AN EVALUATION OF SEVERAL BODY MEASUREMENTS FOR DETERMINING AGE IN LIVE JUVENILE COTTONTAILS [1]

By EDWARD P. HILL III [2]

ABSTRACT

An evaluation of several body measurements for determining age of juvenile cottontail rabbits was undertaken on the Coastal Plains and Piedmont Soils of Alabama from January 1963 to December 1966. Coefficients of variation were calculated, and growth curves were fitted from least squares analyses of measurements of tarsus length, ear length, nose-rump length, and body weight from 151 known-aged cottontails born in pens and raised in large enclosures. Tarsus length provided the best estimate of age in young cottontails.

Body weights at birth were greater than weights reported for cottontails from Pennsylvania and Illinois. A loss of body weight following birth was indicated. After approximately 90 days of age, rates of growth for cottontails in this study were slower than rates reported for Wisconsin, Illinois, and Kentucky cottontails. Implications of the slower rate of growth and its effects on sexual maturity and reproduction by young-of-the-year are mentioned.

INTRODUCTION

Techniques for estimating age of cottontail (*Sylvilagus floridanus*) fetuses based on similar development in the domestic rabbit (*Oryctolagus sp.*) have been previously reported by Schwartz (1942:11). Rongstad (1969:165), based on cottontail fetal measurements from timed gestations, provided a more accurate scale for determining embryonic age. Following birth, ages of nestlings can be estimated from tarsus measurement standards reported by Beule and Studholme (1942:137). Growth curves by Dalke (1942:76), using tarsus length and body weight; by Petrides (1951:321), using hind feet length, weight, and total length; by Lord (1963:29), using body weight; by Bruna (1952:30), using weight and nose-rump length; and by Rongstad (1966:119), using body weight, provide a means for estimating age in post-nestling juveniles without sacrificing the animal. However, the author found no reports on this subject from states adjacent to Alabama.

There were numerous occasions during the early phases of this and related research when the author needed to make reliable estimates of the age of trapped juvenile cottontails that would be used in subsequent reproductive studies. Regional differences in cottontail litter sizes and the differences between the incidence of sexual activity in young-of-the-year from northern latitudes (Evans *et al.*, 1965:183) and those from the South (Pelton, 1969:183; Hill, 1969:7) lead me to question the validity of applying growth rates of rabbits from the northern latitudes to Alabama rabbits. Regional variation in weights of cottontail eye lenses (Rongstad, 1966:117; Hill, 1966:52) also suggest the need for further research in this area.

The objective of this study was to evaluate several body measurements for determining age of live juvenile cottontail rabbits in Alabama and to compare growth rates of Alabama cottontails with those applicable to more northern latitudes.

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METHODS AND PROCEDURES

The study was conducted from January 1963 to December 1966 with 151 known-aged cottontails born in pens near Prattville, Alabama, and raised in enclosures varying in size from approximately 1 to 40 acres; the enclosures were located near Prattville and at Auburn, Alabama. Rabbits were measured frequently as nestlings, when ear tagged before leaving their nest, and at each opportunity thereafter. Body weights and measurements of ear length from the notch, tarsus length, and nose-rump length of nestlings were recorded daily until about five days of age, but less frequently thereafter. Measurements of older juveniles were made at each opportunity. This usually involved one to three subsequent measurements taken at intervals varying from as little as three days to as long as three months.

When at least 320 measurements were recorded for each of the criteria, the data were plotted for visual inspection and subjected to a least squares analysis to determine the coefficients of variation.

RESULTS AND DISCUSSION

Tarsus length was the most accurate estimate of early age in young live cottontails in this study. Ear length and nose-rump lengths also provided reliable estimates of age. Calculated regression curves of tarsus length, nose-rump length, ear length, and body weight on age are presented in Figures 1, 2, 3, and 4, respectively. Coefficients of variation for tarsus length, nose-rump length, ear length, and body weight were .41, .42, .46, and 1.17, respectively. In this study, nose-rump length curves from cottontails through about 120 days were similar to those reported for Kentucky cottontails (Bruna, 1952:30) and similar to data reported for Ohio cottontails ranging in age from about 10 to 150 days (Petrides, 1951:320). The mean tarsus length from Ohio cottontails began, however, to diverge from that of Alabama cottontails at approximaeely 50 days of age to the extent that, at 120 days of age, tarsus measurements from Ohio cottontails were 95 mm or more, while those from Alabama cottontails were approximately 80 mm.

Differences in growth rates were also detected when body weights were examined. Petrides (1951:320) reported weight of 1100 grams for cottontails approximatly 150 days old, whereas cottontails from Alabama at that age weighed about 950 grams. Age-weight curves from Wisconsin, Illinois, and Kentucky indicate more rapid growth after approximately 90 days of age than the author found for Alabama cottontails in this study (Figure 5). This difference in growth rate between the mid-western United States and Alabama is perhaps due to factors which also produce the regional differences in the incidence of breeding by young-of-the-year cottontails mentioned earlier. It appears likely that factors such as the nutritional plane which is thought to influence litter size in adult rabbits among soil regions and within soil regions at different times (Hill, 1971) would also exert the same effects on young-of-the-year females. Females born early in the breeding season on fertile Ohio soils probably mature faster and, in my opinion, would be more apt to be reproductively active than cottontails from the Coastal Plain of Alabama which appear to grow more slowly.

A difference in weight at birth was also indicated between cottontails from the northern mid-western United States and those from Alabama. Lord (1963:28) noted a mean weight of 25.6 grams for 10 cottontails born in captivity. Beule and Studholme (1942:136) reported an average birth weight of 29.5 grams for five cottontails. In this study, the mean weight (within eight hours after birth) of six cottontails from two litters was 42.2 grams. While the data from this and other studies are too few for drawing firm conclusions, the indicated trends are noteworthy due to the scarcity of information on the subject.

It is generally known in domestic animals having multiple births that smaller litters usually contain significantly larger individuals than large litters. Assuming that this pattern holds true for the cottontail,

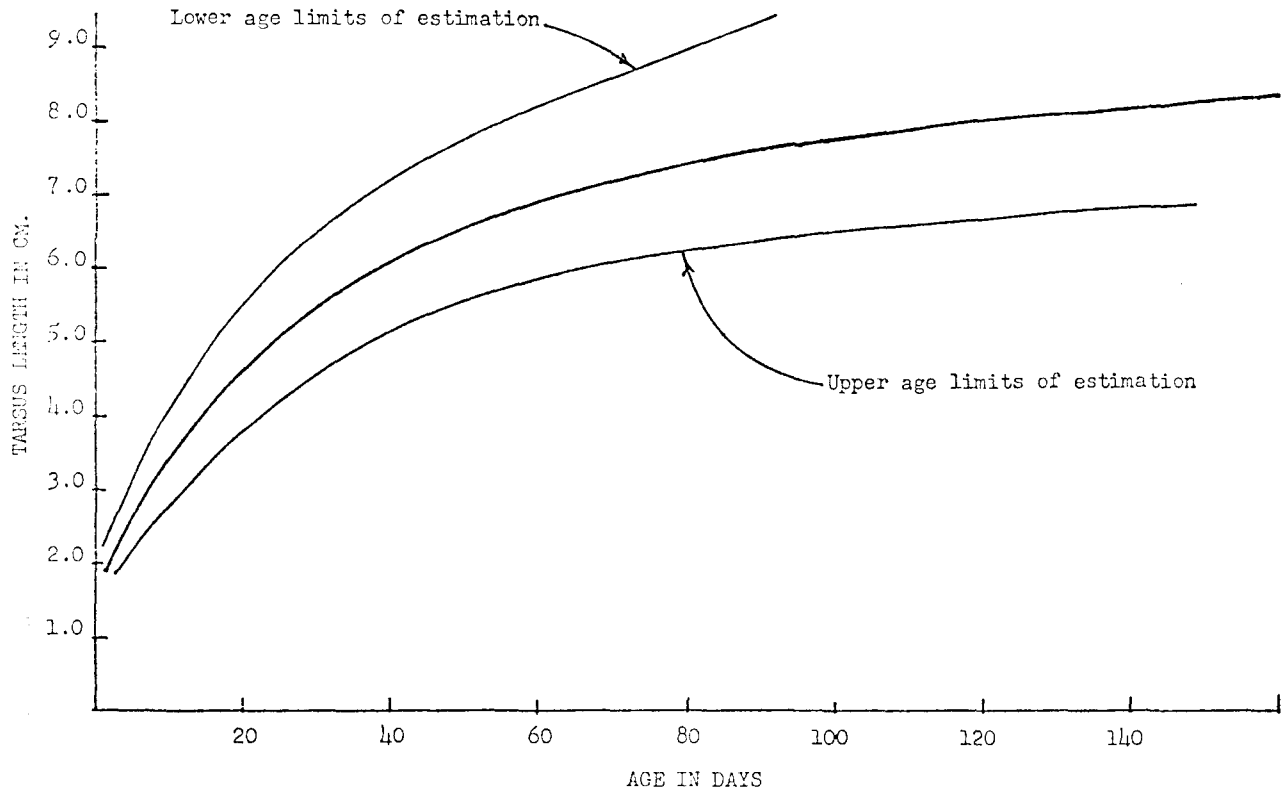

FIGURE 1. Relationship of tarsus length on age based on 347 measurements of known age cottontails from Alabama. Age limits of estimation were calculated at $P<0.05$, however, P is slightly greater due to the constant K which was included in the calculation to minimize the mean square for deviations from linear regression.

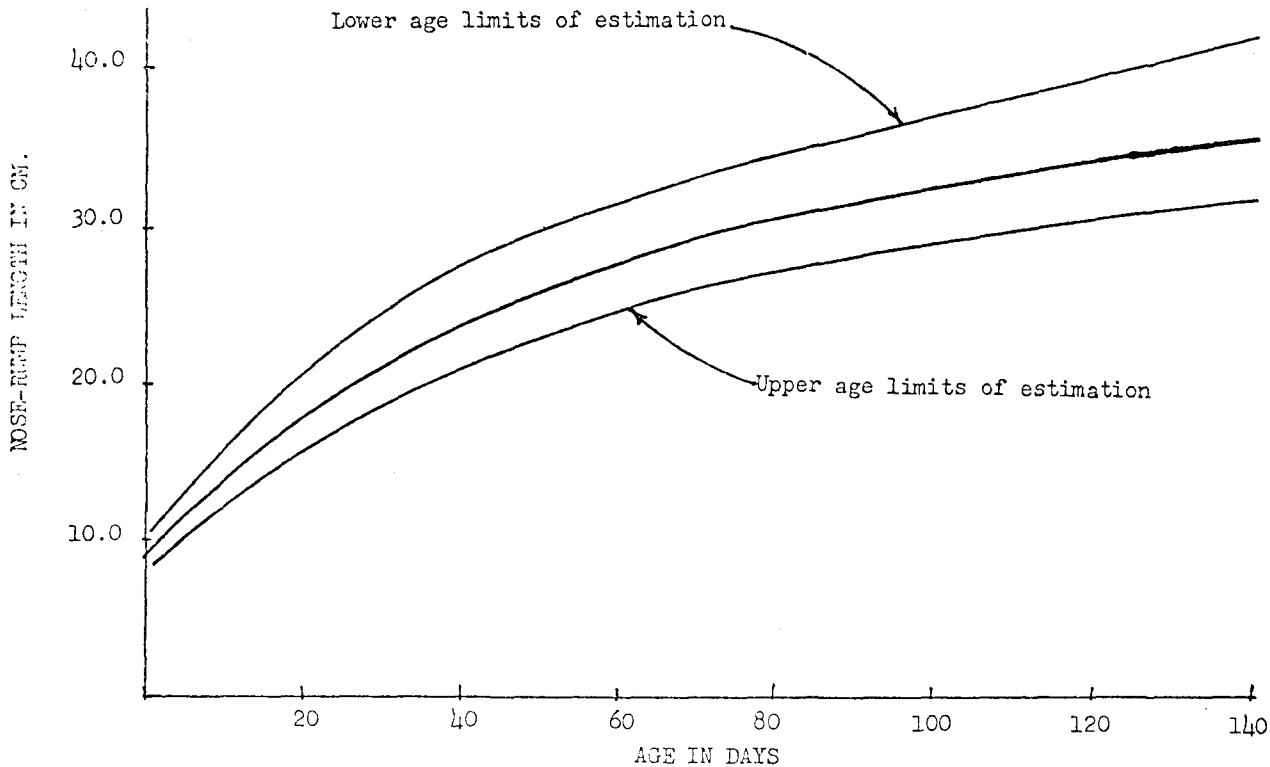

FIGURE 2. Relationship of nose-rump length on age in days based on 322 measurements of known age cottontails from Alabama. Age limits of estimation were calculated at $P<0.05$, however, P is slightly greater due to the constant K which was included in the calculation to minimize the mean square for deviations from linear regression.

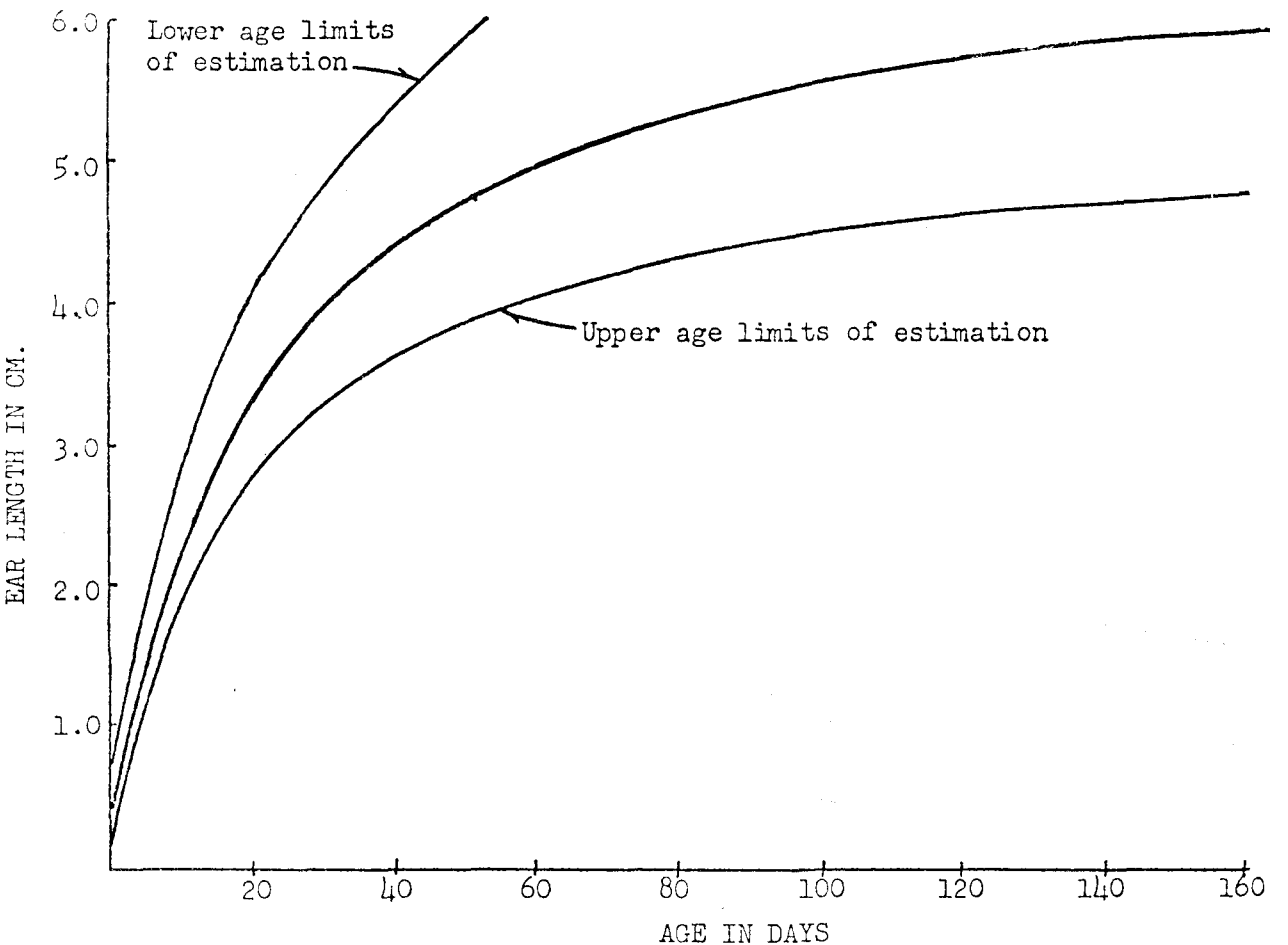

FIGURE 3. Relationship of ear length on age based on 339 measurements of known age cottontails from Alabama. Age limits of estimation were calculated at $P<0.05$, however, P is slightly greater due to the constant K which was included in the calculation to minimize the mean square for deviations from linear regression.

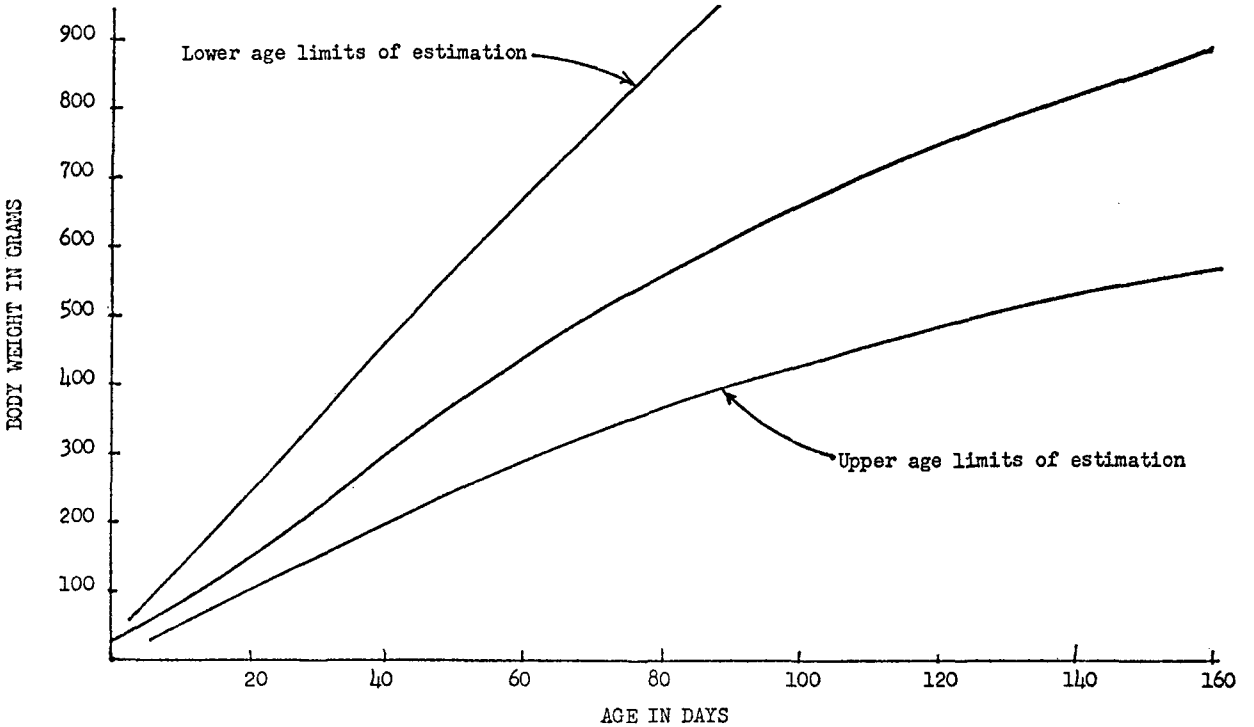

FIGURE 4. Relationship of body weight on age based on 320 measurements of known age cottontails from Alabama. Age limits of estimation were calculated at $P<0.05$, however, P is slightly greater due to the constant K which was included in the calculation to minimize the mean square for deviations from linear regression.

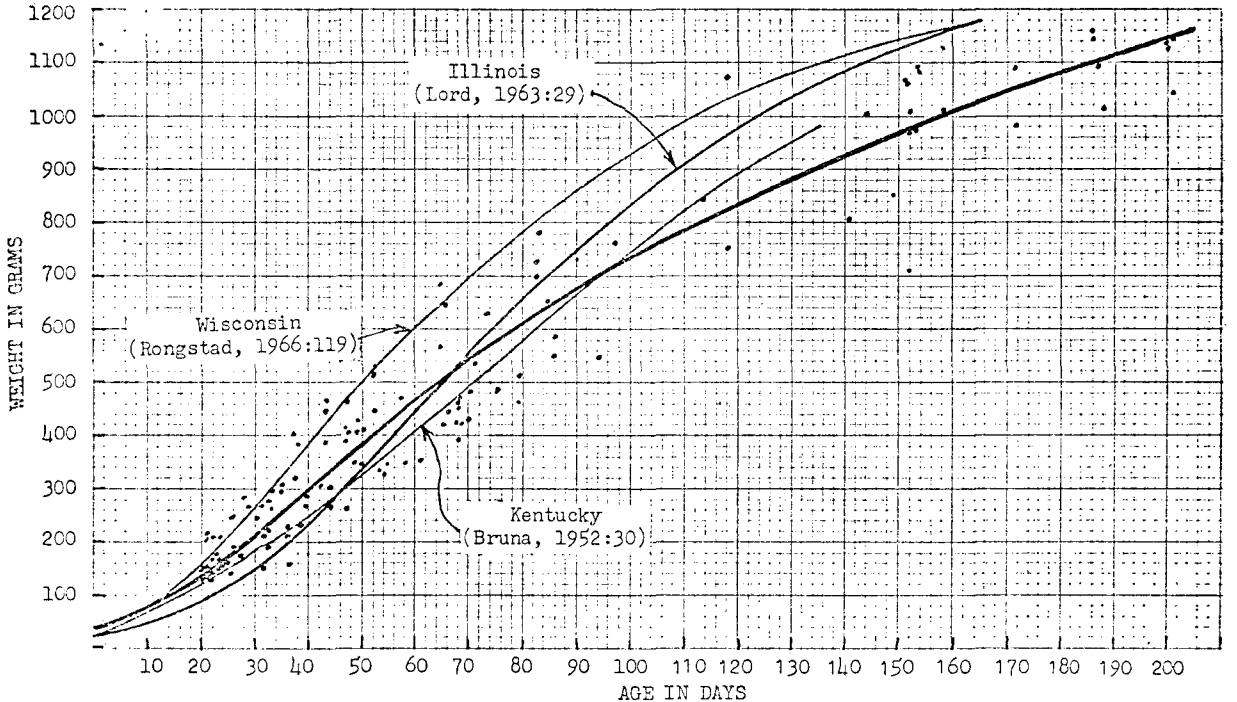

FIGURE 5. Relationship of age and body weight from 151 known age cottontails raised in pens and enclosures on Upper Coastal Plain and Piedmont Plateau soils of Alabama fitted by inspection. The three fine lines were fitted from cottontail data from the areas indicated. Data points were not plotted for rabbits less than 30 days old.

one may expect birth weights of individuals in small litters to be heavier than individuals in large litters.

Another pattern of early growth which the author noted in this study and did not find reported for cottontails was an initial loss of weight after birth while tarsus length measurement indicated continued growth. This initial weight loss pattern, a well-known phenomenon in other mammals including man, is shown in the mean body weights and tarsus measurements presented in Table 1. A factor possibly influencing this indicated trend in early weight loss was the penned environment which limited dispersal of young rabbits from previous litters to areas other than adjacent pens. It is possible that juveniles from a previous litter nursed the female when lactation began following the second parturition leaving no milk for the day-old nestlings.

TABLE 1. Mean weights and tarsus lengths of known-aged cottontails born in pens in Alabama

Age (in days)	Body Weight (gm)	Tarsus Length (mm)	number
1	42.2 (36.0-49.0)*	19.6 (19.0-21.0)	6
2	37.2 (30.0-45.0)	21.3 (20.0-23.0)	10
3	36.3 (31.0-48.0)	22.5 (22.0-24.0)	6
4	47.4 (43.0-50.0)	22.8 (22.0-24.0)	5
5	59.5 (50.0-74.0)	25.0 (23.0-28.0)	7

* Numbers in parenthesis are ranges.

Curves fitted by inspection to the data plots in each measurement criteria indicated some interesting relationships in growth before 50 days of age. Each curve, particularly those for ear length and tarsus length, showed a geometric increase in growth to approximately 15 days of age, after which the rate of growth appeared to flatten out and start a second geometrically increasing, but more gradual, rate of growth (Figures 6, 7, 8, and 9). The slower rate of growth after approximately 15 days of age is perhaps due to lower quality diet associated with lack of milk following weaning.

That these patterns of early growth differ from that presented by Lord (1963:29) is due, in part, to the different methods employed in plotting the curves. Another factor which appeared to contribute to the differences was that his data were obtained from bottle-fed nestlings, whereas data in this study were obtained from nestlings nursed by their mother. Rabbits in this study weighed approximately 150 grams at 20 days of age, whereas Lord (1963:28) reported a mean weight of 94.4 grams for 24 caged rabbits the same age.

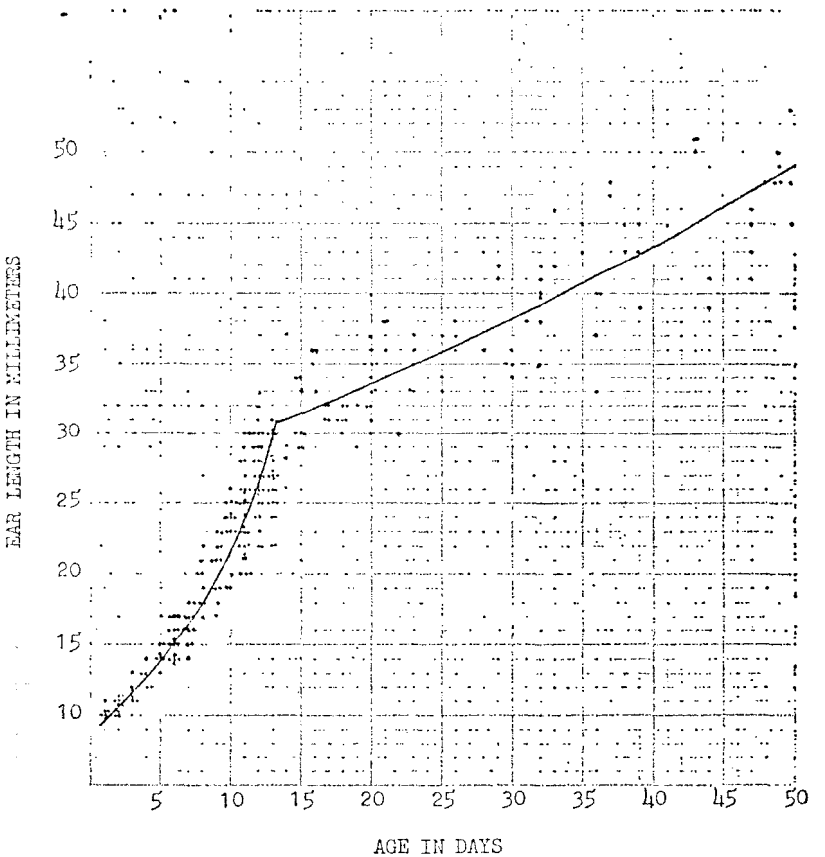

FIGURE 6. Relationship of ear length plotted against age based on measurements taken from 151 known aged pen raised cottontails less than 50 days old.

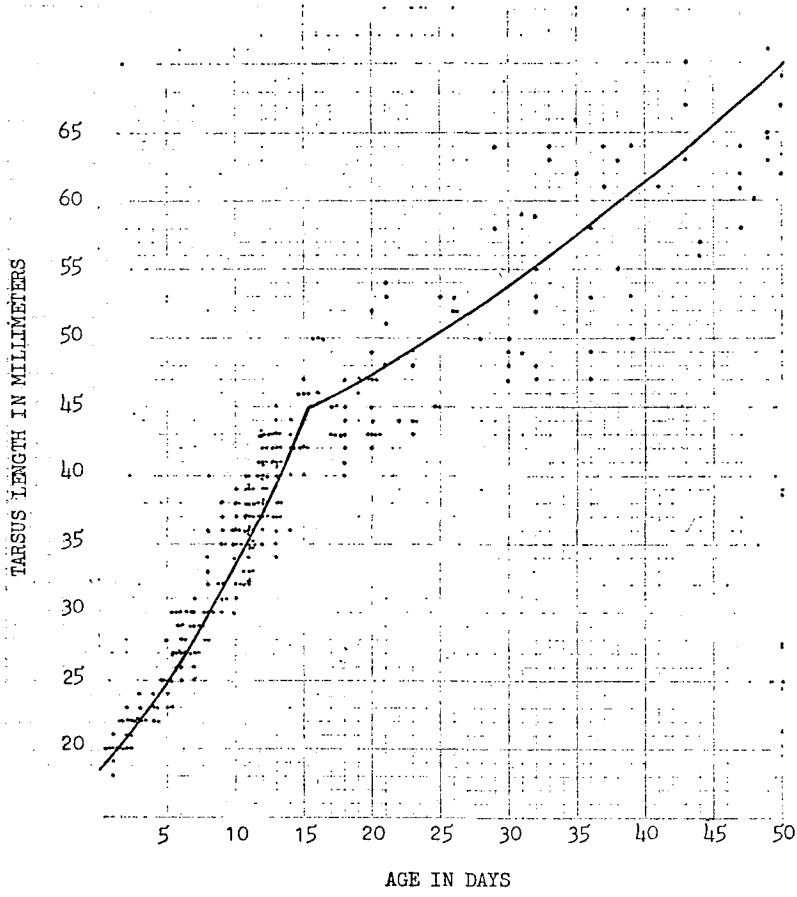

FIGURE 7. Relationship of tarsus length plotted against age based on measurements taken from 151 known aged pen raised cottontails less than 50 days old.

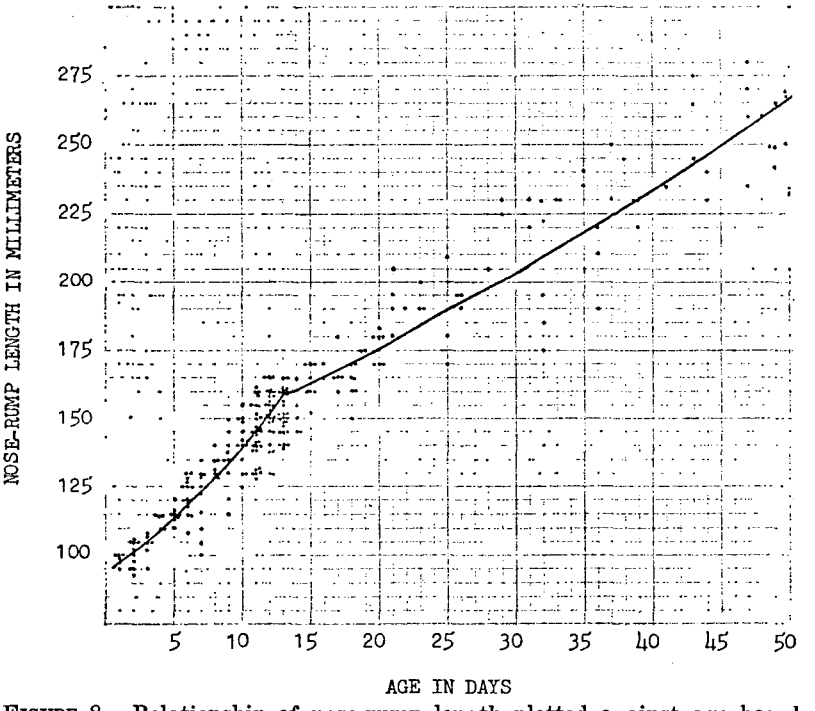

FIGURE 8. Relationship of nose-rump length plotted against age based on measurements taken from 151 known aged pen raised cottontails less than 50 days old.

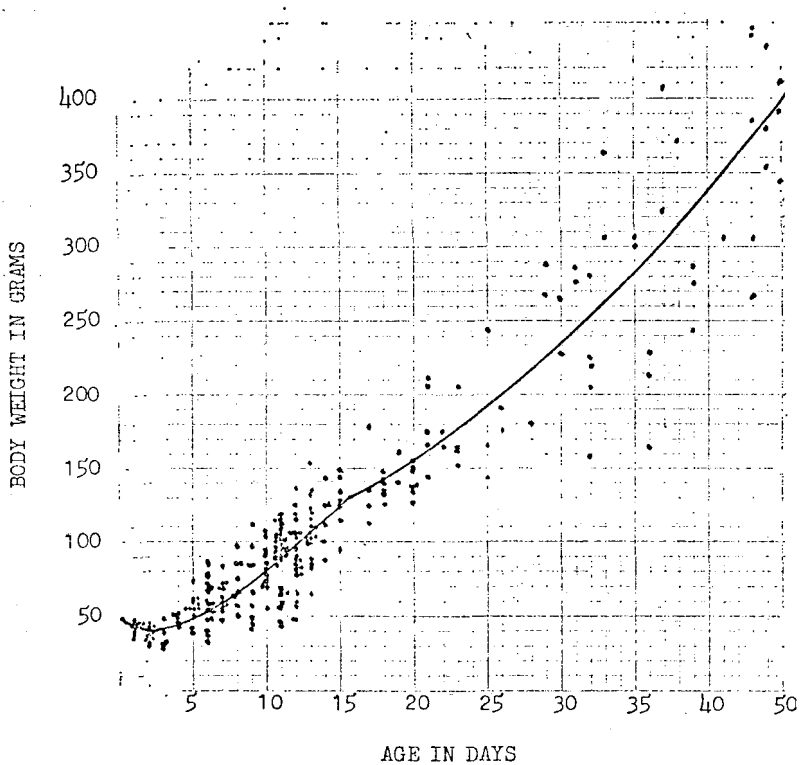

FIGURE 9. Relationship of body weight plotted against age based on measurements taken from 151 known aged pen raised cottontails less than 50 days old.

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FOOD HABITS OF THE BOBWHITE QUAIL IN THE GEORGIA PIEDMONT

By JAMES G. DICKSON

INTRODUCTION

The bobwhite quail (*Colinus v. virginianus*) is traditionally and inseparably linked with the State of Georgia. Historically, this bird has been associated with the "Peach" state, constituting a major esthetic and economic entity. The present investigation is concerned with obtaining important management ingredients from food habits information.

DESCRIPTION OF STUDY AREA

The Georgia Piedmont Plateau consists of foothills and gently undulating terrain with broad interstream areas. Its soils range in texture from sandy loams to clay loams. The most extensive series is Cecil. Mid-summer maximum temperatures average about 90°F., with the frost free season averaging around 230 days. Annual precipitation averages close to 50 inches. Cropland, pasture, and woodland are important components in land usage.

MATERIALS AND METHODS

The food habits investigation was accomplished by an examination of 279 crops collected during the November 21-February 28 hunting seasons of 1965-66, 1966-67.

The air dried crop contents were weighed on a Mettler electronic balance to the nearest milligram. Individual food item weights and the frequency of occurrence were tallied by individual months, but combined for the two winters and summarized for the entire period. Individual item weight percentages were obtained by dividing item weight by the total weight. Percentage of frequency of occurrence was calculated for the individual months and entire period by dividing the number of crops in which an item was found by the total number of crops containing food. Identification of seeds was made mostly by reference to Martin and Barkley (1961) and Musil (1963).

Classification was taken as far as possible considering the material dealt with and the availability and occurrence of similar organisms. Due to the importance of the lespedezas in the present study, an attempt was made to classify them to the specific level, if possible.

RESULTS

The quail crop collection covered a 10 county Piedmont area, with 81 per cent of the crops coming from Clarke, Jackson, Oconee, and Walton counties. Sixty-three (22.6 per cent) of the crops were empty of food matter. Weight of crop contents ranged from .003g to 13.321g, and averaged 1.9g for all crops and 2.4g for crops containing food.

A total of 42 individual plant food items and 10 separate animal items were identified. Items identified as plant matter comprised 99.91 per cent of the bobwhite's fall and winter diet, with the remaining 0.09 per cent labeled as animal matter. Of the 513.907 gram plant matter weight, only 4.829g (0.94 per cent) could not be classified.

Insects comprised 81.8 per cent of the animal matter with the remaining 18.2 per cent recognized as spiders (Aranea). Coleoptera (beetles), primarily Carabidae (ground beetles), made up over 60 per