

# KENTUCKY RABBIT INVESTIGATIONS

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This study, concerning the life history and ecology of the cottontail rabbit (*Sylvilagus floridanus mearnsii*) in Kentucky, has been in effect since September, 1949. Its northern cousin has been extensively investigated, but little has been brought to light about the cottontail south of the Mason-Dixon line. Most of the northern life history data are not applicable in the south, so much of the work had to be duplicated. The management phase of this study has been lightly touched in favor of gathering the basic facts.

## METHODS

Originally, three study areas, with a combined total of 920 acres were used. The major part of the trapping was conducted on one area of 237 acres in central Kentucky. This area falls into the general dairy farming classification. The main crops, in order of importance, are hay, corn, oats, barley, rye and tobacco. The soil types range from deep, well drained, naturally fertile bottoms of low grade limestone to acid, hard pan soils of low fertility. The topography varies from level land in the southern portion to 2 to 10% slopes in the northern end. A small creek flows through the northern one-third of the farm, dividing the area, north and south. The only woodlot, of thirteen and one-half acres, is located in the southeastern corner. A majority of the fencerows are left in their natural brushy state. A breakdown of the area, into generally broad categories, is as follows: Woods 5.7%, idle land 12.7%, cultivated and miscellaneous land 81.6%. There was no lack of cover in the area at any season of the year.

Life history data has been obtained through live trapping, shooting, road kill autopsy, interviews, tracking and direct observation.

A Pennsylvania type box trap was used for all live trapping operations. This is a pine box 24 inches long, and nine inches square. It has a wire mesh back and a door that swings up and against the top and trips by means of a treadle. Later on, some 57 ammunition boxes were converted into traps and used.

Ninety traps were originally set approximately 100 yards apart. When it became apparent that the location of some traps would be in the way of farm operations, they were moved to the nearest cover. This gave an irregular spacing pattern, but areas of suitable cover were pretty well included in the trapping pattern. During the summer, all traps were placed so they would receive the maximum shade possible. All traps were numbered and their designated position and number recorded on a cover map.

Apples proved to be the best all around bait, with corn second. One drawback to apples, is their tendency to attract red ants. A commercial ant repellent, "Ant-bane," remedied the situation. Other baits tried were rolled oats, wheat, carrots and scratch feed. None of these additional baits proved promising.

The effectiveness of the baits varied with the season and reaction of the rabbits. During the winter season of food scarcity, apples were consistent in their

effectiveness. Summer, and resultant food abundance, reduced the catching efficiency of apples. Also, trap success was sporadically good and poor.

When possible, trap lines were tended once a day, usually before noon. During hot spells, the traps were run twice a day to avoid losing rabbits from heat prostration. Rabbits were taken from traps and placed into a cloth bag that could be opened at each end. Each individual was examined for ectoparasites, sex, age, general condition and its weight was taken. In addition, the hind foot and ears were measured, and nose-rump length recorded. Adult males had the length of testes measured. Adult females were examined for signs of pregnancy and lactation. All rabbits were ear tagged when captured for the first time. Consecutively numbered button tags were attached to the right ear of females and the left ear of males. Only one rabbit is known to have lost an ear tag.

Several snows, during the winter of 1950 - 51, offered excellent chances for tracking individual rabbits. Daily winter range could be determined, and, to some extent, food habits. The effect of cold weather on activity was in evidence by the lack of tracks. Foxes roaming the study area were tracked, and some signs of rabbit kills found.

A 1.2-acre wire enclosure was put up in the spring of 1951, and stocked with young rabbits. The purpose was to obtain growth rates on immature cottontails by periodic measurements. The ground cover within the enclosure was orchard grass (*Dactylis glomerata*), ladino clover (*Trifolium repens*), briars (*Rubus sp.*), sassafras (*Sassafras albidum*), and weeds. Several brush piles were built for escape cover.

## LIFE HISTORY

Data on reproduction were obtained through live trapping, road kill autopsy, nesting studies and farm interviews. Uterine swellings in live trapped females were determined by gently pinching the walls of the abdomen together between the thumb, index and second fingers. This is the same method used by Haugen (1942). By feel, the uterine swellings can be determined and classified as approximately the size of a (1) peanut, (2) acorn, (3) walnut, or advanced size. These are only relative sizes, and the diagnosis of a given stage is only an approximation.

While the rabbit is enclosed in a cloth bag, the hind quarters are left protruding. Turning the rabbit on its back, the testes, with epididymus, are forced into the lower scrotal sac by a sliding pressure from the thumb, index and second finger of the left hand. The measurement was taken by using a pair of calibrated calipers. On dead rabbits, the testes and epididymus were removed before measuring. Only testes lengths were recorded.

## RESULTS

### Gestation Period

The only information on gestation periods is for northern cottontails. In Pennsylvania, Gerstell (1937) reported a range of 25 - 32 days with a normal period of 30 days. Dice (1929) found that a litter of three were born in 28 days. Of the total of 66 females handled, only five were retaken a sufficient number of times, and at proper intervals, to acquire data pertaining to the length of the

gestation period and number of litters. Only two of these were retaken at times when they were carrying embryos of a size comparable with those from the previous capture and pregnancy.

Table 1 presents data on elapsed time between similar stages of development in successive pregnancies of individual females. One female was found with three comparable stages of pregnancy 29 and 67 days from the date of the initial capture. Female 61 took 26 days from the first capture, to develop walnut sized embryos. Nine days later, the walnut sized embryos were gone and peanut sized embryos had developed. This was a total of 36 days for a late stage of pregnancy followed by an early one.

Table 1. Dates of capture of individual tagged females indicating succeeding pregnancies in all stages.

Animal number	Capture date	Time between captures	Time between first capture	Embryo size	Lactating	Litter number
58	3/20			PN <sup>a</sup>		1
	5/12	53	53	AC <sup>b</sup>	x	2
	8/9	89	142	A <sup>c</sup>		3
62	3/23			PN		1
	4/24	32	32	PN	x	2
	7/4	71	103	WAL <sup>d</sup>		3
65	4/12			WAL		1
	4/27	15	15	PN		2
	7/24	88	103	A	x	3
61	3/22			A		
	3/23	1	1	A		1
	4/18	26	27	WAL		2
	4/27	9	36	PN	x	3
59	8/16	111	146	AC		4
	3/20			PN		1
	4/18	29	29	PN	x	2
	5/26	38	67	PN	x	3
	7/12	47	114	AC		4

<sup>a</sup>PN = Peanut size.

<sup>b</sup>AC = Acorn size.

<sup>c</sup>A = Advanced.

<sup>d</sup>WAL = Walnut size.

The gestation period for this species is, therefore, less than 36 days. Another female (59) showed the same stages of pregnancy only 29 days apart. These findings indicate that the range of the gestation period is from 29 to less than 36 days. The average interval of days lapsed between succeeding comparable size embryos of five females was 30.5.

#### Number of Litters

All data, indicative of the number of litters of an individual female in one season, are presented in Table 1. Five females were recaptured a sufficient number of times in various stages of pregnancy, to determine the number of litters

they had to date. If a female was lactating or the hair about the nipples was worn and matted, it was considered that she had borne young.

The earliest pregnant female was trapped on March 16, 1951. Three have had three litters and two had four. There is a possibility that animals 58, 62 and 65 have had four litters, also, since the elapsed time between the last successive capture has been 71 days or more. Animal 59 had peanut size swellings when first captured on March 20. Twenty-nine and 67 days after the initial capture, she was found with uterine swellings of the same size. One hundred and fourteen days from the date of the initial capture, she had acorn size embryos. During each of the two captures succeeding the initial one, this female was lactating. Therefore, this female must have completed gestation of the first embryo and become pregnant while suckling this litter. Then, she gave birth to her second litter, became pregnant the third time while suckling the second litter, all in 67 days. She was captured for the last time on July 12, 114 days after the first capture on March 20, 1951. At the time, she was carrying acorn size swellings, her fourth pregnancy.

In 36 days, female 61 showed three different stages of pregnancy. At the time of her initial capture, she was in an advanced stage of pregnancy. Twenty-six days later she had walnut sized swellings, and nine days later peanut sized embryos. At the time of her third pregnancy, she was lactating. One hundred and eleven days elapsed before this female was caught again. She carried acorn sized embryos, indicating a fourth pregnancy. Since such a long period of time elapsed between the last two succeeding captures (111 days), it is entirely possible that she had five pregnancies, instead of the observed four.

From the evidence, it seems that the number of litters per year ranges from three to four. Two of the females have had time to breed five times during the season.

### Litter Sizes

Litter sizes were collected through observations of 36 active nests, 52 embryonic litters of road killed and collected females, and farmer interviews. Litter sizes are presented in Table 2.

Table 2. Number of litters and size obtained from nesting studies, road kill, autopsy and farmer interviews.

Month	Size of litters and no. in each size class							Average litter size
	3	4	5	6	7	8	9	
Jan.	1	1	2	3	1			5.3
Feb.	1	2	2	2	1			5.0
March	9	4	3	1				3.8
April	8	11	5	1	1		1	4.0
May	1	6	1	1				4.2
June	5	8	3	4				4.3
July	2	7	4	1				4.3
August	1	2	2					4.2
	28	41	22	13	3		1	4.4

The size of litters seems to vary by months. The data show that early litters average larger than later ones. Average litter size in February, 1951, was 5, and it dropped progressively during the following months until it was 4.2 in August. The seasonal average was 4.4 young per litter.

The litter size ranged from 3 to 9 young. On April 6, a farmer reported finding a nest with nine young, located in orchard grass. The nest was observed by the leader in the evening of the same day. The author returned to the site the next day, intending to take pictures, but the nest had been destroyed by a predator.

In Connecticut, (1942), litter sizes average 5.0 to 5.5. Haugen (1942) found 5.4 as an average for twelve litters. An average of 5.04 was found by Trippensee (1934) for 27 litters in Michigan.

When compared with data from other states, the average litter size in Kentucky in 1951 (4.4) was much lower. Of seven active nests observed and eight embryonic litters examined during 1950, the average litter size was 5.0. This is 0.6 higher than the 1951 average. According to a basic concept in wildlife management, litter sizes or number of litters are reduced as populations reach a peak, thus proportionately reducing the quantity of food and cover to be distributed among the increased individuals. This is comparable to the theory of diminishing returns. The increased population, with no increase in food or cover, is supposedly reflected in the reproductive capacity of the females due to their physical condition. If this theory is operative, then it can be applied to Kentucky's conditions. During the past several years, the rabbit population has been building up to a peak. What is considered a peak in terms of rabbits per acre, I do not know. Nevertheless, the recent rabbit upsurge leads the author to believe that the peak has been or will be reached within the next two years. Only time will tell.

### Nesting

In order to determine the earliest nesting date, litter sizes, survival of litters, and cover in which nests were found, a determined search was conducted for nests. The use of several farm boys, especially during the hay mowing season was productive in finding nests. Farmer interviews gleaned considerable information on nesting, and quite a few nests reported by farmers were observed.

Nests were classified according to the state of condition of use when found. If a nest was occupied by young, it was classed as active. When a depression lined with grass was found, it was classified as pre-nesting excavation and marked for future examination. An apparently abandoned nest was categorized as inactive and examined to determine if it was successful or unsuccessful. A successful nest is one in which the young have been raised the required time and then abandon the site. The presence of small greenish droppings within the nest or its vicinity, indicates that the young were large enough to take green foods, and, therefore old enough to leave the nest. Remains of young rabbits or the absence of small green pellets, are good indicators that the young have been removed or killed. Such a nest was tabulated as unsuccessful.

### Use of Cover Types for Nesting

The results of the nesting study are summarized in Tables 3 and 4. The data show fairly well the relative value of cover types for nesting.

Table 3. Classification of nests according to use and month found.

Month	Active	Pre-nesting		Total
		Excavation	Inactive	
February	2	3	0	5
March	6	10	7	23
April	14	0	3	17
May	3	7	6	16
June	7	0	1	8
July	3	0	5	8
August	1	0	4	5
Totals	36	20	26	82
% <sup>a</sup>	44	24	32	100

<sup>a</sup> Percent in each category.

Table 4. Cover type and number of nests in each based on nesting studies and farmer interviews.

Month	Cover Type <sup>a</sup>									Total
	KL	BS	FN	GR	WDS	CL	BR	AL	GA	
Feb.	3	2								5
March	4	15	2	2		1	1			25
April	1	14		17	2	4	3			41
May	10		1	4	1	2		4	4	26
June	1			26	1	1		6	2	37
July				1		5		4		10
August	1	2		2		1				6
Total	20	33	3	52	4	14	4	14	6	150
% <sup>b</sup>	13.3	22	2	34.6	2.6	9.3	2.6	9.3	4	100

<sup>a</sup> KL = Korean lespedeza, BS = broomsedge, FN = fencerow, GR = grass, WDS = weeds, CL = clover, BR = briers, AL = alfalfa, GA = grains.

<sup>b</sup> Percent of total nest in each cover type.

As early nesting cover, Broomsedge (*Andropogon virginicus*) is the leader of all types. Twenty-two percent of the 150 nests found or reported were in this type. Its cover qualities and conditions during all seasons of the year are excellent, and, due largely to this, it is extensively used for early nesting. During the second week of April, the author checked a Broomsedge field of some 15 acres that had been burned the day before. Eight nests were found containing 29 rabbits that had been killed by burning. Burning of Broomsedge fields is a common practice, and this instance may be duplicated many fold throughout Kentucky.

The most important nesting cover, particularly later in the season, was grass. Orchard grass and fescue (*Festuca sp.*) were the two main species utilized. This cover type furnishes both food and cover, and contained 34% of the nests found. Many nests in this cover are, undoubtedly, destroyed by mowing. Korean lespedeza, clovers (*Melilotus sp.*) and alfalfa (*Medicago sp.*) are also used extensively for late nesting.

A majority of the nests found were within 150 feet of the field's edge. The nearby cover varied from dense to very sparse, and no apparent correlation can be found with location of nests in respect to nearby cover.

Of the 82 nests actually observed in 1951, 36 were active, 20 pre-nesting excavations and 26 were inactive. Only 10% of the 36 active nests were successful. These successful nests occurred in April. Most of the active nests were destroyed by farm operations, adverse weather and some by predators.

A pre-nesting excavation found on March 9, was occupied by four young on March 22, thirteen days later. The nest was successful. Another pre-nesting excavation discovered on March 30, was occupied by four young, twenty-four days later. This nest was also successful. That the same female who built the nest used it at a later date, is not known, but the possibility seems very feasible.

#### Loss of Young Due to Exposure

Six nests were found during February and March where the young had died of exposure due to heavy rains. Three were in Korean lespedeza, two in Broomsedge, and one in grass. Early sparse cover was insufficient protection against cold and rain.

#### Nesting Dates

The earliest active nest was found on February 23. The young had died of exposure due to heavy rains. Previous to this date, several pre-nesting excavations were found. Road census data show the first young were seen on March 7, 14 days after discovery of the first active nest. In the first two weeks of February, the state experienced severely cold weather. This, undoubtedly, held up nesting and breeding. Any nesting earlier than February 14 would have been unsuccessful due to below zero temperatures. The latest active nest was found on August 22 in a clover field.

#### Care of Young and Development

Two nests with newly born young were kept under observation. One with four young was located in a fencerow about 20 yards from a house. Two farm boys had noticed the doe building the nest, and reported it when the young appeared. Measurements were taken of the day-old young. On the third day, the nest was visited again, and only two young were present. No signs of violence were in evidence, so it was assumed the doe was moving the young to a new location because of human disturbance. The two remaining rabbits were kept in captivity and fed a mixture of karo syrup and condensed milk. The eyes of one opened on the seventh day, and the others on the eighth. The first green food, consisting of grass and lettuce, was consumed when they were 16 days old. At this time, they were very active and scampered about quite energetically. Both died shortly, of what seemed like paralysis.

The second nest was located in open Korean lespedeza field beneath a sassafras sprout. This nest was also reported by a farm boy who discovered it while cutting sassafras. No attempt was made to handle the young after the previous experience. The five young appeared to be one to two days old.

The doe was flushed from the nest on several occasions. On three of these occasions, the time was between 5:30 - 6:00 a.m. The other two flushes occurred in the evening between 6:30 - 7:15 p.m. The female left the nest when a person approached to within 100 feet.

The eyes of the five young opened on the eighth and ninth day after discovery of the nest. On the 14th day, they were able to hop about and scattered when the nest was approached. Small greenish pellets were first observed on the 14th day. The nest was abandoned on the 17th day after discovery.

### Breeding Season

The duration of the breeding season for both males and females was determined by live trapping, nesting observations and autopsy of road killed and collected individuals.

The term breeding season as used here refers to the length of time between the first fertile coitions of the season, and the time when the last young of the season are capable of an independent existence (Haugen 1942). Hungerford showed that the male cottontail was in breeding condition from January through August. Trippensee (1936) states that the breeding season for Mearns cottontail in Michigan begins in the middle of January and extends to the middle of August.

The earliest pregnant doe was found on January 7, 1951. This road killed rabbit was carrying six embryos 10 mm long. Allowing seven to nine days for development of the embryos, this female conceived between December 30 and January 1. The young would have been born between January 29 and February 1. Conservation officers reported seeing quarter grown rabbits on March 7. These two observations seem to substantiate each other. Also, the earliest active nest was found on February 23, 1951. Existing data seem to verify that fertile coitions were accomplished in January as a rule and not an exception.

The last evidence of pregnancy was discovered on September 11 when a collected female was found to be carrying five 20 mm embryos. On October 2, a female was collected that weighed 1075 grams and measured 374 mm from nose to rump. The clitoris was small and sharply pointed, indicating a young of the year. Upon squeezing the teats, milk was seen to exude and the mammae were all well developed. In view of the size and condition of this doe, it seems probable she was a juvenile that had bred during her first year. Based on weight and length this female was probably five months of age.

The fact that a pregnant doe was found in January, indicates that some males were in breeding condition at that time or sooner. Some authorities claim that the size of testes is an indicator of breeding condition. Haugen (1942) states that fertile coitions were made from early March to the middle of August, during which time the testes averaged 1.8 inches or more. During January, the average testes length of Kentucky cottontails was 1.7 inches, while the maximum size recorded was 2.3 inches.

From this evidence, it appears that rabbits in Kentucky have an eight month breeding season, starting in early January and ending in late September. Fertile coitions were accomplished from January to the middle of September.

A study of Connecticut cottontails (Hosley 1942) showed that the testes began to increase in early November, and by April and May, the maximum was reached. The low point came during September and October. In Michigan, Trippensee (1934) found the testes began to increase in early December and reached a maximum size by April. During July and August the low point occurred.

During this study, the testes plus epididymus (in scrotum) of 63 live trapped males were measured a total of 122 times. Also, 39 adult bucks were autopsied and their testes measured. Only the length was recorded.



The length of testes began to increase fairly rapidly toward the end of January, and accelerated in March (Fig. 1). From the first of April until June, when the maximum size was reached, the increase was relatively slow. The decline started late in June, dropped rapidly during August and September, and arrived at the lowest point in November. There was a rapid, but slight increase, in December. The average testes length during the breeding season (January - September), was 52 mm.

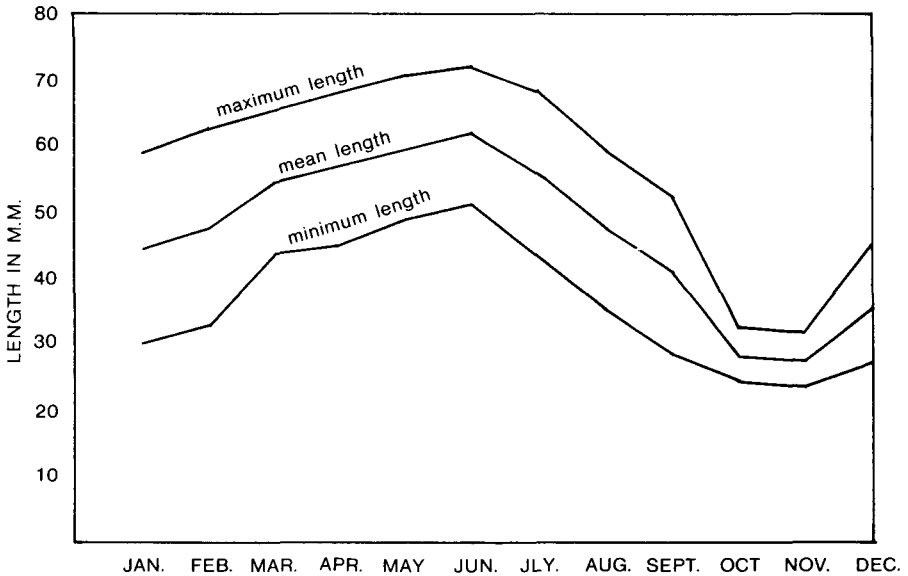


Fig. 1. Change in lengths of adult cottontail testes.

### Sex Ratios

Of 129 live trapped rabbits, composed of 63 males and 66 females, 48% were males. During the 1949 - 50 hunting season, 5,797 rabbits were sexed. Males composed 54% of the total number shot. On the second day of the 1950 - 51 hunting season, the northern part of Kentucky experienced considerable snow and cold weather. This inclement weather persisted for several days. During this period, 221 rabbits checked consisted of 59% males. The previous hunting season showed 54% males in the hunter's bag. Trautman (Trippensee 1936) found that, during cold weather, females like to hole up and an excess of males are shot.

### Age and Growth

Weights, nose-rump length measurements and tarsus lengths were taken of 220 live trapped and dead rabbits. By retrapping juvenile rabbits, weight and length increases were obtained. In addition, 47 nestlings, ranging from one to sixteen days of age, were measured, weighed and sexed, when possible. Nine juveniles, of known age, and three adults were confined to a large enclosure. They were measured and weighed on an average of every ten days.

The nose-rump lengths and weights of the nine known age individuals confined to the enclosure were plotted on graph paper (Fig. 2) and an average weight-length curve drawn. The measurements of nestlings and juvenile animals trapped at suitable intervals was superimposed. Since the original ages of these rabbits were unknown, they had to be estimated. The position occupied along the curve by the superimposed animals was determined by interpolating from the weight-length curve of known age individuals. This method proved very satisfactory as the animals of unknown age did not vary appreciably from the curve. The sexes were not separated because there seems to be little difference in growth rate for the first few months. This curve, therefore, may be acceptable as representing the average growth rate of Kentucky cottontails.

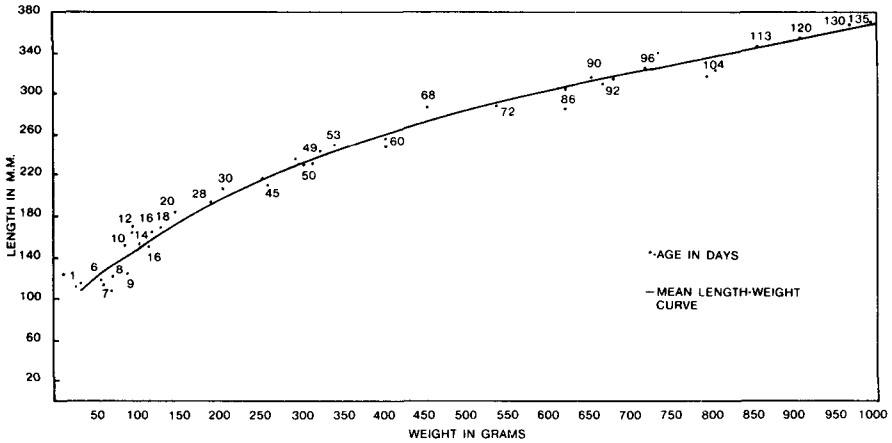


Fig. 2. Increases in weight and nose-rump length of immature wild cottontails.

The separation of juveniles from adults on the basis of weight, tarsus length or nose-rump length is difficult. There is some variation in all these measurements among individual adults and juveniles.

Fig. 3 shows that beyond three and half to four months, tarsus length levels off and is not a useful criterion of size or age. Body length is less subject to fluctuations than weight, and is more useful for aging purposes. After five to five and a half months, no measurements of size seem useful or accurate. At this time, most juveniles are adult size. Generally, rabbits over 1100 g and 280 - 285 mm in nose-rump length, were considered adult. This means that individuals could be aged as juveniles, until late September, on the basis of length measurements and weight.

Adult females averaged heavier and longer than males during all seasons of the year. The average yearly weights of adult females was 2 lbs., 15.9 oz. (1156 g), for adult males, 2 lbs., 13 oz. (1300 g). Table 5 shows average and maximum sizes for both sexes.

### Seasonal Cottontail Range

Live trapping of tagged rabbits, during all seasons of the year, yielded data on individual ranges. Fig. 4 and 5 show the maximum yearly ranges of both sexes. The figures can be overlaid to show overlapping of doe and buck territories.

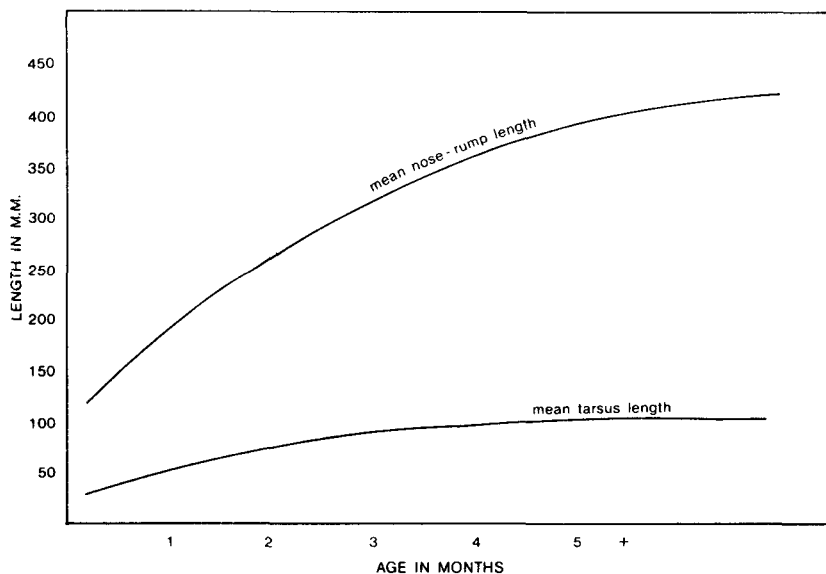


Fig. 3. Increase in nose-rump length and tarsus length of immature cottontails, males and females.

Table 5. Average length and weight of adult male and female cottontail rabbits.

	Males	Females
Average length (mm)	391	397
Average weight (g)	1300	1356
Maximum length (mm)	419	439
Maximum weight (g)	1521	1798

The yearly range of the eight adult females in Fig. 4 varied from 0.6 acres to 8 acres. The territories overlapped in all but two cases. The range of each of five does overlapped the territories of two other females.

Figure 5 represents the range of five males. The yearly size of the territories varied from 1.9 - 49 acres (Table 6). All the ranges overlapped each other so that one buck crossed the territories of four other males. Apparently, the individual territories are not well defined, but are all interrelated. One buck may range across the territories of as many as six does. There was far more overlapping of buck ranges than doe territories. The ranges of individual bucks overlapped as much as 50 - 90%.

#### Diseases and Parasites

This portion of the study has not been fully completed, and many of the parasites are now being identified by various authorities. In order to determine the prevalence of tularemia (*Pasteurella tularensis*), the leader has been taking blood samples from each live trapped rabbit since the first of April. The blood is sent to the Kentucky Department of Health for agglutination tests. In order to draw a sufficient quantity of blood (3 cc) for testing, without harming the rabbit, it is

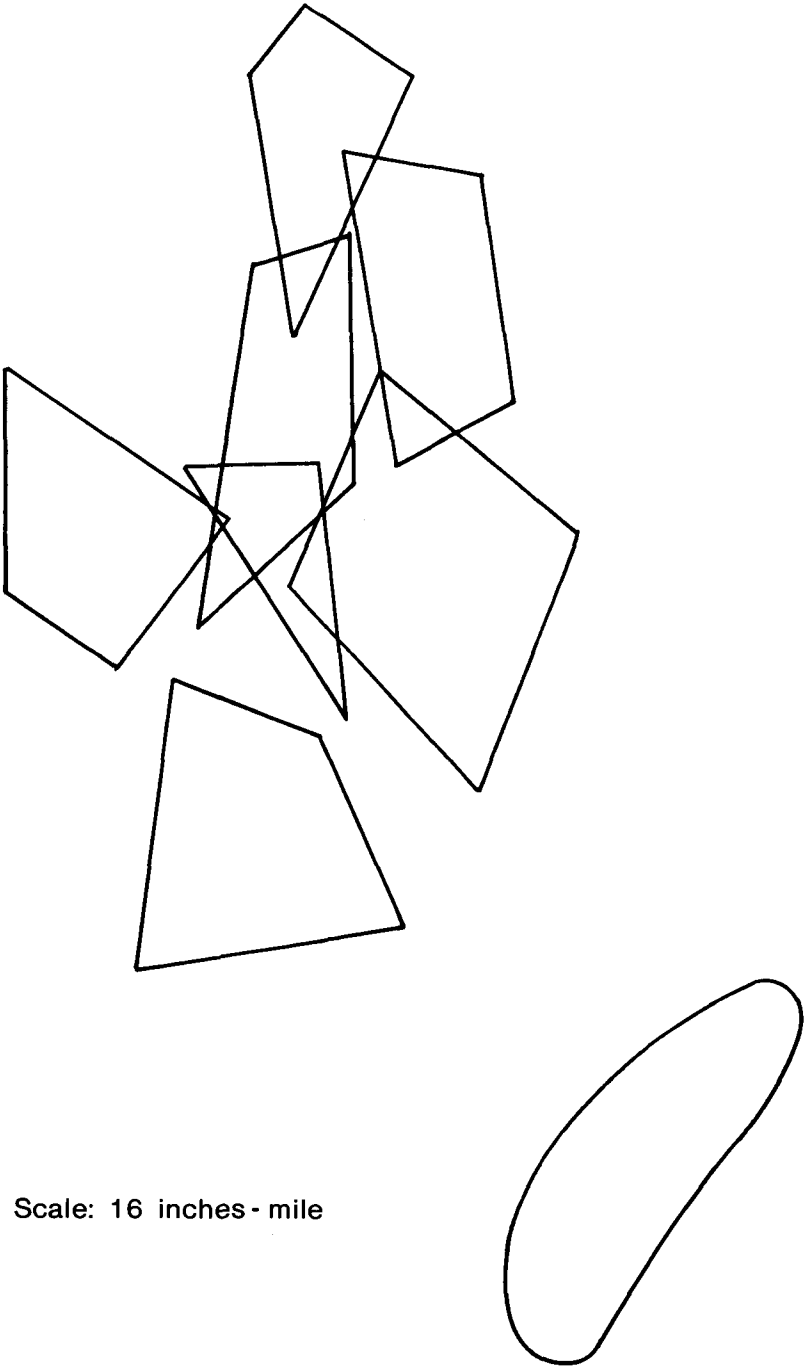
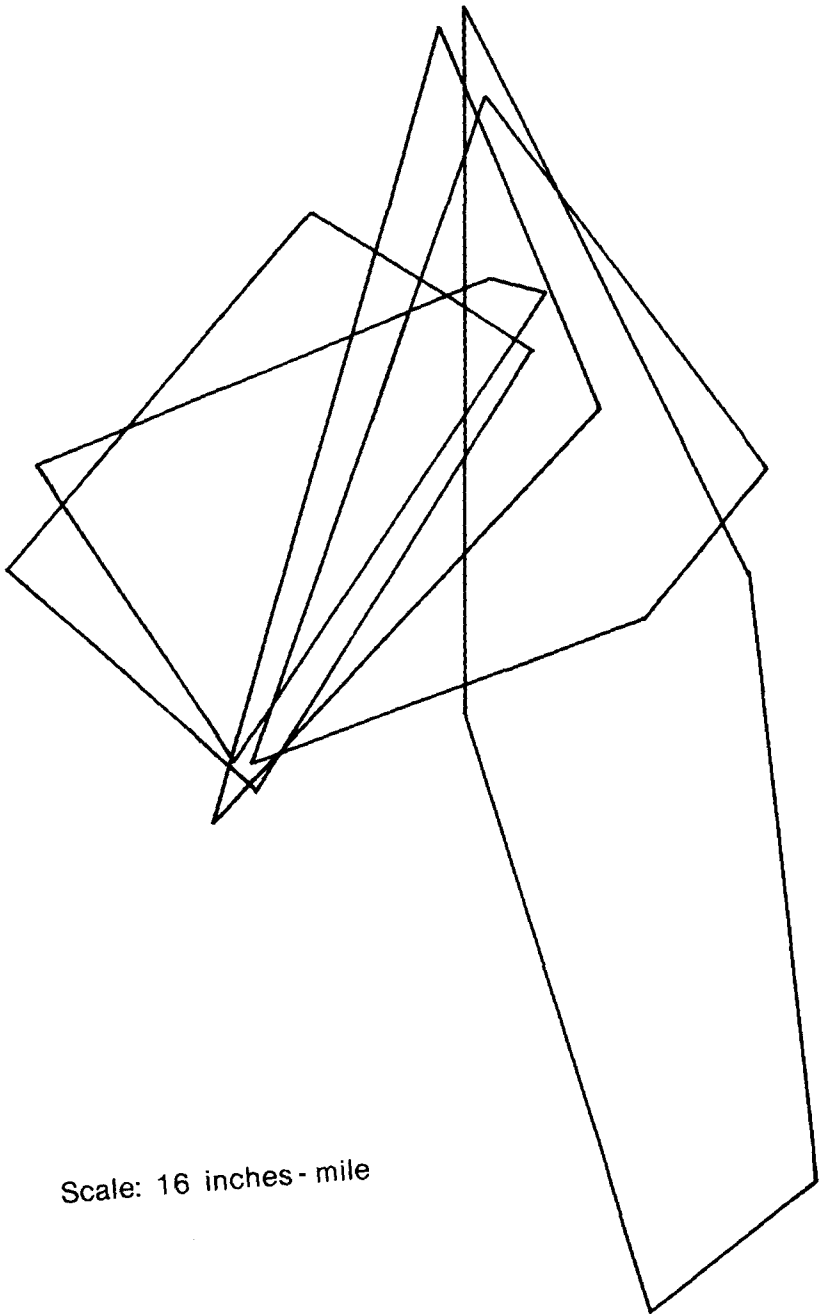


Fig. 4. Ranges of adult females as determined by trapping.



Scale: 16 inches - mile

Fig. 5. Ranges of adult males as determined by trapping.

Table 6. Seasonal territories of adult cottontail rabbits.

Season	Adult males (AC)		Adult females (AC)	
	Min.	Max.	Min.	Max.
Spring	6.0	49.0 <sup>a</sup>	2.0	8.0
Summer	5.0	15.0	1.7	8.0
Fall	4.0	16.0	1.2	5.0
Winter	1.9	11.0	0.6	6.0

<sup>a</sup> Only one record.

necessary to take a sample directly from the heart. After considerable practice, on specimen rabbits, the desired proficiency was obtained. To date, only one case of tularemia has been diagnosed. The prevalence of this disease, as determined by autopsy and blood tests, is one in a hundred.

Warble larvae were first noted on a collected male rabbit on June 10. Since then, of 40 collected specimens, ten were infested by warbles. This is 25% of the total number collected. There were never more than two larvae on a single specimen. The most common site of warble emergency was the region of the neck or back. Two collected male specimens had warbles in one side of the scrotum. The testis appeared degenerate. Three half grown rabbits with warbles were confined to a large enclosure. One died the following day. The other two lost weight gradually, and one died in eleven days, and the remaining one in twenty days. Autopsy showed general emaciation with a loss of body fluids. The wound extended deep into the muscle layer and the area around it was hemorrhaged. The lungs were congested and discolored, suggesting pneumonia. The author's theory is that the warbles caused emaciation and loss of weight, leaving the victim susceptible to secondary infection. In this case, pneumonia was the secondary infection, probably causing death. Of 22 trapped rabbits, only four, or 14% had warbles. At present, specimens of warble larvae are being identified at the University of Kentucky Entomology Department.

#### Census Techniques

Various censuses have been tried, on a state-wide basis in an effort to obtain a feasible and reasonably accurate technique. The main objective of a state-wide census is to work out a year to year abundance index. This requires a compilation of figures over a long period of time so as to have comparative data. The project has not been in existence long enough to facilitate gathering of sufficient data to make positive conclusions possible.

To date, 100-acre plot censuses, using a driving line of men, have been tried with excellent results. The major drawback here is in assembling the man power.

A trial strip census, based upon soil types, was tried and the size of sample statistically determined. The size of sample necessary to obtain a statistically correct state-wide sample in each major soil type was too large to handle.

So far, best results have been obtained from a state-wide road census conducted by picked Conservation Officers from March through October. All rabbits seen are tabulated by relative sizes, at all times that the officer is driving on duty. The adult/juvenile ratio is used as an indicator to success of the breeding

season, and to determine the peak of nesting. The 1951 adult/juvenile ratio has averaged approximately 10% higher than the previous year. An attempt will be made to correlate this figure with the hunter success.

### Kill Data

For the past two hunting seasons (1949 - 50, 1950 - 51) the annual kill of rabbits has been calculated on the basis of questionnaire returns. Conservation Officers distribute hunting questionnaires to state-wide conservation groups and interested individuals.

Two percent of the total numbers of hunters were sampled during the 1949 - 50 hunting season. (November 20 - January 10). The calculated state-wide kill was 1,454,814 rabbits. Each hunter killed an average of 8.9 rabbits during the season.

During the 1950 - 51 season, 2.2% of the total number of hunters was sampled. The rabbit kill was calculated to be 1,967,488 individuals. This was a 26% increase over the previous season. Each hunter took home 12 rabbits during the season.

### SUMMARY

Some phases of the cottontail investigation were purposely slighted so that more emphasis could be put on gathering basic information. During the next eight months management techniques, kill data and the parasite-disease study will be stressed. Following is a brief summary of findings over a two-year period.

### Breeding

1. The gestation period was found to be 29 to less than 36 days.
2. The largest number of litters recorded for one female was four.
3. The breeding season began in January and extended to the end of September.

### Nesting

4. The average yearly litter size for 1951 was 4.4.
5. Of 36 active nests found, only 10% were successful.
6. Broomsedge was the best early nesting cover and grass was preferred later.
7. A 15-acre burned-over Broomsedge field contained eight nests with 29 burned young.
8. The earliest active nest was found on February 23 and the latest on August 22.
9. The eyes of young nestlings opened from seven to nine days after birth.
10. The first green food was eaten on the 14th day.

## Sex Ratios

11. Of 5797 rabbits shot during the 1949 - 50 hunting season, 54% were males.
12. More males were killed (59%) during inclement weather.

## Age and Growth

13. A weight-length curve for immature cottontails was compiled.
14. Beyond 5 - 5.5 months no measurements of size seem useful or accurate in differentiating adults from juveniles.
15. Generally, rabbits over 1100 g and 280 - 285 mm in nose-rump length were considered adults.
16. Adult females were larger than adult males.

## Ranges

17. Yearly ranges for female cottontails varied from 0.6 - 8 acres.
18. Males ranged over 1.9 - 49 acres during the year.
19. Male territories overlapped as much as 90%.
20. Female territories overlapped less than 50%.
21. One buck may range across the territories of as many as six does and four males.

## Parasites and Disease

22. Tularemia was found in one in a hundred rabbits.
23. Warble fly larvae infested 25% of 40 specimens collected from June through September.

## Census

24. The best census technique was a March - October tabulation of all live rabbits seen along the roads.

## Hunter Kill

25. The 1950 - 51 hunting season kill was 26% greater than the previous season.

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