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Study of the Cotton Rat in Northwestern Arkansas

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A STUDY OF THE COTTON RAT IN NORTHWESTERN ARKANSAS

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The cotton rat, *Sigmodon hispidus*, is one of the most common rodents in southern United States. In most southern states it is an important crop pest, causing severe damage to truck gardens and to such crops as cotton, sugar cane, and sweet potatoes. Destruction of quail eggs and eggs of other ground-nesting birds by cotton rats may seriously affect game-bird populations (Stoddard, 1931; Komarek, 1937). This mammal is also of major epidemiological importance in that it is a potential reservoir of such diseases as typhus and plague (Meyer and Meyer, 1944). Although the cotton rat has been studied by a number of investigators, very few of the studies are of a quantitative nature, and the only ones reported which involve any large number of specimens are those of Meyer and Meyer (1944), Odum (1947), Erickson (1949), and Stickel and Stickel (1949).

Because of the cotton rats' importance in connection with public health, agriculture, and wildlife it was felt that any information concerning this rodent in Arkansas would be of value, especially as no previous study, aside from distributional records, of this species has been made in Arkansas.

The present study was made on 180 northern cotton rats, *Sigmodon hispidus hispidus* Say and Ord, taken in the vicinity of Fayetteville, Washington County, Arkansas, from October, 1950 through June, 1951. Primary consideration was given to reproduction, seasonal weight changes among adult rats, and to criteria for separating the population sample into age classes.

THE STUDY AREA

The study area consisted of eight separate trapping sites, which varied in size from about two to four acres, located in and around Fayetteville, Washington County, Arkansas. The chief vegetational cover in these areas consisted predominantly of broom sedge (*Andropogon virginicus* and *Andropogon scoparius*). Broom sedge occurred mainly on burned-over areas and old fields, and appeared to be one of the first seral stages following burning or denudation of the land. The separate trapping areas differed to some extent in the amount of dead, matted vegetation, proximity to water and wooded areas, and in the number of associated plant species. One of the trapping sites, located about one mile north of Fayetteville, had only scattered clumps of broom sedge, and ragweed (*Ambrosia* sp.) comprised much of the plant cover. Swamp sedge, (*Carex* sp.) also was more abundant than broom sedge in this area.

METHODS

Victor mouse traps and rat traps and small (2"x2.5"x6.5") Sherman live traps were used in the study. Line trapping was employed, with individual traps set about four feet apart and placed so that they faced out into runways. The number of traps set along a given line was determined by the number of suitable trapping sites. In general, a sheltered trap site produced the best catches, and maximum catches were obtained by placing traps along avenues of travel, such as brush piles, logs, stream banks, and matted grass. Except during December and January, traps were attended at least once a day, usually early in the morning. Each trapping site was intensively trapped until it was felt that the population was exhausted, as evidenced by absence of captures over periods of several days' trapping. Traps were moved about in various parts of each area in order to gain some idea of habitat preference.

Traps were baited with oatmeal, peanut butter, prunes, and raisens. All of these proved to be effective baits, but the degree of effectiveness showed considerable seasonal and daily variation. No specimens were captured with rain-soaked oatmeal. This agrees with the results of Anderson (1948) in Canada. Peanut butter was most effective in early spring and late autumn. Cotton rats may have been discouraged from eating this bait during the warmer months when ants swarmed on it. Rain often washed the peanut butter from the trap pan, reducing the efficiency of the snap traps. Prunes and raisins were most effective during colder weather as they were little affected by climatic change. Erickson (1949), who used oatmeal and chickmash as baits, obtained his largest catches in times of least rainfall. He found that trapping success was little affected by temperature or by relative humidity.

Each specimen was weighed shortly after capture to the nearest one-tenth of a gram. Standard measurements were made to the nearest one-tenth millimeter with a vernier caliper.

RESULTS AND DISCUSSION

COTTON-RAT, SMALL-MAMMAL INTERRELATIONSHIPS: During the course of this study five house mice (*Mus musculus*) seven harvest mice (*Reithrodontomys fulvescens aurantius*), five white-footed mice (*Peromyscus leucopus*), one little short-tailed shrew (*Cryptotis parva*), and one short-tailed shrew (*Blarina brevicauda carolinensis*) were captured in cotton-rat runways.

Interrelationships can only be surmised from so few captures. All the white-footed mice were taken on high, comparatively dry ground where few cotton rats were captured. The house mice were taken in close proximity to buildings where cotton rats were seldom taken. Harvest mice, however, were taken in several of the trapping sites, usually where the most cotton rats were taken. Both harvest mice and cotton rats show a marked preference for broom-sedge habitat, although no indication has been obtained that they are active competitors. Other species taken do not appear to share the identical habitat of the cotton rat, but their presence is probably indicative of some overlap in habitat requirements.

Few literature references are made to interrelationships of the cotton rat with other small mammals. Coleman (1929) frequently captured harvest mice in cotton rat runways, while Stickel and Stickel (1949) captured twenty-one Taylor Baiomys (*Baiomys taylori*) along with eighty-three cotton rats during a nine-day trapping period.

COTTON-RAT HABITAT: It is generally agreed (Hamilton, 1943; Stickel and Stickel, 1949; Erickson, 1949; and others) that the preferred habitat of the cotton-rat is in heavily matted grasses with a preference toward a matting of broom sedge. Svihla (1929) found them common in the coastal marshes and cane fields of Louisiana, and Cahalane (1939) found them most numerous under conditions of abundant moisture along irrigation ditches and in cattail marshes of the Chiricahua mountain region of Arizona.

In the region around Fayetteville, cotton rats seemed to prefer matted broom sedge bordering rather moist areas rather than swampy ground.[1] During one month in which records were kept of captures in various parts of a two-and-one-half-acre field of broom sedge within the Fayetteville city limits, the most captures were made in the zone between swampy and dry ground (Table I). Captures decreased progressively with increased distances from this zone. Portions of the trapping area which lacked a grass matting yielded only an occasional rat, whereas portions with a heavy matting yielded the greatest percentage of the total catch.

Cotton-rat runways in the study area were very distinct on open ground, and in many places they were so well worn that no vegetation grew on them. The majority of the runways observed were distinct for only ten to twenty feet and then faded out into many side passages. However, one runway was observed which could be clearly followed for nearly one hundred feet. Many cotton rats of various sizes were seen running along well-marked runways in the study area, and on two separate occasions these rodents were observed while in the process of constructing new runways. In runways which were in use, the characteristic spindle-shaped scat of the cotton rat could generally be found.

Hamilton (1943) states that cotton-rat runways are well-defined trails even where the ground surface is open, but Jameson (1947) and Stickel and Stickel (1949) state that the runways which they studied were ill-defined even in matted regions.

Table I. Numbers and percentages of the total catch of 26 cotton rats in a two-and-one-half-acre field of broom sedge during April, 1951.

Moisture Conditions	Total Catch			
	Matted Broomsedge		Non-matted Broomsedge	
	Number	Per cent	Number	Per cent
Swampy	2	7.7	0	0.0
Moist	20	76.9	2	7.7
Dry	1	3.8	1	3.8

ACTIVITY: During the early winter months, cotton rats were observed traversing runways at all times of the day in various parts of the study area. When traps were checked several times a day during the spring months, however, it was found that very few specimens were captured from the post-dawn to pre-dusk hours, indicating that this species may be least active during midday. It is possible that the high degree of activity during the winter was due to scarcity of food, or to low temperature combined with food shortage. It is felt that the quiescent period during midday is more typical of the warmer months.

PREDATION: A certain amount of incidental information concerning predation upon cotton rats resulted from the study, although the effect of predation upon trapping success or upon cotton-rat populations could not be measured.

In one of the trapping areas, domestic cats seemed to be the chief predators. They were observed working the fields at all times of the day, and on two occasions were observed while capturing cotton rats. Examination of their scat revealed that a considerable portion of it was composed of fur and teeth, which upon comparison with reference material, proved to be from cotton rats.

On May 18, 1951, a five-foot coachwhip snake (*Coluber flagellum*) was captured and killed in a trapping area west of Fayetteville. Its stomach contained a freshly-killed, pregnant cotton rat.

From three to ten red-tailed hawks (*Buteo borealis borealis*) were seen perched in trees daily for over fifty days in a trapping site north of Fayetteville. One specimen was shot and wounded in a tree on the trapping site, and shortly after being captured regurgitated a freshly-killed cotton rat. Three pellets, probably from these hawks, containing cotton rat remains were found at the base of a tree in the same area.

About ten per cent of all cotton rats caught in snap traps were either partially eaten or removed from the traps. It seems likely that at least some of these specimens were cannibalized, while the remainder probably were eaten by scavengers or chance predators. Undoubtedly certain animals will readily eat trapped animals which ordinarily they are unable to capture. For example, both a crow and a four-pound snapping turtle were captured in steel traps baited with cotton rats during this study. Animals such as these should be considered as occasional scavengers rather than true predators.

AGE AND WEIGHT: Separation of Age Classes -- Determination of the age composition of a sample of a cotton-rat population is subject to considerable inaccuracy when based upon weights, measurements, and reproductive condition of specimens gathered in the field, when these data are not compared with similar measurements on animals of known age. Age criteria for cotton rats used by other workers (Erickson, 1949; Stickel and Stickel, 1949) have been based chiefly upon a rough quantitative and/or qualitative estimation of size and of breeding condition.

Size is not a good index of sexual maturity in the cotton rat, inasmuch as cotton rats are capable of breeding at about 40 days of age (Meyer and Meyer, 1944; Asdell, 1946), at which time they are still undergoing rapid growth and may be consideraboy less than half the size of a fully-grown rat. There is also evidence that puberty is reached earlier in spring than in autumn, so that breeding may occur at 30 days of age or possibly at a younger age. Thus, animals classed as juveniles and subadults on the basis of body measurements or weight may be called adults, if sexual maturity is considered the criterion for the adult condition. On the other hand, age-criteria based solely upon reproductive condition may be unreliable because of seasonal changes in reproductive condition.

Young cotton rats are quite precocious and leave the nest to forage for themselves at about ten days of age (Svihla, 1929). Growth is rapid (ibid.), and the rate is fairly constant, not showing a marked decrease until after 100 days of age (Meyer and Meyer, 1944). Meyer and Meyer (1944) state that a large part of the weight gain after 100 days of age is in the form of fat.

The data of Meyer and Meyer (1944) has been used in determining the age composition of the cotton-rat population sample considered in this study. They raised cotton rats from birth in the laboratory and weighed groups of males and females at 10, 20, 30, 40, 50, 100, 150, 200, and 250 days of age. The data on field-caught rats in the present study has been compared with these known weights to obtain the approximate age composition of the sample. Cognizance has been taken of the fact that laboratory-reared rats became fatter, and hence heavier, than wild rats. However, most of the heavy fat deposits observed in wild cotton rats have been in obsiously larger and older animals, and should not appreciably affect the age groupings in view of the weight ranges chosen to represent different age groups.

The population sample was divided into three age groups on the basis of weight: Subadults, young adults, and old adults. Male and female animals weighing from 12 to 46 grams were classed as subadults ranging in age from 10 to 29 days. All male animals weighing from 47 to 138 grams were classed as adults ranging in age from 30 to 50 days, while all females weighing from 47 to 111 grams were considered as adults ranging in age from 30 to 50 days. Males weighing from 139 to 258 grams were classed as old adult males ranging in age from 51 to 250 or more days. Old adult females were considered to be specimens weighing from 112 to 230 grams and ranging in age from 51 to 250 or more days. The weight ranges used for old males and old females varied somewhat in view of the findings of Meyer and Meyer (1944) that males tend to accumulate weight faster than do females after 50 days of age.

A fourth weight range of 3.5 to 11 grams was selected to represent juvenile or young animals ranging in age from 1 to 9 days. None of the specimens collected fell into this category, so it is presumed that animals of this age either remain close to the nest or do not readily enter traps in search of food.

Table II. Age composition of a cotton-rat population in the vicinity of Fayetteville, Arkansas, based upon body weights[1] with correlsted body measurements for each age group.

Age Class	Sex	No. of rats	Weight Range (grams)	Average Weight[2] (grams)	Average body measurements[3] (millimeters) Total Length	Tail Length	Hind Foot	Ear
Sub-adult	M	23	12-46	28.7 (13.2-46)	160.3 (125-215)	68.9 (53-110)	23.8 (19-28)	14.0 (10-17)
Sub-adult	F	12	12-46	38.2 (18.7-44.9)	187.7 (137-221)	82.9 (61-105)	26.4 (22-29.5)	16.1 (13-18)
Young adult	M	68	47-138	80.4 (47.8-137)	214.3 (150.7-270)	86.0 (60-110)	29.5 (25.1-33)	17.4 (14-20)
Young adult	F	49	47-111	69.9 (50-108.1)	207.2 (150-240)	80.6 (50-100)	28.6 (25.9-31)	17.0 (13.9-20)
Old adult	M	8	139-258	160.3 (140-210)	267.3 (256-300)	100.8 (93-107)	31.3 (30-33)	19.5 (18-20)
Old adult	F	20	112-230	132.5 (114.6-191.5)	249.2 (217-293)	98.7 (65-119)	30.2 (26-34)	18.8 (15-20)

1. Cf. Meyer and Meyer (1944)
2. Range in parentheses
3. Range in parentheses

As shown in Table II, males tended to average somewhat heavier than females, except among the subadult class where it appears that the initial growth rate of females probably is more rapid than that of males. The average body weights in the different age classes tended to be somewhat lower than those of laboratory-reared rats in the same weight range, which is to be expected on the basis of comparative growth rates of wild and captive stock (Svihla, 1929; Meyer and Meyer, 1944). Standard body measurements tend to show a considerable amount of overlap between different age groups based on weight, and hence they must be used cautiously as a criterion of age.

The monthly catches of specimens in each age class are summarized in Table III. The monthly percentages of each age class in the population are shown in Figure 1. Changes in percentages of subadults, young adults, and old adults reflect the changing age composition of the population as a whole as reproduction ceases during part of the winter and natural mortality of old adults occurs. With resumption of breeding in the spring months, there was an apparent trend toward a decrease in the percentage of young adults in the population, and in the late spring and early summer months, there was an increase in the percentage of old adults. This is largely accounted for by the maturation of the young adult class into old adults, and a rapid increase in the number of subadults. Komarek (1937) noted that there was a regular yearly decrease in cotton-rat numbers during spring, at which time they evidently reached a population low point.

Table III. Summary of monthly catches of cotton rats of each age class taken in the vicinity of Fayetteville, Arkansas, from October, 1950, through June, 1951.

Month	Number Captured	Per cent of monthly catch	Number Captured	Per cent of monthly catch	Number Captured	Per cent of monthly catch
October	0	0.0	6	85.7	1	14.3
November	11	33.3	21	63.6	1	3.1
December	0	0.0	22	91.7	2	8.3
January	0	0.0	14	93.3	1	6.7
February	7	26.9	19	73.1	0	0.0
March	3	33.3	6	66.7	0	0.0
April	6	22.2	19	70.5	2	7.3
May	5	19.2	10	38.5	11	42.3
June	3	23.1	2	15.4	8	61.5
Total	35		119		26	
Per cent of Total Catch		19.4		66.1		14.5

BODY WEIGHT AND FAT ACCUMULATION: An arbitrary criterion, based upon the gross amount of visible fat in each specimen autopsied, was used to indicate the relative amount of fat deposition in males and females during different months (Table IV).

The time sequence of fat deposition and of depletion of fatty tissue was almost identical in males and females. During the months of November, December, and January, males acquired fat deposits in the posterior body regions about two weeks before females did but these deposits were lost at approximately the same date in both sexes.

Pectoral fat was acquired last and disappeared first in both sexes. Omental and gonadal fat appeared simultaneously with inguinal and anal fat, but disappeared last. During November, December, and January males showed greater fat deposition than females in the inguinal, omental, gonadal, and anal regions.

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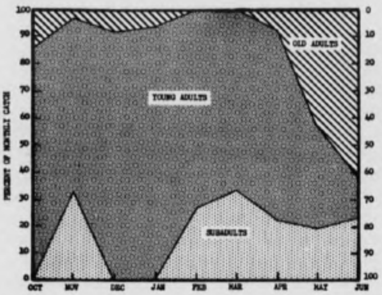

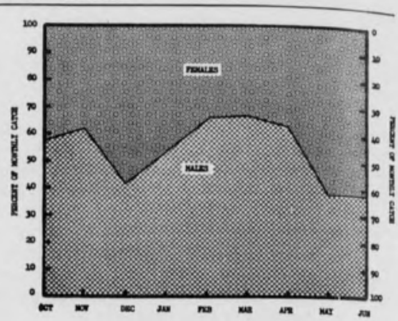

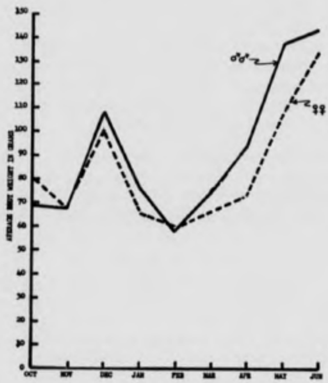

Fig. 1. (Above left) Per cent of monthly catches of cotton rats of each age class taken from October, 1950, through June, 1951 in the vicinity of Fayetteville, Arkansas.

Fig. 2. (Left) Average monthly body weights of 145 adult cotton rats taken in the vicinity of Fayetteville, Arkansas, from October, 1950, through June, 1951.

Fig. 3. (Above) Monthly percentages of male and female cotton rats captured in the vicinity of Fayetteville, Arkansas, from October, 1950, through June, 1951.

Table IV. Relative amount of fat accumulation in six regions of the body of male and of female cotton rats taken in the vicinity of Fayetteville, Arkansas, from October, 1950, through June, 1951.

Month	Sex	Number of Rats	Body Region: Pectoral	Inguinal	Omental	Renal	Gonadal	Anal
October	M	4	0	0	0	0	0	0
	F	3	0	0	0	0	0	0
November	M	21	0	1	1	0	1	1
	F	12	0	0	0	0	0	1
December	M	10	1	1	2.5	2.5	2.5	2.5
	F	14	1	1	2.0	2.0	2.0	2.0
January	M	8	3.0	3.0	3.0	3.0	3.0	3.0
	F	7	1.5	1.5	1.5	1.5	1.5	1.5
February	M	17	0.5	0.5	0.5	0.5	0.5	0.5
	F	9	0.5	0.5	0.5	0.5	0.5	0.5
March	M	6	0	0.5	0.5	0	0.5	0.5
	F	3	0	0.5	0.5	0	0.5	0.5
April	M	17	0	0	0.5	0	0.5	0
	F	10	0	0	0.5	0	0.5	0
May	M	16	0	0	0	0	0	0
	F	5	0	0	0	0	0	0
June	M	5	0	0	0	0	0	0
	F	8	0	0	0	0	0	0

Key 0 - absent; 1 - slight; 2 - medium; 3 - heavy

These observations indicate that heaviest fat deposition took place during the winter months and least fat deposition in late autumn and early spring months. Visible fat deposits were absent during late spring and early autumn. It is presumed that this condition is maintained throughout the summer months.

Monthly weights of male and female cotton rats are presented in Table V. Weight curves for male and female cotton rats (Figure 2) show a definite trend toward increasing weight in both sexes during the spring and summer months. As shown in Table IV, fat deposition was rapid, occurring mainly in December and January, with evident withdrawal of depot fat during February and March as body weights of both sexes declined (Table V, Figure 2) probably as the result of severe weather and food shortages. Bailey (1931) noted that cotton rats in the wild do not accumulate any noticeable amount of fat.

REPRODUCTION

SEX RATIO: Cotton-rat populations probably have a nearly-equal sex ratio. Stickel and Stickel (1949) and Erickson (1949) report sex ratios of 42:40 (105:100 and 84:68 (124:100), respectively. Both studies point out that males range further than females. The greater tendency of males to wander results in more frequent capture, thereby distorting the true sex ratio.

In this study, a sex ratio of 98:82 (120:100) was found for the population sample. A sex ratio of 9:8 (110:100) was found in three litters of cotton rats, which compares closely with the sex ratio of the population sample. Monthly sex ratios are summarized in Table VI. The increase in percentage of males during February, March and April (Figure 3) appears to coincide with the onset of the breeding season. At this time males apparently range further, probably in search of females, and evidently are more active, resulting in greater frequency of captures. Females, on the other hand, probably become more retiring while rearing litters, and hence are less frequently captured during this period. The increase in percentage of females during May and June may be indicative of a population trend which was not, however, followed through trapping during succeeding months. The decline in number of males caught and the increase in number of females caught (Table VI, Figure 3) may indicate some sort of compensatory population adjustment, whereby a low population density may be compensated for by an increase in number of females, thus restoring the reproductive potential of the species (Elder, 1951). Elder (personal communication) mentions an apparent decline of cotton-rat populations in Missouri during 1951, based on a reduction of fifty percent in frequency of occurence in stomachs of predators. A similar decline may have occurred in Arkansas. Other workers also have noted a tendency toward unbalanced sex ratios with changes in population levels (cf. Linduska, 1950.)

LITTER SIZE: During the present investigation, 23 females were found containing embryos, placental scars, or both. Seven females taken during November and December contained from 5 to 22 placental scars. Visible embryos did not appear until April, when one female contained five visible embryos which were approximateoy 7 millimeters long. Assuming no intra-uterine mortality once the embryos have become visible in the horns (Emlen and Davis, 1948), the litter size in 16 pregnant females varied from 4 to 10 with an average of 6.6. The average litter size for May was 6.0, and for June it was 7.6. These litter sizes compare favorably with those found by other workers (cf. Asdell, 1946).

BREEDING POTENTIAL: Assuming that the period of visible pregnancy in the 27-day gestation period of the cotton rat (Meyer and Meyer, 1944) is directly proportional to that of the Norway rat (which is 18 days of the 21-day gestation period), then the period of visible pregnancy for the cotton rat is 23 days.

Using this figure, frequency of pregnancy can be calculated by the following formula (Emlen and Davis, 1948).

$F = I \times t/23$, in which
F = Frequency of pregnancy
I = Incidence (percentage visibly pregnant)
t = Length of time during which specimens were collected

Of the nine-month period, 219 days were spent trapping. During the study, 41 adult females were trapped, of which 16 (39.0 per cent) were visibly pregnant. Applying the equation for determination of pregnancy frequency,

$$F = 0.39 \times 219/23$$

we obtain,

$$F = 3.71$$

According to the above calculation, the average adult female brought 3.71 litters successfully to term in the 219-day study period. This is equivalent to a rate of one litter every 59 days, or six litters per year. Using the same formula, Emlen and Davis (1948) obtained a pregnancy frequency of 3.44, or one litter every 65 days for wild brown rats. Svihla (1931) found that one Texas rice rat produced six litters in a year, or one litter every 40.55 days. The breeding potentials of these two prolific rodents thus compare favorably with that found for the cotton rat in this study, definitely indicating its high degree of productivity.

PROBABLE LENGTH OF THE BREEDING SEASON: The data are insufficient to determine the actual length of the breeding season. The latest record of placental scars was on December 12, 1950, while the earliest record of visible embryos was on April 19, 1951. The largest number of pregnant females were taken in May and June. Two separate breeding periods seem to be indicated by the bimodal distribution of the subadult population, and, to a lesser degree, the adult population (Figure 1). One major breeding period may have its onset in February or March and probably continues through July, while another shorter breeding period may begin in late September or October and continue through November.

Table V. Monthly weights of 145 adult male and female cotton rats taken in the vicinity of Fayetteville, Arkansas, from October, 1950, through June, 1951.

Sex	Month	Number Captured	Average Weight (grams)	Weight Range (grams)
	October	4	68.5	50.3 - 120.0
	November	10	67.8	49.2 - 100.0
M	December	10	1 8.0	84.3 - 145.0
a	January	8	76.9	58.3 - 96.3
l	February	14	58.6	48.0 - 87.1
e	March	4	75.0	60.0 - 91.0
s	April	14	93.9	62.6 - 152 0
	May	9	137.6	77.2 - 210.0
	June	3	143.7	126.0 - 168.0
	October	3	80.5	56.0 - 127.5
F	November	12	67.9	50.0 - 128.5
e	December	14	100.2	53.6 - 191.5
m	January	7	65.5	52.1 - 114.6
a	February	5	59.5	55.0 - 65.1
l	March	2	66.4	52.3 - 80.5
e	April	7	73.6	60.0 - 80.0
s	May	13	108.7	60.0 - 142.0
	June	6	133.2	118.2 - 150.0

Table VI. Summary of monthly catches of male and female cotton rats of all age classes taken in the vicinity of Fayetteville, Arkansas, from October, 1950, through June, 1951.

Month	Number of Males	Per cent of Monthly Catch	Number of Females	Per cent of Monthly Catch	Sex Ratio
October	4	57.9	3	42.1	133:100
November	21	63.6	12	36.4	175:100
December	10	41.7	14	58.3	71:100
January	8	53.3	7	46.7	114:100
February	17	65.4	9	34.6	189:100
March	6	66.6	3	33.3	200:100
April	17	62.6	10	37.4	170:100
May	10	38.5	16	61.5	63:100
June	5	38.5	8	61.5	63:100
Total	98		82		120:100
Per cent of Total catch		54.4		45.6	

SUMMARY

A study was made on a cotton-rat population in and around Fayetteville, Washington County, Arkansas, from October, 1950 through June, 1951. Emphasis in the study was placed on body measurements and reproductive condition, with the objective of determining age composition and reproductive status of the population. Some consideration was given also to habitat, activity, predation, and cotton-rat, small-mammal interrelationships.

The population was divided into three groups on the basis of weight: Subadults, young adults and old adults. Young adults (47-138 grams) comprised over 66 per cent of the total population, while subadults (12-46 grams) and old adults (112-258 grams) made up over 19 and 14 per cent of the total population, respectively. No individuals which could be classed as juveniles were trapped during the study. Monthly catches showed shifts in the proportion of different age groups in the population, which could be accounted for by changes in reproductive status of the population, coupled with natural mortality of older individuals and maturation of subadult and young-adult animals.

Heaviest fat deposition occurred during the winter months. No visible fat deposits were present during late spring and early autumn, although both sexes showed a definite trend toward increasing weight during this period. Fat deposition was rapid, and apparently occurred mainly in December and January, with evident withdrawal of depot fat during February and March. In general, male cotton rats averaged heavier in weight than females, except in the subadult class.

A sex ratio of 120:100 was found for the population sample. There was some evidence of shift in the sex ratio from February through June, possibly indicating a compensatory population adjustment whereby a decline in the total population may have been compensated for by an increased percentage of females.

Visible embryos were found in 16 females. The average litter size was found to be 6.6, assuming no intra-uterine mortality, with a range of 4-10. A reproductive rate of one litter every 59 days for an average adult female was calculated from the percentage of visibly pregnant females among the adult females in the population during the entire trapping period. The length of the breeding season could not be determined accurately from the data available.

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