number of moose observed suggest a relatively stable population while white-tailed deer and elk counts have fluctuated widely.

ACKNOWLEDGMENTS

This aerial survey contains the results of a combined effort between Axys Environmental Consulting Ltd. (formerly the Delta Environmental Management Group Ltd.) (the Delta Group), Alberta Environmental Protection, Development and Operations Division, Water Management Headworks Branch, and Alberta Environmental Protection, Fish and Wildlife Services. Mr. John Mahoney, project biologist, Water Management Headworks Branch coordinated the study with the Axys Group. John Mahoney also provided a review of the draft which improved the report. Mr. Colin Markle (Blairmore office) and Mr. Richard Quinlan (Claresholm office) of Alberta Fish and Wildlife Services assisted with the aerial survey and data collection. Mr. Jim Potts, Water Management Headworks Branch, relocated radio-collared deer in the western study area.

We would like to acknowledge Mr. Mike Vermet of Alberta Public Works, Supply and Services Division, who piloted the survey.

TABLE OF CONTENTS

	Page
Executive Summary	ii
Acknowledgments	iii
Table of Contents	iv
List of Figures	v
List of Tables	vi
List of Appendix Tables	vii
 1.0 INTRODUCTION	 1
1.1 BACKGROUND	1
1.2 OBJECTIVE	2
 2.0 STUDY AREA	 3
2.1 LOCATION AND LAND USE	3
2.2 DESCRIPTION OF THE RESERVOIR	3
 3.0 METHODS	 5
3.1 AERIAL SURVEY TECHNIQUE	5
3.2 AERIAL SURVEY INTENSITY	6
3.3 ACCURACY OF THE SURVEY	9
 4.0 RESULTS AND DISCUSSION	 10
4.1 MULE DEER POPULATION	10
4.1.1 Population Estimate	10
4.1.2 Distribution and Group Size	12
4.1.3 Age and Sex Composition	14
4.1.4 Habitat Use	16
4.1.5 Regional Population Trend	17
4.2 OTHER UNGULATES	17
4.2.1 Regional Population Trends	19
 5.0 SUMMARY AND CONCLUSIONS	 20
 6.0 LITERATURE CITED	 21
 7.0 APPENDIX	 22

LIST OF FIGURES

	Page
Figure 1. Oldman Reservoir in southwestern Alberta showing full supply level.....	4
Figure 2. Oldman Reservoir showing survey flight path.....	7
Figure 3. Location of Fish and Wildlife Services Survey Control Blocks	8
Figure 4. Winter aerial surveys of the Oldman Reservoir and environs, 1985 to 1994.....	10
Figure 5. Location and number of ungulates observed during mid-winter aerial survey of the Oldman Reservoir, 28 February to 1 March 1994 ...	13
Figure 6. Distribution of mule deer by habitat type observed during mid-winter aerial surveys of the Oldman Dam and environs.....	17
Figure 7. Regional mule deer density (deer/ 100 km ²) collected from mid-winter aerial surveys of Foothills Control Blocks in the Porcupine and Lundbreck Hills, 1978 to 1994.	19

LIST OF TABLES

	Page
Table 1. Number of ungulates observed during mid-winter aerial surveys of the Oldman Reservoir and environs.....	11
Table 2. Mean size of ungulate groups observed during mid-winter aerial surveys of the Oldman Reservoir and environs.....	15
Table 3. Age and sex classification of mule deer observed during mid-winter aerial surveys of the Oldman Reservoir and environs.....	16
Table 4. Number of ungulates observed during mid-winter aerial surveys of Alberta Fish and Wildlife Service's Foothills Control Blocks	18

LIST OF APPENDIX TABLES

	Page
Appendix Table 1. Flight summary for aerial surveys of the Oldman Reservoir and environs, 28 February and 1 March 1994	23
Appendix Table 2. Aerial survey time (minutes) during mid-winter aerial surveys of the Oldman Reservoir and environs, 28 February and 1 March 1994.....	25
Appendix Table 3. Relocation data (UTM grid references) and the identification of radioed deer observed during the 28 February - 1 March 1994 aerial survey of the Oldman Reservoir.....	26
Appendix Table 4. Number of wildlife observed during a mid-winter aerial surveys of the Oldman Reservoir and environs, 1 to 3 February 1993.	27

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1.0 INTRODUCTION

Axys Environmental Consulting Ltd. (formerly the Delta Environmental Management Group Ltd.) was retained by Alberta Environmental Protection, Development and Operations Division, Water Management Headworks Branch to assist with a mid-winter aerial survey for mule deer within the Oldman Reservoir basin. The Axys Group assisted during the first day of the survey, providing guidance on methodology used during previous aerial surveys of the Oldman Dam study area. The objectives of the Axys Group's limited involvement was to provide consistency of technical conditions with earlier winter aerial surveys of mule deer conducted entirely by the Axys Group. The project biologist subsequently completed the aerial survey and returned the results to the Axys Group for the preparation of this report.

1.1 BACKGROUND

Population estimates are required for detecting changes in wildlife abundance, particularly in areas where habitat availability may be decreasing. Concern for mule deer (*Odocoileus hemionus*), which are the most visible and economically important wildlife in the Oldman River basin area, arose during the construction of the Oldman Dam. The Oldman Dam was constructed during the late 1980's to regulate downstream flows by storing water in an onstream reservoir. Initial filling of the reservoir began during spring 1991, although the dam was not completely operational until 1992. The development of the Oldman Reservoir removed riparian forests and shrubland habitats associated with river breaks, transforming the habitat of mule deer to one dominated by agricultural uplands in a non-timbered prairie environment.

Various predictions have been made regarding the potential effects of the Oldman Reservoir on the local mule deer population. Predictions have included: severe populations declines, blockage of seasonal movements, shifts in movement and habitat utilization patterns toward increasing farmland depredation, an increase in the number of road kills on the paved grid road surrounding the reservoir, fatal injuries from the hazards of winter ice, both from lack of footing and the attendant danger of being trapped by shelf ice as the winter reservoir level subside.

Mitigation programs have been established to lessen the impact of dam construction and operation on wildlife. Each component has been conducted in four general phases:

- Overview and Data Collection;
- Assessment and Mitigation Design;
- Mitigation Implementation; and
- Long-term Monitoring.

This report contains the results of the February-March 1994 aerial survey of the Oldman Reservoir basin and environs as part of the Long-term Monitoring program of the Oldman Dam mule deer population. This was the second consecutive winter of aerial surveys that have been conducted since the reservoir was filled to full supply level. The

survey was conducted with 23 radio-collared mule deer in the censused population. Where possible, comparisons are made between the current results and the previous survey results.

1.2 OBJECTIVE

The objective for the aerial survey was to obtain a minimum winter population estimate of mule deer within the reservoir basin. Foothills Control Blocks outside the reservoir basin were also surveyed in order to obtain population trend information from the region. A concerted effort was made to follow previously established survey methodology in an attempt to make comparisons with previous year's data relevant.

2.0 STUDY AREA

2.1 LOCATION AND LAND USE

The Oldman Reservoir basin is approximately 12 km north of the town of Pincher Creek (Figure 1). The area is located in the fescue grassland ecoregion of southwestern Alberta, adjacent to the eastern edge of the Rocky Mountain foothills (Strong and Leggat 1981). Because reservoir development has inundated the deep coulees and river breaks along portions of three river systems, only small remnant forest stands occur in the study area. The landscape surrounding the reservoir is gently undulating, dominated by mixed-farming practices. Hay crops, barely and wheat are the principle grains, and beef cattle are the dominant livestock (Alberta Agriculture 1991).

Native grasses within non-cultivated areas and coulee ridges immediately surrounding the reservoir include rough fescue (*Festuca scabrella*), western wheatgrass (*Agropyron smithii*), parry oat grass (*Panthonia parryi*) and june grass (*Koeleria gracilis*). Shrub communities within the remaining river breaks and coulees are comprised primarily of saskatoon (*Amelanchier alnifolia*), chokecherry (*Prunus virginiana*), wolf willow (*Elaeagnus commutata*), skunkbrush (*Rhus trilobata*) and creeping juniper (*Juniperus horizontalis*). Prior to clearing the river valley to the reservoir's full supply level, the river bottom was dominated by cottonwood (*Populus spp.*), aspen (*Populus tremuloides*), and Douglas fir (*Pseudotsuga menziesii*) on the steeper, north-facing slopes of the river valleys. Only remnant stands of these forest communities now remain above the full supply line. A detailed description of the vegetation in the study area prior to flooding of the reservoir is provided by Reid *et al.* (1985).

2.2 DESCRIPTION OF THE RESERVOIR

Three river systems comprise the watershed and basin of the Oldman Reservoir: the Oldman River, the Crowsnest River and the Castle River (see Figure 1). The north stem of the Oldman River drains the lower slopes of the Porcupine Hills. The Castle River drains the Carbondale Hills along the eastern slopes of the Rocky Mountains, while the Crowsnest River drains the southern slopes of the Livingstone Range. The reservoir basin occupies 15.4 km of the original Main Stem of the Oldman River. Approximately 12 km of the Castle River and 7.5 km of the Crowsnest River have been incorporated into the reservoir. The reservoir also extends about 5.4 km into the North Stem of the Oldman River. The volume of the reservoir at full supply level is 400,000 acre feet with a surface area of approximately 1,842 ha (1,118.6 m asl). The shoreline at full supply level has a perimeter of about 104 km.

The Oldman Reservoir was initially filled during spring 1991, overflowing the spillway on 4 June. The reservoir was allowed to empty during summer-fall 1991 and did not refill until mid-summer 1992. The reservoir level was near full supply level (1114 m asl) during the current survey.

Figure 1. Oldman Reservoir in southwestern Alberta showing full supply level

3.0 METHODS

Aerial surveys conducted by helicopter have been widely used for censusing extensive inaccessible areas for large mammals such as ungulates (deer, elk and moose). Numerous studies and reviews of aerial survey techniques have been published with an emphasis on visibility bias and the development of correction factors (e.g., DeYoung 1985; Pollock and Kendall 1987, White *et al.* 1989; Potvin *et al.* 1992). Inevitably, aerial census techniques underestimate the actual population size. Although the technique is biased low because of a number of interacting factors that detract from a "total" count, it remains the best available technique for obtaining trend and distribution information. Trend information is considered reliable (precision maintained) if potential biases can be "controlled" (held constant) among surveys. Potential biases result from a combination of technical conditions (helicopter speed, altitude and strip width which comprise the level of search effort), observer experience and fatigue, environmental conditions such as ground snow conditions and habitat conditions, and including animal behavior and group size. In the current survey, the technical conditions were held constant as described below, and we used mostly experienced crew members.

3.1 AERIAL SURVEY TECHNIQUE

The parallel line-transect technique was conducted with 100% visual coverage of the terrain. The survey were flown with a Bell 206B Jet Ranger helicopter, at a constant altitude of 120 m (400 ft.) above ground, and with a ground speed of approximately 110 km/hr (65-70 mph). The navigator/ observer sat in the front left seat of the helicopter accompanied by two rear-seated observers. The pilot also participated as an observer. Two slightly different navigator/ observer crews were used on different days, and some differences in recording techniques were employed. During the first day of survey, the navigator/ observer (GEH) plotted all wildlife observations on 1:50,000 scale topographic maps and recorded all of the information for each observation on tape recorder. During the second day of survey, the navigator (RQ) plotted the wildlife locations while requesting a rear observer to record the information. Complete turns (often several turns) were made when wildlife were observed in order to obtain the best count and to obtain age/sex information (if possible). Deer were sexed with the aid of 7 x 50 mm binoculars using the presence or absence of antlers, and fawns were identified by relative body size and conformation. For two groups of deer seen in Douglas Fir, we had no opportunity to observed all deer at the same time so we were left to estimate the total number. For age/sex analysis, we summarized only the data from groups that were completely classified. We had limited opportunity to classify deer by landing the helicopter, a proven technique that should be used whenever possible.

Three regions of the Oldman Reservoir study area were planned for the survey, although the survey was incomplete because of poor survey conditions were judged to be too poor to continue (primarily lack of snow cover). The three areas of the reservoir basin that have been part of the long-term monitoring program include:

1. Oldman Reservoir basin and environs (environs include tributary streams and adjacent areas of the agricultural uplands). The flight path covering the reservoir basin followed linear, parallel north-south transects spaced at 400 m intervals providing a 200 m observation width that resulted in 100% visual coverage (Figure 2).

Flight lines within the Castle River section south of the full supply level of the reservoir paralleled the river channel following the contours of the associated coulee systems and upland benches. Two passes with the helicopter were made on each side of the Castle River while maintaining a 200 m observation width.

2. River basin downstream of the Oldman Dam. The downstream component of the survey was planned with parallel 400 meter wide north-south transects aligned at right angles to the flow of the river. Wildlife observations were to be plotted on a 1:250,000 scale topographic map.
3. Regional Foothills Control Blocks. The Foothills Control Blocks were flown with parallel linear transects providing 100% visual ground coverage. Wildlife observations were plotted on 1:10,000 scale aerial photographs.

The Alberta Fish and Wildlife Division established the Foothills Control Blocks in 1978. The blocks were selected as representative of "key" ungulate winter ranges in the Lundbreck and Porcupine Hills. The survey blocks were designed for monitoring regional ungulate population trends in Wildlife Management Units 302, 304-306, and 308 (Figure 3). Survey blocks are within the montane ecoregion of southwestern Alberta, dominated by forests of lodgepole pine (*Pinus contorta*) mixed with stands of Douglas Fir and aspen. These blocks provide regional ungulate population information to aid the interpretation of survey results from the Oldman Reservoir basin.

The Oldman Reservoir basin study area was surveyed in the following sequence in order to provide systematic, non-overlapping coverage of landscape units:

1. North side of the Reservoir from Summerview to the North Stem;
2. South side of the Reservoir from Summerview to approximately Cowley;
3. Both sides of the Reservoir along the Crowsnest River, from the North Stem to approximately Lundbreck.

3.2 AERIAL SURVEY INTENSITY

A summary of survey conditions and flight times are provided (Appendix Table 1). The current survey is compared with two previous aerial surveys conducted by the Delta Group: 10 to 12 January 1991, and 1 to 3 February 1993 (Appendix Table 2). This comparison suggests that survey intensity within the Oldman Reservoir basin was approximately the same for all three survey years, between 1.3 min/ km² and 1.4 min/ km². It should be noted that snow conditions during the current survey were noted to be poor in the Reservoir area during the second day of the survey (1 March) but that these conditions were not unlike previous years. Lack of continuous snow cover is a chronic condition in this part of the province and government helicopters have not been available on short notice to take advantage of the best snow conditions.

Figure 2. Flight path during aerial surveys of (was not flown).

The survey intensity within the Foothills Control Blocks was similar between 1991 and 1993, but was noticeably lower during the current survey. Also, the overall greater survey intensity of Control Blocks compared to the Reservoir sections may have resulted from a combination of long transects over large areas of the Reservoir vs. short transect lines within relatively small Control Block quadrats, and the presence of forest cover in the Control Blocks which required that survey lines were closer together to maintain 100% visual coverage. Quadrats used for the Control surveys required shorter survey lines resulting in more turns with the helicopter.

3.3 ACCURACY OF THE SURVEY

This was the second winter aerial survey of the Oldman Reservoir study area to be conducted with radio-collared mule deer in the surveyed population. The accuracy of the aerial survey can be estimated from the ratio of marked (radio-collared) to unmarked deer. The radio collars were made of 5 cm wide (2.5 inches) off-white machine belting. The collars are highly visible and can be easily noticed at long range. The helicopter survey crew did not have prior knowledge of the precise locations of the marked deer.

Twenty-three (23) radio-collared deer were known to be within the study area during the aerial survey (Appendix Table 3). Location information of the radioed deer was provided at the completion of the survey, mostly from relocations obtained during the two days of the survey. Y8 was relocated outside of the survey area, and deer #45 was assumed to have been outside of the survey area.

4.0 RESULTS AND DISCUSSION

4.1 MULE DEER POPULATION

4.1.1 Population Estimate

A total of 739 mule deer were observed within the Oldman Reservoir basin and surrounding agricultural uplands during the current survey (Table 1). This count is slightly larger than the winter survey conducted during 1 - 3 February 1993. The current estimate of deer numbers continues the increasing population trend that was evident in the previous survey results (Hornbeck and Balagus 1993) (Figure 4). The increase between 1990 and 1993 as previously reported appears to have been sustained through mid-winter 1994. The increase may in fact be somewhat larger than indicated given that the current survey did not include the southern portion on the Castle River.

As discussed in the previous report (Hornbeck and Balagus 1993), improved visibility of deer from clearing the reservoir basin may account for the increase in deer numbers recorded around the Oldman project area between the 1985-86 and the 1990-91 period. However, there were no further habitat changes (clearing of forest and shrublands) between the 1990 and 1994 winter surveys. The overall population trend as shown in Figure 4 is highly significant ($r^2 = 0.985$).

Figure 4. Winter aerial surveys of the Oldman Reservoir and environs, 1985 to 1994. The 1985 and 1986 surveys were conducted by Allison and Russell (1985 and 1986).

Table 1. Number of ungulates observed during mid-winter aerial surveys of the Oldman Reservoir and environs.

Reservoir Segment	1 to 3 Feb 1990					10 to 12 Jan 1991					1 to 3 Feb 1993					28 Feb - 1 Mar 1994		
	White-tailed					White-tailed					White-tailed					White-tailed		
	Mule deer	deer	moose	Elk	Total	Mule deer	deer	moose	Elk	Total	Mule deer	deer	moose	Elk	Total	Mule deer	deer	Total
Castle	137	0	6	0	143	166	112	8	0	286	52	94	3	0	149	69	1	70
Crowsnest	129	0	1	0	130	73	22	3	0	98	138	40	0	0	178	112	4	116
North Stem	143	0	0	0	143	136	32	0	1	169	147	0	0	0	147	126	0	126
Main Stem	145	0	0	0	145	177	0	1	0	178	353	0	0	0	353	432	1	433
Subtotal	554	0	7	0	561	552	166	12	1	731	690	134	3	0	827	739	6	745
Downstream	177	139	0	0	316	10	79	0	0	89	12	59	0	0	71	not surveyed		
Total	731	139	7	0	877	562	245	12	1	820	702	193	3	0	898	739	6	745

1

There were no moose or elk observed during the 1994 surveys, largely because survey coverage was incomplete.

2

Survey of the Castle River was incomplete; not flown south of the full supply line.

3

Survey conditions were noted as relatively poor, with little background snow along the Crowsnest section.

4

The Downstream survey during the February 1993 survey was incomplete.

Although speculative, factors that may have contributed to improved mule deer survival at the Oldman Dam might include the "sanctuary effect" created by the construction activity and subsequent Provincial Recreation Area. The mule deer population has been at least partially protected from hunting since construction began in the mid-1980's. While at the same time cattle were withdrawn from the river valleys (reducing competition) as the mitigation plans were being implemented.

It seems apparent that clearing the river valley basin for the Oldman Reservoir has not resulted in detrimental habitat changes for the mule deer. The landscape undoubtedly has been changed and altered; a considerable amount of habitat otherwise available to deer for traveling, feeding, shelter and security has been inundated. It is speculative, but population changes may occur in the future with the loss of habitat below full supply level and with deer "packing into" and becoming increasingly dependent on the surrounding agricultural landscape. That is to say, mule deer may be more dependent upon the agricultural landscape as a result of reservoir development. The changed circumstances may place mule deer in a more vulnerable position when they are forced to cope with a severe winter with fewer ecological options for food, shelter and security. Shelter and security for deer being equated to the former river break and coulee formations that have been inundated.

Mark-Recapture Estimate

Seventeen (17) of the 23 radio-collared deer within the study area were observed during the current aerial survey (Appendix Table 3). The proportion of marked deer counted (74%) suggests that the actual deer population was larger than observed. The precision of the mark-recapture method, however, is dependent upon the proportion of the population that is marked. In general, the larger the proportion of marked animals the better the precision of the mark-recapture estimate. Also, the important assumption that there was a random intermixing of marked deer with unmarked deer, and that each marked deer had the same chance of being observed, probably did not hold.

Therefore, with consideration for the following conditions and constraints:

- the proportion of marked deer in the population during this survey was only about 3% (23 marked from an observed population of about 700);
- marked deer were observed in groups within the population;

it is not possible to apply the mark-recapture ratio as a direct linear function to correct the observed population estimate. While it may be that the actual population was 26% larger than observed ($1 - 0.74 = 0.26$), a larger number of marked deer (e.g., >10% of the population) would improve the potential biases of small sample sizes. The assumptions of randomness would also be more closely met with a larger proportion of marked deer. Therefore, with the available information, we estimate with caution that the population of mule deer at the Oldman Reservoir is at least 739 but may be as large as 932 deer.

4.1.2 Distribution and Group Size

Mule deer were observed for the most part during the current aerial survey in the agricultural uplands, feeding in large groups on cropland (Figure 5). This distribution is consistent with the previous aerial survey (1993), also conducted after the reservoir was filled to full supply level. The interpretation is that the overall distribution of mule deer

Figure 5. Location and number of ungulates observed during mid-winter aerial surveys of the Oldman Reservoir, 28 February and 1 March 1994.

onto the agricultural landscape is concomitant with a decrease in available river valley forest habitat and shrubland coulee habitat.

Mule deer were observed around the Oldman Reservoir in large groups similar to previous mid-winter aerial surveys (Table 2). The mean group size during the current survey was 12.9 deer/ group ($n = 57$; range 1 to 52). Increasing group size that has been recorded with the development of the reservoir appears to be correlated with decreasing amounts of shrub and forest habitat and diminishing topographic complexity (large areas of river breaks and coulee formations have been inundated by the Reservoir).

During the current survey, large concentrations of deer were observed in the vicinity of the Dam Control buildings where these animals are associated with three relatively deep coulee systems. Mule deer may have been "enticed" into close proximity with people at the Dam site by a cover crop of oats that was seeded around the buildings in the landscape reclamation mix. This concentration of mule deer near the Dam was not evident during the previous winter survey (Hornbeck and Balagus 1993), although the habitat value of the nearby coulee systems have been previously recognized (Allison and Russell 1986). It seems apparent that a degree of habituation (reduction or loss of a response to humans as a result of repeated experience) has occurred; a process that probably started several years ago with construction of the dam.

Other concentrations of deer around the Reservoir were evident, but particularly in the upper arms of the reservoir, the Castle, the North Stem and the Crowsnest. In contrast to 1993, large numbers of deer were observed on the north side of the Main Stem, primarily associated with Tennessee Coulee.

4.1.3 Age and Sex Composition

The current survey results are compared to the most recent survey of February 1993 (Hornbeck and Balagus 1993). Age and sex classifications are reported only for deer within groups which were completely classified. The relatively large mid-winter fawn:female ratio (58:100) indicates that recruitment of mule deer within the Oldman project area is high (Table 3). The sex composition of the population is highly skewed toward females, which probably reflects the result of the November antlered hunting seasons.

We assume that age and sex ratio classifications obtained from aerial surveys underestimate population parameters. Based on repeated mule deer ground classifications at the Oldman Reservoir during an intensive deer trapping study conducted during February and March 1992, male:female ratios were 10:100 while a significantly larger fawn ratio was observed (79 fawns:100 females) (Hornbeck and Balagus 1992). The results obtained from the aerial surveys and from the ground counts indicate that survival of fawn mule deer at the Oldman Dam is relatively high. These classification counts support the trend shown by the aerial survey counts that suggests the Oldman mule deer population is increasing.

Table 2.

Mean size of ungulate groups observed during mid-winter aerial surveys of the Oldman Reservoir and environs. (No. below mean is number of groups observed.)

Reservoir segment	1 to 3 Feb 1990					10 to 12 Jan 1991					1 to 3 Feb 1993					28 Feb - 1 Mar 94	
	White-					White-					White-					1	
	Mule deer	tailed deer	Moose	Elk		Mule deer	tailed deer	Moose	Elk		Mule deer	tailed deer	Moose	Elk		Mule deer	White-tailed deer
Castle	7.6 18	0.0	1.2 5	0.0		10.4 16	28.0 4	1.6 5	0.0		10.4 5	31.3 3	1.5 2	0.0		2.0 8	1.0
Crowsnest	5.9 22	0.0	1.0 1	0.0		12.2 6	5.5 4	3.0 1	0.0		19.7 7	40.0 1	0.0	0.0		22.4 5	4.0 1
North Stem	9.5 15	0.0	0.0	0.0		9.7 14	8.0 4	0.0 1	1.0		18.4 8	0.0	0.0	0.0		11.4 11	
Main Stem	7.2 20	0.0	0.0	0.0		10.4 17	0.0	1.0 1	0.0		16.8 21	0.0	0.0	0.0		13.1 33	1.0
Downstream	3.8 46	5.0 28	0.0	0.0		3.3 3	4.2 19	0.0	0.0		5.5 2	7.4 8	0.0	0.0		not surveyed	

1

The Castle River segment was incomplete during the current survey. No moose or elk were observed.

Table 3. Age and sex classification of mule deer observed during mid-winter aerial surveys of the Oldman Reservoir and environs. (Not including Control Blocks)

Date	Adult Female	Fawn	Yearling Male	Adult Male	Total
February 1993 ¹	134	67	3	2	206
Feb-March 1994	278	160	0	10	448
	Males:100 Females ¹		Fawns:100 Females ¹		% Fawns ²
February 1993	4:100		50:100		32
Feb-March 1994	4:100		58:100		36%

¹ Data from groups with all individuals classified.

² Fawns as a percent of all classified deer observed.

4.1.4 Habitat Use

The distribution patterns of mule deer observed among various vegetation categories during the current and recent aerial surveys are presented as a first approximation for analysis of habitat use. The data is not specific to landform or topography, and there is no habitat availability information that would be useful in establishing a measure of habitat preference.

The distribution of mule deer among habitat types indicates that changes in winter habitat use may have occurred during the course of the last few years, particularly with respect to use of croplands (Figure 6). During the current survey, 38% of the deer were observed in cultivated fields, attracted to waste grain and chaff piles. This is comparable to the percent of deer observed in agricultural lands during the 1993 survey. Approximately 25% of the deer during the current survey were observed in shrublands, which is a larger percent than previous two winter surveys but less than observed in 1990. Increased use of agricultural lands may be a direct response to the relative availability of waste grain and hay. That is, increased use of uplands may be related to the loss of deciduous and shrubland river valley habitats that were removed from the landscape when the Reservoir was filled to full supply level. There may also be an element of learned behavior for the use of agricultural lands. Presumably mule deer have been "forced" out of the river valleys, resulting as suggested with deer "packing into" agricultural uplands.

Figure 6. Distribution of mule deer by habitat type observed during winter aerial surveys of the Oldman Reservoir and environs.

4.1.5 Regional Population Trend

Based on winter aerial surveys of the Foothill Control Blocks, the regional mule deer population appears to have declined over the course of the last 16 years (Table 4, Figure 7). Mule deer density within the control blocks declined from 11.4 deer/ km² in 1978 (793 deer/ 69.9 km²) to about 1.6 deer/ km² in 1994 (147 deer/ 92.5 km²). Although the population trend is based on only a few data points (7 surveys during 17 years), the strength of the relationship lies with the fact that this information has been collected over a relatively long term from several independent survey blocks.

4.2 OTHER UNGULATES

White-tailed deer were the only other ungulate besides mule deer that were observed around the Main Stem and periphery of the Reservoir (see Table 1). Three groups of white-tailed deer were observed. A single female was observed associated with a group of 29 mule deer in agricultural uplands south of the Main Stem of the reservoir (see Figure 5). A small group of 4 whitetails were observed along the Crowsnest River and a single female was observed along the Castle River south of highway #3.

Table 4. Number of ungulates observed during mid-winter aerial surveys of Alberta Fish and Wildlife Service's Control Blocks. (see Figure 3 for location of control blocks.)

Control Block	19 78			19 80			19 90			19 91			19 93			19 94		
	White-tailed deer	Moose	Elk	White-tailed deer	Moose	Elk	White-tailed deer	Moose	Elk	White-tailed deer	Moose	Elk	White-tailed deer	Moose	Elk	White-tailed deer	Moose	Elk
FH 1	262	0	8	73	0	6	67	0	3	48	0	1	13	0	3	20	0	0
FH 2	316	0	0	255	0	2	201	3	0	269	79	0	128	0	0	113	8	4
FH 4	65	0	3	39	0	0	11	20	5	Not surveyed			0	0	4	0	0	160
FH 9	51	0	3	Not surveyed			26	0	0	40	0	1	8	0	0	11	0	0
FH 10	25	0	0	39	0	0	36	0	0	9	0	0	49	0	0	3	0	0
FH 12	39	0	7	Not surveyed			14	2	6	8	0	5	2	0	15	0	0	1
FH 13	35	11	0	Not surveyed			39	4	7	6	0	13	0	15	20	0	0	1
FH 14	Not surveyed			32	0	2	4	0	0	0	0	0	0	0	2	0	0	0
FH 15	Not surveyed			18	0	4	5	0	2	Not surveyed			4	0	1	0	0	1
Total	793	11	21	456	0	14	403	29	23	380	79	20	204	15	45	147	8	7

Alberta Fish and Wildlife Division conducted the 1978 and 1980 surveys.
The Delta Group Ltd. conducted the February 1990, January 1991, and February 1993 surveys.

Figure 7. Regional mule deer density (deer/ 100 km²) collected from mid-winter aerial surveys of Foothills Control Blocks in the Porcupine and Lundbreck Hills, 1978 to 1994. (See Table 4 for actual survey counts; the 1985 data is from Allison and Russell 1985). (n = no. of control blocks surveyed).

Moose have not been observed around the reservoir during recent surveys (Table 1). Small numbers of moose have been observed, however, on the Castle River upstream of the reservoir full supply level. The number of moose in the survey area have ranged from 7 (February 1990) to 12 (January 1991) to 3 (February 1993) during recent surveys (Table 1). Several years ago a single observation of a branch-antlered elk had been observed within the survey area (January 1991).

4.2.1 Regional Population Trends

The number of moose observed within the Foothills Control Blocks have remained relatively stable over time compared to elk which have fluctuated more widely, but showing an overall increasing trend (Table 4). The number of moose observed among surveys have varied from a low of 7 during the current survey to a high of 45 the previous winter. The numbers of white-tailed deer in the regional population has also fluctuated widely among surveys. The current survey results are not consistent with hunter success reports that show white-tailed deer increasing steadily in the southern foothills region (L. Gudmundson, Wildlife Biologist, Alberta Fish and Wildlife Services, Lethbridge, pers. comm.). The extent to which these fluctuations reflect actual population changes is not known. The average size of Control Blocks was 10.3 km² (Appendix Table 2), which are relatively small landscapes compared to annual home ranges for these ungulates. However, year-to-year changes are not considered as important as long-term trends.

5.0 SUMMARY AND CONCLUSIONS

A total of 739 mule deer were observed within the Oldman Reservoir basin and surrounding agricultural uplands during the current aerial survey. The count was 6% larger than observed during the previous winter survey. This relatively high count continues an increasing population trend that has been apparent since mule deer surveys were initiated during 1985. Improved visibility of mule deer from clearing of the reservoir basin may account for part of the increase, at least initially. In addition, a slightly improved aerial survey intensity (about a 10% increase) may also have contributed to the apparent increase. In any case, the established trend provided by the aerial surveys exhibits a highly significant relationship. Classification counts indicate high survival and recruitment which is consistent with an increasing population trend.

Recent mid-winter aerial surveys provide a trend toward increasing mule deer group size. This may be related to the loss of forest and shrub habitat with the development of the reservoir. Habitat use has also changed over the last few surveys, with an increasing amount of use in the agricultural uplands and Douglas fir, and a decreasing amount of use of aspen and grasslands. These trends are attributed to the loss of native habitats associated with the filling of the reservoir.

The regional population of mule deer appears to have gradually and steadily declined since the late 1970's, as indicated by the survey results of the regional Foothills Control Blocks. The indication is that the regional white-tailed deer and elk populations have fluctuated widely, while moose numbers have appeared relatively stable.

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7.0 APPENDIX

Appendix Table 1. Flight summary for a mid-winter aerial wildlife surveys of the Oldman Reservoir and environs, 28 February and 1 March 1994.

Date:	28 February 1994
Helicopter:	C-GFSO Bell 206B, Supplies and Services Alberta
Pilot:	Mike Vernet
Observers:	G.E. Hornbeck (LF), R. Quinlan (RR), C. Markle (LR)
Snow conditions:	Snow cover beginning to melt off; some open areas and fields without snow.
Weather conditions:	+5 °C , mostly clear skies, westerly chinook winds gusting to 40 knots

		<u>Fly (min.)</u>	<u>Survey (min.)</u>
T-off from Oldman Dam Bldgs	1012		
Begin survey Main Stem north side	1016	4	
Stop survey, Land for ground count	1133		77
Toff, resume survey	1143		
Complete survey Main north side	1320		97
Land at Oldman Dam Bldgs	1325	5	
T-off	1415		
Begin survey southeast of Reservoir	1418	3	
Complete survey southeast	1608		110
Land at Oldman Dam Bldgs	1615	7	
		<hr/> 19 min. (0.32 hrs.)	<hr/> 284 min. (4.73 hrs.)

Total flying time = 5.05 hrs.(303 minutes)

Continued...

Appendix Table 1. Continued.

Date:	1 March 1994
Helicopter:	C-GFSO Bell 206B, Supplies and Services Alberta
Pilot:	Mike Vermet
Observers:	R. Quinlan (LF), J. Mahoney (LR), C. Markle (RR)
Snow conditions:	Snow drifts only in treed areas; open areas and fields without snow
Weather conditions:	+6 °C, cloudy skies, SW wind at 15 knots.

		<u>Fly (min.)</u>	<u>Survey (min.)</u>
T-off from Oldman Dam Bldgs	0900		
Begin survey FH4	0914	14	
Complete survey FH4	0933		19
Begin survey FH15	0937	4	
Complete survey FH 15	0954		17
Begin survey FH 1	0958	4	
Complete survey FH 1	1019		21
Begin survey FH 2	1021	3	
Complete survey FH 2	1051		31
Begin survey FH 10	1056	5	
Complete survey FH 10	1103		7
Begin survey FH 9	1211		
Complete survey FH 9	1222		11
Begin survey FH 14	1230	8	
Complete survey FH 14	1243		13
Begin survey FH 12	1254	11	
Complete survey FH12	1309		15
Begin survey FH 13	1309		
Complete survey FH 13	1319		10
Begin survey Crowsnest Section	1350		
Stop survey Crowsnest	1446		56
Resume survey Crowsnest	1523		
Complete survey Crowsnest	1537		14
Begin survey south of Lundbreck	1537		
Complete survey south of Lundbreck	1555		18
		<hr/> Incomplete	<hr/> 232 min. (3.87 hrs.)

Appendix Table 2. Comparison of aerial survey times among years (minutes flown) during mid-winter aerial surveys of the Oldman Reservoir and environs.

Survey location	10 to 12 January 1991	1 to 3 February 1993	28 February and 1 March 1994
Reservoir and environs (268 km ²)	340 (1.268 min/km ²)	362 (1.351 min/km ²)	372 (1.388 min/km ²)
Downstream of Dam	83	51	not flown
Control Blocks (km ²)			
FH 1 18.1	49	41	21
FH 2 13	39	33	31
FH 4 11 not surveyed		28	19
FH 9 5.8	24	20	11
FH 10 5.8	16	24	7
FH 12 7.1	24	26	15
FH 13 8.4	18	21	10
FH 14 12.3	15	20	13
FH 15 11 not surveyed		32	17
Area surveyed (km ²) 92.5			
Subtotal	185	Subtotal 245	Subtotal 144
Control Block Search Intensity	2.6 min/km ²	2.6 min/km ²	1.6 min/km ²
Total survey minutes (hrs.)	608 (10.13)	658 (10.97)	516 (8.60)

Notes: The survey of the Downstream was incomplete during February 1993. The south section of the Castle River was not flown in 1994.

Appendix Table 3. Relocation data (UTM grid references) and the identification of radioed deer observed during the 28 February to 1 March 1994 aerial survey of the Oldman Reservoir.

Radio-collared Deer No.	Radio Frequency	Date Relocated	UTM Grid Reference			Observed During Survey	
			Easting	Northing	Map Sheet	Yes	No
No. 6	148.731	28-Feb-94	92.5	93.9	82 H/12	1	
No. 7	149.921	1-Mar-94	7.2	97.7	82 G/9		1
No. 8	149.951	28-Feb-94	90.4	93.5	82 H/12	1	
No. 13	150.095	28-Feb-94	90.4	99.8	82 H/12	1	
No. 16	150.116	28-Feb-94	87.5	100.6	82 H/12	1	
No. 22	150.014	28-Feb-94	90.4	93.5	82 H/12	1	
No. 25	150.045	26-Feb-94	11.8	102.4	82 G/9	1	
No. 26	150.055	27-Feb-94	90	99.7	82 H/12		1
No. 28	148.565	26-Feb-94	12.8	99.5	82 G/9	1	
No. 29	150.064	26-Feb-94	12	102.4	82 G/9	1	
No. 35	150.073	1-Mar-94	7.8	97.3	82 G/9	1	
No. 38	150.083	28-Feb-94	14.2	90.3	82 G/9		1
No. 39	150.263	1-Mar-94	7.2	97.7	82 G/9		1
No. 42	150.104	27-Feb-94	86.7	98.5	82 H/12	1	
No. 45	150.124		Not available				
No. 47	150.164	19-Feb-94	8	99.4	82 G/9		1
No. Y8	150.036	1-Mar-94	6.5	89.9	82 G/9	Outside survey area	
No. 51	150.206	28-Feb-94	90.3	93.4	82 H/12	1	
No. 54	150.555	28-Feb-94	90.4	93.5	82 H/12	1	
No. 55	150.303	28-Feb-94	15.4	95	82 G/9	1	
No. 57	150.023	28-Feb-94	14.8	93	82 G/9	1	
No. 59	150.295	1-Mar-94	16.2	95.2	82 G/9	1	
No. 60	150.314	1-Mar-94	8	97.8	82 G/9		1
No. 62	150.194	12-Mar-94	12.9	103.8	82 G/9	1	
No. 65	150.005	1-Mar-94	12.1	97.3	82 G/9	1	
No. of radio-collared deer observed						17	6
Observability of radio-collared deer						0.739	

Appendix Table 4. Number of wildlife observed during mid-winter aerial surveys of the Oldman Reservoir and environs, 28 February and 1 March 1994.

Obs. no.	Date	Time	Reservoir segment	Species	Number of Wildlife Observed					Location (UTM)	Habitat Type	
					Female	Fawn	Yrl. Adult		Total			
							Male	Male				
1	28-Feb-94	1020	Main Stem	Mule Deer	2	1				3	Tk 928 958	Stubble field
2	28-Feb-94	1028	Main Stem	Coyote						2	Tk 961 968	Coulee edge
3	28-Feb-94	1034	Main Stem	Mule Deer	10	7	1		5	23	Tk 919 945	Stubble field
4	28-Feb-94	1046	Main Stem	Mule Deer	4	2				6	Tk 925 940	Coulee shrub
5	28-Feb-94		Main Stem	Mule Deer	4	2				6	Tk 915 945	Stubble field
6	28-Feb-94	1050	Main Stem	Coyote						3	Tk 914 969	Coulee edge
7	28-Feb-94		Main Stem	Coyote						1	Tk 908 939	Coulee edge
8	28-Feb-94	1130	Main Stem	Mule Deer	19	13				32	Tk 894 986	Stubble field
9	28-Feb-94	1130	Main Stem	Mule Deer	15	13	3			31	Tk 875 995	unrecorded
10	28-Feb-94		Main Stem	Mule Deer	18	13		2		33	Tk 873 987	unrecorded
11	28-Feb-94		Main Stem	Mule Deer	2	1				3	Tk 873 982	unrecorded
12	28-Feb-94	1151	Main Stem	Mule Deer	20	10				30	Tk 876 977	Coulee
13	28-Feb-94	1155	Main Stem	Mule Deer	3	1				4	Tk 866 988	unrecorded
14	28-Feb-94	1202	Main Stem	Mule Deer	3	2				5	Tk 862 996	Coulee tall shrub
15	28-Feb-94	1202	Main Stem	Mule Deer				7		7	Tk 859 999	Coulee tall shrub
16	28-Feb-94	1210	Main Stem	Coyote				1		1	Tk 854 972	Grassland
17	28-Feb-94	1218	Main Stem	Mule Deer	2					2	Qe 163 999	Grassland
18	28-Feb-94	1228	Main Stem	Mule Deer	1	1		1		3	Qf 162 1029	Coulee tall shrub
19	28-Feb-94	1234	Main Stem	Mule Deer				42		42	Qf 147 1034	Douglas Fir
20	28-Feb-94	1240	Main Stem	Mule Deer				20		20	Qf 141 1041	Douglas Fir
21	28-Feb-94		North Stem	Mule Deer	7	6				13	Qf 129 1034	Coulee tall shrub
22	28-Feb-94	1250	North Stem	Mule Deer	2	3				5	Qf 129 1026	Coulee shrub
23	28-Feb-94		North Stem	Mule Deer				29		29	Qf 124 1007	unrecorded
24	28-Feb-94		North Stem	Mule Deer				5		5	Qf 123 1008	Coulee tall shrub
25	28-Feb-94		North Stem	Mule Deer	4	2		2		8	Qf 121 1043	Douglas Fir

Appendix Table 4. Number of wildlife observed during mid-winter aerial surveys of the Oldman Reservoir and environs, 28 February and 1 March 1994.

Obs. no.	Date	Time	Reservoir segment	Species	Number of Wildlife Observed					Location		Habitat Type
					Female	Fawn	Yrl. Male	Adult Male	Unclass.	Total	(UTM)	
26	28-Feb-94		North Stem	Mule Deer					22	22	Qf 118 1041	Riverine poplar unrecorded
27	28-Feb-94		North Stem	Mule Deer	7	3				10	Qf 120 1028	
28	28-Feb-94		North Stem	Mule Deer	2	1			1	4	Qf 120 1024	Douglas Fir
29	28-Feb-94	1320	North Stem	Mule Deer	16	8				24	Qf 120 1021	Coulee tall shrub
30	28-Feb-94	1425	Main Stem	Mule Deer	1	2				3	Tk 919 929	Subble field
31	28-Feb-94		Main Stem	Mule Deer	1					1	Tk 913 931	Riverine poplar
32	28-Feb-94		Main Stem	Mule Deer					11	11	Tk 907 930	Agriculture field
33	28-Feb-94		Main Stem	Mule Deer					7	7	Tk 910 928	Agriculture field
34	28-Feb-94		Main Stem	Mule Deer	24	5				29	Tk 910 927	Agriculture field
35	28-Feb-94		Main Stem	Mule Deer	5	4				9	Tk 909 924	Agriculture field
36	28-Feb-94		Main Stem	Mule Deer					19	19	Tk 903 930	Agriculture field
37	28-Feb-94		Main Stem	Mule Deer					11	11	Tk 901 934	Coulee Fir/shrub
38	28-Feb-94		Main Stem	Mule Deer					8	8	Tk 904 932	Coulee Fir/shrub
39	28-Feb-94		Main Stem	Mule Deer					13	13	Tk 902 934	Coulee Fir/shrub
40	28-Feb-94		Main Stem	Mule Deer	4	2				6	Tk 900 936	Coulee Fir/shrub
41	28-Feb-94		Main Stem	Mule Deer	3	2				5	Tk 893 945	Upland pasture
42	28-Feb-94		Main Stem	Mule Deer	1	2				3	Tk 890 945	Tall shrub
43	28-Feb-94	1500	Main Stem	Coyote					2	2	Tk 888 923	Upland pasture
44	28-Feb-94		Main Stem	Mule Deer	10	8		2		20	Tk 882 945	Upland pasture
45	28-Feb-94		Main Stem	Mule Deer	2	2		1		5	Tk 875 950	Upland pasture
46	28-Feb-94		Main Stem	Coyote					1	1	Tk 875 952	Shrub coulee
47	28-Feb-94		Main Stem	Mule Deer	2	1				3	Tk 873 946	Tall shrub
48	28-Feb-94	1508	Main Stem	Mule Deer	19	9		1		29	Tk 845 950	Subble field
49	28-Feb-94	1508	Main Stem	White-tailed	1					1	Tk 845 950	Subble field
50	28-Feb-94		Main Stem	Coyote						1	Tk 840 965	Coulee
51	28-Feb-94		Main Stem	Coyote						2	Tk 839 959	Pasture

Appendix Table 4. Number of wildlife observed during mid-winter aerial surveys of the Oldman Reservoir and environs, 28 February and 1 March 1994.

Obs. no.	Date	Time	Reservoir segment	Species	Number of Wildlife Observed				Location (UTM)	Habitat Type
					Female	Fawn	Yrl. Male	Adult Male	Total	
52	28-Feb-94		Castle River	Coyote					1 Qe 163 965	Pasture
53	28-Feb-94	1528	Castle River	Mule Deer	7	5			12 Qe 163 945	unrecorded
54	28-Feb-94		Castle River	Coyote					3 Qe 165 960	unrecorded
55	28-Feb-94		Castle River	Mule Deer	6	7			13 Qe 156 938	Coulee shrub
56	28-Feb-94		Castle River	Mule Deer				5	5 Qe 156 936	Coulee shrub
57	28-Feb-94		Castle River	Mule Deer	1	2			3 Qe 159 934	Coulee shrub
58	28-Feb-94		Castle River	Mule Deer	10	4			14 Qe 164 930	Coulee shrub
59	28-Feb-94	1547	Castle River	Mule Deer				17	17 Qe 157 928	Riverine poplar
60	28-Feb-94		Castle River	Mule Deer	2	1			3 Qe 149 929	Riverine poplar
61	28-Feb-94	1600	Castle River	Mule Deer	2				2 Qe 156 952	Coulee shrub
62	1-Mar-94	1350	Crowsnest	Mule Deer	1	2	1		4 Qe 125 970	Cultivated field
63	1-Mar-94		North Stem	Mule Deer	2	1	1		4 Qf 110 1009	Cultivated field
64	1-Mar-94		North Stem	Mule Deer	1	1			2 Qf 107 1004	Cultivated field
65	1-Mar-94		Crowsnest	Mule Deer	11	7	1		19 Qf 75 1032	Poplar/ willow
66	1-Mar-94		Crowsnest	Mule Deer				4	4 Qf 74 1013	Cultivated field
67	1-Mar-94		Crowsnest	Mule Deer	36	16			52 Qf 65 103	Cultivated field
68	1-Mar-94		Crowsnest	Mule Deer	21	12			33 Qe 74 969	Grassland
69	1-Mar-94		Crowsnest	White-tailed	2	2			4 Qe 63 978	Grassland
70	1-Mar-94	1555	Castle River	White-tailed	1				1 Qe 148 920	Grassland
Total, Mule Deer only					313	184	11	231	739	
Total, Mule Deer from groups completely classified					278	160	10		448	

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