OLDMAN RESERVOIR MULE DEER STUDIES

Progress Report On

Fawn Studies, 4 - 18 June 1993

Prepared for

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by

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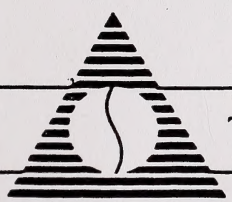

The Delta Environmental Management Group Ltd.

EXECUTIVE SUMMARY

Fawn studies of mule deer at the Oldman Reservoir were initiated during spring 1992. Spring 1992 was the first fawning period of a long term radio-telemetry study of the Oldman mule deer population. Sixteen adult females with radio-collars were available for individual study. This report contains the results of a second, consecutive year of fawn studies from the same 16 radio-collared females. Comparisons with the information gained during 1992 are discussed.

Field study of radio-collared adult females during parturition revealed that:

- *radio-collared females dropped fawns during the second and third week of June;*
- *there was a degree of annual fidelity to "fawning areas;"*
- *the twinning rate was approximately 12 - 36%, similar to previous year;*
- *females were observed during parturition in a wide variety of habitat types, most were associated with coulee formations within the upper arms of the Reservoir, particularly shrub cover, Douglas fir stands, riparian popular forests and aspen (hardwood) cover. Parturient females were also observed in upland habitats such as native grasslands, shrublands and pasture;*
- *females with neonates tended to be alone or with last year's offspring.*

As information from radio-collared mule deer at the Oldman Reservoir continues to accumulate, it is becoming evident that the mule deer are largely sedentary and dependent on the mitigation landbase surrounding the Reservoir. Although mule deer have habituated to vehicle traffic in the area, the deer do not accept close approach on foot. On-going study is required in order to provide an improved amount of understanding of the dynamics and life history of the Oldman mule deer population.

ACKNOWLEDGEMENTS

We would like to acknowledge Lorne Fitch, Manager of Wildlife Mitigation, Fish and Wildlife Services, for providing the opportunity to conduct a second, consecutive year of mule deer fawn studies at the Oldman Reservoir. We would also like to acknowledge the staff at the Oldman Dam Control Building for loan of the radio-telemetry equipment.

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1.0 INTRODUCTION

The Oldman Dam was constructed in order to regulate downstream flows by storing water in an onstream reservoir. The Oldman Reservoir will ensure a dependable water supply for Albertans living downstream (Oldman River Dam Fact Sheet). The Reservoir was initially filled during spring 1991, although the dam was not completely operational at that time. The Reservoir was re-filled and became fully operational in 1992. The transportation grid road servicing the Dam and surrounding recreational facilities was paved during 1991 and 1992.

Mitigation programs have been established around the periphery of the Reservoir in order to lessen the impact of dam construction and operation on the environment. The four mitigation components are: fisheries, wildlife, historical resources, and recreation. Each component has been conducted in four general phases:

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

This report is one of a series of wildlife reports that have been produced in the wildlife mitigation monitoring phase. In this report we provide the results of behavioural studies of radio-collared adult female mule deer during the second, consecutive fawning season. This follows the initiation during winter 1991-92 of a long-term monitoring program of mule deer population dynamics using radio telemetry (Hornbeck and Balagus 1992). This monitoring program was initiated in order to assess the effects of the operation of the Oldman Dam and Reservoir with respect to various aspects of the mule deer's ecology and life history.

1.1 BACKGROUND

Mule deer are one of the most highly visible and economically important wildlife in the Oldman River basin. Recent studies have indicated that the Oldman Reservoir basin supports about 700 to 900 mule deer (Hornbeck and Balagus 1993). Various predictions have been made regarding the effects of the Oldman Dam and Reservoir on the local mule deer population. These predictions have ranged from severe populations declines to changes in movement and habitat utilization patterns, particularly during winter when lack of riparian forest and shrubland in the reservoir basin may cause deer to move to adjacent farmland for food and shelter. There is also the potential for an increased number of road kills resulting from the development of a paved grid road surrounding the Reservoir.

The effects of the operation of the Oldman Dam and Reservoir are being studied with respect to the following aspects of the mule deer's life history:

- seasonal habitat utilization and local movement patterns with particular reference to the maturation of habitat mitigation projects;

- regional movement patterns and seasonal distribution with respect to winter severity;
- fawning habitat with particular concern for use of reservoir perimeter and islands;
- accidental drowning of mule deer; and
- increased occurrences of road kills on the transportation grid road.

1.2 SCOPE AND OBJECTIVES

The objectives of this study were to monitor on a semiweekly basis the movements and habitat utilization patterns of parturient female mule deer during the fawning season. Answers to the following questions were sought:

- What is the chronology of the mule deer fawning season?
- What is the productivity of the mule deer (number of females giving birth and the twinning rate)?
- What are the local movement and habitat use patterns of parturient females, and can "fawning areas" be identified?

2.0 STUDY AREA

The Oldman Reservoir has been constructed 10 km northeast of Pincher Creek, southwestern Alberta, near the confluence of the Crowsnest, Castle and Oldman Rivers. The length of the reservoir is approximately 24 km and it is 3 km at its widest point. The surface area is 2,420 ha at full supply level.

Descriptions of the study area can be found in various reports on vegetation and wildlife of the Oldman basin (e.g., Reid *et al.* 1985 and Young *et al.* 1986). For this study, we have recognized 10 different habitat types in the Reservoir basin. A brief description of each follows:

1. Upland Pasture. Upland pastures are seeded grasslands in areas of former agricultural lands which have been incorporated into the Reservoir landbase.

2. Upland Shrub. Upland shrub communities occur in areas of sheltered terrain on gentle slopes associated with the agricultural landscape and generally above the coulee formations of the river breaks.

3. Cultivated Field. Cultivated fields are primarily planted to grain, and they occupy most of the surrounding agricultural landscape.

4. Mitigation Project. Mitigation projects have been established around the Reservoir perimeter. Specific projects to benefit mule deer are comprised of plantings of aspen (*Populus tremuloides*) and willow (*Salix* spp.) for shelter and for food.

5. Hardwood Draw. Hardwood draws are comprised of aspen groves and are primarily associated with areas of river bank along portions of the river valleys.

6. Shrubland Draw. Shrub communities of chokecherry (*Prunus virginiana*) and saskatoon (*Amelanchier alnifolia*) occur within most of the coulee formations leading into the Reservoir. Shrublands occupy the lee slopes of coulees where moisture and soil conditions are most favorable.

7. Grassland Draw. Grassland draws are associated with coulee formations, mostly the windward slopes which are drier aspects. Generally, rough fescue (*Festuca scabrella*) is the dominant grass in these coulees.

8. Douglas Fir. Several Douglas fir (*Pseudotsuga menziesii*) stands remain on steep slopes in a number of areas surrounding the Reservoir and extending to the full supply line.

9. Upland Native Grassland. Upland grasslands occur on the shoulders of the river valleys and are dominated by wheat grass (*Agropyron smithii*) - june grass (*Koeleria cristata*) with some fescue - oat grass (*Danthonia parryi*).

10. Riparian Poplar. Stands of riverine poplar (*Populus* spp.) remain in areas of the reservoir above the full supply level and within some of the deeper coulee formations where ground water is at or near the surface.

3.0 METHODS

To determine movements, habitat use and fawn locations, radio-collared deer were relocated several times each week by close approach from the ground during the two week interval from 4 to 18 June. Relocations of instrumented deer were recorded to the nearest 100 m with UTM grid references taken from 1:50,000 topographic maps. Visual contact with each deer was sought in order to confirm the birth of fawns. The biologist approached each deer guided by the direction and amplitude of the radio collar's signal received by a hand-held H-type antenna. During the course of field studies, 18 man-days consisting of 189 hours were spent searching for and observing radio-collared females (Table 1).

Table 1. Field hours conducted during fawn surveys of 16 radio-collared adult female mule deer at the Oldman Reservoir, 4 to 18 June 1993.

Date	Biologist	Hours during the day	Field hours
4 June 1993	P. Balagus	0920 - 1745	8.4
5 June 1993	P. Balagus	0600 - 1400, 1725 - 2030	11.1
	G. Hornbeck	0830 - 1930	11.0
6 June 1993	P. Balagus	0620 - 1345, 1700 - 1945	10.1
	G. Hornbeck	0700 - 1930	12.5
7 June 1993	P. Balagus	0640 - 1815	11.6
	G. Hornbeck	0700 - 2000	13.0
8 June 1993	P. Balagus	0640 - 1535	8.9
	G. Hornbeck	0700 - 1700	10.0
9 June 1993	P. Balagus	0645 - 1735	10.9
10 June 1993	P. Balagus	0700 - 1450	7.9
	R. Lauzon	0948 - 1900	9.3
11 June 1993	R. Lauzon	0730 - 1915	11.8
14 June 1993	R. Lauzon	0700 - 2115	14.3
15 June 1993	R. Lauzon	0730 - 1530	8.0
16 June 1993	R. Lauzon	1200 - 2130	9.5
17 June 1993	R. Lauzon	0730 - 2030	13.0
18 June 1993	R. Lauzon	0745 - 1545	8.0
Total hours			**189.3**

Most of the relocation attempts succeeded with visual contact of the radio-collared deer. For each relocation, the number of conspecifics and the habitat type was recorded (Appendix Tables 1 and 2). For all observations of fawns, notes were kept regarding their agility, and their birthdates were estimated by backdating 1 to 4 days depending on their strength and ability to follow the dam (Appendix Table 3). When radio-collared deer were in the open (grasslands or low shrub habitat), we observed them continuously with a spotting scope from several hundred meters for an extended period ($\geq$ 2 hours) in order to determine by visual confirmation or by clues if fawns were present. When deer were concealed in tall shrub or forest, we maneuvered for a visual confirmation of a fawn. When a deer was startled unexpectedly, we searched the immediate area for the possibility that a fawn was concealed.

4.0 RESULTS AND DISCUSSION

4.1 CHRONOLOGY OF FAWNING SEASON

Most mule deer fawns at the Oldman Reservoir were born over a 3-week period beginning in early June (Figure 1). Most fawns had been born before the end of the third week, although some fawns were born later in June. The median date of all fawn births observed at the Oldman Reservoir was 12 June. Fawn births were confirmed for 12 of the 16 radio-collared females (Figure 1), with 14 June being the median date of fawn drop for radio-collared females (Figure 2). These observations are in general agreement with information from Jasper National Park which suggested that most fawns in western Alberta were born in the second week of June (*in* Taylor 1956:378). The peak fawning period in Utah has been estimated at 19-20 June (Robinette *et al.* 1977, *in* Wallmo 1981), and in Colorado between 16 June and 6 July (Anderson and Medin 1967, *in* Wallmo 1981). In Washington, Steigers and Flinders (1980) estimated the fawning period for mule deer to be from 25 May - 15 June with a peak on 29 May. Peak fawning period for mule deer in northcentral Montana was observed during mid-June (Riley and Dood 1984). Based on a gestation period of 200 to 208 days (Robinette *et al.* 1973 and Anderson 1981 *in* Anderson and Wallmo 1984), the peak of the mule deer rut at the Oldman Reservoir can be expected to occur in mid to late November (19 to 27 November).

The first mule deer fawns in the study area were observed on 5 June near the Dam Control buildings. Twin fawns were observed with an unmarked female travelling from upland pasture east of the Dam to the large coulee formations immediately south of the Dam and Spillway. These fawns were estimated to be at least 3 days old based on their ability to negotiate rough terrain while closely following the adult. A series of twin fawns were observed during the next few days from unmarked females in the study area. The last pair of twins observed in the study area were born on 12 June to radio-collared deer #38. It is interesting to note that deer #38 was observed with twin fawns on the same day near the same location the previous year. Most twin fawns were born in the early season as previously mentioned, with a median date of 5 June.

During the previous year's fawn study, only one fawn was observed in the study area by the first week of June, and only 3 unmarked females were observed with fawns in the entire study area that spring. Results of the current year's study may suggest that fawn chronology was earlier during 1993 compared to 1992. However, because our field hours during 1993 were double the amount expended during 1992, we believe this difference between years was related to the differences of field effort.

We were unable to confirm dates of fawn drop for 4 radio-collared females that were observed to be pregnant in the early season. Two females (Deer #16 and #29) eluded subsequent relocations; deer #16 was last observed pregnant on 10 June, while deer #29 was last observed pregnant on 8 June (see Appendix Table 1). Deer #Y8 appeared to have dropped a fawn after 14 June, but during subsequent relocation on 18 June Y8 did not appear to be attending a fawn. Y8 was observed undisturbed on 18 June for 2.5 hours, all the while no fawns were evident and she was accompanied by another adult female, a yearling female (12 months old) and 2 adult males. Y8 may have lost her fawn(s) to predation. Recognizing that mule deer are "classic hiders" (Giest 1981:219), and that females only visit neonates occasionally for brief periods, we realize that our observation on this deer was not definitive. White *et al.* (1972) observed in white-tailed deer that when not attending fawns they were often observed feeding or resting from 50

No. - indicates that the female was observed with a fawn(s).
X - indicates presence of a fawn identified by tracks.
P - indicates pregnant appearance when last observed.
nP - indicates that female may have lost her fawn following initial pregnancy.

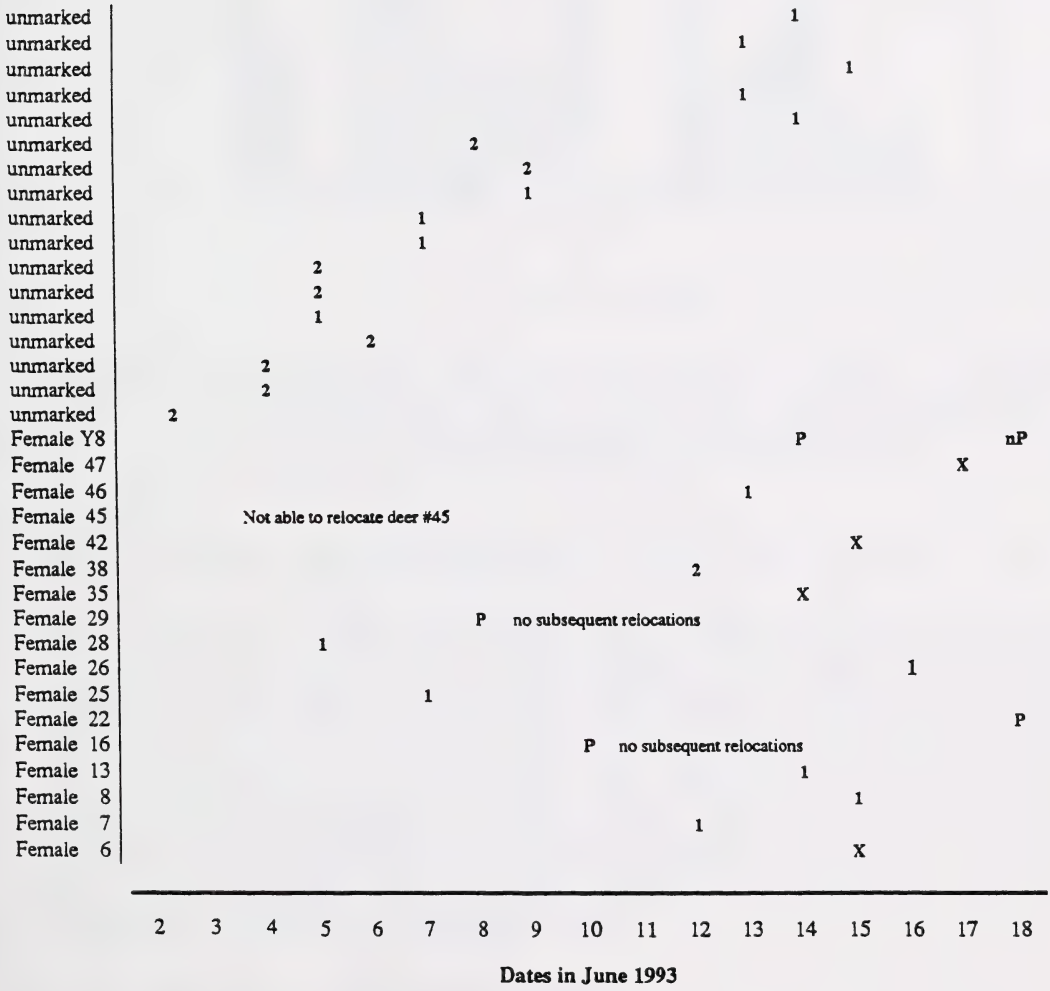

Figure 1. Birthdates of mule deer fawns (backdated) from observations of mule deer at the Oldman Reservoir during 2 weeks of repeated observations among 17 instrumented adult females.

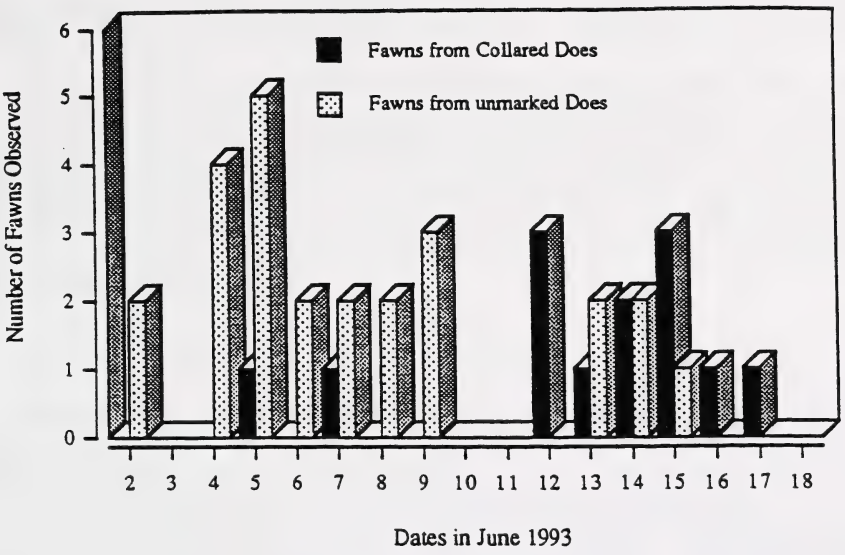

Figure 2. Chronology of mule deer fawn births during June 1993 at the Oldman Reservoir, southwestern Alberta. The median date of all fawn births was 12 June; median date of fawn births to radio-collared females was 14 June. Most twin births occurred early in the fawning season (prior to 12 June).

yards to a mile away in the company of other deer. Deer #22 was still pregnant (carrying a fawn) on 18 June, our last day of field work.

Coyotes are common in the Oldman basin and are likely an important predator of mule deer, particularly neonates as has been observed in other mule deer ranges (case studies reviewed by Connolly 1981). The following observation illustrates the point. On 6 June, deer #28 was observed with her fawn at 0745. Within 10 minutes, the fawn laid down and #28 walked away and out of sight. At 0940 a coyote was observed lopping along the contour of the river breaks, crossing the immediate area where #28's fawn was bedded. The coyote was again observed at 0955 crossing #28's fawning area in the opposite direction; the coyote was scenting the wind and gave the impression of actively searching. On close approach to the fawning area at 1030 hr, the biologist flushed the coyote. While searching the immediate area for evidence of predation, #28 also flushed from a nearby saskatoon shrub thicket. Although the coyote was actively searching the fawning area, no evidence of predation was found.

4.2 FIDELITY TO FAWNING AREAS

Mule deer at the Oldman Reservoir are largely non-migratory as indicated by relatively small annual home ranges of radio-collared adult females (Hornbeck 1993, professional paper in prep.). All of the radio-collared deer have remained within a few kms of where they were trapped during February-March 1992. Most of the deer were trapped from upper reaches of the Reservoir or downstream of the Dam. Two of the 16 instrumented deer were trapped in the vicinity of the Main Stem of the Reservoir (deer #42

and #Y8), and they maintain home ranges within this general area; #42 on the north side near Tennessee Coulee, and #Y8 on the south side of the Main Stem along the Castle River

During 1992 and during 1993 (current report), all radio-collared females dropped their fawns within their annual home ranges, and most radio-collared deer dropped fawns close to the previous fawning site. On average, fawns were born during 1993 within 1 km of the previous year's location (Table 2, Figure 3). Deer #42 was a clear exception, both in terms of the large size of her home range and the distance between fawning areas which was about 8.6 km between two consecutive years. Riley and Dood (1984) noted consecutive years' fawns of the same marked females in northcentral Montana occupied partially overlapping home ranges.

4.3 HABITAT USE AND DISTRIBUTION

During parturition, female mule deer were observed in a variety of habitat types with a large percentage of observations in shrubland coulee draws, Douglas fir, upland grassland and riparian poplar forest (Figure 4). All of these habitat types, with the exception of the upland grasslands, are physiographically associated with the river valley systems and coulees that lead into the Reservoir. No radio-collared females were observed during parturition in cultivated lands surrounding the Reservoir. This distribution is in contrast to the winter months when radio-collared deer have been observed in large groups feeding in agricultural fields (Hornbeck and Balagus 1993). Although there was no indication of deer using specific mitigation sites that are under development, all of the deer with radio-collars were residing within the mitigation landbase, including the mule deer downstream of the Dam. Based on the information to date, it seems evident that the mitigation landbase currently contains the core habitats for the mule deer in the Reservoir basin.

In terms of the Reservoir as a potential barrier to deer movements, the accumulated evidence suggests that deer do not cross the deep stillwater associated with the Main Stem of the Reservoir. Radio-collared deer with home ranges in the upper reaches of the Reservoir and those residing downstream of the Dam have been known to frequently cross the river. Neither of the two radio-collared deer with home ranges in the vicinity of the Main Stem (deer #Y8 and #42) have been known to cross the Reservoir during full supply level. Robinette (1966) mentions that mule deer in Utah have been noted to swim reservoirs that have been built between seasonal home ranges. Mule deer were observed to swim 0.8 kms across a reservior in order to reach traditional winter range, despite the availability of adequate winter range on the same side of the reservoir as the summer range.

Also, in terms of the Reservoir as a drowning hazard to mule deer, there has been no evidence to date of such an occurrence. During current field studies, however, a domestic cow was observed floating dead along the shoreline in the North Stem of the Reservoir, which suggests drowning may have been the fate of this animal.

The young fawns that we observed with radio-collared females (< 2 days old) were observed in different habitats than fawns observed opportunistically from unmarked females, which tended to be somewhat older (> 2 days). The youngest fawns from radio-collared females were observed in tree and shrub dominated habitats (n = 12), while the majority of unmarked females' fawns were observed in grassland and upland pasture/ grassland habitats adjacent to shrub and tree cover (12/ 17 = 71%). It was apparent that fawns > 2 days were following their dam, and were using a variety of habitats that changed throughout the day. Only after several days when the fawns became highly mobile did they become visible on a opportunistic basis to the researchers.

Table 2. Distance between parturient female locations during the 1992 and 1993 fawning seasons at the Oldman Reservoir.

Radio-collared Female	1992 UTM Location of Parturient Female		1993 UTM Location of Parturient Female		Distance between Successive birth locations (km)
	Easting	Northing	Easting	Northing	
6	95.6	92.7	95.8	92.8	0.22
7	**6.3**	**98.2**	**6.7**	**97.6**	0.72
8	24.2	93.3	**24.0**	**93.7**	0.45
13	28.6	92.2	**29.4**	**93.1**	1.20
16	28.5	92.7	29.8	93.3	1.43
22	22.6	98.4	24.0	93.6	1.61
25	**12.1**	**101.1**	**11.7**	**102.5**	1.46
26	**5.7**	**97.3**	**7.4**	**97.8**	1.77
28	12.1	100.1	**12.0**	**100.3**	0.22
29	11.6	101.6	12.5	100.4	1.50
35	8.1	97.3	7.7	97.0	0.50
38	**13.7**	**90.7**	**14.5**	**91.3**	1.00
42	12.5	100.3	**20.8**	**98.2**	8.56
45	3.6	96.5	not relocated		
46	11.9	100.9	**11.7**	**101.7**	0.82
47	7.4	96.6	**8.0**	**97.4**	1.00
Y8	Not radio-collared		No clear indication of fawn survival		
Mean (n = 15)					1.50
Mean (excluding #42, n = 14)					1.00

NOTE: Plain type represents locations of parturient female; bold type represents locations of females that were observed attending fawns.

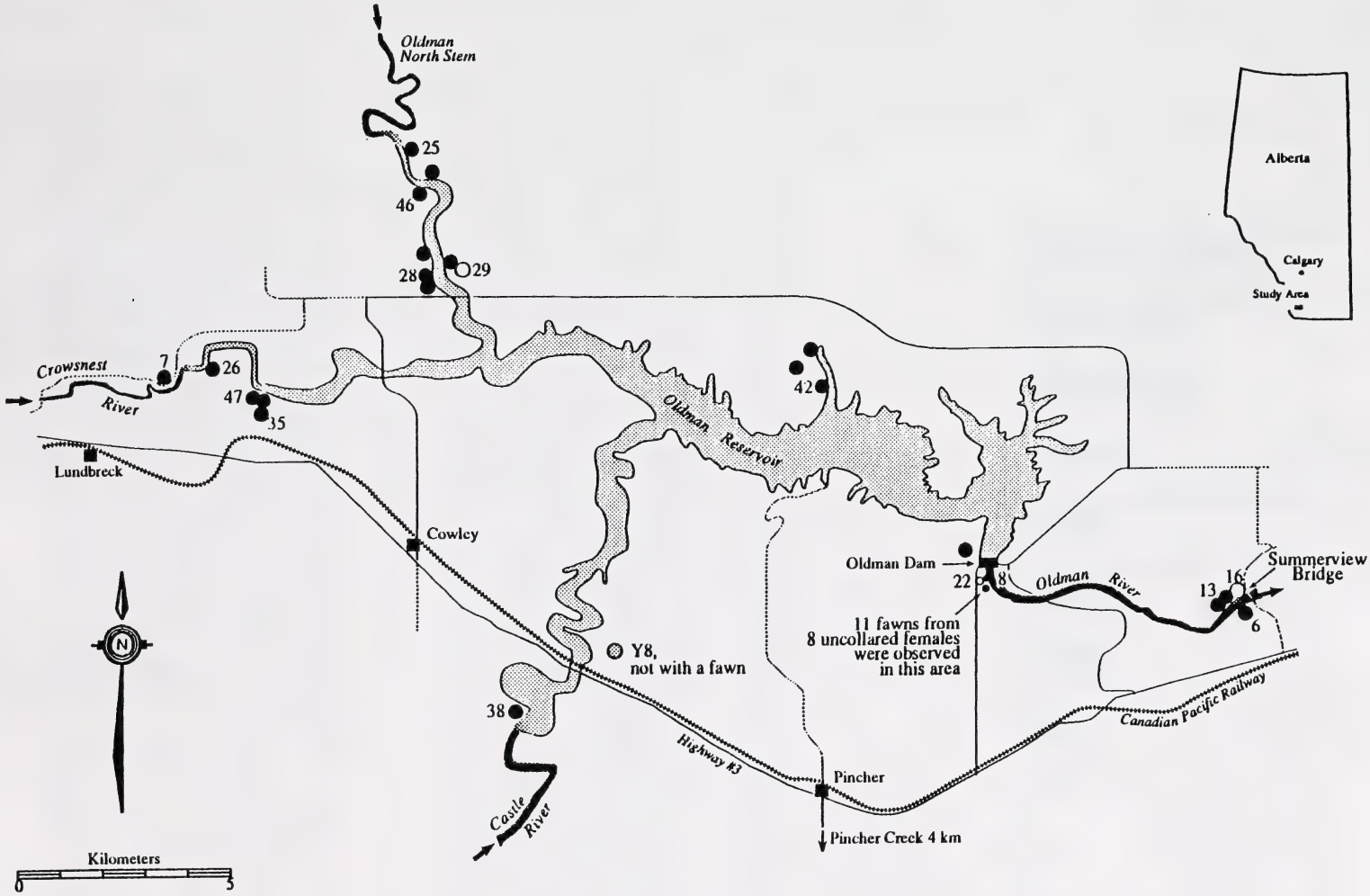

Figure 3. Locations of radio-collared female mule deer during parturition within the Oldman Reservoir basin, 2-18 June 1993. Solid dots indicate where fawns were born; open dots indicate last observation of parturient female. Seventeen un-marked females with fawns are also shown as unlabelled solid dots.

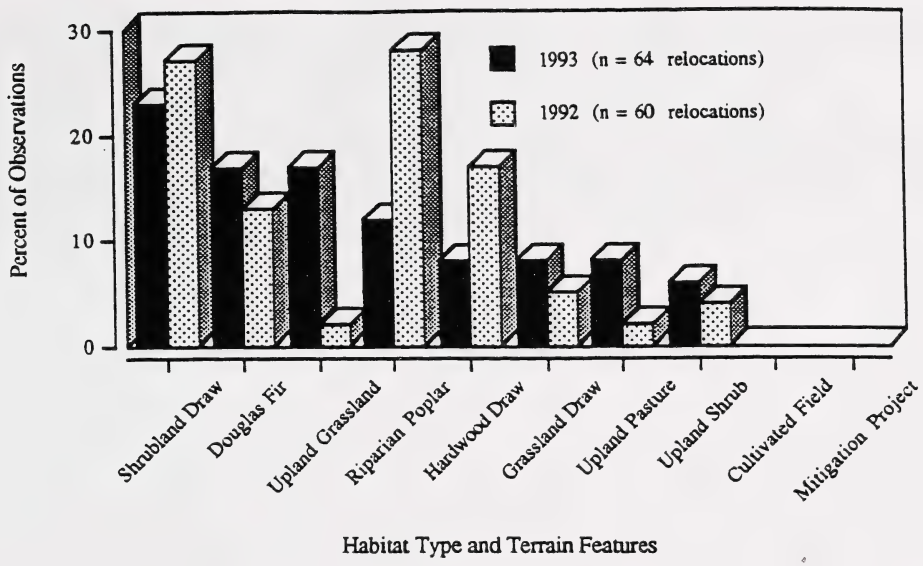

Figure 4. Habitat utilization of radio-collared adult female mule deer during the 1992 and 1993 fawning season at the Oldman Reservoir. (1992 data from Hornbeck and Balagus 1992).

As shown in Figure 3, 11 fawns were born to 8 different females within the three coulee systems south and within 1 km of the Dam Control Buildings and Spillway. The main entrance road from Highway #3 to the Dam Control Buildings bisects these coulee systems near the top end. During construction of the Dam and Reservoir, this area received intensive disturbance from heavy equipment and the central coulee was occupied by a main haul road. The haul road through the bottom of the coulee has since been regraded and reclaimed, and mule deer have moved back to use this area despite its proximity of the main road and Control Buildings. The deeply incised coulee systems evidently provide mule deer with sufficient security from direct disturbance, and the grasslands, tall shrub (> 2 m) and Douglas fir communities in these coulee systems provide adequate food and shelter.

4.4 GROUP SIZE AND PRODUCTIVITY

Mean group size of radio-collared females during parturition was 2.4 (Appendix Table 1); females in groups > 3 were rare (eg., 3 groups of 4 deer, 4 groups of 5 deer, 1 group of 8 deer and 1 group of 9 deer). Most radio-collared females were observed alone or accompanied by another adult female or a yearling female (presumably last year's offspring). Adult females attending neonates were most often seen alone with the fawn(s), although two exceptions occurred. Deer #28 was observed with a young fawn estimated to be 1 day old and was accompanied by a yearling female and a yearling male. Deer # 46 was observed with a fawn estimated to be several days old (≈ 4 days) and was accompanied by an adult female and a yearling female. During the mule deer fawning season, yearlings become discouraged after rebuffs by parturient does and some leave their mothers permanently, while others return after the fawns are a few weeks old (Robinette 1966). Riley and Dood (1984) observed that maternal does were intolerant of other deer until their fawns were at least 1 month old.

The twinning rate (an index of productivity) among radio-collared females was approximately 12%, estimated from 1 set of twins observed from 8 radio-collared females with young-of-the-year. However, based on all twins observed in the study area, the twinning rate increases to 36% (9 twins among 25 females observed with fawns). The twinning rate estimated during the previous fawning season was 28% (2 sets of twins among 7 births; Hornbeck and Balagus 1992). While all of these estimates are based on small samples, the overall impression is that the twinning rate at the Oldman Reservoir is on the low end of the scale. For example, Steigers and Flinders (1980) observed a 56% twinning rate in mule deer along the Columbia River in Washington.

5.0 SUMMARY AND CONCLUSION

Radio-telemetry studies of mule deer at the Oldman Reservoir began during late winter 1992. During February and March of that year, sixteen (16) adult females were radio-collared. Subsequent relocations of these collared deer have been conducted with varying intensity, generally on a 10-day schedule (Hornbeck in prep.). During the last two fawning seasons, however, relocations have been intensified to approximately a semi-weekly basis in order to identify fawning habitats and seasonal fidelity to fawning areas. This progress report contains the results of the second year of fawn studies.

Intensive field study of 16 radio-collared female mule deer at the Oldman Reservoir was conducted during 4 to 18 June 1993. Observations of instrumented does during this fawning season revealed that fawns begin arriving in early June, but that most fawns are born during the second and third week of June. Most females dropped their fawns within 1 km of the previous year which is being interpreted as demonstrating fidelity to fawning areas. During parturition, females were alone or accompanied by another adult female or accompanied by last year's female offspring. The twinning rate was observed to be about 12 to 36%. The estimated twinning rate was about the same as the previous year and interpreted to be at the low end of the scale for the species.

The majority of the fawning areas were associated with riparian habitats of the river valley system, primarily upper reaches of the Reservoir and downstream of the Dam, and the rough terrain of coulee formations surrounding the Reservoir. There were no fawns born in habitats closely associated with the cultivated uplands. All but two of the radio-collared females occupied home ranges either downstream of the Dam or in the upper reaches of the Reservoir Basin (ie., in the shallow arms of the reservoir). In both these areas, several of these deer have been known to cross the river channel. The two radio-collared deer that occupy home ranges in the vicinity of the Main Stem of the Reservoir have never been known to cross the Reservoir, which implies that the wide sections of the reservoir may present a barrier to deer movements.

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7.0 APPENDIX

Appendix Table 1. Relocations of radio-collared female mule deer during the 1993 fawning season at the Oldman Reservoir, showing conspecifics and arrival of fawns.

Date	Time (24h)	Radio-Collared Deer no.	Location (UTM grid)		Visual location	Radio location	Group size	Sex and Age Classifications					
			Easting	Northing				Adult Female	Fawn (Neonate)	Yrlg female (12 mo.)	Yrlg male (12 mo.)	Adult Male	Unclass.
5-Jun-93	1420	6	93.9	92.3	1		5	1		3			
7-Jun-93	1320	6	94.7	92.3		1							
10-Jun-93	1630	6	95.7	92.7	1		1						
16-Jun-93	1253	6	95.8	92.8	1		2		1				
6-Jun-93	815	7	5.9	97.3	1		1						
8-Jun-93	715	7	5.9	97.3		1							
10-Jun-93	1051	7	5.9	97.4	1		1						
15-Jun-93	840	7	6.7	97.6	1		2		1				
4-Jun-93	1450	8	90.2	93.7	1		2			1			
5-Jun-93	1810	8	90.3	93.7	1		3	2					
7-Jun-93	715	8	90.4	93.2	1		3	1		1			
8-Jun-93	1425	8	90.2	93.7	1		1						
11-Jun-93	1038	8	90.4	93.4	1		2			1			
16-Jun-93	2045	8	90.3	93.7	1		3	1		1			
18-Jun-93	904	8	90.0	93.6	1		2		1				
5-Jun-93	1507	13	93.9	92.3	1		5	1		3			
7-Jun-93	1450	13	94.0	92.3		1							
10-Jun-93	1030	13	94.2	92.3	1		8	2		2	1		2
16-Jun-93	1645	13	95.4	93.1	1		2		1				
7-Jun-93	930	16	89.1	94.7	1		2			1			
10-Jun-93	805	16	95.6	93.4	1		2			1			

Cont'd

Appendix Table 1. Relocations of radio-collared female mule deer during the 1993 fawning season at the Oldman Reservoir, showing conspecifics and arrival of fawns.

Date	Time (24h)	Radio-Collared Deer no.	Location (UTM grid)		Visual location	Radio location	Group size	Sex and Age Classifications					
			Easting	Northing				Adult Female	Fawn (Neonate)	Yrlg female (12 mo.)	Yrlg male (12 mo.)	Adult Male	Unclass.
5-Jun-93	1715	22	88.7	95.0	1		2	1					
7-Jun-93	910	22	88.6	94.6	1		1						
9-Jun-93	1515	22	88.4	94.6	1		2			1			
11-Jun-93	815	22	90.2	93.3	1		1						
16-Jun-93	2015	22	89.9	93.6	1		1						
18-Jun-93	800	22	90.0	93.6	1		3	1		1			
6-Jun-93	1700	25	12.0	102.8	1		3	1		1			
8-Jun-93	1325	25	11.7	102.5	1		2		1				
6-Jun-93	1005	26	6.6	98.3	1		3	1			1		
8-Jun-93	901	26	6.9	98.1	1		5	2			2		
10-Jun-93	1036	26	7.0	97.8	1		1						
17-Jun-93	2021	26	7.4	97.8	1		2		1				
6-Jun-93	745	28	12.0	100.3	1		4		1	1	1		
6-Jun-93	1410	29	12.8	100.5	1		2	1					
8-Jun-93	1120	29	12.5	100.4	1		9	1		7			
5-Jun-93	1905	35	8.4	97.5	1		1						
7-Jun-93	1215	35	8.5	97.5	1		1						
9-Jun-93	1220	35	8.4	97.5		1							
10-Jun-93	1320	35	8.1	97.4	1		3	1			1		
14-Jun-93	1540	35	7.7	97.0	1		2		1				Cont'd

Appendix Table 1. Relocations of radio-collared female mule deer during the 1993 fawning season at the Oldman Reservoir, showing conspecifics and arrival of fawns.

Date	Time (24h)	Radio-Collared Deer no.	Location (UTM grid)		Visual location	Radio location	Group size	Sex and Age Classifications					
			Easting	Northing				Adult Female	Fawn (Neonate)	Yrlg female (12 mo.)	Yrlg male (12 mo.)	Adult Male	Unclass.
5-Jun-93	710	38	13.6	90.5	1		2				1		
7-Jun-93	1700	38	13.6	90.6	1		2				1		
9-Jun-93	730	38	14.0	90.8	1		1						
14-Jun-93	740	38	14.5	91.3	1		3		2				
6-Jun-93	1910	42	87.1	98.7	1		2	1					
7-Jun-93	1930	42	86.4	99.3	1		5	3		1			
8-Jun-93	845	42	86.4	98.5	1		1						
11-Jun-93	1225	42	86.7	98.4	1		1						
17-Jun-93	1140	42	86.8	98.2	1		2		1				
		45	Not able to relocate deer #45										
6-Jun-93	1310	46	12.0	100.3	1		2			1			
9-Jun-93	1350	46	11.7	101.6	1		1						
11-Jun-93	1855	46	11.7	101.6	1		1						
17-Jun-93	1730	46	11.7	101.7	1		4	1	1	1			
5-Jun-93	1055	47	8.5	97.3	1		3	1		1			
7-Jun-93	1205	47	8.2	97.4	1		3	2					
9-Jun-93	1220	47	7.9	97.0	1		1						
10-Jun-93	1330	47	7.9	97.3		1							
14-Jun-93	1619	47	8.2	97.3	1		4			3			
18-Jun-93	1450	47	8.0	97.4	1		2		1				Cont'd

Appendix Table 1. Relocations of radio-collared female mule deer during the 1993 fawning season at the Oldman Reservoir, showing conspecifics and arrival of fawns.

Date	Time (24h)	Radio-Collared Deer no.	Location (UTM grid)		Visual location	Radio location	Group size	Sex and Age Classifications					
			Easting	Northing				Adult Female	Fawn (Neonate)	Yrlg female (12 mo.)	Yrlg male (12 mo.)	Adult Male	Unclass.
7-Jun-93	1015	Y8	16.1	92.9	1		1						
9-Jun-93	825	Y8	16.2	92.7	1		1						
11-Jun-93	1004	Y8	16.0	92.7	1		1						
18-Jun-93	1012	Y8	16.4	92.6	1		5	1		1		2	
Mean					59	5	2.4	1.3	1.1	1.7	1.1	2.0	2.0

Appendix Table 2. List of relocations of radio-collared female mule deer during the 1993 fawning season at the Oldman Reservoir, showing habitat use.

Date	Time (24h)	Radio-Collared Deer no.	Location (UTM grid)		Habitat types and terrain features									
										Coulee				
			Easting	Northing	Upland Pasture	Upland Shrub	Cultiv. Field	Mitigat. Project	Hardwd Draw	Shrub Draw	Grassland Draw	Doug Fir	Upland Grassland	Riparian Poplar
5-Jun-93	1420	6	93.9	92.3						1				
7-Jun-93	1320	6	94.7	92.3						1				
10-Jun-93	1630	6	95.7	92.7										1
16-Jun-93	1253	6	95.8	92.8										1
6-Jun-93	815	7	5.9	97.3										1
8-Jun-93	715	7	5.9	97.3										1
10-Jun-93	1051	7	5.9	97.4						1				
15-Jun-93	840	7	6.7	97.6										1
4-Jun-93	1450	8	90.2	93.7								1		
5-Jun-93	1810	8	90.3	93.7						1				
7-Jun-93	715	8	90.4	93.2									1	
8-Jun-93	1425	8	90.2	93.7								1		
11-Jun-93	1038	8	90.4	93.4									1	
16-Jun-93	2045	8	90.3	93.7								1		
18-Jun-93	904	8	90.0	93.6								1		
5-Jun-93	1507	13	93.9	92.3						1				
7-Jun-93	1450	13	94.0	92.3		1								
10-Jun-93	1030	13	94.2	92.3									1	
16-Jun-93	1645	13	95.4	93.1										1
7-Jun-93	930	16	89.1	94.7									1	
10-Jun-93	805	16	95.6	93.4						1				

Cont'd

Appendix Table 2. List of relocations of radio-collared female mule deer during the 1993 fawning season at the Oldman Reservoir, showing habitat use.

Date	Time (24h)	Radio-Collared Deer no.	Location (UTM grid)		Habitat types and terrain features									
											Coulee			
			Easting	Northing	Upland Pasture	Upland Shrub	Cultiv. Field	Mitigat. Project	Hardwd Draw	Shrub Draw	Grassland Draw	Doug Fir	Upland Grassland	Riparian Poplar
5-Jun-93	1715	22	88.7	95.0								1		
7-Jun-93	910	22	88.6	94.6		1								
9-Jun-93	1515	22	88.4	94.6						1				
11-Jun-93	815	22	90.2	93.3							1			
16-Jun-93	2015	22	89.9	93.6									1	
18-Jun-93	800	22	90.0	93.6									1	
6-Jun-93	1700	25	12.0	102.8							1			
8-Jun-93	1325	25	11.7	102.5										1
6-Jun-93	1005	26	6.6	98.3									1	
8-Jun-93	901	26	6.9	98.1					1					
10-Jun-93	1036	26	7.0	97.8										1
17-Jun-93	2021	26	7.4	97.8		1								
6-Jun-93	745	28	12.0	100.3						1				
6-Jun-93	1410	29	12.8	100.5						1				
8-Jun-93	1120	29	12.5	100.4									1	
5-Jun-93	1905	35	8.4	97.5							1			
7-Jun-93	1215	35	8.5	97.5									1	
9-Jun-93	1220	35	8.4	97.5								1		
10-Jun-93	1320	35	8.1	97.4								1		
14-Jun-93	1540	35	7.7	97.0								1		Cont'd

Appendix Table 2. List of relocations of radio-collared female mule deer during the 1993 fawning season at the Oldman Reservoir, showing habitat use.

Date	Time (24h)	Radio-Collared Deer no.	Location (UTM grid) Easting	Northing	Habitat types and terrain features: Upland Pasture	Upland Shrub	Cultiv. Field	Mitigat. Project	Coulee: Hardwd Draw	Shrub Draw	Grassland Draw	Doug Fir	Upland Grassland	Riparian Poplar
5-Jun-93	710	38	13.6	90.5						1				
7-Jun-93	1700	38	13.6	90.6					1					
9-Jun-93	730	38	14.0	90.8						1				
14-Jun-93	740	38	14.5	91.3	1									
6-Jun-93	1910	42	87.1	98.7							1			
7-Jun-93	1930	42	86.4	99.3	1									
8-Jun-93	845	42	86.4	98.5		1								
11-Jun-93	1225	42	86.7	98.4						1				
17-Jun-93	1140	42	86.8	98.2						1				
		45	Not able to relocate deer #45											
6-Jun-93	1310	46	12.0	100.3						1				
9-Jun-93	1350	46	11.7	101.6					1					
11-Jun-93	1855	46	11.7	101.6								1		
17-Jun-93	1730	46	11.7	101.7					1					
5-Jun-93	1055	47	8.5	97.3	1									
7-Jun-93	1205	47	8.2	97.4					1					
9-Jun-93	1220	47	7.9	97.0								1		
10-Jun-93	1330	47	7.9	97.3								1		
14-Jun-93	1619	47	8.2	97.3	1									
18-Jun-93	1450	47	8.0	97.4						1				

Cont'd

Appendix Table 2. List of relocations of radio-collared female mule deer during the 1993 fawning season at the Oldman Reservoir, showing habitat use.

Date	Time (24h)	Radio-Collared Deer no.	Location (UTM grid)		Habitat types and terrain features									
									Coulee					
			Easting	Northing	Upland Pasture	Upland Shrub	Cultiv. Field	Mitigat. Project	Hardwd Draw	Shrub Draw	Grassland Draw	Doug Fir	Upland Grassland	Riparian Poplar
7-Jun-93	1015	Y8	16.1	92.9									1	
9-Jun-93	825	Y8	16.2	92.7									1	
14-Jun-93	1004	Y8	16.0	92.7	1									
18-Jun-93	1012	Y8	16.4	92.6							1			
Total					5	4	0	0	5	15	5	11	11	8

Appendix Table 3. List of mule deer fawn observations around the Oldman Reservoir from unmarked and radio-collared females, June 1993.

List of adult Females	Date fawn(s) observed	No. of fawns	Location UTM (easting - northing)		Comments on observed agility of fawns	Backdated from observed date	Estimated fawn drop
1	5 June	2	90.0	93.9	Fawns easily follow female across paved road	3	2 June
2	6 June	2	12.0	99.8	Fawns unsteady, not able to follow female	2	4 June
3	6 June	2	12.4	100.0	Fawns unsteady, not able to follow female	2	4 June
4, #28	6 June	1	12.0	100.3	Fawn unsteady walking behind female #28	1	5 June
5	6 June	1	12.0	101.9	Fawn unsteady walking beside female	1	5 June
6	7 June	2	90.4	93.4	Fawns very unsteady walking with female	1	6 June
7	7 June	2	86.4	98.7	Fawns easily follow female while walking	3	5 June
8	7 June	2	8.4	97.5	Fawns steady, able to walk & jump beside female	3	5 June
9	8 June	1	90.5	93.3	Fawn remained bedded, not observed walking	1	7 June
10, #25	8 June	1	11.7	102.5	Fawn stands unsteady beneath female #25	1	7 June
11	8 June	1	90.1	93.2	Fawn remains bedded	1	7 June
	9 June	0			No Fawns Observed on the 9th		
12	10 June	1	90.4	93.3	Fawn remains bedded, very small, < a day old	1	9 June
13	11 June	2	90.2	93.4	Fawns very unsteady while walking with female	2	9 June
14	11 June	2	90.2	93.4	Fawns steady on feet while following female	3	8 June
	12 June				No field work conducted because of heavy rainfall		
	13 June				No field work conducted because of heavy rainfall		
15, #38	14 June	2	14.5	91.3	Fawn unsteady walking with female #38	2	12 June
16, #35	14 June	1(?)	7.7	97.0	Females #35 has large extended udder as if nursing	0	14 June
17, #7	15 June	1	6.7	97.6	Fawn steady walking with female #7	3	12 June
18, #6	16 June	1	95.8	92.8	Female #6's physical appearance indicates birth	1	15 June
19	16 June	1	95.5	93.1	Single fawn, steady while walking	3	13 June
20, #13	16 June	1	95.4	93.1	Fawn unsteady walking with female #13	2	14 June
21	16 June	1	90.4	93.3	Fawn observed steady walking	3	13 June
22	17 June	1	86.1	99.0	Fawn observed steady walking	3	14 June
23, #42	17 June	1	86.8	98.2	Fawns tracks in the mud near female's location	2	15 June
24	17 June	1	11.8	100.1	Fawn remained bedded, appears > 2 days	3	14 June
25, #46	17 June	1	11.7	101.7	Fawn ran away bleating when approached closely	4	13 June

Cont'd.

Appendix Table 3. List of mule deer fawn observations around the Oldman Reservoir from unmarked and radio-collared females, June 1993.

List of adult Females	Date fawn(s) observed	No. of fawns	Location UTM (easting - northing)		Comments on observed agility of fawns	Backdated from observed date	Estimated fawn drop
26, #26	17 June	1	7.4	97.8	Fawn bedded w/#26	1	16 June
27, #8	18 June	1	90.5	93.7	Fawn steady on feet walking with #8	3	15 June
28	18 June	1	90.2	93.7	Fawn walked with steady feet	3	15 June
29, #47	18 June	1	8.0	97.4	Fawn tracks in the mud near female's location	1	17 June
Y8	18 June	0			No indication of a fawn with Y8		
#22	18 June	0			Still looks pregnant on the 18 June		
#29	8 June	0			Appeared pregnant, but subsequently not relocated		