



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

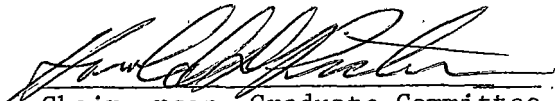
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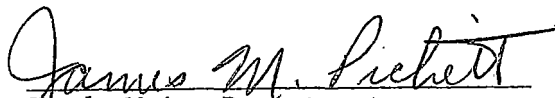
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ABSTRACT

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.

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

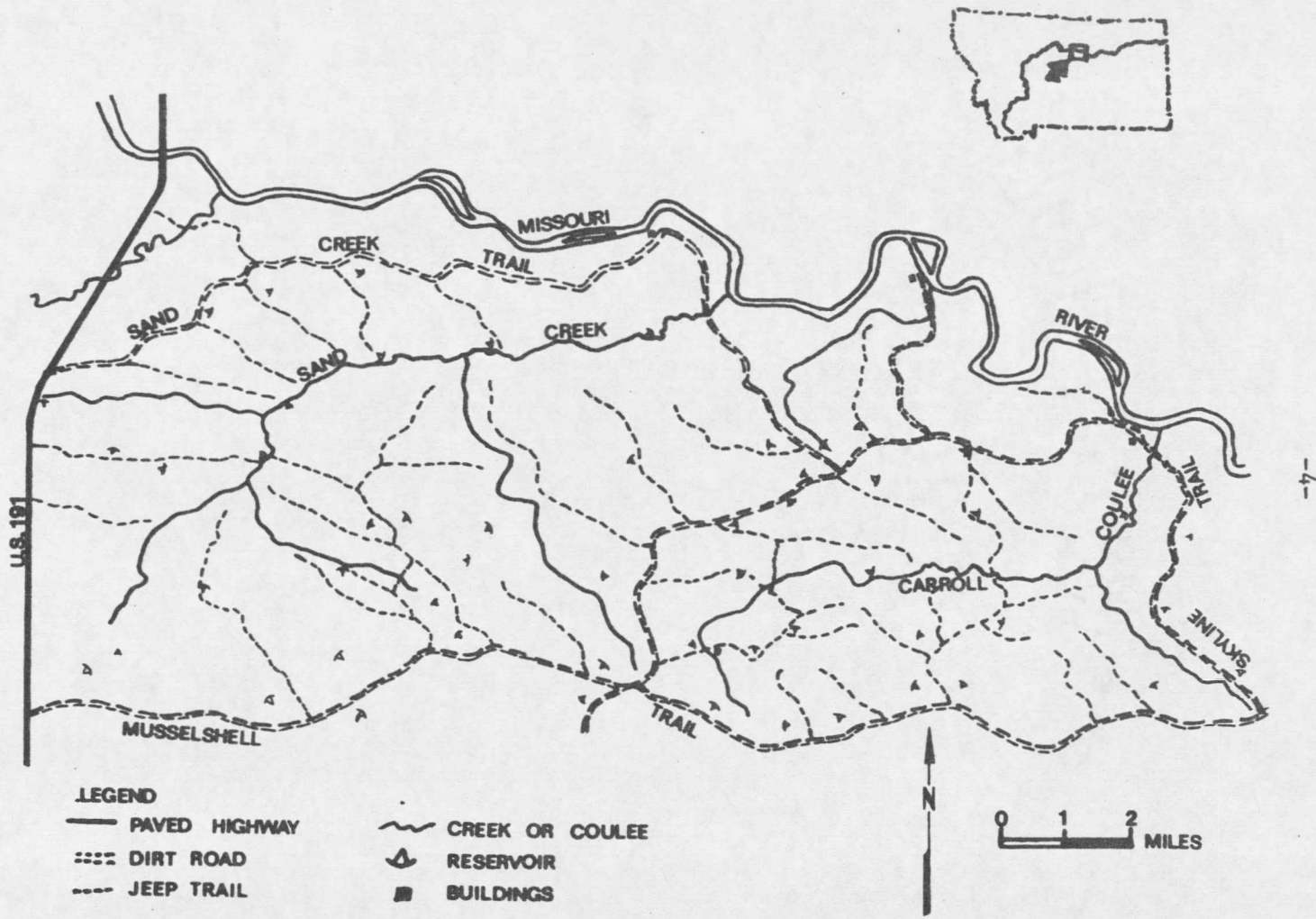


Figure 1. Map of the study area showing boundaries and drainages.

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	Deviation		Deviation		Deviation	
		1975	from \bar{X}	1976	from \bar{X}	1977	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.

