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WEIGHTS AND MEASUREMENTS OF GEORGIA COTTONTAILS AND AN ECOLOGICAL PRINCIPLE[2]

by

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ABSTRACT

Body weight and basic body measurements were recorded on 395 adult cottontails collected from three physiographic regions in Georgia. Eight different skull measurements were taken on 65 individuals.

Little variation was noted in the percentage change of paunched weights as compared to the animals' total body weight. No significant seasonal variations were noted in total body weight. Coastal Plain adults exhibited significantly greater hind foot length, ear length, total length, and body weight than Piedmont or Mountain rabbits. Six of eight Coastal Plain skull measurements were significantly greater than measurements from either Piedmont or Mountain cottontails. These data are in opposition to Bergmann's Rule which states that mammals in general increase in size as one proceeds northward.

Use of total body weight rather than paunched weight at any time of day or season was verified for cottontails in Georgia. General land use rather than basic soil fertility is suggested as having a greater influence on production of heavier, larger rabbits in the Coastal Plain as compared to Piedmont or Mountain regions of Georgia.

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INTRODUCTION

Differences in body weight of cottontail rabbits by sex have been reported by numerous authors. Trippensee (1933), Schwartz (1942), Sowls (1957), and Williams (1964) noted the heavier weight of adult females. However, few studies have considered variations in body weight of adult cottontails through a 12-month period (Schwartz, 1942). Because Trippensee (1933) noted weight gains in young rabbits up to nine months of age and no accurate aging technique was developed for the cottontail until recently (Lord, 1959), the ability to accurately plot monthly weight changes in adult cottontails has been limited.

Crawford (1950) and Williams (1964) presented conflicting evidence concerning soil fertility and body weight variations in rabbits collected from different areas of Missouri. Also, neither author considered possible differences existing in body and skull measurements. Analysis of the above factors would help clarify relationships between cottontail populations from contrasting physiographic regions in Georgia.

METHODS

Between October, 1965 and April, 1968, 1,158 cottontail rabbits were collected from the Mountain, Piedmont, and Coastal Plain physiographic regions of Georgia. Body weight to the nearest gram was recorded on 395 adult rabbits (eye lens weights greater than 220mg.). Pregnant females were excluded from the sample. Total length, hind foot length, and ear length were also recorded on each individual. The paunched weight (body weight without stomach and intestines) on a sample of 133 individuals was taken to evaluate total body weight as an accurate method for weighing cottontails. The skulls of 65 adults from the three physiographic regions were cleaned and a series of eight measurements taken. Body weight and measurements and skull measurements were analyzed statistically using Duncan's Multiple Range Test (0.05) to determine effects of sex, month, and region.

RESULTS

Little variation was noted in the percentage change of paunched weights of 133 cottontails as compared to their total body weight with a range of only 16.13 to 18.27 percent change at the 95 percent confidence interval (Table 1).

Significant differences between adult females and males were found in total length and body weight (females being larger) (Table 2). Coastal Plain adults exhibited significantly greater hind foot length, ear length, total length, and body weight than Piedmont or Mountains rabbits (Table 3). With the exception of body weight of Mountain rabbits, significant differences in hind foot, ear, and total length were found among animals of the three regions. Mountain rabbits were smallest, Piedmont intermediate, and the largest were found in the Coastal Plain. The small sample obtained from the Mountain region prohibits many inferences regarding data obtained on the mountain specimens. Although adult cottontails were significantly heavier in certain months, seasonal body weight variations were not found (Table 4).

Table 5 presents data on eight skull measurements taken on 65 adult cottontail skulls from the three major physiographic regions of Georgia. With the exception of zygomatic breadth and interorbital constriction, Coastal Plain measurements were significantly larger than those from either Piedmont or Mountain areas. Although Coastal Plain zygomatic breadth and interorbital constriction measurements were not significantly greater than the Piedmont measurements, they were when compared to the Mountain measurements.

TABLE 1

THE RELATIONSHIP BETWEEN PAUNCHED AND TOTAL BODY WEIGHTS OF COTTONTAILS FROM GEORGIA

Region	Number of Individuals	Total Body Weight Range (gms.)	Paunched Wt. (Mean % of Total Body Weight)	Percentage Change	Range of Percentage Change at 95% C.I.
Piedmont	70	574-1365	83.0 + 3.7	17.0 + .87	16.13 - 17.87
Coastal Plain	63	772-1669	82.6 + 3.5	17.4 + .87	16.53 - 18.27
Totals	133	574-1669	82.8 + 3.6	17.2 + .87	16.13 - 18.27

TABLE 2

A COMPARISON BETWEEN SEXES OF MEASUREMENTS AND BODY WEIGHT FOR ADULT GEORGIA COTTONTAILS

Sex	No.	Mean	S.D.	S.E.	Range
HINDFOOT LENGTH (mm.)					
Males	214	95.46	4.41	.30	83-107
Females	312	95.96	4.39	.24	85-107
Totals	526	95.70	4.40	.27	83-107
EAR LENGTH (mm.)					
Males	214	62.20	2.93	.20	52-71
Females	312	61.60	3.02	.17	51-71
Totals	526	61.90	2.97	.19	51-71
TOTAL LENGTH (mm.)					
Males	214	426.4	19.42	1.33	385-475
Females	312	436.9	20.56	1.16	390-500
Totals	526	431.7	19.99	1.25	385-500
BODY WEIGHT (gms.)					
Males	214	1175.3	135.4	9.3	886-1535
Females	181	1275.4	175.3	13.0	793-1671
Totals	395	1225.4	155.4	11.2	793-1671

TABLE 3
MEASUREMENTS AND BODY WEIGHT OF ADULT GEORGIA COTTONTAILS.

Measurement	No.	Mean	S.D.	S.E.	Range
COASTAL					
Hindfoot Length (mm.)	244	98.23	4.02	.26	88-107
Ear Length (mm.)	244	63.37	2.58	.17	57-71
Total Length (mm.)	244	444.50	18.87	1.20	395-500
Body Weight (gms.)	182	1313.30	141.0	10.50	986-1671
PIEDMONT					
Hindfoot Length (mm.)	248	93.65	3.50	.22	83-101
Ear Length (mm.)	248	60.59	2.74	.17	51-67
Total Length (mm.)	248	422.9	16.64	1.05	385-465
Body Weight (gms)	189	1131.5	135.6	9.90	793-1579
MOUNTAIN					
Hindfoot Length (mm.)	34	93.44	3.70	.63	84-101
Ear Length (mm.)	34	60.03	2.34	.40	56-65
Total Length (mm.)	34	417.90	12.85	2.21	395-445
Body Weight (gms.)	24	1228.70	112.70	23.00	1093-1461
TOTALS					
Hindfoot Length (mm.)	526	95.11	3.74	.37	83-107
Ear Length (mm.)	526	61.33	2.55	.25	51-71
Total Length (mm.)	526	428.40	16.12	1.49	385-500
Body Weight (gms.)	395	1224.50	129.80	14.50	793-1671

TABLE 4

MONTHLY VARIATIONS IN BODY WEIGHT OF ADULT GEORGIA COTTONTAILS

Month	Number	Mean Body Weight	S.D.	S.E.	Range
January	14	1,172.6	180.3	48.2	926 - 1,502
February	54	1,218.0	160.4	21.8	896 - 1,671
March	41	1,199.8	133.4	20.8	898 - 1,490
April	27	1,226.6	177.1	34.1	964 - 1,596
May	53	1,250.2	154.8	21.3	952 - 1,630
June	44	1,216.2	155.2	23.4	950 - 1,608
July	17	1,139.6	125.1	30.3	935 - 1,377
August	40	1,235.9	138.1	21.8	910 - 1,590
September	36	1,322.1	153.7	25.6	951 - 1,570
October	19	1,285.5	187.6	43.0	1,016 - 1,669
November	22	1,156.9	150.7	32.1	886 - 1,445
December	28	1,135.9	185.9	35.1	793 - 1,506

TABLE 5

SKULL MEASUREMENTS OF ADULT GEORGIA COTTONTAILS*

	Coastal				Piedmont				Mountain				Total Mean			
Measurement	No.	Mean	S.E.	Range	No.	Mean	S.E.	Range	No.	Mean	S.E.	Range	No.	Mean	S.E.	Range
Zygomatic Breadth	27	36.03	.16	34.1-37.8	25	35.46	.16	34.1-37.0	12	35.78	.15	35.0-36.7	64	35.76	.16	34.1-37.8
Orbitonasal Length	27	32.42	.28	30.0-35.3	25	30.16	.25	28.1-33.2	13	29.86	.27	28.0-32.2	65	30.81	.27	28.0-35.3
Interorbital Constriction Width	26	19.05	.22	17.1-21.5	25	18.32	.22	16.0-20.8	13	19.03	.34	17.1-20.7	64	18.80	.26	16.0-21.5
Condylobasal Length	26	77.63	.43	72.0-81.4	25	73.72	.42	70.0-79.1	12	72.94	.43	70.0-75.7	63	74.76	.43	70.0-81.4
Basal Length	25	61.89	.35	57.3-65.5	25	59.46	.32	57.0-63.2	8	58.74	.26	57.5-60.2	58	60.03	.31	57.0-65.5
Basilar Length	25	58.41	.35	54.0-62.0	25	56.62	.82	53.2-74.6	8	55.40	.25	54.3-56.5	58	56.81	.63	53.2-74.6
Palatal Length	27	32.16	.16	30.6-34.3	25	30.79	.22	28.3-33.0	13	30.49	.18	29.1-31.5	65	31.15	.19	28.3-34.3
Diastema-Tooth Row Length	23	38.63	.26	36.6-41.7	24	36.70	.19	34.0-39.0	12	36.43	.23	35.4-37.8	59	37.25	.22	34.0-41.7

*All measurements were taken in milimeters using vernier calipers.

DISCUSSION

Watson and Williams (1955) warned of bias inherent in total body weight of the wild rabbit *(Oryctolagus cuniculus)* when they found that differences between dead and paunched weight varied with the time of day the animal was collected. Williams (1964) avoided this bias in cottontails by keeping the numbers of morning-killed to afternoon-killed rabbits the same. He also suggested a possible seasonal change in cottontail body weight and planned his collections accordingly. No significant variations in total body weight were found between individuals collected during early morning, late afternoon, and night in the present study. Also, monthly total body weight values of adults did not exhibit significant seasonal variation, thus making adult weight values valid when collected at any time of the year in Georgia. However, this phenomenon may not be true for northern areas where the cottontail is faced with a more severe winter (marked reductions in food and cover).

The significantly greater size of the female cottontail has been well documented in the literature by earlier workers (Schwartz, 1942; Sowls, 1957; and Trippensee, 1933) and the data in the present study verify this fact for Georgia cottontails.

The positive correlation between soil fertility and body weight of various species of wildlife in Missouri (Crawford, 1950 and Rowe, 1947) was questioned by Williams (1964). Williams found no significant difference in body weight of cottontails collected from soils of contrasting fertility when such factors as sex, age, genetics, restriction of collections to specific soil series, and proper statistical treatment were considered. The author also stated the possibility that one of the reasons for the differences in body weight of cottontails in Rowe's work was because collections were statewide, thus exhibiting latitudinal variation in body weight as expressed by Bergmann's Rule (decrease in body size with a decrease in latitude.). Data from the present study casts some doubt on the possible influence of this Rule in relation to weight and/or size variations of Georgia cottontails since the reverse is true for Georgia (weight and measurements increased from north to south). Williams further criticized Rowe's work because the latter did not distinguish between subspecies of *Sylvilagus floridanus, (mearnsii* and *alacer)*, thus, introducing a possible genetic source of variation of body weight. In the present study this possibility is eliminated since it is assumed only the subspecies *mallarus* occurs in Georgia (Hall and Kelson, 1959).

In the present study only adult cottontails were used. The sex ratio was essentially 50:50 in the areas being compared, proper statistical treatment was performed on the data, and although rabbits were collected over widespread areas in the middle Coastal Plain and Piedmont regions, size and weight variations between regions were obvious regardless of the collection site within a given region. Thus, in the present study, all of Williams' criticisms of Rowe's earlier work were met, and cottontail size and weight variations are still obvious.

The greater size and weight of Coastal Plain cottontails become perplexing when one considers some of the following facts. Apparently no major differences occur in basic soil fertility between the Piedmont and Coastal Plain regions (Perkins and Giddens, 1952). Pelton (1968) presented evidence that Georgia cottontails in the Coastal Plain exhibit significantly higher bone marrow fat levels (hence, better physical condition) than Piedmont region individuals. But, no significant differences were noted in litter sizes between Piedmont and Coastal Plain regions (Pelton, 1968). However, it has been clearly shown by Negus (1956) and Stevens (1962) that in Ohio soil fertility has a significant effect on litter size. (These authors do not mention any size or weight differences in adult cottontails between the contrasting soil areas). Thus, on the one hand, weight and measurement variations (as well as level of marrow fat) indicate that better environmental conditions exist and result in a reversal of Bergmann's Rule. On the other hand, a complete lack of any significant differences in reproduction and no apparent differences in soil fertility, offers evidence that there are not better environmental conditions in the Coastal Plain.

The possibility exists that Middle Coastal Plain rabbits collected in this study were from a better soil regime, but expected increased litter sizes were masked by the latitudinal litter size phenomenon reported by Barkalow (1962) and Lord (1960) in which litter sizes decrease as one goes south.

Also, since 1953, 41 percent of the idle and abandoned cropland in the Piedmont of Georgia has reverted to forests either by natural reseeding or planting. Pine comprises a high proportion of these woodlands. In the Coastal Plain land-clearing has offset reversion of nonforest land to forest (Larson and Spada, 1963). The above facts, plus the active and widespread policy of prescribed burning, clearing and cultivation (with concomitant fertilization) probably provides a better qualitative food regime for Coastal Plain cottontails. In contrast, little control burning and less and less cultivation and clearing are being carried out in the Piedmont region.

The above mentioned factors would tend to place a greater responsibility on general land use rather than basic soil fertility in regard to heavier, larger rabbits in the Coastal Plain region of Georgia. With an ever-increasing intensity of land use for specific purposes, one might expect even more examples of the "condition" of wildlife populations being a reflection of land use practices rather than basic fertility of the soil.

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CONTROL OF RACCOONS WITH RODENTICIDES

A Field Test

by

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ABSTRACT

A field test to evaluate anticoagulant rodenticides as a method of controlling raccoon populations was carried out on the Cape Romain National Wildlife Refuge, South Carolina. Fumarin mixed with corn was dispensed at ten permanent feeding stations over a six-week period. A marked decline in the number of raccoons was noted on the study area as a result of the experiment. Feeders for the study were developed by refuge personnel and proved to be relatively bird and mouse proof, but easily accessible to raccoons. In addition to the field study, observations were made of six caged raccoons fed varying amounts of rodenticide to determine lethal dosage and the length of time required to bring death.

OBJECTIVES

This study was designed to control raccoons *(Procyon lotor)* on the Cape Romain National Wildlife Refuge, South Carolina, by the use of permanent feeding stations using an anticoagulant rodenticide. The study was conducted during the summer of 1967. Caged raccoons were observed at the same time as the field study to determine actual bait intake and length of time that an animal must feed on anticoagulant before death occurs.

Raccoons prey heavily on the nests of shorebirds and the Atlantic loggerhead turtle *(Caretta caretta caretta)* on the Cape Romain National Wildlife Refuge. The use of quick-killing, non-selective poisons to control raccoons was ruled out as potentially too detrimental to non-target species on the refuge. The anticoagulant rodenticide Fumarin was used throughout the study.

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STUDY AREA

The study area was Cape Island. Cape Island is a nearly treeless, 2,000-acre