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Rabbits

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Population Structure, Reproduction, Feeding,
and Use of Forms

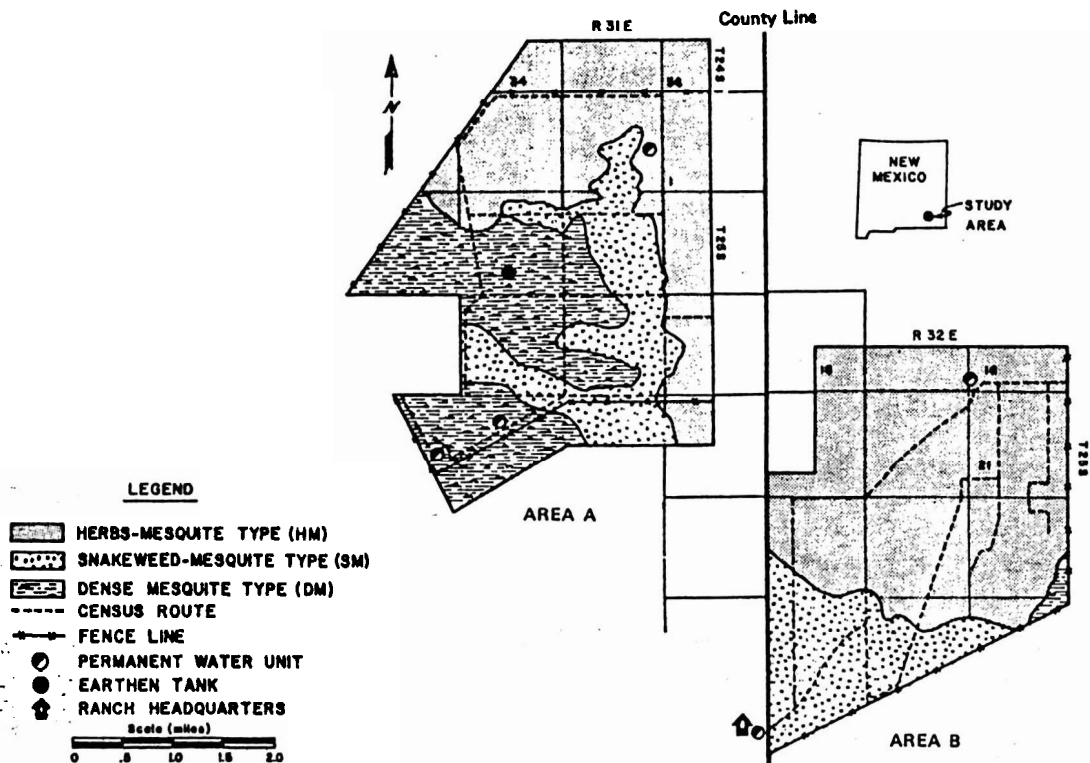


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Fig. 1. Vegetation types, census routes, and water units in areas of jackrabbit study, southeastern New Mexico



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Black-Tailed Jackrabbits in Southeastern New Mexico: Population Structure, Reproduction, Feeding, and Use of Forms

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The black-tailed jackrabbit is a common herbivore of shrub-grasslands in southeastern New Mexico and, in terms of standing biomass, may be the greatest wild consumer of green vegetation. The only larger, wild herbivore in this area is the pronghorn antelope (*Antilocapra americana*).

There are few published reports on the black-tailed jackrabbit in New Mexico. Vorhies and Taylor (1933), in their Arizona study, quoted Aldous' unpublished data from south-central New Mexico. Norris (1950) investigated effects of wild primary consumers on vegetation of the Jornada del Muerto of south-central New Mexico. Other reports have described body measurements and abundance of jackrabbits in the same area where these data were collected (Griffing, 1974; Davis et al., 1975). Data for this report were collected June, 1971 through August, 1971 and December, 1971 through January, 1972.

STUDY AREA

The study was conducted on approximately 20 square miles of public land in southeastern New Mexico, 40 miles southeast of Carlsbad (figure 1). The land is used for cattle grazing under administration of the U.S. Bureau of Land Management. The vegetation of the area is shrub-grassland, typical of extensive areas of southeastern New Mexico. Principal shrubby species are mesquite (*Prosopis juliflora*), snakeweed (*Gutierrezia sarothrae*), shinnery oak (*Quercus havardii*), and soaptree yucca (*Yucca glauca*). Principal grasses are black grama (*Bouteloua eriopoda*), three-awn (*Aristida* spp.), and plains bristlegrass (*Setaria macrostachya*). Further details on vegetation are provided by Davis et al. (1974).

Topography, soils, and climate in the vicinity of the study area were described by Maker et al. (1970). Topography is gently sloping to undulating and dunelike, and soils are mostly sandy and underlain by caliche. Climate is semi-arid and continental, with warm summers, cool winters, abundant sunshine, and large daily and annual ranges of temperature. Average annual precipitation is approximately 12 inches, most of which falls during the growing season, April through October. Spring and early summer of 1971 were very droughty, with less than one inch precipitation recorded from January through mid-July at nearby Red Bluff Dam (U.S. Dept. of Commerce, 1971). Until the rains in late July, green vegetation was limited to perennials, such as mesquite, shinnery oak, snakeweed, yucca, sand sagebrush (*Artemisia filifolia*), and prickly pear (*Opuntia* sp.).

METHODS

Jackrabbits were collected by shooting. The date and time of each collection were recorded. Humeri were removed, and each animal was placed in one of three age classes, according to the degree of epiphyseal closure (Lechleitner, 1959; Tiemeier, 1965; Tiemeier and Plenert, 1964). Sex was confirmed by examination of internal anatomy. Females were examined for pregnancy, and numbers of embryos were recorded. Active lactation was indicated by free flow of milk from incised mammarys.

Weight of stomach contents was determined as the difference between weights of the excised stomach before and after emptying. Contents were

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examined for identification of obvious foods and then discarded. Statistical procedures followed Steel and Torrie (1960).

Jackrabbit behavior was observed during the course of other field studies and recorded in as much detail as available time permitted. During censuses, times at which jackrabbits were seen in forms were recorded. Weather conditions at start and finish of censuses also were recorded. Jackrabbits were censused from a pickup, along two 18-mile routes. Each census was started at 10 minutes past sunrise and completed in approximately three and one-fourth hours. On each route, all censuses were made from the same starting point. They were usually conducted twice per week on each route when field work was in progress. A total of 254 censuses were conducted, and numbers of jackrabbits seen were reported previously (Davis et al., 1975).

POPULATION STRUCTURE

Sex Ratio

Approximately equal numbers of adults (age classes II and III, combined) of each sex were found in the collection (table 1), indicating similar overall rates of survival. Similar findings have been made in other studies (Lechleitner, 1959; Tiemeier, 1965). However, significantly more females than males were found during spring and summer along the Utah-Idaho border (Gross et al., 1974).

Age Structure

Black-tailed jackrabbits can "... be accurately separated into three age classes by visually observing the degree of epiphyseal closure of the humerus" (Tiemeier and Plenart, 1964). In the total summer collection, only five animals (8 percent) were young enough to be placed in age class I (table 1). This is considerably fewer than ex-

Table 1. Sex and age class of black-tailed jackrabbits collected in southeastern New Mexico during summer, 1971, and winter, 1971-1972

	Age Class					
	Male			Female		
	I	II	III	I	II	III
Summer						
Summer, 1971	3	15	12	2	23	9
Winter, 1971-1972	0	1	1	0	4	1

pected, since Lechleitner (1959:67) and Tiemeier (1965:11-12) each found approximately 65 percent of the individuals collected in summer to be in age class I.

The low number of young jackrabbits indicates either that collections were made only during the beginning of breeding season, or production/survival rate of young was low for the 1971 breeding season. Direct evidence of the date of beginning of the 1971 breeding season is not available. If breeding began in winter or early spring, as is usual for southwestern states (Bailey, 1931:50-58; Cahalane, 1947:606-614; Davis, 1960:213-217; Vorhies and Taylor, 1933:496), then the low numbers of young jackrabbits must be attributed to either low reproductive rate or low survival rate.

Sex Ratios Within Age Classes

Age class I sex ratio was 1.5:1 (males per female) in the collection. However, sample size ($n = 5$) was too small for meaningful interpretation. Age class II sex ratio was 0.65 ($n = 43$) and age class III sex ratio was 1.33 ($n = 23$). This reversal from class II to class III was tested and the ratios were found to be significantly non-homogeneous ($P < 0.005$; adjusted Chi-square = 19.7; one degree of freedom; Steel and Torrie, 1960:371). This suggests a high mortality rate among females after age class II. It probably was related to stress of pregnancy, added hazard during additional feeding required for lactation (see discussion under "Feeding"), or both. The reason for the greater proportion of females in age class II is unknown.

REPRODUCTION

Breeding Season

Female jackrabbits were considered to be reproductively active if lactating or containing one or more embryos. On June 20, 1971, a pregnant (near term), lactating female was collected. Assuming gestation period to be 40 days (Gross et al., 1974: 14), the breeding season had begun by late April. Breeding probably began by late winter or early spring, as shown for other areas in various years (Bailey, 1931:50-58; Cahalane, 1947:606-614; Davis, 1960:213-217; Vorhies and Taylor, 1933: 496). Davis et al. (1975), working in the same area, suggested that breeding in 1971 began early enough to cause the increase in numbers which they observed between January and March.

The last pregnant female was collected August 21, 1971, shortly before the end of summer field work. She contained three embryos as indicated by uterine swelling approximately one-half inch in diameter. Therefore, breeding season definitely continued into September. Results of other studies indicate that most breeding ends in August or September in various parts of this species' range (Bronson and Tiemeier, 1958; Cahalane, 1947:606; Davis, 1960:213; Vorhies and Taylor, 1933:580).

No reproductively active females were collected in December, when field work was resumed. Although sample size is small ($n = 5$) for December-January, there is reasonable certainty that this was a non-breeding period.

Litter Size

During the summer of 1971, the average litter size varied from 1.50 to 2.50 embryos per pregnant female (table 2). The overall average litter size was 1.95; the largest litter contained three embryos. In southeastern Arizona, average litter size for 70 pregnant females was 2.24 with 19 percent of the litters containing four to six embryos (Vorhies and Taylor, 1933:496). In south-central New Mexico, 31 of 32 females collected by Aldous between February and early April were pregnant with one to three young for an average of 1.48 embryos per female (reported by Vorhies and Taylor, 1933:497).

FEEDING

Vorhies and Taylor (1933:542) reported that in southeastern Arizona "the jack rabbit feeds at night, before and after sunrise, and for several

hours of the morning. . ." However, "Stomachs examined were never empty, no matter what time they were taken."

The same appears to be true for southeastern New Mexico. Wet weights of contents of 29 stomachs were recorded during summer, 1971. The average weight was 67 grams with a range of 29 to 116. The four fullest stomachs averaged 108 grams and were found four to seven hours before sunset.

Lactation greatly increases food requirements of the female mammal (Davis and Golley, 1963:250). Comparison of mean weights of stomach contents of lactating females ($X = 81.5$ grams, $n = 10$) and non-lactating animals (males and females, $X = 60.9$ grams, $n = 19$) indicated a significant difference ($P < 0.05$, Student's t-test). The greater food intake of lactating females increases their foraging time and increases their susceptibility to predation. This may account for the higher male-to-female ratio in the age class III animals.

Cursory examination of stomach contents during summer, 1971 indicated a preference for green, succulent vegetation. This was probably related to the animal's water needs. Yucca leaves were recognized by their stringy fibers. Mesquite seeds (most appeared undamaged) were noted in 40 percent of the stomachs.

During daylight hours, jackrabbits were often observed as they fed, and the method of feeding was noted. The outer leaves of yucca plants were clipped near the ground. The clipped portion was chewed as it was held in the mouth without the use of forepaws. If the leaf dropped to the ground, it was not retrieved but a fresh one was clipped. On yucca plants which were heavily utilized by jackrabbits, a number of outer leaves were clipped within a few inches of the ground.

When feeding on mesquite leaves and seed pods, the animal stood high on its hind legs and grasped stems in its mouth without the use of forepaws. It then dropped its forefeet to the ground and backed from the plant until the stem separated. Again, when a piece of plant material fell to the ground, it was not retrieved.

During summer, 1971, at least one jackrabbit was observed eating mesquite bark, snakeweed, croton (*Croton* sp.), and spurge (*Euphorbia* sp.). Hansen and Flinders (1969), in a review of black-tailed jackrabbit foods, did not mention croton or spurge.

USE OF FORMS

Jackrabbits "habitually rest by day in somewhat sheltered sitting places commonly known as

Table 2. Reproductive condition of female black-tailed jackrabbits collected in southeastern New Mexico during summer, 1971 and winter, 1971-1972.

Month	Sample Size	Pregnant	Lactating	Reproductively Active*	Embryos per Pregnant Female
		percent	percent	percent	
June	3	67	67	100	1.50
Jul	8	50	63	88	2.50
Aug	24	63	58	83	1.87
Dec	4	0	0	0	---
Jan	1	0	0	0	---

*Pregnant and/or lactating

forms.' . . . These average from 3 to 6 inches wide, and from 11 to 18 inches in length" (Vorhies and Taylor, 1933:502). The shelter is commonly provided by small shrubs (snakeweed, yucca, etc.) and clumps of bunchgrasses. West et al. (1961:346) stated that "shade probably is the determining factor. . . ."

Personnel conducting jackrabbit censuses in the summer of 1971 suspected that the time at which the animals moved into forms might be affecting census results. The time at which the first five animals were seen in forms each day was determined and compared to census results, but there was no apparent relationship. The data, however, indicated a probable relationship between time into forms and divisions (A and B) of the study area and between time into forms and weather conditions.

On area A during normal weather conditions (winds less than 5 mph, cloud cover less than 75 percent, and moderate relative humidity—no dew on vegetation and no precipitation), the first five jackrabbits were seen in forms at an average of 2.7 hours after sunrise (n = 6, range: 2.5 - 2.9). On area B, the average time was 3.4 hours after sunrise (n = 6, range: 2.4 - 3.6). The difference is probably attributable to the area B route starting in a location which contains many man-made structures (oil and gas wells, and associated storage tanks and processing units) and greatly increased vehicular traffic associated with them.

During abnormal weather conditions, the jackrabbits behaved differently. It was not unusual to see fewer than five jackrabbits in forms. During two censuses of area B when there was either 100 percent cloud cover or heavy dew, none was seen in a form despite 24 and 26, respectively, being seen during censuses. During other censuses when there was either high relative humidity, high winds, or both, fewer than five animals were seen in forms.

Thus, it is suspected that high relative humidity, high winds, heavy cloud cover, or a combination of these conditions delay the time at which jackrabbits enter forms. West et al. (1961:346) stated that, in Kansas, ". . . use of forms was not related to temperature or barometric pressure fluctuations (sic)." Their "observations were made every day after 2 p.m." (*ibid*:345) and, therefore, probably would not indicate hourly increase in use of forms.

SUMMARY

Black-tailed jackrabbits (*Lepus californicus*) were observed and 71 were collected in a shrub-grassland of southeastern New Mexico during the summer of 1971 and the winter of 1971-72.

Mortality appeared greater for females than males in age class III, and vice versa in age class II. Very few age class I individuals were collected.

Reproductively active females were collected June through August, the only months of summer collections. Examination of reproductive tracts indicated some females were reproductively active from April through September. The average number of embryos per pregnant females was 1.95.

Average wet weight of stomach contents was 67 grams. Lactating females had significantly ($P < 0.05$) heavier stomach contents than nonlactating animals (males and females). Yucca (*Yucca glauca*) leaves and mesquite (*Prosopis juliflora*) leaves and seed pods were common foods. The methods of eating them are described.

Jackrabbits went into forms later on windy, rainy, or very humid days than on clam, dry days.

ACKNOWLEDGMENTS

This study was conducted under Contract No. 14-11-0008-3254 of the Bureau of Land Management, U.S. Department of Interior. Several officials of that agency contributed materially to the study. Paul E. Sawyer, former graduate research assistant in wildlife science at New Mexico State University, assisted in the collection of data.

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