



Summer movements, habitat use, and mortality of mule deer fawns in the Missouri River Breaks,
Montana
by Arnold Robert Dood

A thesis submitted in partial fulfillment of the requirements for the degree of master of science in Fish
and Wildlife Management
Montana State University
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Abstract:

A study of mule deer fawns was conducted in the timbered breaks adjacent to the Missouri River, northcentral Montana, during the summers of 1976 and 1977. Radio telemetry was used to obtain information on the causes, extent and timing of neonatal mortality. Seven males and 4 females were marked in 1976 and 12 males and 9 females in 1977 for a total of 32 marked fawns. Fawns appeared to have been born earlier and weighed more in 1977 when average weight was 5.40 kg as compared to 5.08 kg in 1976. Fawn behavior when approached was divided into three general categories: "fawn freeze", at age 7-10 days, "head up alert", at age 10-20 days, "jump and run", at age 15+ days. A general intolerance of females with fawns towards other deer was noted. Average movements between relocations were 0.75 km and 0.87 km in 1976 and 1977 respectively. Average home range size showed a significant increase from 169 ha in 1976 to 235 ha in 1977. Pinus-Juniperus, Artemisia-Agropyron, and Pseudotsuga-Juniperus vegetation types received over 90 percent of the recorded fawn use during both summers. Highly significant differences in vegetation type use were evident between years and from early to late summer during the same year. Measurements of the vegetation in the immediate vicinity of fawn bed sites indicated a uniform cover of 50 percent or more to a height of 3 dm was a constant characteristic of fawn bedding sites. Mortality rates were 36 and 32 percent in 1976 and 1977 respectively with predation by coyotes accounting for the majority of the mortality which occurred. No instance of mortality due to starvation (i.e. abandonment) or disease was recorded, and accidents accounted for only one death. In 1976 mortality was confined to the first 45 days of life while the majority of mortality in 1977 occurred after this period. Differential mortality by sex was not observed. Possible relationships between fawn behavior, movements, habitat use, bedding site selection, and mortality were discussed.

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SUMMER MOVEMENTS, HABITAT USE, AND MORTALITY OF MULE DEER

FAWNS IN THE MISSOURI RIVER BREAKS, MONTANA

by

ARNOLD ROBERT DOOD

A thesis submitted in partial fulfillment
of the requirements for the degree

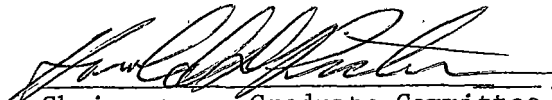
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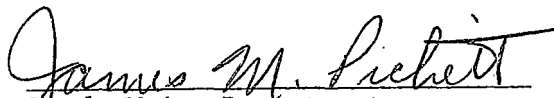
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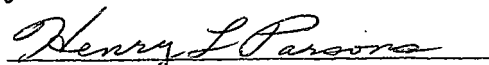
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ABSTRACT

A study of mule deer fawns was conducted in the timbered breaks adjacent to the Missouri River, northcentral Montana, during the summers of 1976 and 1977. Radio telemetry was used to obtain information on the causes, extent and timing of neonatal mortality. Seven males and 4 females were marked in 1976 and 12 males and 9 females in 1977 for a total of 32 marked fawns. Fawns appeared to have been born earlier and weighed more in 1977 when average weight was 5.40 kg as compared to 5.08 kg in 1976. Fawn behavior when approached was divided into three general categories: "fawn freeze", at age 7-10 days, "head up alert", at age 10-20 days, "jump and run", at age 15+ days. A general intolerance of females with fawns towards other deer was noted. Average movements between relocations were 0.75 km and 0.87 km in 1976 and 1977 respectively. Average home range size showed a significant increase from 169 ha in 1976 to 235 ha in 1977. Pinus-Juniperus, Artemisia-Agropyron, and Pseudotsuga-Juniperus vegetation types received over 90 percent of the recorded fawn use during both summers. Highly significant differences in vegetation type use were evident between years and from early to late summer during the same year. Measurements of the vegetation in the immediate vicinity of fawn bed sites indicated a uniform cover of 50 percent or more to a height of 3 dm was a constant characteristic of fawn bedding sites. Mortality rates were 36 and 32 percent in 1976 and 1977 respectively with predation by coyotes accounting for the majority of the mortality which occurred. No instance of mortality due to starvation (i.e. abandonment) or disease was recorded, and accidents accounted for only one death. In 1976 mortality was confined to the first 45 days of life while the majority of mortality in 1977 occurred after this period. Differential mortality by sex was not observed. Possible relationships between fawn behavior, movements, habitat use, bedding site selection, and mortality were discussed.

INTRODUCTION

The role of predation in regulating deer populations has long been debated. The debate has been prolonged and unsettled because there is a paucity of information on the role of predation and predator-prey interrelationships in mule deer (*Odocoileus hemionus*). Most of the evidence of predation on mule deer fawns to date has been indirect and, therefore, subject to considerable uncertainty.

Since 1972, observed mule deer fawn:doe ratios during early winter in the Missouri River Breaks (northcentral Montana) have been low to moderate despite average or above average spring-summer precipitation and mild open winters (Mackie, 1976). Similar situations for mule deer have been documented in other areas of the western United States (Trainer, 1977; Salvasser, 1976). During 1975-1976, predation by coyotes on mule deer fawns in the Missouri River Breaks was suspected during fall because of declining fawn:doe ratios and was actually observed during winter (Knowles, 1976). Because of the secretive nature of newborn mule deer fawns the nature and causes of fawn mortality from summer to fall had not been documented in this area.

This study was initiated in the summer of 1976 and continued in the summer of 1977. Objectives were to document the causes, extent and timing of fawn mortality in the neonatal stage, and to obtain information on fawn movements, habitat use, bedding site selection.

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and activity to aid in the evaluation of the predation that occurred.

DESCRIPTION OF STUDY AREA

The 30,353 hectare (75,000 acre) study area was located in northeastern Fergus County approximately 40 kilometers northeast of Roy, Montana, adjacent to the Missouri River (Figure 1). Boundaries were U. S. Highway 191 on the west, the Skyline Trail on the east, the Musselshell Trail on the south and the Missouri River to the north. The area is part of a broad plain dissected by intermittent streams and slopes gently to the north and east. Steep coulees, ridges and creek bottoms are closely interspersed in the northern half of the study area resulting in rugged terrain characterized by river "breaks". Gently undulating prairie occurs to the southern boundary and beyond. Elevation ranges from 701 m (2250 ft) along the river to 966 m (3,100 ft) on the prairies to the south.

Giesekear (1938) described the soil as being predominately heavy clay loams of the Lismas and Pierre series. The soils were derived from the underlying Bearpaw Formation which consists largely of clay shale with moderate amounts of alkali and other salts. These "gumbo" soils are relatively impermeable to water resulting in high runoff and are heavy and sticky when wet.

Relatively low rainfall and relative humidity along with extremes in summer and winter temperatures typify the semi-arid climate of the area. Records from the Roy 8 NE, weather station (Climatological Data, 1975, 1976, 1977) approximately 24 kilometers southwest of the

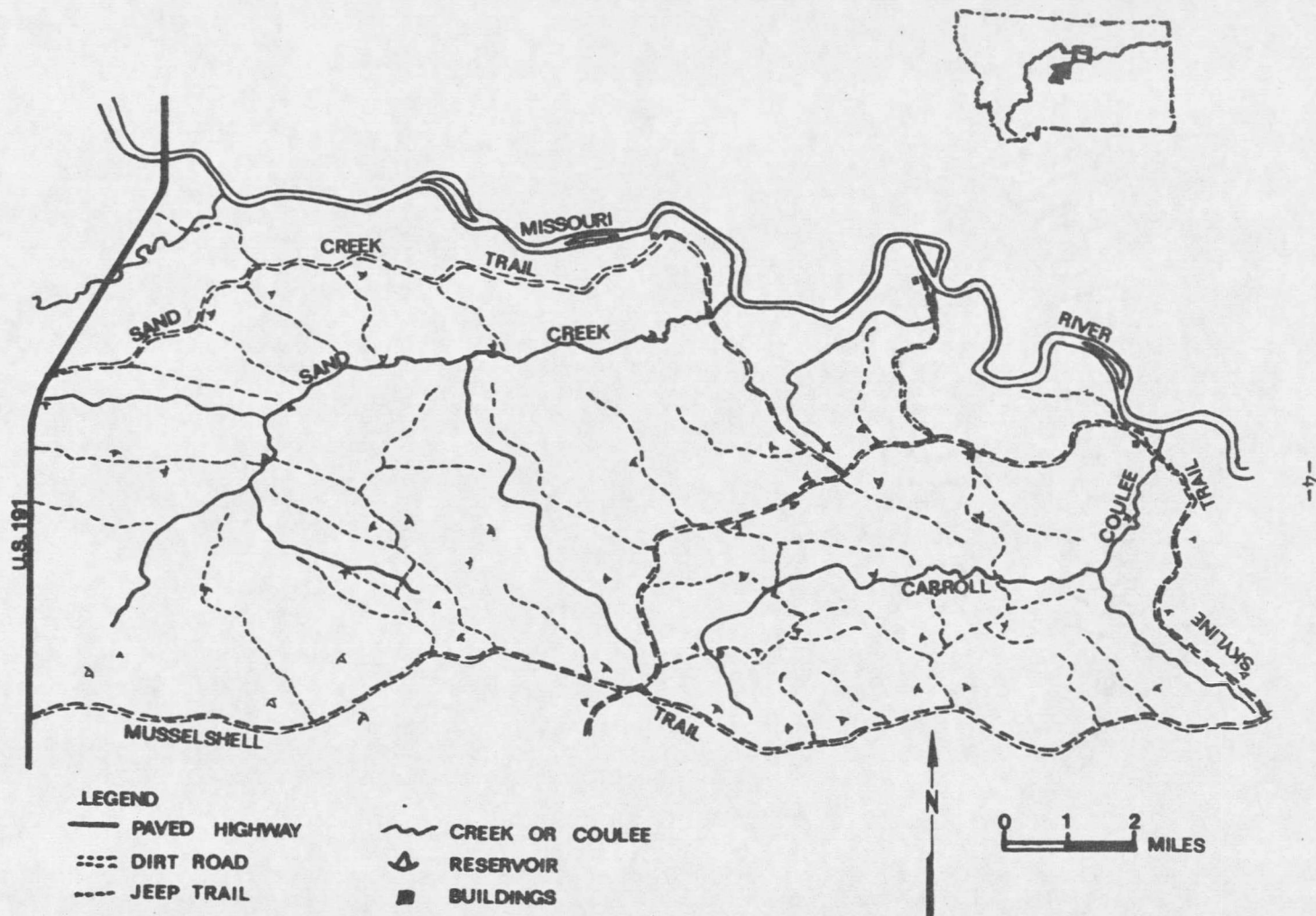


Figure 1. Map of the study area showing boundaries and drainages.

center of the area show an annual mean temperature of -8°C (17°F) in January and 21°C (70°F) in July. Precipitation occurs mainly in the spring and summer. In 1975 precipitation was higher than normal while 1976 and the spring of 1977 were below the 29 year mean (Table 1).

The study area and vicinity were subject to widespread grazing beginning in the 1880's. In the early 1900's much of the area was homesteaded, and upland sites were cultivated. Droughts and other factors led to the abandonment of homesteads, and grazing again became the major land use (Gieseke et al., 1953). Domestic livestock, mainly cattle and a few horses, now use the area. Grazing by sheep, as reported by Mackie (1966), has been eliminated.

The vegetation generally reflects the edaphic and climatic conditions occurring on the area. The ridge tops in the breaks and the prairies to the south are covered by shrub-grasslands dominated by big sagebrush (*Artemisia tridentata* Nutt.) and western wheatgrass (*Agropyron smithii* Rydb.). Timbered slopes are dominated by ponderosa pine (*Pinus ponderosa* Dougl.) or Douglas fir (*Pseudotsuga menziesii* (Mirbel) Franco) depending on exposure. Mackie (1970) described eight major vegetation types for this area and provides a more complete description of the study area.

Artemisia-Agropyron Vegetation Type

This type occupies approximately 31 percent of the study area and is generally restricted to level or gently rolling ridge tops with

Table 1. Monthly precipitation (in centimeters) for 1975, 1976, 1977 and 29 year mean for the Roy 8 NE, Montana weather station.¹

Month	29 yr. $\bar{X}$'s ²	1975	Deviation from $\bar{X}$	1976	Deviation from $\bar{X}$	1977	Deviation from $\bar{X}$
Jan.	1.14	2.08	0.94	0.33	-0.81	3.12	1.98
Feb.	1.02	0.51	-0.51	1.70	0.68	0.51	-0.51
Mar.	1.47	2.03	0.56	1.07	-0.40	5.26	3.79
Apr.	2.69	8.81	6.12	2.84	0.15	0.51	-2.18
May	6.35	8.05	1.70	2.54	-3.81	6.76	0.41
June	8.46	11.86	3.40	9.80	1.34	4.01	-4.45
July	3.86	7.72	3.86	2.97	-0.89	5.97	2.11
Aug.	3.28	7.26	3.98	2.57	-0.71	6.15	2.87
Sept.	2.97	0.99	-1.98	2.87	-0.10		
Oct.	1.93	3.48	1.55	1.73	-0.20		
Nov.	1.24	3.00	1.76	1.57	0.33		
Dec.	0.94	1.30	0.36	0.41	-0.53		
Total	35.35	57.09	21.74	30.40	-4.95	32.29	4.20

¹ Climatological Data, 1975, 1976, 1977.

² $\bar{X}$ indicates mean.

slopes of less than 15°. Big sagebrush and western wheatgrass dominate the more level areas. Big sagebrush and bluebunch wheatgrass (*Agropyron spicatum* (Pursh) Scribn. and Smith) tend to dominate on the edges of the main ridges, on the tops of side ridges and on the more level portions of the sides of ridges (Knowles, 1975). Forbs are common in these vegetation types.

Agropyron-Poa Vegetation Type

This type occurs on areas once occupied by the *Artemisia*-*Agropyron* vegetation type and is usually confined to areas of past cultivation or artificially reseeded locations. Dominant plants are western wheatgrass and Sandberg bluegrass (*Poa secunda* Trin.). This type occupies only 1.5 percent of the area.

Pinus-Juniperus Vegetation Type

The *Pinus*-*Juniperus* type occurs extensively on slight to moderately steep slopes and covers 45 percent of the study area. This type is found on south or west facing slopes in most places but can occur on north or east slopes where degree of slope is slight. *Pinus*-*Juniperus* vegetation type often occurs as an ecotone between *Artemisia*-*Agropyron* and *Pseudotsuga*-*Juniperus* types on northerly exposures. The stands of pine are generally open with closed canopies being found in occasional stands on slight, north facing slopes. Pine savannahs appear frequently on old burns and in the ecotone between pine forests and the *Artemisia*-*Agropyron* type. Dominant plants in this type are ponderosa pine and Rocky Mountain juniper (*Juniperus scopulorum* Sarg.) and in some areas

big sagebrush.

Pseudotsuga-Juniperus Vegetation Type

This type covers 13 percent of the area and generally appears on moderate to steep northerly exposures where cool mesic conditions prevail. Douglas fir dominates the well developed tree layer, and Rocky Mountain juniper dominates the dense shrub undergrowth. Choke-cherry (*Prunus virginiana* L.) and western snowberry (*Symphoricarpos occidentalis* Hook.) are also common in the undergrowth. This type is a topographic climax on sites where it occurs.

Artemisia longifolia Vegetation Type

This very limited type occurs only on loose shale of cuts and slopes. The dominant plant is longleaf sagebrush (*Artemisia longifolia* Nutt.), although greasewood (*Sarcobatus vermiculatus* Hook.) can be prominent and may dominate local stands on south-facing slopes. The herbaceous layer is poorly developed.

Sarcobatus-Agropyron Vegetation Type

This limited type (5% of the area) is generally found on foot slopes and low benches along larger coulees and Missouri River bottom lands, however, the type extends upward along adjacent slopes on clay slides (formed by downslope movement of clay overlying unstable shale). Dominant plants are greasewood and western wheatgrass and in some cases big sagebrush, which codominates with greasewood. The herbaceous layer is usually sparse, sometimes extremely so.

Agropyron-Symphoricarpos Vegetation Type

This restricted type is recognized by a wet meadow aspect dominated by western wheatgrass and western snowberry, which frequently occurs in dense patches.

Xanthium strumarium Vegetation Type

The *Xanthium strumarium* vegetation type is composed of vegetation characteristically associated with cuts or beds of intermittent water courses where the shale, silty clay, or gravelly substrate is typically moist and alkaline. Cockleburr (*Xanthium strumarium* L.) is the most widely distributed and prominent species.

Other Plant Communities

Plant communities characteristic of Missouri River bottom lands occur on the study area. These included a *Populus-Symphoricarpos* type occurring on approximately 405 hectares (1000 acres) where plains cottonwood (*Populus sargentii* Dode.) and western snowberry appear to be typical dominants of the tree and understory layer, respectively. The *Salix* type comprising 202 hectares (500 acres) of dense thicket in which *Salix* spp. are common also occurred on the area. Allen (1968) has described these bottoms in some detail.

METHODS

Mule deer fawns were marked June 14 to June 26 in 1976 and June 13 to June 28 in 1977. Fawns were located by ground and aerial surveillance. Aerial surveillance for locating does with fawns at side proved much more effective than ground observations. A fixed wing aircraft (Piper Super Cub) with pilot and one observer was used on seven mornings and 3 evenings in 1976 and 11 mornings and 1 evening in 1977 to aid in locating fawns. Radio transceivers were used to coordinate field efforts. Fawns were captured with the aid of long handled hoop nets. Capture was facilitated by attempting to approach only bedded fawns. In some cases fawns standing with does were induced to bed by placing a crew member in a conspicuous but fairly distant location which caused the fawn to bed and the doe to move off. Captured fawns were marked with radio transmitters and ear tags, or ear tags and individually recognizable streamers (5.5 X 7.5 cm). Several fawns were marked with both transmitters and streamers. Sex and weight was noted for each fawn and a hair sample from the shoulder area was removed. An attempt was made to keep handling time to a minimum (usually 10-15 min) and to minimize disturbance to the fawn and capture site to reduce the chance of abandonment by the doe.

Radio transmitters in the 150-151 MHz range equipped with mercury and thermal switches were used. The radio transmitter (Wildlife Materials Inc.) and lithium battery were fitted in a 2.5 X 8 cm piece of curved plastic which was attached to an expandable, elastic neckband.

The radio transmitter and battery were then sealed in dental acrylic. An external whip antenna approximately 2 dm long extended from the 70 to 81 gm radio package. The radios were attached snugly to the fawn's neck with the use of pop rivets through the neckband.

Ground tracking of fawns was done by use of an AVM Model LA12 radio receiver and a hand held directional four-element Yagi antenna. During 1976, radio marked fawns were radio located on a daily basis and visual contact was established at three or four day intervals. An increase in the number of radios used in 1977 resulted in radio locations being made less often but at least once during each three day interval. Activity, vegetation type, slope, exposure, group associations, time of day and condition of the fawn were recorded for each visual sighting. A visual sighting was considered as a relocation. When a relocation was obtained, fawn location was plotted on a mosaic aerial photo of the study area.

When carcasses were located the area was searched for tracks, scats and other site evidence, and a detailed written report of carcass appearance and damage, if any, was made. Photographs were taken at the site and of the carcass before and during necropsy. Criteria used to establish cause of death were similar to those employed by Rowley (1970), White (1973), and Henne (1975). Subcutaneous hemorrhages below bite marks were considered sufficient evidence of a predator caused death. Probable predator kills were those in which the site evidence was considered to be

sufficient to implicate a predator in the kill but where insufficient carcass remains prohibited confirmation of predation as the cause of death. Predator involved mortality is that in which an encounter with a predator was believed to be responsible for the mortality, but death did not occur at the time of the encounter. Predator excluded deaths are those in which the cause of death did not appear to be linked to predation.

Fawn home ranges were calculated using the modified minimum area method (Mohr, 1947) and modified (Harvey and Barbour, 1965) whenever data were insufficient or otherwise failed to justify connecting the outlying points. Home ranges were calculated only for fawns with 10 or more relocations.

Cover was measured at selected fawn bedding sites. Canopy coverage by decimeter height classes for grass and forbs was measured using a 2 x 5 dm plot frame and that of shrubs with a 4 x 10 dm plot frame (Daubenmire, 1959). Canopy coverage was estimated and recorded by class as follows: Class 1 = 0-5%; Class 2 = 5-25%; Class 3 = 25-50%; Class 4 = 50-75%; Class 5 = 75-95%; and Class 6 = 95-100%. For calculations the midpoint of each class was the value used. Ten plots at three-meter intervals were placed along two bisecting right angle 15-meter lines at each site. The first two plots were placed next to each other directly over the bedding site.

Concealment cover of total vegetation was measured at decimeter height classes with a vertical 3 x 10 dm cover board placed on the bedding site. Cover was estimated to the nearest 5 percent. The board was divided into ten height classes by alternating fluorescent orange and light blue colors to facilitate the estimation of percent cover. Four readings at 90° intervals were made with the observer standing 6 m away from the cover board. The initial reading was taken from a point directly uphill.

Additional data about deer populations on the area were obtained from helicopter and fixed winged aerial surveys (Hamlin, 1977).

RESULTS

Tagging

In 1976, observations of 11 females with 17 fawns led to 8 attempts to capture 12 fawns of which 11 were caught and marked (Table 2). In 1977, observations of 27 females with 41 fawns led to 18 attempts to catch 27 fawns of which 21 were caught and marked (Table 3). Calculations from population data (Hamlin pers. comm.) indicate that a minimum of four percent and six percent of the fawn population was marked in 1976 and 1977 respectively. Seven males and four females were marked in 1976, and 12 males and 9 females in 1977. Fawns weighed more and appeared to have been born earlier in 1977 when the average weight was 5.40 kg as compared to 5.08 kg in 1976 (Tables 2, 3).

Fawn Behavior

When captured the younger fawns tended to be docile and silent while older, heavier fawns were generally vociferous and struggled violently. Older fawns usually ran off when released.

Fawn behavior when approached during the summer can be divided into three general categories as follows: "fawn freeze", "head up alert" and "jump and run". During the first 7-10 days of life a fawn when approached will assume a position with the legs pulled against the body, neck outstretched, chin resting on the ground, and the ears laid back against the neck. A fawn in this position will remain motionless, therefore, the term "fawn freeze" is applied. In this stage fawns are difficult to locate but could be approached to the point of contact.

Table 2. Sex, weight, marking device, temporal aspects and fate for marked fawns, 1976.

Fawn No.	Sex	Weight (kg)	Type of Marker	Date Captured	Time Captured	Date Last Observed	No. Days Followed	Fate of Fawn	Comments
1	M	Unknown	R ¹	6/16	1130	8/1	46	Radio came off.	One of set of twins-other fawn escaped capture.
2	M	4.5	R	6/17	1330	2/7/77	6	Radio failed.	
3	F	3.7	R	6/18	0900	9/14	88	Last observed alive.	One of set of twins-both captured.
4	M	3.7	R	6/18	0800	6/28	10	Killed by coyotes.	Twin of No. 3.
5	M	6.8	R	6/25	2050	8/17	54	Radio failed.	
6	M	5.7	R	6/25	1000	8/29	66	Radio failed.	
7	F	6.4	R	6/25	0850	8/26	63	Radio failed.	
8	M	3.2	R	6/26	0830	8/1	36	Probable coyote kill.	One of set of twins. Both captured.
9	M	2.9	R	6/26	0830	7/7	12	Probable coyote kill.	Twin of No. 8.
10	F	6.8	R	6/26	1010	7/17	22	Killed by coyotes.	One of set of twins. Both captured.
11	F	7.0	ET ²	6/26	1010	5/5/77	19	Last observed alive.	Twin of No. 10

¹ Fawn radio transmitter.

² Ear tag with black and white streamer.

Table 3. Sex, weight, marking device, temporal aspects and fate for marked fawns, 1977.

Fawn No.	Sex	Weight (kg)	Type of Marker	Date Captured	Time Captured	Date Last Observed	No. Days Followed	Fate of Fawn	Comments
12	M	4.5	R ¹	6/13	1900	9/12	92	Last observed alive.	One of set of twins. Both captured.
13	M	4.0	R	6/13	1900	9/12	92	Last observed alive.	Twin of No. 12.
14	F	5.2	R	6/15	1900	6/20	5	Fawn dead from unknown cause. Carcass completely consumed by coyotes.	One of set of twins. Other fawn escaped capture.
15	F	7.0	R, ET ²	6/17	1015	8/19	63	Radio failed.	
16	M	4.1	R	6/17	1045	9/14	89	Last observed alive.	
17	M	7.5	R, ET	6/18	0900	8/6	48	Fawn killed by coyotes.	One of set of twins. Other fawn escaped capture.
18	F	3.9	R	6/20	0930	9/12	84	Last observed alive.	One of set of twins. Both captured.
19	F	3.2	R	6/20	0930	8/17	58	Probable coyote kill.	Twin of No. 18.
20	M	6.4	R	6/20	0700	9/14	86	Last observed alive.	One of set of twins. Both captured.
21	M	5.7	R	6/20	0700	9/14	86	Last observed alive.	Twin of No. 20.

Table 3. (continued).

Fawn No.	Sex	Weight (kg)	Type of Marker	Date Captured	Time Captured	Date Last Observed	No. Days Followed	Fate of Fawn	Comments
22	F	5.0	R, ET	6/20	0800	8/24	65	Probable coyote kill.	
23	F	7.0	R, ET	6/20	0845	8/7	48	Predator involved death.	
24	M	5.0	R	6/22	0720	9/13	83	Last observed alive.	One of set of twins. Both captured.
25	M	5.2	R	6/22	0720	9/13	83	Last observed alive.	Twin of No. 24.
26	M	5.4	R	6/23	0715	6/26	3	Fawn died as a result of an accident.	One of set of twins. Both captured.
27	M	4.8	ET	6/23	0715	-	-	Fawn never reobserved.	Twin of No. 26.
28	M	5.7	R	6/22	0945	9/12	82	Last observed alive.	One of set of twins. Other fawn escaped capture.
29	F	5.9	R	6/28	0830	9/13	77	Last observed alive.	
30	F	5.2	R	6/28	1000	9/13	77	Last observed alive.	
31	F	6.4	ET	6/23	0745	-	-	Fawn never reobserved.	One of set of twins. Both captured. 5 cm gash on top of skull; left eye possibly blinded; right ear punctured.
32	M	6.6	ET	6/23	0745	-	-	Fawn never reobserved.	Twin of No. 31.

¹ Fawn radio transmitter

² Ear tag with individually recognizable streamer.

The second stage generally occurs during 10-20 days after birth. It is termed "head up alert" as this is the position assumed by the fawn when approached. In this stage a fawn can generally be approached to within 10 m or less before flight. The third stage occurs at 15+ days and is labelled "jump and run" as this is the action the fawn takes when approached. A fawn can seldom be approached to within 10 m in this stage.

Observations indicated a general intolerance of does with fawns towards other deer as had been observed by Mackie (1970) and Knowles (1975). Tolerance of females with fawns towards other deer generally increased as the summer progressed.

Foraging by fawns was first noted on 14 July and 2 July in 1976 and 1977 respectively. General observations indicated increased foraging by fawns with increasing age.

Movements

Mule deer fawns were capable of extensive movements early in life. Maximum movement between relocations observed during the study was 3.78 km; the minimum was approximately 20 m (Table 4). The maximum movement resulted when a 3 week old fawn moved after its twin had been killed by coyotes. Average movement between relocations was 0.75 km in 1976 and 0.87 km in 1977 (Tables 4, 5). Movements were variable between individuals and at different times for the same individual. Twin fawns usually moved together. Most of the movements were the result of fawns following the doe during their active periods.

Table 4. Maximum, minimum, and average movements between relocations, maximum diameter and home range of marked fawns for summer 1976.¹

Fawn No.	No. Relocations	Maximum Movement (km)	Minimum Movement (km)	Average Movement (km)	Maximum Diameter (km)	Area (hectares)
1	13	1.77	0.08	0.60	1.77	109
2	2	1.21	0.16	0.69	1.21	-
3	28	3.78	0.04	0.98	3.86	372
4	3	0.40	0.32	0.35	0.40	-
5	15	1.45	0.16	0.55	2.09	97
6	20	1.45	0.02	0.56	1.61	134
7	22	1.61	0.16	0.80	2.57	174
8	11	2.01	0.24	0.92	2.90	126
9	3	2.01	1.04	1.48	2.57	-
10	8	1.29	0.04	0.53	2.01	-
Average	13	1.70	0.23	0.75	2.10	169

¹

Fawn No. 11 not listed due to limited data.

Table 5. Maximum, minimum, and average movements between relocations, maximum diameter and home range of marked fawns for summer 1977.¹

Fawn No.	No. Relocations	Maximum Movement (km)	Minimum Movement (km)	Average Movement (km)	Maximum Diameter (km)	Area (hectares)
12	24	1.61	0.16	0.84	2.17	231
13	22	1.61	0.16	0.89	2.17	231
14	2	1.13	1.13	-	-	-
15	18	1.29	0.16	0.87	2.25	178
16	24	1.61	0.16	0.66	2.25	170
17	14	2.01	0.48	0.95	2.41	243
18	24	1.93	0.24	0.87	2.98	299
19	18	1.93	0.24	0.89	2.82	267
20	23	1.77	0.08	0.79	3.22	231
21	22	1.77	0.08	0.81	3.22	231
22	18	1.77	0.16	0.58	2.25	134
23	14	2.74	0.08	1.22	4.02	320
24	21	1.93	0.16	0.87	2.74	251
25	21	1.85	0.16	0.77	2.74	251
26	2	0.40	0.40	-	-	-
28	23	2.41	0.16	0.90	3.46	267
29	21	2.82	0.08	1.05	3.22	227
30	20	1.93	0.24	0.90	2.57	223
Average	18	1.81	0.24	0.87	2.78	235

¹ Fawns not relocated after marking are not listed.

Home range sizes observed for all marked fawns with 10 or more relocations varied from a maximum of 372 hectares (Figure 2) to a minimum of 97 hectares (Figure 3) with averages being 169 hectares in 1976 and 235 hectares in 1977 (Figure 4, Tables 4, 5). Statistical analysis indicated the increase in average home range size in 1977 was significant (t test, $P \leq .05$). Home range overlap did occur (Figure 5) but use of the overlap areas by one generally excluded use by the other. Range (i.e. maximum diameter across home range) averages varied from 2.10 km in 1976 to 2.78 km in 1977.

Habitat Use

The Artemisia-Agropyron, Pinus-Juniperus, and Pseudotsuga-Juniperus vegetation types received over 90 percent of the recorded fawn habitat use during both summers. All other types received only minor fawn use (Tables 6, 7).

Highly significant (χ^2 , $P \leq .001$) differences in habitat use were evident between years and from early to late summer during the same year. Habitat use by the fawns varied from heavy use of Artemisia-Agropyron (27%) and Pinus-Juniperus (48%) in the first half of the summer to almost exclusively Pseudotsuga-Juniperus (88%) in the second half of summer 1976. Use of Artemisia-Agropyron (4%) during 1977 was almost eliminated and a corresponding increase in the use of Pinus-Juniperus (46%) and Pseudotsuga-Juniperus (42%) occurred in the early summer. In the second half of summer use of Pinus-Juniperus (31%) declined but still showed a

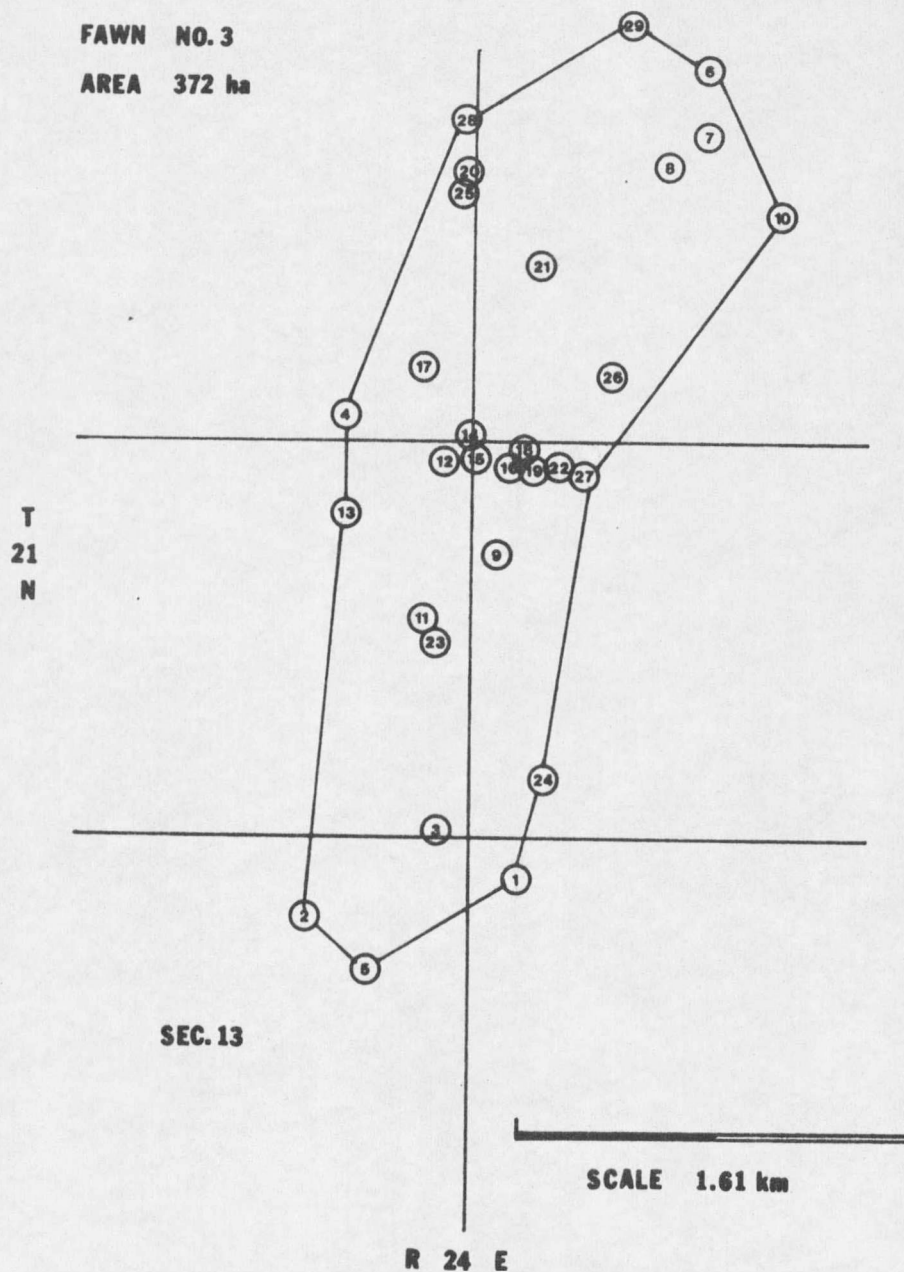


Figure 2. Home range of fawn No. 3, which had the largest home range observed for all marked fawns with 10 or more relocations (numbers indicate relocations in order of occurrence).

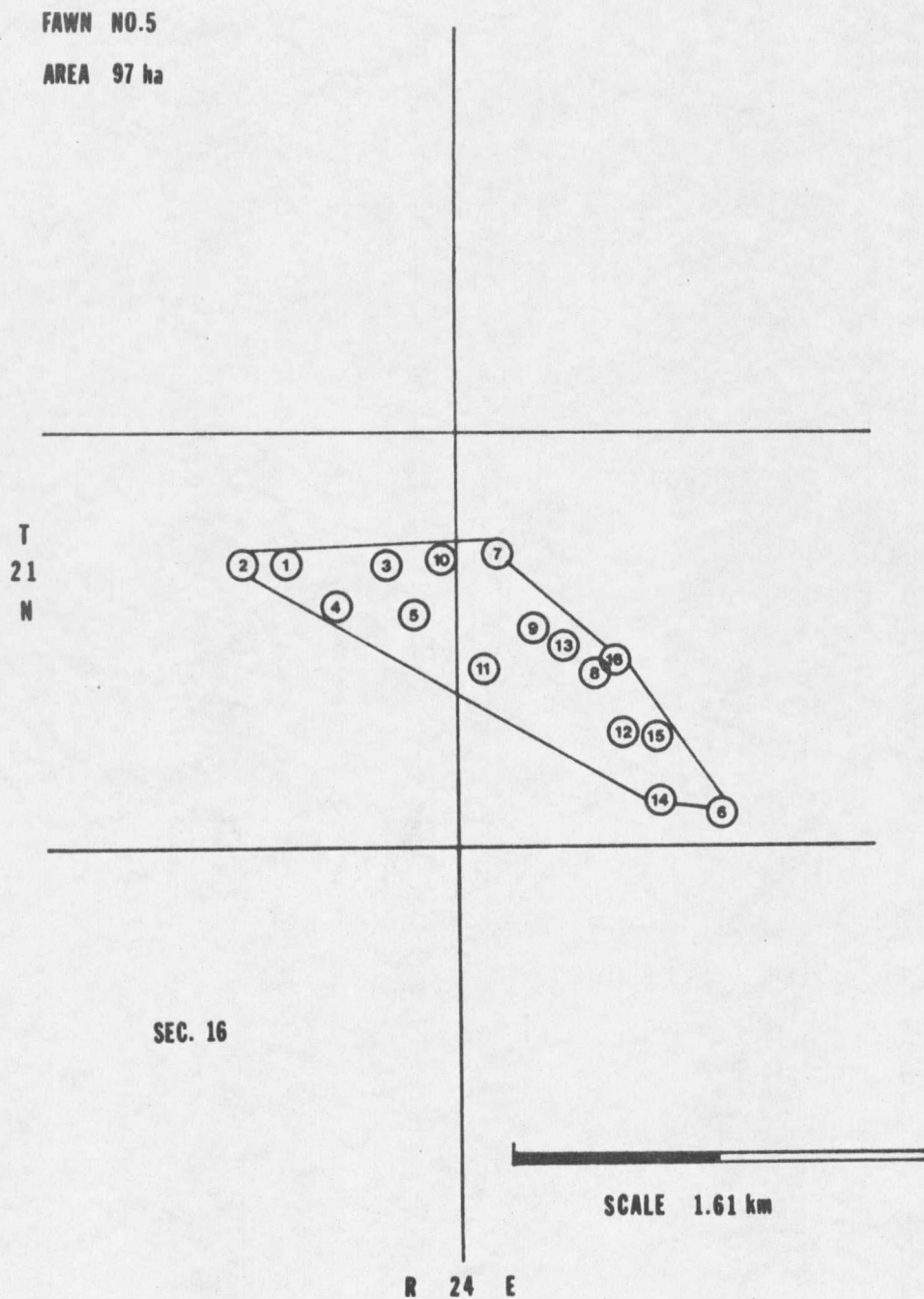


Figure 3. Home range of fawn No. 5, which had the smallest home range observed for all marked fawns with 10 or more relocations (numbers indicate relocations in order of occurrence).

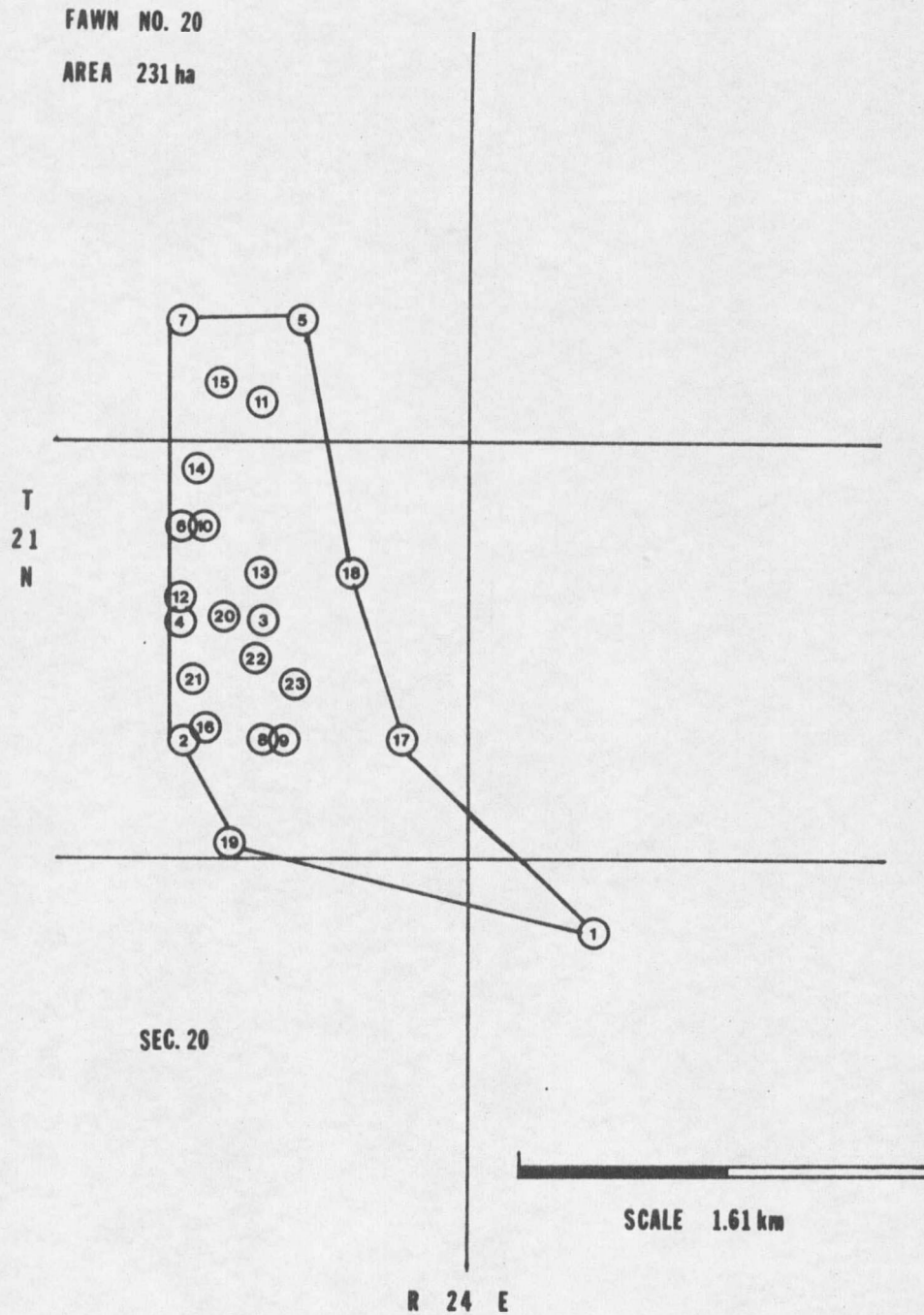


Figure 4. Home range of fawn No. 20 demonstrating an average size home range observed for all marked fawns with 10 or more relocations (numbers indicate relocations in order of occurrence).

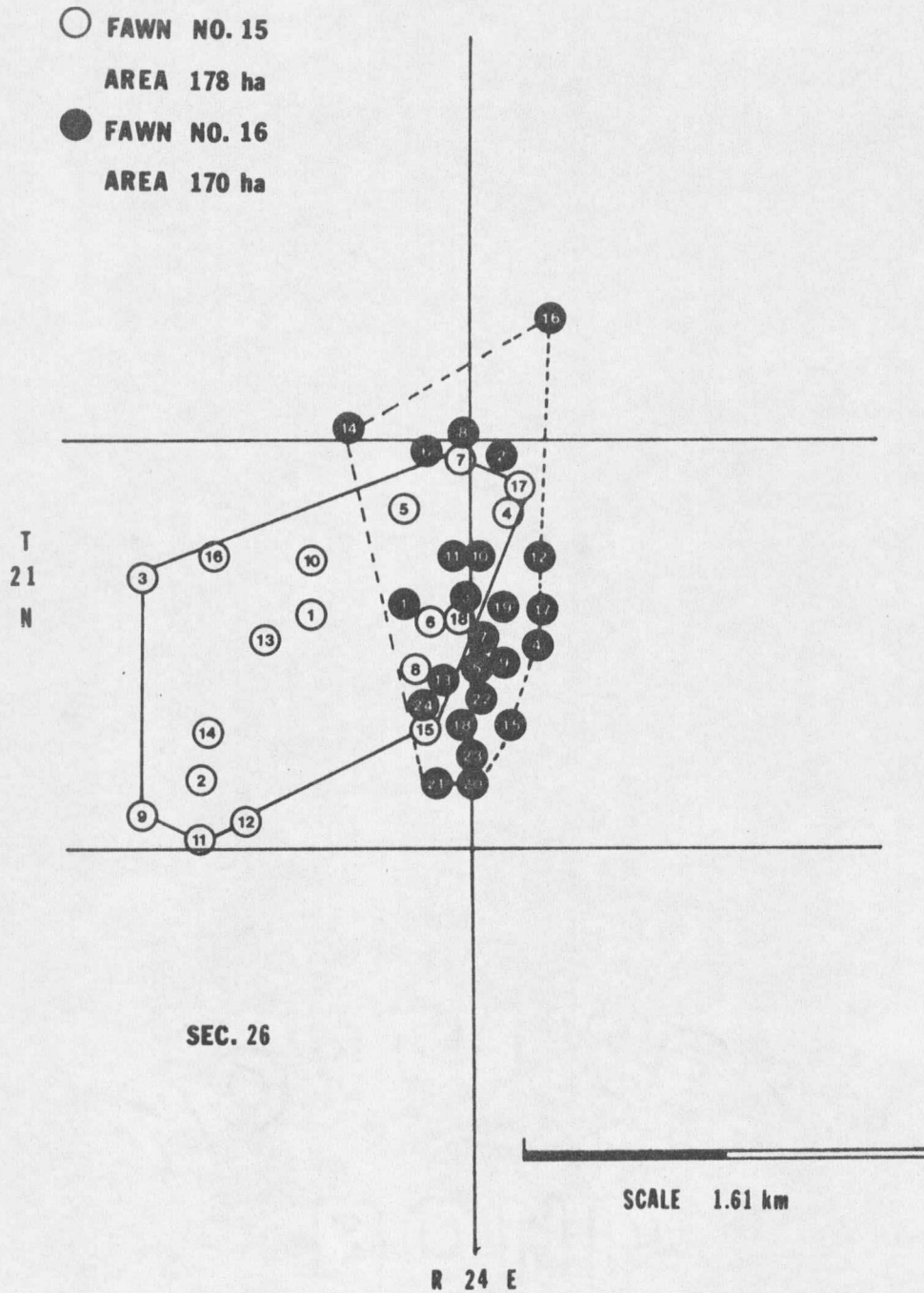


Figure 5. Home ranges of fawns No. 15 and 16 showing home range overlap (numbers indicate relocations in order of occurrence).

Table 6. A summary of fawn habitat use for the summer of 1976. The figures indicate the percent habitat use for all marked fawns. Early summer (June - July 30) / late summer (July 31 - Sept. 14).

Fawn No.	Number of Observations	<i>Artemisia-¹ Agropyron</i>	<i>Pinus- Juniperus</i>	<i>Pseudotsuga- Juniperus</i>	<i>Artemisia longifolia</i>	<i>Sarcobatus- Agropyron</i>	<i>Xanthium strumarium</i>	<i>Populus- Symphoricarpos</i>	Other
1	12/1	8/0	58/0	25/100	8/0	-	-	-	-
2	2/0	50/0	50/0	-	-	-	-	-	-
3	13/15	27/0	46/0	23/93	-	8/0	-	0/7	-
4	3/0	100/0	-	-	-	-	-	-	-
5	8/7	0/4	88/0	0/86	-	-	-	-	13/0
6	9/11	22/0	22/0	44/100	11/0	-	-	-	-
7	9/13	22/23	56/0	11/77	11/0	-	-	-	-
8	10/1	70/0	-	10/0	10/100	-	-	-	-
9	3/0	67/0	33/0	-	-	-	-	-	-
10	8/0	-	88/0	-	-	-	-	-	13/0
11	2/0	-	100/0	-	-	-	-	-	-
Total 79/48		27/8	48/0	15/88	5/2	1/0	-	0/2	4/0

¹ Vegetation types not listed had no instances of fawn use.

Table 7. A summary of fawn habitat use for the summer of 1977. The figures indicate the percent habitat use for all marked fawns. Early summer (June - July 30) / late summer (July 31 - Sept. 14).

Fawn No.	Number of Observations	<i>Artemisia-Agropyron</i> ¹	<i>Pinus-Juniperus</i>	<i>Pseudotsuga-Juniperus</i>	<i>Artemisia longifolia</i>	<i>Sarcobatus-Agropyron</i>	<i>Xanthium strumarium</i>	<i>Populus-Symphoricarpos</i>	Other
12	12/11	-	83/82	8/18	-	-	-	-	8/0
13	12/9	-	83/78	8/22	-	-	-	-	8/0
14	1/0	-	-	100/0	-	-	-	-	-
15	11/6	9/0	55/0	36/100	-	-	-	-	-
16	11/11	9/0	9/0	82/100	-	-	-	-	-
17	11/2	-	55/0	9/0	-	-	-	27/100	-
18	11/12	18/0	64/58	18/42	-	-	-	-	-
19	10/6	-	80/17	20/83	-	-	-	-	-
20	10/12	-	10/25	90/67	-	-	0/8	-	-
21	10/11	-	10/27	90/64	-	-	0/9	-	-
22	10/7	0/14	70/0	30/86	-	-	-	-	-
23	10/3	-	20/0	80/100	-	-	-	-	-
24	10/10	-	40/10	40/90	-	-	-	-	10/0
25	10/10	20/0	40/10	40/90	-	-	-	-	-
26	1/0	-	-	-	100/0	-	-	-	-
27	-	-	-	-	-	-	-	-	-
28	11/10	-	64/90	27/10	-	9/0	-	-	-
29	8/12	-	13/17	38/33	-	13/0	-	38/50	-
30	9/10	-	22/10	78/80	-	-	-	-	0/10
31	-	-	-	-	-	-	-	-	-
32	-	-	-	-	-	-	-	-	-
Total 168/142		4/1	46/31	42/61	1/0	2/0	0/1	4/6	2/1

¹ Vegetation types not listed had no instances of fawn use.

substantial increase over 1976. Use of *Pseudotsuga-Juniperus* (61%) increased but not to the level observed in 1976.

Use of Exposure

Fawn use of exposure was similar between early and late summer and between years (Table 8). North facing slopes and aspects received the greatest use during early and late summer of both years because the fawns used the more timbered types occurring on these exposures. A slight decline in the use of north slopes and aspects was observed during late summer 1977 compared to values obtained in late summer of 1976. During both years use of south and east facing slopes declined slightly from early to late summer in conjunction with declining use of more open vegetation types occurring on these exposures.

Use of Slope

Slopes in the 11-25° range generally received the majority of fawn use during both years (Table 9). In the early summer of 1976 however, the majority of fawn use was on slopes in the 0-10° range because the fawns were using the more level *Artemisia-Agropyron* and *Pinus-Juniperus* vegetation types at that time. Slopes greater than 36° are generally open and were used only occasionally by fawns.

Fawn Bedding Site Selection

Mule deer fawns generally selected bed sites on small level areas on slopes. Ridge tops and coulee bottoms were seldom used for bed sites. After a period of activity with the doe had been terminated, the fawn

Table 8. Use of exposure (in percent) during early summer (June - July 30) and late summer (July 31 - Sept. 14) for all marked fawns.

	N	NE	E	SE	S	SW	W	NW
1976 Early	31	17	12	3	17	3	7	10
Late	28	35	0	0	2	5	7	23
1977 Early	21	18	13	7	6	10	10	16
Late	26	13	8	7	4	9	20	15

Table 9. Use of slope (in percent) during early summer (June - July 30) and late summer (July 31 - Sept. 14) for all marked fawns.

	Degrees of Slope			
	0 - 10	11 - 25	26 - 35	36+
1976 Early	45	34	11	10
Late	22	39	22	17
1977 Early	22	47	24	7
Late	20	55	18	8

would move off and select a bed site. Upon selection of a bed site the fawn would paw the area with a foreleg and create a small depression. The doe seldom bedded in the immediate vicinity of her fawn although this occurred more often late in the summer. Twin fawns bedded separately. Distances between bedded twins varied from 0 - 0.8 km with 5-15 m being common.

Canopy cover and frequency data from bed sites are presented in Table 10. Comparison of data between years from similar habitats indicates a decrease in both canopy coverage and frequency of forbs at bed sites in 1977. Canopy coverage and frequency of shrubs increased correspondingly. Canopy coverage of grasses was similar between years. The tendency of fawns to choose more shrub rich and less forb rich sites in 1977 as compared to 1976 can be attributed to changes in available vegetation due to decreased precipitation and changes in habitat use between years.

Concealment cover data indicate that cover of 50 percent or more to a height of 3 dm is normally found at fawn bedding sites (Table 11). Fawns used vegetation and topography or both to provide concealment. Rocky Mountain juniper, big sagebrush, greasewood and other shrubs were typically used by fawns to provide at least a portion of the concealment. Concealment of fawns was generally good from three sides. The side which was open was variable and no trend could be ascertained.

Table 10. A summary of the vegetation at fawn bedding sites as related to fawn concealment determined from 2 X 5 dm plots (mean percent canopy coverage/mean percent frequency).

Height Class (dm)	1976 <i>Artemisia longifolia</i> (1) ¹	1976 Artemisia- Agropyron (3)	1977 Artemisia- Agropyron (1)	1976 Pinus- Juniperus (4)	1977 Pinus- Juniperus (6)	1976 Pseudotsuga- Juniperus (1)	1977 Pseudotsuga- Juniperus (6)
Grass 1	4/20	4/47	5/20	4/45	6/30	1/30	13/38
Grass 2	15/70	7/63	22/40	5/58	7/18	4/50	14/42
Grass 3	1/20	18/77	6/50	6/45	8/18	20/70	6/20
Grass 4	-	9/53	-	3/15	6/20	8/30	4/13
Grass 5	-	2/10	12/40	1/3	2/3	2/10	1/5
Grass 6 ²	-	2/17	11/30	1/3	1/3	-	2/3
Forb 1	3/60	6/73	-	6/65	4/40	5/80	4/45
Forb 2	1/10	4/70	7/40	3/33	1/2	1/20	1/3
Forb 3	4/50	8/60	-	2/18	1/2	10/30	-
Forb 4	-	4/17	-	1/13	-	-	-
Forb 5 ²	-	3/7	-	1/10	1/2	-	-
Shrub 1	2/20	1/20	18/60	4/30	26/62	2/20	26/75
Shrub 2	-	3/40	18/60	5/28	26/48	8/40	23/50
Shrub 3	-	2/10	14/50	12/35	30/52	3/30	21/50
Shrub 4	10/30	6/17	5/20	8/25	29/50	3/20	19/48
Shrub 5	-	3/13	2/10	7/15	26/40	-	10/28
Shrub 6	-	2/13	-	5/13	23/35	5/30	12/27
Shrub 7	-	1/3	-	4/13	20/33	-	10/15
Shrub 8	-	-	-	2/8	15/27	-	9/18
Shrub 9	-	-	-	2/8	12/20	-	6/12
Shrub 10	-	-	-	11/23	12/20	-	6/10

¹ Sample size.

² Above this class canopy coverage means $\leq$ 2%, frequency less than 20%.

Table 11. A summary of the concealment cover at fawn bedding sites as determined with a vertical 3 X 10 dm cover board. Numbers indicate the mean percent of concealment cover for the 10 height classes,

Height Class (dm)	1976 <i>Artemisia</i> <i>longifolia</i> (1) ¹	1976 Artemisia- Agropyron (3)	1977 Artemisia- Agropyron (1)	1976 Pinus- Juniperus (4)	1977 Pinus- Juniperus (6)	1976 Pseudotsuga- Juniperus (1)	1977 Pseudotsuga- Juniperus (6)
1	14	61	75	77	84	55	80
2	9	48	43	67	81	51	73
3	11	32	13	61	71	36	66
4	10	30	6	60	64	23	62
5	8	16	3	55	56	1	56
6	-	3	-	48	57	7	50
7	-	3	-	44	54	6	44
8	-	-	-	45	51	6	46
9	-	-	-	43	50	4	41
10	-	-	-	39	49	4	39

¹ Sample size

Hair Sample Analysis

Hair sample analysis (Sims, 1968) by Dr. Harold Picton indicated no periods of in-utero protein deficiency were evident for any fawn marked during the study.

Mortality

Deer density on the area was estimated at approximately 3.5 deer/sq mi (Hamlin, 1977). Coyote densities were estimated to be a minimum of 0.6 coyotes/sq mi, and data indicated a slight decrease in densities from 1976 to 1977 (Pyrah, 1977).

In 1976, 4 of 11 fawns died for a total mortality of 36 percent. During 1977, 6 of 19 died for 32 percent mortality. A breakdown of the causes of mortality is presented in Table 12. No instance of mortality due to starvation (ie. abandonment) or disease was recorded, and accidents accounted for only 1 death. None of the fawns exhibited signs of poor condition prior to their death. Predation was the major source of fawn mortality during both summers. Mortality was known to have occurred during the June tagging period. In 1976 a portion of a fawn carcass was recovered on 15 June, and in 1977 a fawn (No. 14) marked early in the tagging period was dead before tagging ceased. During 1976 mortality was confined to the period 10-36 days after fawns were marked with no mortality occurring after 1 August. Timing of mortality was different in 1977. Two fawns died within 10 days of being marked and the majority of mortality (67%) occurred after 1 August. Three males and

Table 12. A resumé of fawn mortality in 1976 and 1977.¹

	Cause	No. of Mortalities
1976	Confirmed coyote kill	2
	Probable coyote kill	2
	Total	4 (36%)
1977	Confirmed coyote kill	2
	Probable coyote kill	1
	Coyote involved death	1
	Accidental death	1
	Unknown	1
	Total	6 (32%)

¹ For a description of mortality classes see page 11.

one female fawn died in 1976 and two males and four females in 1977. Of the fawns that died, 75 percent in 1976 and 67 percent in 1977 were from multiple litters.

Patterns in the method of killing and consumption by coyotes were evident. Coyotes killed fawns by grasping them with the lower jaw on the throat and the upper jaw and canines on the dorsal surface of the skull. This generally resulted in fracturing the skull of young fawns or suffocation in older fawns. Consumption proceeded from the viscera to the hindquarters then forward to the shoulder, neck and head. Carcass and site evidence indicated coyotes would drag the kill into cover before consumption. Appendix A presents a complete description of all mortalities.

DISCUSSION

Mule deer population trends are ultimately determined by recruitment. It is generally felt that the reproductive side of the population equation is seldom the cause of low population recruitment in big game populations (Caughley, 1966). Ovarian analysis and in-utero fetal counts from statewide carcass collections (Knowles, 1977) and aerial classifications (Hamlin, 1977) indicate normal levels of fawn production statewide and on the study area. The mortality side of the population equation, particularly the mortality rate during the first year of life, is the usual variable which adjusts population size to the carrying capacity (Caughley, 1970). Hence an incriminating finger is pointed at fawn mortality as an explanation of the low fawn:doe ratios observed on the study area (Hamlin, 1977). Many factors, including behavioral, physiological, and environmental, affect the number of fawns surviving to provide recruitment.

Behavior

The cryptic nature of newborn fawns, a general inactivity of fawns in the absence of the doe, the bedding behavior of fawns from multiple litters, and the intolerance of females with fawns towards other deer all serve to lessen the likelihood of predation on neo-natal fawns. Secretive newborns are undoubtedly difficult for potential predators to locate. Separate bedding of twin fawns also reduces the chance that both will be lost to predation although the possibility that one of the

fawns will be lost is probably increased due to the inability of the doe to provide as much individual protection for twins as compared to singles. Intolerance of females with fawns towards other deer provides for a good dispersion of fawns and avoids concentrations which would prove attractive to predators. Trainer (1977) noted the majority of predator caused fawn mortality occurred after they had reached ten days of age. Data from the present study tend to support this observation. Explanation of this fact probably lies in the increased activity and hence vulnerability of fawns who have reached the "head up alert" stage in their behavioral development. Carroll and Brown (1974) noted that white-tailed deer fawns (*Odocoileus virginianus*) with adequate cover were free from predation until they approached flushing age.

Movements

Movements of fawns are a reflection of the movements of the doe. The increase in the average movement, range and home range observed during 1977 was undoubtedly related to changes in range and forage use brought on by the drought conditions which occurred. Mackie (1970) and Knowles (1975) have shown forbs to be important in the diet of mule deer in the Breaks during the late spring and early summer. Mackie (1970) observed a change in forage use from forbs to browse as a result of drought conditions and associated this change with more extensive movements. During the present study, a documented decrease in forbs at fawn bed sites combined with the observed heavy use of the timbered

vegetation types early in the summer indicated a change in forage use by the doe was partially responsible for the increased fawn movements observed in 1977. There was no clear effect of increased movements on mortality. Restricting movements to the more secure timbered vegetation types possibly offset increased mortality due to more extensive movements. Home range sizes for mule deer fawns were much greater than those reported for white-tailed fawns (Carroll and Brown, 1974; Garner, 1976). Differences are probably related to dissimilar habits and habitats of the two species.

Habitat Use

Data from this study indicate a relationship between use of more open vegetation types and fawn mortality. All of the mortality in 1976 occurred in the first half of summer when use of the more open types was greatest. A change in use to the more timbered types in the latter half of summer 1976 coincided with decreased fawn mortality. During 1977 little mortality occurred in the first half of summer when fawns were already in the timbered types. An increased use of the more open types observed in the latter half of summer coincided with increased mortality.

Range use by the fawns is a reflection of use by the doe. Changes in use of vegetation type observed between early and late summer and between years may have been the result of changes in forage use by the doe. An increased use of the more timbered types in the latter half

of the summer of 1976 was probably associated with a switch in forage use from forbs to browse as the forbs dessicated in the more open vegetation types. Below normal precipitation in 1976 and during the spring of 1977 probably resulted in an earlier change from forbs to browse and the resulting heavy use of the timbered types observed in the early summer of 1977. Increased rainfall and a green up of grasses during the latter half of the summer of 1977 can account for the use of the more open vegetation types observed at that time.

Observations of cattle distribution on the area (Pyrah pers. comm.) indicate that observed changes in range use can also be correlated with changes in cattle distribution. Fawns were never observed in the close proximity of cattle during the study. The vegetation types used most by fawns are those generally used least by cattle. Observed use of the more timbered types during the latter half of summer 1976 can be related to an increased distribution of cattle on the ridge tops and coulee bottoms in the Breaks. Also a more extensive use of timbered types during early summer 1977 can be related to a change in distribution of cattle observed at that time. Due to the drought conditions that existed, cattle moved into the coulee bottoms and ridges in the breaks earlier in 1977 than in 1976.

Knowlton (1964), working with white-tailed fawns in Texas, reported fawn survival during a dry summer was not consistent but seemed to vary by vegetation type with more diversified habitats permitting the highest

survival rates.

Fawn Bedding Site Selection

The vegetation types on the area have differing capacities to provide secure fawn bed sites. Fawns selecting bed sites in more open areas would be more easily located and captured than those selecting sites in dense cover. Garner (1976) stated that white-tailed fawns selected bed sites surrounded by herbaceous vegetation that supplied a relatively uniform level of concealment regardless of the vegetative species composition. Salwasser (1974a) noted a requirement for dense cover and interspersed habitat types for an area to provide fawn bed sites and felt that in cover deficient areas coyotes could readily take fawns (Salwasser et al., 1978).

Measurements of the vegetation in the immediate vicinity of fawn bed sites during this study indicated a uniform cover to 3 dm or more was correlated with areas providing fawn bed sites. Environmental factors which decrease availability of the cover required by fawns would probably increase their vulnerability to predation. Grazing and drought are the two major factors affecting low lying cover on this study area. Garner (1976) found that daytime fawn bed sites were located on range sites in good to excellent condition. Heavy grazing by cattle on the more open vegetation types undoubtedly reduces their ability to provide secure fawn bed sites. A long term drought would have a similar affect through decreased production of grass and forbs. Knowlton (1964), Carroll

and Brown (1974), Mackie (1970), and Beasom (1974) have documented the adverse effects of drought on fawn survival. An anomaly was noted in that short term drought on the area brought about increased survival, at least temporarily, by increasing use of the more secure timbered types. The lower ambient temperatures in the timbered types may have been involved in fawn bed site selection as was noted by Garner (1976) for white-tailed fawns in Oklahoma.

Mortality

Studies of fawn mortality for white-tailed deer (Beasom, 1974; O'Pezio, 1978; Davis et al., 1976; Knowlton, 1964; Carroll and Brown, 1974; Logan, 1972; Cook et al., 1971; Garner, 1976) and mule deer (Trainer, 1977; Salwasser, 1974a, 1974b, 1978) indicate its variable nature. The observed mortality rates during this study can best be described as moderate when compared to mule deer fawn mortality rates obtained by workers in other areas (Trainer, 1977; Salwasser, 1978). In almost all cases where fawns and their predators occupy the same range, predation is the major factor in determining the extent of summer fawn mortality. The only exception to this has been a study by Logan (1972) where disease as influenced by high deer densities and malnutrition played an important role in fawn mortality. Potential predators of mule deer fawns on the study area were golden eagles (*Aquila chrysaetos*), bobcats (*Lynx rufus*), and coyotes (*Canis latrans*) but only the latter had a significant effect on fawn mortality.

Data from this study indicate periods of major mortality can occur at any time from parturition throughout the summer. Previous work by Salwasser (1974a, 1974b, 1978), Knowlton (1964), Trainer (1977), Logan (1972), White (1966), Cook et al. (1971), and Julander and Robinette (1950) have indicated that the majority of mortality was confined to the first few weeks of life. Differential mortality of male fawns has been reported by Jackson et al. (1972), White (1966), Knowlton (1964), and Taber and Dasmann (1954) and was felt to be related to increased activity levels on the part of males. Data from this study tend to support the conclusions of Trainer (1977) and Robinette et al. (1957) in that differential mortality in male mule deer fawns occurs after the first summer of life. Patterns of killing and consumption were similar to those reported for coyotes elsewhere (White, 1973). Heavy utilization of fawn carcasses by coyotes on the area during both years was similar to that reported by White (1973) in a year when coyote foods were much less abundant than normal. There was no evidence of coyote scavaging of fawns that had died from other causes.

Data from aerial surveys on the area (Hamlin, pers. comm.) indicate that the sample sizes of telemetered fawns in this study were adequate to provide estimations of summer fawn mortality.

The proximate factors of fawn mortality were documented during this study but the ultimate reason or reasons for this mortality remain elusive. Also the extent to which the mortality occurring is of a

compensatory nature has yet to be determined. Declining fawn:doe ratios on the area during the fall and winter (Hamlin, 1977) indicate major mortality can occur during these periods. Data from this study point to a need for more information on those factors which influence fawn survival during the fall and early winter in order to more fully appreciate the potential influence of predators on mule deer populations in the Breaks.

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APPENDIX

APPENDIX

Fawn Mortality Case Histories

CASE NO. 1 Unmarked fawn found during tagging period.

Date carcass located - 6/15/76

Sex - Male

The carcass was located by a tagging crew on an east slope (5-10°) in an old burn with juniper cover. The doe had been observed in the vicinity and was very reluctant to leave. Remains consisted of that portion of the fawn from the pelvis posteriorly including both hind limbs. The bladder was intact and full of urine. Mud on the hooves indicated the fawn had been active previously. No other remains were located and no hemorrhages were found during necropsy. The remains of the fawn had been pulled under a juniper and were well hidden. Cause of death was unknown.

CASE NO. 2 Fawn No. 4.

Date last observed alive - 6/23/76

Date carcass located - 6/28/76

Sex - Male

The carcass was located on a northwest slope (10-15°) in the Pinus-Juniperus vegetation type in an old burn area. Remains were found under a juniper with dense cover of snowberry and big sagebrush in the immediate vicinity. The doe was observed 50 m from the carcass and again seemed reluctant to leave. Herbaceous vegetation around

the fawn was matted, probably due to feeding activity of coyotes. The carcass was fresh and rigor mortis had not set in. That portion of the fawn posterior from the scapulas had been completely consumed with only the lower portions of the hind limbs remaining. Splintered bone and torn muscle indicating predator feeding were observed on the exposed portions of the carcass.

No hemorrhages were found on the remaining portions of the hind limbs. The viscera had been completely consumed. Massive subcutaneous hemorrhages were found on the inside of the upper portion of the right front limb. The right ear was torn and puncture marks with associated subsurface hemorrhages were located below the right eye, on top of the skull and in the throat region posterior to the jaws. Bones anterior to the left eye and the dorsal surface of the skull were fractured. Litter was found in the mouth and was probably picked up during the death throes. Evidence indicated coyote predation as the cause of mortality.

CASE NO. 3 Fawn No. 8.

Date last observed alive - 7/28/76

Date carcass located - 8/1/76

Sex - Male

The carcass was located in a narrow coulee bottom with snowberry and chokecherry providing a dense cover nearby. Herbaceous vegetation was matted down in several areas around the radio. Carcass

remains consisted of one hind limb and pelvic bone with most of the skeletal muscle removed and several small bone fragments and pieces of hair scattered 5 - 10 m from the radio. The radio collar had several blood spots on the elastic band and teeth marks were evident on the radio and antenna. Fawn tracks were located proceeding up the coulee to where the radio was found and coyote tracks were evident around the collar location. Site evidence and a change from the previous days radio location indicate probable coyote predation as the cause of mortality.

CASE NO. 4 Fawn No. 9.

Date last observed alive - 7/4/76

Date carcass located - 7/7/76

Sex - Male

The radio was found in a dense patch of juniper, snowberry and rose.

The carcass had been completely consumed. Matted vegetation, coyote tracks, scats and hair were found in the area around the radio.

Teeth marks were evident on the radio and antenna. Site evidence and a change from the previous days radio location indicate probable coyote predation as the cause of mortality.

CASE NO. 5 Fawn No. 10.

Date last observed alive - 7/16/76

Date carcass located - 7/17/76

Sex - Female

The carcass was found at the base of a juniper on a north slope (10-15°) in the Pinus-Juniperus vegetation type. The portion of the carcass remaining consisted of the anterior half of the fawn and several fragments of various bones located from 1 to 20 m from the carcass. Hair had been rubbed off below the left eye and ear and the posterior portion of the right ear indicating the carcass had been pulled some distance before being consumed. Bleeding was evident from the right ear and teeth marks were seen at the base and 3 cm below the ear. The dorsal surface of the skull was fractured and subcutaneous hemorrhages were present at all bite sites. Bite marks and associated hemorrhages were also present 6 cm below the left ear and a massive hemorrhage was evident at the base of the skull. Hemorrhages and bite marks were present on the anterior part of the sternum and the upper portion of the right limb. The viscera was completely consumed. Blood was present on the radio and antenna. Coyote tracks and scats indicated coyote predation as the cause of mortality.

CASE NO. 6 Fawn No. 14.

Date last observed alive - 6/15/77

Date carcass located - 6/20/77

Sex - Female

The radio collar was recovered on a northwest slope (10-15°) in the Pseudotsuga-Juniperus vegetation type 20 m from an active

coyote den. Carcass remains consisted of several small patches of hair. The radio package and antenna had numerous teeth marks.

Cause of mortality could not be determined.

CASE NO. 7 Fawn No. 17.

Date last observed alive - 8/2/77

Date carcass located - 8/6/77

Sex - Male

The carcass was located in a dense patch of willows bordering a small mud flat in the Populus-Symphoricarpos vegetation type. The radio collar was discovered 30 m from the carcass with all seams expanded and the elastic band snapped. Three large patches of blood were located on the mud flat approximately 10 m from the carcass. Numerous coyote tracks and scats from adult and young were present at the site. Tracks of the doe suggested repeated efforts to run the coyotes from the carcass. Carcass remains consisted of the head, neck, thoracic wall, forelimbs, vertebra, and skeletal structures of the hind limbs. The viscera had been completely consumed as had the skeletal muscle and hide from the back and hind limbs. The left scapula, humerus and ribcage were exposed and skeletal muscle consumed. The posterior ribs on the right side had been partially consumed. Both ears had been consumed and bite marks and associated hemorrhages were visible below the left eye, on the throat posterior to the jaws, and on the dorsal surface of the skull. The right frontal bone of the skull

was fractured. Cause of death was coyote predation.

CASE NO. 8 Fawn No. 19.

Date last observed alive - 8/14/77

Date carcass located - 8/17/77

Sex - Female

The radio collar and carcass remains were recovered on a southwest slope (10-15°) in the Pinus-Juniperus vegetation type. The radio collar had been buried in a small depression and covered with litter. Numerous teeth marks were visible on the radio and antenna and several small blood spots were found on the elastic band.

Carcass remains consisted of the contents of the rumen and numerous small bone fragments and bits of hair. The remains were located up to 35 m from the radio and numerous coyote tracks were present at the site. Site evidence indicated probable coyote predation as the cause of mortality.

CASE NO. 9 Fawn No. 22.

Date last observed alive - 8/19/77

Date carcass located - 8/24/77

Sex - Female

The radio collar was recovered on a flat ridge top in the Artemisia-Agropyron vegetation type. The elastic collar had snapped and numerous teeth marks were evident on the radio and antenna along with a few small blood spots. Bits of hair were found 30 m from

the collar along with many coyote tracks. Site evidence indicated probable coyote predation as the cause of mortality.

CASE NO. 10 Fawn No. 23.

Date last observed alive - 8/3/77

Date carcass located - 8/7/77

Sex - Female

Carcass wt. - 15.9 kg

The complete carcass was recovered on a steep (35-40°) northeast slope in the Pseudotsuga-Juniperus vegetation type. The right ear was torn along the lateral aspect. Numerous linear foci of epidermal tearing were noted bilaterally ventral to the ear.

These defects were covered by a hardened exudate. Three puncture wounds were noted between the legs and on the parineum. Two were covered and appear sealed by exudate. The third to the right of the midline between the legs, remained open. Autolysis was severe and involved all organs. The rumen was full of vegetation and milk curds and there was an excess of hemoglobin stained fluid in the thoracic and abdominal cavities. A small defect near the midline of the left frontal bone was noted. There appeared to be a small spur of bone on the inner aspect of this bone. This death is probably related to a traumatic episode with a predator at some earlier time.

CASE NO. 11 Fawn No. 26.

Date last observed alive - 6/23/77

Date carcass located - 6/26/77

Sex - Male

Carcass wt. - 5.9 kg

The carcass was recovered from a small pool of water in a deeply entrenched head cut in the *Artemisia longifolia* vegetation type. Mud approximately 30 cm deep surrounded the pool of water. There was no evidence of external trauma. Mud and debris obstructed the naso and oropharynx and larynx. The trachea was full of froth and lungs congested. The abomasum was full of milk curd. Site evidence indicated a rapid death due to suffocation after accidental aspiration of liquid, mud and debris.

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