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Mule Deer Behavior in Relation to Fencing and Underpasses on Interstate 80 in Wyoming

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Where Interstate 80 crosses the migration route of approximately 1000 mule deer (Odocoileus hemionus), there were 37-60 vehicle accidents involving deer each year from 1973 to 1976. A 7.8-mile section of the right-of-way fence was replaced with an 8-ft-high big-game fence in October 1978 to force the deer to use three machinery and four box-type underpasses in the area. During four migration periods immediately following installation of the fence, more than 4000 deer went through these underpasses, as recorded by track counts and surveillance cameras. About 70 percent of the deer used the machinery underpasses to move to their winter range; the others passed through the box-type concrete underpasses. During spring migrations, more than 90 percent of the deer used the two machinery underpasses at the east, or higher end, of the migration area. Baiting with alfalfa hay, fresh vegetable trimmings, and apple pulp helped lure deer through the underpasses the first time. There was only one deer-vehicle accident inside the fenced area during the two years after the big-game fence was completed. In addition, two deer were killed above (east of) the end of the fenced section of the highway and a few were killed below (west of) the fenced area in an area where accidents had been common before the deer fence was constructed. The major difficulties associated with the fencing were (a) selection of the proper area for the fence (an additional mile of fence was built to discourage deer from going around the ends), (b) inadequacy of deer guards on ramps of an interchange, and (c) the need for continuous monitoring for holes in the fence.

Interstate 80 is a busy highway for east-west travelers in southern Wyoming, and a 55-mile section of the highway bisects the migration routes of between 1600 and 2000 mule deer (Odocoileus hemionus) that move from their summer range on the Medicine Bow Range west of Laramie to their winter ranges in the lower sagebrush steppe country. Since this section of highway opened in late 1970, about 1000 mule deer have been recorded killed by vehicles. The Wyoming Game and Fish and Highway Departments became concerned and, in 1973, with guidance and funding from the Federal Highway Administration (FHWA), they teamed up with the Rocky Mountain Forest and Range Experiment Station of the Forest Service at Laramie to try to solve the problem. The primary objective of the studies was to determine the effects of highway operation practices and facilities on elk (Cervus canadensis), mule deer, and pronghorn antelope (Antilocarp americana) and to assess the effectiveness and impact of 8-ft-high gameproof fencing on mule deer at a heavy migration crossing along I-80 at Dana Ridge near Walcott, Wyoming (Figure 1). This study area was 7.8 miles along the highway where previous data had shown at least 1000 deer crossed twice a year and between 37 and 60 deer-vehicle accidents had occurred yearly (1,2).

The studies were conducted by the crew from the Rocky Mountain Station. The $240 000 gameproof fencing was funded by FHWA (93 percent) and the Wyoming Game and Fish Department (7 percent). The Wyoming Highway Department furnished the planning design, negotiated the contracts for construction, and monitored the project. The Highway Department also accepted maintenance responsibility after construction was completed and approved.

METHODS

Major methods used to collect deer behavior, population, distribution, and movement data were visual observation, track counts, telemetry-radio collars (tracking and monitoring), and automatic day and night movie camera surveillance systems (2). During the fall-to-spring period, regular daily survey trips were made to record animal populations, distribution, and activity in relation to I-80. The track counts were made across raked patches of loose dirt or snow at each end of the underpasses or along the end of the high fence. The telemetry equipment enabled the tracking of individual animals and their associates as they moved throughout their range in both summer and winter. Because track counts become inaccurate when more than about 20 deer are involved, a surveillance camera system was developed and used to photograph deer that use the major underpasses. From these photographs, deer behavior, numbers, and classification (bucks, does, or fawns) could be determined.

BIG-GAME FENCING

The fencing constructed along I-80 at Dana Ridge is

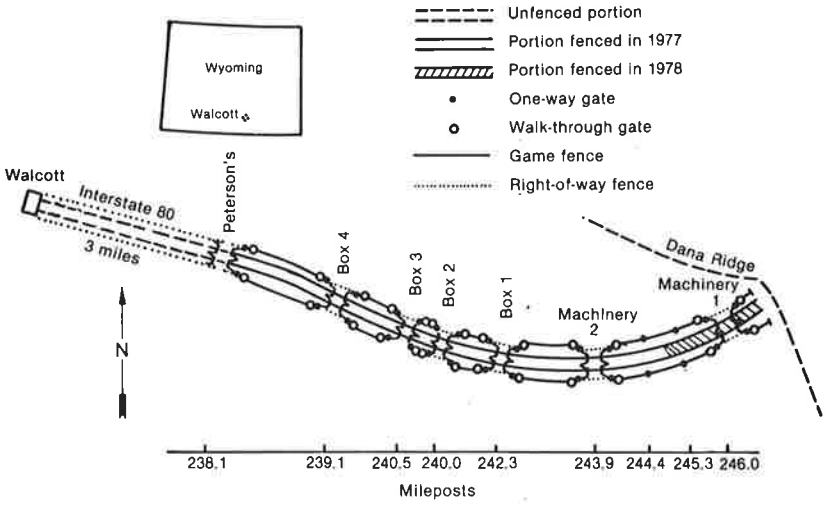


Figure 1. Mule deer winter range and big-game fenced area along I-80.

a modification of elk fence recommended in guidelines adopted by the Wyoming Game and Fish Department (Figure 2). Modifications were made to the existing 46-in-high right-of-way fence by setting 12-ft by 5-in treated line posts at alternate existing fence posts, thus making the taller posts 16.5 ft apart and 8 ft tall. After removing the barbed wire strands from the top of the existing fence, crews added two panels of 32-in eight-strand woven wire (weighing approximately 234 lb/110 yards) above the existing panel. The new panels and existing panels were then laced together with 12-1/2 gauge wire. Brace panels were built as required to support the wire over uneven terrain.

The gameproof fence was constructed for 6.7 miles along both sides of I-80 during the summer of 1977. Because deer made end-runs around the upper (east) end of the fence during the first year, additional fencing was constructed along 1.1 miles of the highway before the fall migration of 1978.

The high fence was constructed to allow deer access to the three machinery and four box-type underpasses. At the Peterson Interchange (milepost 238.1) and at machinery underpass 2 (milepost 243.9), the high fence was constructed all the way through the underpasses by using the pillars for guides (Figure 3). At machinery underpass 1 (milepost 246), the high fence was built to the end of the structure and had sections between the separated lanes of the highway, which allowed more open space under the highway and helped alleviate the possibility of snowdrift build-up in the underpass.

The 46-in right-of-way fence was left in place at all underpasses, with the exception of the south end of box underpass 3 (milepost 240.5), where it was removed. This was done at the request of the landowner and livestock operator. In order to move through the underpasses or boxes, deer were forced to jump the right-of-way fence during the time livestock were on the range (from April until snow covered the ground in December). The gates were left open when cattle were gone. The deer jumped these fences without much difficulty but used the open gates when available.

One-way deer gates, as described by Reed and others (3), were built into the gameproof fence at all four corners of each underpass where the right-of-way line and the underpass entrance wings meet. To allow deer to leave the right-of-way without traveling to the end of the high fence, one-way gates were built on each side of the highway at two places (mileposts 244.4 and 245.3) where right-of-way width changed, thus making construction convenient.

There was a problem with fawns getting into the corners at underpasses between the back side of the one-way gates and the short 46-in right-of-way fence, particularly during the fall migration. A few fawns went through the one-way gates the wrong way until the tines on the one-way gates were closed to within 4 in. This problem could be avoided by locating the one-way gates at least 100 yards away from the underpasses or by removing the short right-of-way fences. It is questionable whether the short fences are necessary, because a low gate at the mouth of the underpasses would keep the livestock out just as well.

Walk-through gates (pipe frame, 5 ft wide by 7 ft high) were installed in the fence lines adjacent to the one-way deer gates at each underpass. These gates are used by highway maintenance crews to get through the high fence without climbing over them. These gates were all chained and locked to prevent public entrance and to ensure that they are kept closed so deer cannot get into the highway right-of-way.

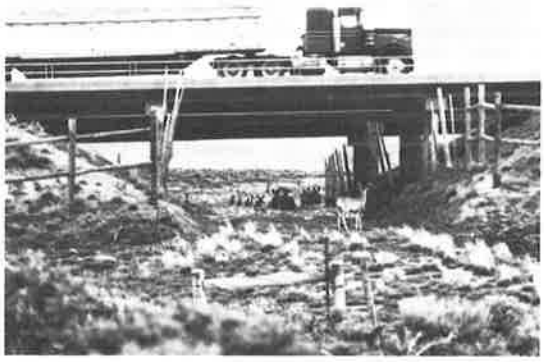
Deer-crossing records on I-80 before the gameproof fence was constructed in 1977 did not justify extending the first fence construction beyond the top of Dana Ridge at milepost 244.9. After a few deer were found inside the right-of-way within the gameproof-fenced area at the upper end in December 1977, tracking patches were monitored at the end of the high fence and the deer tracks showed that deer were moving around the end and coming back inside. Many deer used the one-way gate on the south side of the highway and escaped. Others moved across the highway, and there were 19 deer-vehicle accidents. The same problem developed during the spring migration of 1978, which resulted in six deer-vehicle accidents.

An unsuccessful attempt was made to turn the deer back away from the end of the high fence on the south side of the highway by parking a trailer house between the game fence and a 12-ft snow fence 324 ft long, but deer (tracked in the snow) either walked past the trailer or came around the snow fence.

With the cooperation of federal and state agencies, a 1-mile extension of gameproof fence was constructed in 1978 on both sides of the highway to reach machinery underpass 1 (milepost 246.0). When the deer came back during the fall and winter of 1978-1979, they were forced to use the underpass or move even farther around the end of the high fence. They did not get inside the game-fence right-of-way area, and there were no accidents. During the 1979 spring migration, 85 deer used the upper machinery underpass, and 27 deer tracks were counted going

Figure 2. Big-game fence used to force mule deer to use underpasses along I-80.

Figure 3. Mule deer using machinery underpass 2 on I-80.



around the end and across the highway. Only one accident was reported, about 100 yards beyond the end of the gameproof-fenced area. No consistent track counts have been made for the past two years, but there was only one accident in November 1979. No accidents have been reported in this area by the Wyoming Highway Department during the past year.

There were some problems associated with the gameproof fence that should be recognized. The first and foremost is holes, whether through or under the fence. The only deer killed on the highway inside the fenced area during the migration of 1978-1979 was one that crawled under the fence at a washed-out place. It is essential that all holes more than 6 in deep under the fence be filled with dirt or rocks.

Even though four people inspected the entire fence for signs of weakness and filled all low spots, they missed a gap between the mesh wire panels in an area where the fence passed through very thorny saltbush (Atroplex nutalli), which makes the lower panels difficult to see. The deer found the hole in late January, and 31 deer moved through the hole and onto the right-of-way before the fence was repaired. The deer were herded out through the walk-through gates. Twice holes were found that had been cut by people--one was used to gain entrance to obtain antlers from a large, dead buck mule deer, and the other showed indications that it had been used for access for poaching.

Two truck tires came off moving semitrailer trucks and hit the fence, and one caused a hole. Two deer and nine antelope came through before the hole was found. The animals were again herded out through a walk-through gate.

The possibility of holes developing in the fence makes it imperative that, during deer migrations, highway maintenance crews or Game and Fish Department personnel monitor the fence constantly to find and repair holes. The sooner holes are repaired, the better.

Two heavy snow winters were ideal for evaluating the gameproof fence and underpasses in relation to drifting snow. The snow depths of 14-16 in at the top of Dana Ridge were the heaviest since 1973, and there was enough wind to blow drifts into problem areas. Three areas accumulated enough drifting snow to cause concern that snow bridges would allow deer to cross. Two drifts were on the south side of the highway at mileposts 243.4 and 243.5 and the other was under machinery underpass 2. All problems developed after more than 90 percent of the deer had already moved to their winter range beyond the highway. There were no problems during spring migrations. The snow can be controlled by snow-fence construction. Building short sections of extended woven wire fence on top of the high fence would prevent deer from walking over drifted fences.

When snow depths reached about 12 in at machinery underpass 2 the first year after deer-fence construction, deer started moving down hill along the fence on the south side of the highway. One morning in January 1978 at least 26 deer were tracked around the end of the deer fence and back across the cattleguard at the Peterson Interchange at the lower end. Another herd of 18 deer crossed the cattleguard in February 1978. These deer accounted for 11 deer-vehicle accidents before the remaining deer either went through one-way deer gates or were herded out through walk-through gates or over cattleguards. During the 1978-1979 winter, only 11 deer crossed the cattleguard; 6 of these came back out the same way and the other 5 were herded out without an accident. Because there is no such thing as an effective deer guard at present (4), about the only solution is gates over the cattleguards, which would be an inconvenience for people.

For the past two years, panty hose filled with human hair have been hung under both sides of the cattleguard at the Peterson Interchange. Very few deer crossings have been observed and no accidents reported but, because of light snow cover and few deer seen in the area, it is not possible to evaluate the usefulness of the human hair deterrent.

UNDERPASSES

The inside dimensions of the three machinery underpasses and four box-type underpasses are given in Table 1. Machinery underpasses 1 and 2 are at the upper (east) end of the area and were constructed mainly for animal use and have dirt floors. Machinery underpass 1 has a seldom-used road through it. The underpass at the Peterson Interchange is at the lower (west) end of the fence. A double-lane macadam road goes under I-80 at this interchange, and the area is plowed open during periods of deep and drifting snow. Drifts of snow accumulate across the machinery underpasses, but deer walk over the dense snow.

The box underpasses have concrete walls and floors and only end openings. Box underpasses 1 and 3 have accumulated a few inches of dirt over the concrete on the floor. During periods of blowing snow, drifts accumulate in the boxes, particularly box underpasses 2, 3, and 4. Visibility is good through box underpasses 1 and 4; they are high enough to see the skyline from either end. They are also the shortest. Box underpasses 2 and 3 are low and long and carry the water flow from Coal Bank

Table 1. Location and dimensions of underpasses.

Underpass	Location (milepost)	Length (ft)	Width (ft)	Height (ft)
Machinery 1	246.0	200	30	15
Machinery 2	243.9	110	30	13
Box 1	242.3	153	10	10
Box 2	240.8	280	10	10
Box 3	240.5	393	10	10
Box 4	239.1	282	10	10
Peterson Interchange	238.1	200	50	17

Table 2. Number of deer-vehicle accidents on I-80 in the Dana Ridge area.

Migration Period	No. of Accidents		
	West Deer Fence Area	At Fence Location	East Deer Fence Area
Before deer fence construction			
Spring, 1976	2	7	0
Fall-winter, 1976-1977	4	33	0
Spring, 1977	2	13	0
Deer fence constructed to top of Dana Ridge			
Fall-winter, 1977-1978	5	37	9
Spring, 1978	2	1	5
Deer fence extended to machinery underpass 1			
Fall-winter, 1978-1979	4	0	0
Spring, 1979	0	1	1
Fall-winter, 1979-1980	5	0	1
Spring, 1980	1	0	1
Fall-winter, 1980-1981	4	0	0
Spring, 1981	0	0	0

Draw during periods of snowmelt or seldom-occurring rainstorms. They do not have a skyline view from either end and are cold and dark in the center. Noise at either end of the boxes is echoed throughout them. Traffic noise in the boxes is very low, especially toward the middle. Noise levels under the machinery underpasses are between 64 and 69 dB(A) for cars and 65 to 80 dB(A) for trucks. The faster trucks in the westbound lane going downhill are noisier than those in the uphill, eastbound lane.

RESULTS

Mule deer mortality along the 55 miles of I-80, including the migration area at Dana Ridge, was reported through the period 1967 to 1975 by Goodwin and Ward (5). Over the entire route, 571 deer kills were reported, 70 of which were in the Dana Ridge area. The number of deer-vehicle accidents recorded since 1975 in the Dana Ridge area is shown in Table 2. The 61 deer struck by vehicles during the two spring migrations and one fall-winter migration between April 1976 and June 1977 (before gameproof-fence construction) were killed west of where Dana Ridge crosses the highway. Eight were killed west of the Peterson Interchange, beyond the end of the future deer fence.

The first year after the deer fence was constructed from the Peterson Interchange to the top of Dana Ridge, 59 deer were killed. Most of the problems were associated with deer making end-runs, particularly at the upper end at Dana Ridge. Some deer crossed the cattleguards at the Peterson Interchange and some found holes in the fence. The holes were repaired, but end-runs continued during the spring migration. The number of accidents at the lower end of the high fence did not show as much change as at the top of Dana Ridge. There were some deer crossing in the area west of the Peterson Interchange prior to gameproof-fence construction, but some additional deer moved down the fence and crossed the highway. Deer are reluctant to use the interchange underpass, possibly because of the double-lane macadam road through it and because plowing the road often leaves an icy surface.

After the deer fence was extended to machinery underpass 1 during the late summer of 1978, the major problem of end-runs at the east end of the fence was alleviated. There are still deer-vehicle accidents below the Peterson Interchange, but they are not increasing in number.

The one deer killed inside the deer-fenced area during spring 1979 crawled under the fence where the dirt had washed out. It appears the deer will always be testing the fence, so a good maintenance program is mandatory. A fence is of little use if it has holes through which the deer can pass.

Regular early morning observation trips to the Dana Ridge area were started in mid-October 1977 and continued through the fall, winter, and spring until 1979. During 1980 and 1981, the inspection trips were at irregular intervals but usually made once a week to check the surveillance cameras. Accurate track counts were possible when ground cover was either loose dirt or snow and less than 20 deer were involved. Poor counts resulted during periods of intermittent or blowing snow or when ice or running water were in the underpasses. As a result, counts are considered conservative except those made with surveillance cameras. Cameras were used in box underpass 3 and machinery underpass 2 during daylight hours from October 1978 to March 1979 and during both day and night at box underpass 1 and machinery underpass 2 during the April-June 1979 migration and all migration periods from October 1979 to January 1981, with the exception of the period December 3-9, 1979, when vandals stole the camera and film.

Table 3 shows the number of deer passing under I-80 at machinery underpass 2, box underpass 3, and around the east end of the deer fence for the migration periods from October 1977 to January 1981. In mid-February 1978, a baiting program was initiated to attract deer under the highway at all of the underpasses and boxes except the Peterson Interchange at the lower (west) end. Third-cutting baled alfalfa hay, with a supplement of apple pulp, was used at box underpasses 2 and 3, and vegetable trimmings were used in box underpass 1 and machinery underpass 2. Both baits work well and deer began using the underpasses immediately. The baiting continued for a month, and the deer became familiar with the late afternoon baiting program. The baiting undoubtedly improved the use of the underpasses, especially box underpasses 2 and 3, which are long and dark. After a few days of baiting, deer were commonly found bedded down inside the underpasses during the day. The biggest problem was associated with motorists who stopped above the underpasses and spooked the deer. People are not accustomed to seeing deer as close as 100 ft. The deer paid little attention to the moving traffic but, when vehicles stop and people get out, the deer move away.

About 200 deer never did cross the highway the first year after fence construction but remained on the large sagebrush flats to the south between mileposts 239 and 240.5. The delay of deer going under the highway caused heavy use of the browse, particularly the sagebrush within 440 yards of the highway.

The first year after fence construction the deer were reluctant to cross under the highway, and deer accumulated in large numbers on the south side of the highway through February and into March. The highest count for one day was on February 11 when

Table 3. Number of mule deer passing under I-80 and making end-runs.

Year	Migration Period	Machinery 2 N	Machinery 2 S	Box 3 N	Box 3 S	Upper End-Runs N	Upper End-Runs S
1977-1978[a]	Fall	877	311	126	12	160	71
	Spring	107	698	0	6	88	105
1978-1979[b]	Fall	712	93	161	10	16	5
	Spring	37	708	1	10	27	0
1979-1980	Fall	656[c]	39	21	6	_[d]	_[d]
	Spring	52	709	0	10	_[d]	_[d]
1980-1981	Fall	512	47	4	0	_[d]	_[d]

Note: N = north-moving migrations and S = south-moving migrations.
[a]Fence construction only completed to milepost 244.9.
[b]Fence constructed to machinery underpass 1 at milepost 246.0.
[c]Camera data missing December 3-19.
[d]No record.

525 deer were seen on the south side of the highway and 86 on the north side. It was obvious from monitoring telemetered deer in the herd that they were concerned about the high fence and underpasses. Their extensive movements up and down the fence for distances of seven miles indicated frustration. In some cases they passed approaches to underpasses and boxes several times. "Collared deer" took from two weeks to three months to decide to move under the highway.

The difference between years in the number of deer seen adjacent to the highway reflects a learning pattern by the deer to use the underpasses. It was first observed during the spring migration of 1978 and has been even more evident in recent years. The telemetered deer have been monitored during movement and are spending only a few days near the highway and in many cases are moving through in one day. The deer activity along the fence and at the entrances to the underpasses also indicated less anxiety and hesitation. Baiting was used only for the one period. No baiting has been necessary recently.

Machinery underpass 2 near the top of Dana Ridge (milepost 243.9) received the most use during all migrations. More than 60 percent of the deer used this underpass during movement to their winter range and about 90 percent during the spring migration. This underpass is near a previously identified heavily used highway crossing site (1). During the first fall and winter there was considerable movement in both directions through this underpass, mainly because of the baiting program. The deer showed less concern for their safety, even though it is open sagebrush habitat. They were often seen feeding and resting under the highway, even during the early morning when traffic, particularly trucks, is heavy (Figure 3). Movement of deer back and forth through the underpass has decreased considerably in recent years, particularly after the first year of baiting. There is no apparent reason for this activity except during the rut when the bucks can be seen on the film making sure they have accounted for all the does and fawns in the group. One buck may make a couple of round trips through the underpass during such an event.

DISCUSSION

Because of the expense involved in patrolling game fences for gaps, planners will generally want to limit such patrols to the times when deer are likely to be migrating across the fenced sections of highway. Observations during the course of this study indicate that migration timing and duration are variable and that detailed knowledge of local conditions is valuable in planning for patrolling fences.

The first deer arrived at I-80 in mid-October during all four years. Activity increased through November and generally reached a peak in December when the heavy snow cover came. Some deer moved regardless of how much snow was on the ground, but most showed a definite movement toward their winter range when snow depths of 6-12 in accumulated. The major migratory triggering device is snow depths (1, 2, 6-8). It is especially evident in deer moving from summer to fall or intermediate ranges. On the intermediate range, deer show variation in tolerance to snow depths less than about 12 in. After each snowfall, different groups of deer move lower and show up at I-80.

The number of days the telemetered deer spent on the spring, summer, fall, or intermediate and winter ranges is summarized in Table 4. There appear to be two herd segments. One arrives at I-80 in October and November and the other in December and January. Good examples are D45 and D20 and their segment that arrives early and D5, D14, D21, D37, and D46 and their segment that arrives late. (Note that the "D" listed before the numbers refers to the deer collar numbers given in Table 4.) Average days spent on the summer range were similar for both herd segments (averages 143 days for early arrivals and 147 days for late arrivals). The major difference was the amount of time spent on the intermediate or fall range. Early migrants spent from 5 to 45 days (average 22 days) on the fall range while the late arrivals spent from 8 to 73 days (average 39 days) in the area. These same differences are also reflected in the amount of time spent on the winter range. Only D5, D21, and D34 spent more than 40 days during the spring on the intermediate range, and D5 was a summer resident. D34 stayed on the intermediate range until early August both years before moving to higher elevations.

During the very light snow year of 1980-1981, at least 200 deer did not leave the fall or intermediate range. D46, in fact, stayed south about 20 miles above Saratoga for both winters of 1979-1980 and 1980-1981. This fact was also reflected in the lower counts of deer moving through the underpasses along I-80, especially during 1980-1981.

Radio tracking data show the individual animals migrating at the same relative time each year. Mature doe D45 was tracked through two migrations and spent 5-14 days on the intermediate or fall range in October. D20 (a mature doe) was tracked through five fall migrations and moved to her winter range in a period of 11-45 days in October and November. D37 was tracked for two migrations and both years arrived at the highway in December after spending only 8 and 19 days, respectively, on the intermediate range. However, she spent both summers on the northeast side of Elk Mountain, 18 miles southeast of Walcott, at about the same elevation as the intermediate range on the west side of Elk Mountain. D45 moved to the fall range in late October both years and proceeded to her winter range along the North Platte River, 6 miles west of Walcott, on the south side of I-80.

Deer classification was summarized by month from October through January when bucks, does, and fawns were easily identified, both in the field and on film. October consistently had the lowest number of deer counted and the lowest ratios of does to fawns. The number of deer increased in November and again in December with a corresponding increase in the ratios of does to fawns. Both figures decreased in January. The yearly totals followed the same trend with a few notable exceptions. It appears that the major factor that accounts for the low fawn ratios of early migrants is the length of time spent

Table 4. Summary of days spent by telemetered mule deer on seasonal ranges.

Deer Collar Number	Fall Arrival Date	Spring Departure Date	Days Spent on Seasonal Ranges			
			Spring	Summer	Fall	Winter
2		5/28/74	12	133	-	-
	10/28/74		-	-	6	-
3	12/17/74		-	-	65	-
5	12/28/73		-	-	-	88
		3/30/74	68	157	14	-
14	12/17/75		-	-	58	137
		5/3/76	23	135	-	-
	12/5/77		-	-	59	-
16	12/18/76		-	-	67	-
20	12/1/76		-	-	45	162
		5/13/77	2	150	-	-
	11/10/77		-	-	29	176
		5/6/78	19	150	-	-
	11/19/78		-	-	26	176
		5/17/79	8	147	-	-
	11/1/79		-	-	11	196
		5/17/80	9	142	-	-
	11/26/81		-	-	40	179
		5/19/81	7	-	-	-
21	12/23/76		-	-	73	119
		4/21/77	41	-	-	-
24		5/11/77	7	144	-	-
	12/17/77		-	-	71	-
25		5/6/77	13	185	-	-
	12/6/77		-	-	16	-
28	12/5/77		-	-	63	-
33		4/29/78	16	151	-	-
	12/5/78		-	-	49	153
		5/7/79	12	142	-	-
34		5/19/78	156	110	-	-
	12/2/78		-	-	40	168
		5/21/79	144	100	-	-
37		5/13/78	16	187	-	-
	12/11/78		-	-	8	157
		5/11/79	17	169	-	-
	12/3/79		-	-	19	141
45		5/18/79	9	142	-	-
	10/24/79		-	-	5	204
		5/17/80	9	142	-	-
	10/17/80		-	-	14	194
		5/15/81	5	-	-	-
46	12/14/78		-	-	15	157
		5/19/79	10	160	237	-[a]
		6/2/80	-	130	221	-[a]
		5/28/81	-	-	-	

[a]Intermediate range.

on the intermediate or fall range on the west side of Elk Mountain, about 8-10 miles southeast of the Dana Ridge area. There is no indication that the late arrivals with high productivity are from any particular summer or winter areas. Both summer and winter ranges have telemetered deer staying in the same general area but moving at different times. With its diversity of browse species, the intermediate range would be expected to have greater nutritive value of food supply as expressed by Dietz (9) in Colorado and by Julander and Robinette (10) and by Robinette and others (11) in Utah. Thus, the deer in the high-producing segment of the deer herd that spend more time on the intermediate range are in better condition than the deer that go directly to the winter range.

The ratio of 61 fawns/100 does in 1979-1980 was the lowest for any year and reflects the results of the harsh winter of 1978-1979. Strickland (6) reported that a severe winter affected production of deer in a similar way in an area 35 miles south of Walcott.

The percentage of bucks in the migrating population was consistently low (7-19 percent). All counts were made after the hunting season, which was geared to put heavy pressure on the bucks.

CONCLUSIONS

Mule deer are using machinery and box-type underpasses to cross under I-80 since the construction of 8-ft-high big-game fencing to replace the regular right-of-way fence. Deer-vehicle accidents have been reduced more than 90 percent--a significant savings of deer life and vehicle damage. Major difficulties associated with big-game fencing on I-80 were (a) overcoming deer anxiety and reluctance to use the underpass the first time, (b) extending the high fence to a length great enough to prevent end-runs, (c) preventing deer from crossing cattleguards on the ramps, (d) finding and promptly repairing holes either under or through the fence, and (e) building one-way gates at the proper distance from the underpass.

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