

# PARTURITION TIMES AND LITTER SIZES OF GRAY SQUIRRELS IN VIRGINIA<sup>1</sup>

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## ABSTRACT

*Reproductive data on the gray squirrel (Sciurus carolinensis) were obtained from 215 litters born in nest boxes in the Piedmont and Coastal Plain regions of Virginia over a 4-year period and from 110 adult and subadult females collected in the Mountain Region over a 12-month period. Two distinct parturition periods were determined from the data; these were February-March and July-August. Eighty percent of all litters in the Piedmont and Coastal Plain were born in these 4 months. Parturition may have occurred slightly later and litter size may have been slightly smaller in the Mountain Region. Comparison of these data with those of similar studies elsewhere indicate that latitude has little effect on breeding season or litter size of the gray squirrel.*

Although studies on gray squirrel reproduction have been conducted in several locations in the U. S. and elsewhere (see Table 1), little definitive data exist on the timing of breeding and parturition of gray squirrels in Virginia. Detailed information on reproduction of squirrel populations are needed if these populations are to be managed properly. The present studies were undertaken to determine the time of parturition and lactation of gray squirrels in the Mountain, Piedmont and Coastal Plain regions of Virginia. Examination also was made for differences in litter size where possible and all data were compared with those of similar studies at other latitudes.

## MATERIALS AND METHODS

### *Nest Box Study*

Two hundred nest boxes were placed in each of the three major physiographical regions of Virginia in June 1967. Fifty boxes were located at each of four locations in each region. The counties in which boxes were located were as follows: Mountain Region—Tazewell, Giles, Rockbridge, Rockingham; Piedmont Region—Fauquier, Appomattox, Powhatan, Nottoway; Coastal Plain Region—Caroline, York, Surry, Nansemond. The nest boxes were examined for use by gray squirrels each month of the year from June 1967 through June 1971.

When litters were found in the boxes, litter size was recorded and age of young was estimated by use of nasal vibrissae length (Barrier 1967). The birth dates were then calculated and recorded by month of birth.

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Table 1. Summary of selected reports on mating periods, parturition periods and litter sizes for gray squirrels at different locations and latitudes<sup>(a)</sup>.

Approximate Latitude (degrees)	Location	Investigator(s)	Winter-Spring			Summer-Fall		
			Mating Period	Parturition Period	Litter Size	Mating Period	Parturition Period	Litter Size
31	Texas	Goodrum (1940)	Late Dec.- Early Feb.			June-July	Aug.-Sept.	
35	Ala.	Colin (1957)	Late Dec.- Early Feb.			June-July		
36	N.C.	Allison (1953)	Late Jan.-Feb.	Mar.		Late June-July	Aug.	
36	N.C.	Smith (1967)	Late Dec.-Jan.	Late Feb.- Early Mar.	2.47	June- Early July	Late July- Aug.	3.06
37	Va.	Present study (Piedmont Coastal Plain)	Jan.- Early Feb.	Feb.-Mar.	2.35	Late May-June	July-Aug.	2.91
37	Va.	Present study (Mountain)	Feb.- Early Mar.	Mar.-Apr.		Late June-July	Aug.-Sept.	
37	Va.	Perry (1948)	Late Jan.-Feb.			Late July-Aug.		
37	Ky.	Hibbard (1935)	Jan.	Feb.	2.3	June	Late July- Early Aug.	2.7
38	W. Va.	Uhlig (1955)	Late Dec.-Jan.	Late Feb.-Mar.		Late May-June	July	
38	Ky.	Brauer & Dusing (1961)	Jan.			July		
39	Ohio	Chapman (1938)	Jan.-Feb.				July-	
42	Ill.	Brown & Yeager (1945)	Late Dec.- Jan.	Feb.-Mar.		May-June	Early- Aug.	
51	England	Deansley & Parkes (1933)	Jan.-Feb.	Late Feb.- Apr.		Late May-June	July-Aug.	
52	England	Shorten (1951)	Jan.-Feb.	Mar.-Apr.	2.50	Early June- July	Late July- Aug.	3.23

<sup>(a)</sup> Adapted from Mellace (1973).

### Necropsy Study

A total of 110 adult and subadult female gray squirrels was collected by shooting, trapping, and by other means between December 1966 and November 1967 in the vicinity of Blacksburg, Virginia. Blacksburg is located at about 2,200 feet elevation in the Mountain Region of Virginia. All females were necropsied in the laboratory and examined for the presence or absence of milk in the mammae. The uterus was examined for uterine swelling indicating the presence of fetuses and if present, the number was recorded. If the animal was not pregnant the uterus was further examined for the presence of placental scars.

## RESULTS

### Nest Box Study (Piedmont and Coastal Plain)

No litters were born during the 4-year period in any of the 200 nest boxes erected in the Mountain Region; hence, the necropsy data given below provided the only available information on the timing of reproduction in this area. Records of the litters born in the remaining 400 nest boxes in the Piedmont and Coastal Plain are shown in Tables 2 and 3. The combined records for these two physiographic regions demonstrated two distinct peaks of parturition. Of the 215 litters recorded, 81 (38 percent) were born in February-March and 93 (43 percent) were born in the July-August period. The remaining 41 litters (19 percent) were distributed throughout the remaining months of the year, with births being recorded in every month except November. There appeared to be little difference between years in the timing of parturition, but litter size declined significantly ( $P < 0.05$ ) from 1969 to 1971 (the 3 years for which data were obtained for all 12 months).

The average litter sizes for these 3 years were 2.81, 2.67, and 2.42, respectively. The average litter sizes for the Piedmont and Coastal Plain regions were 2.34 and 2.36 for the December through May period and 3.04 and 2.67 for the June through November period, respectively. Differences in litter size between breeding periods were significant ( $P < 0.05$ ) but differences between regions were not.

### Necropsy Study (Mountain Region)

The number of female squirrels collected each month and their reproductive states are shown in Table 4. Females were found pregnant in the Mountain Region first in February

Table 2. Reproductive data obtained for gray squirrels by examination of 200 nest boxes in the Piedmont Region of Virginia, June 1967-June 1971.

Year		Month											
		J	F	M	A	M	J	J	A	S	O	N	D
1967	No. Litters	—	—	—	—	—	1	15	10	3	6	0	0
	Mean Litter Size	—	—	—	—	—	2.0	2.7	3.2	2.7	4.0	—	—
1968	No. Litters	1	12	3	2	1	2	7	2	0	1	0	1
	Mean Litter Size	2.0	2.6	1.3	3.5	5.0	2.5	3.3	3.0	—	4.0	—	4.0
1969	No. Litters	0	5	2	0	0	0	6	3	0	0	0	0
	Mean Litter Size	—	2.4	1.5	—	—	—	2.5	3.3	—	—	—	—
1970	No. Litters	0	3	4	0	0	0	8	4	1	3	0	0
	Mean Litter Size	—	1.3	1.5	—	—	—	3.2	3.0	3.0	2.7	—	—
1971	No. Litters	0	8	4	3	1	0	—	—	—	—	—	—
	Mean Litter Size	—	2.8	2.5	1.7	2.0	—	—	—	—	—	—	—
All Years	No. Litters	1	28	13	5	2	3	36	19	4	10	0	1
	Mean Litter Size	2.0	2.3	2.2	2.4	3.5	2.3	2.9	3.0	2.5	3.8	—	4.0
Combined	± SE	±0	±0.2	±0.2	±0.5	±1.5	±0.9	±0.2	±0.2	±0.6	±0.4	—	±0

Table 3. Reproductive data obtained for gray squirrels by examination of 200 nest boxes in the Coastal Region of Virginia, June 1967-June 1971.

Year		Month											
		J	F	M	A	M	J	J	A	S	O	N	D
1967	No. Litters	—	—	—	—	—	0	4	2	2	1	0	0
	Mean Litter Size	—	—	—	—	—	—	2.2	2.5	2.0	4.0	—	—
1968	No. Litters	0	10	7	0	0	0	5	4	1	0	0	0
	Mean Litter Size	—	2.8	2.7	—	—	—	3.2	2.5	3.0	—	—	—
1969	No. Litters	0	3	1	1	0	0	1	12	3	6	0	0
	Mean Litter Size	—	1.7	3.0	2.0	—	—	4.0	2.8	2.7	3.0	—	—
1970	No. Litters	0	8	5	0	0	0	6	4	1	0	0	0
	Mean Litter Size	—	2.5	2.0	—	—	—	2.3	2.0	3.0	—	—	—
1971	No. Litters	0	5	1	0	0	0	—	—	—	—	—	—
	Mean Litter Size	—	1.4	3.0	—	—	—	—	—	—	—	—	—
All Years	No. Litters	0	26	14	1	0	0	16	22	7	7	0	0
	Mean Litter Size	—	2.3	2.6	2.5	—	—	2.7	2.7	2.6	3.1	—	—
Combined	± SE	—	±0.2	±0.2	±0.0	—	—	±0.2	±0.2	±0.2	0.3	—	—

Table 4. Reproductive data obtained by necropsy of 110 female gray squirrels collected in the Mountain Region of Virginia, December 1966-November 1967.

Month	No. Females Examined	No. Pregnant	No. Lactating	Mean No. Fetuses ± SE	Females Placental Scars	Mean No. Placental Scars ± SE
Jan.	7	0	0	0	0	0
Feb.	9	3	0	3.0±0.6	0	0
Mar.	10	1	4	2.0±0.0	4	2.2±0.2
Apr.	10	0	4	0	4	3.2±0.5
May	10	0	6	0	8	2.2±0.4
June	13	0	0	0	2	2.0±0.0
July	4	4	0	3.8±0.2	0	0
Aug.	11	5	2	2.6±0.4	5	3.0±0.3
Sept.	11	3	6	4.0±0.6	6	3.0±0.4
Oct.	13	0	10	0	12	2.4±0.2
Nov.	4	0	0	0	2	2.5±0.5
Dec.	8	0	0	0	0	0

and March with 4 of 19 (21 percent) being pregnant in these two months. Four of the 10 females collected in March, however, had already given birth as evidenced by placental scars and the presence of milk in the mammary glands. None of the 20 females collected in April and May was pregnant, although 10 were lactating and 12 had placental scars. None of the 13 animals in the June collection was pregnant or lactating, but two had placental scars.

In July only 4 females were collected, and all 4 were pregnant. Eight of 22 females (36 percent) collected in August and September were pregnant and 8 others were lactating. Eleven of the nonpregnant females had placental scars during these 2 months. In October no pregnancies were found, but 10 of 13 females (77 percent) were lactating and 12 had placental scars. No animals were found pregnant or lactating in either November or December although two of the November females had placental scars.

Monthly fetal and placental scar counts are shown in Table 3. The average fetal counts for the February-March and July-August-September periods were 2.75 and 3.33 respectively. Mean placental scar counts during and immediately following these two periods were 2.44 and 2.68.

## DISCUSSION

Two distinct peaks of pregnancy, parturition, and lactation can be seen in these studies. For the Piedmont and Coastal Plain regions of Virginia the vast majority of litters were born in February and March and in July and August. The limited data for the Mountain Region indicates that the two periods of parturition may occur slightly later there, i.e. in March and April and in August and September. This is based on the fact that no females were found to be lactating or to have placental scars in either February or July as one would expect if parturition were occurring during these months. One should keep in mind however, that only one year's data are available for the Mountain Region and that they were not collected concurrently with those of the nest box study.

Smith (1967) has indicated that fetal and placental scar counts overestimate litter size considerably, due to prenatal and early postnatal mortality. The fetal counts were 15 percent greater than the corresponding placental scar counts in the present necropsy study. Theoretically, placental scar counts should equal fetal counts if one assumes that all fetuses which implant leave a placental scar. The reason for the discrepancy in the two counts in this study is not known. It may be that placental scar counts by gross visual inspection are not accurate estimates of the number of fetuses which implanted.

Results of these studies agree rather closely with those reported by others from various areas at various times (Table 1). Also there appears to be very little difference in parturition dates (and therefore mating times) or litter sizes between the most southern and the most northern studies. The earliest reported dates for the beginning of the winter-spring mating period are the latter part of December whereas the latest beginning date reported was late January. Most authors agree that the summer mating period is most intense in June and July at all latitudes studied.

From a practical standpoint, game biologists are interested in avoiding the harvest of female squirrels while young are still dependent on them, especially if this significantly affects productivity of the population. If 70 days is used as the average age at which young gray squirrels are normally weaned (Shorten 1951), most young born in July and August (as determined for the Coastal and Piedmont regions) should become independent during October. Using these data, it is estimated that 44 percent of the total young born each year are completely weaned by 15 September, 51 percent by 1 October, 69 percent by 15 October and 82 percent by 31 October. Data from the Mountain Region largely support these estimates since the majority of females collected in September and October in that area were still lactating. None was found lactating in November even though some births occurred in September in that region. The small sample size in November may account for this apparent discrepancy.

According to our records the only hunting season which would completely avoid conflict with the squirrel breeding season would be restricted to the month of November. Since we believe that the gray squirrel is underharvested throughout most of the Southeast (Mosby

et al. 1976), a restrictive season such as this does not seem necessary to maintain populations at relatively high and stable levels. Mosby (1969) has shown that heavy fall hunting beginning in early fall does not adversely affect squirrel populations in succeeding years. Some loss of nestlings due to hunting may be inevitable in order to provide more recreational hours for the hunter by way of the squirrel resource.

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