

and flowers, fish, animals and birds never become a reality. But it readily can, unless we possess the vision, feel the need and exert the will to safeguard and perpetuate this natural resource for ourselves and those to come. Let posterity not find us wanting. Think it over, now!

## FOREST AND SMALL GAME SESSION

### PROGRESS REPORT ON WHITE-TAILED DEER PRODUCTIVITY STUDIES IN MISSISSIPPI

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#### INTRODUCTION

Very little has been known about the productivity of the white-tailed deer (*Odocoileus virginianus*) in Mississippi. Up until recently no information was available relative to prenatal mortality, sex ratios in uteri, reproductive capacity, minimum and maximum breeding ages of does, and dates of breeding and fawn drop. This study is designed to provide answers to these and similar questions.

The Mississippi Game and Fish Commission initiated an extensive deer collecting program in February, 1960. During February, March, and April, 1960, sixty (60) female deer were collected. Study plans call for an additional sample of eighty-five (85) gravid does to be taken during the 1962 gestation period and perhaps 100 during 1963. The final results of this study will be based on approximately 245 female deer.

This preliminary report is based on sixty (60) specimens collected from five of the state's ten physiographic regions (Figure 1).

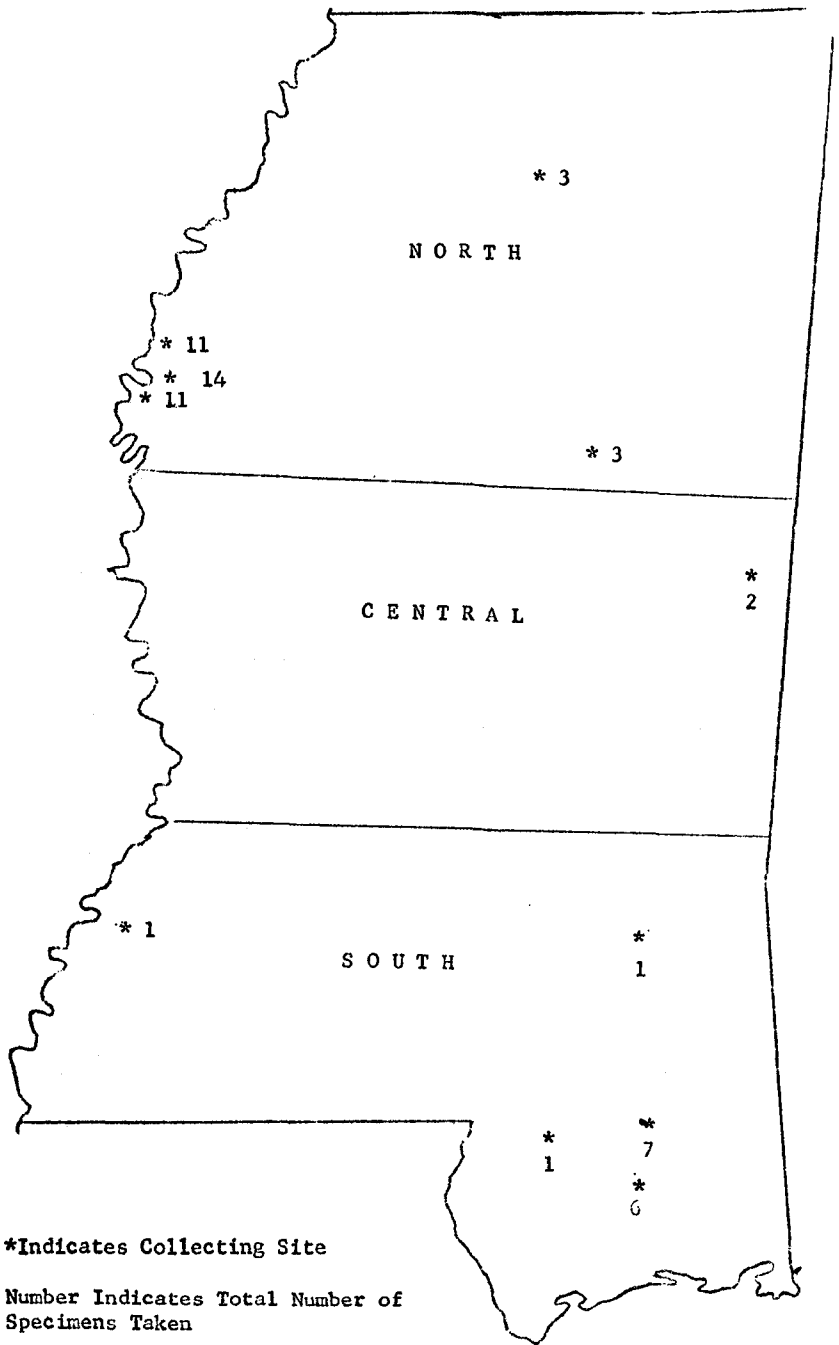
#### SPECIMEN COLLECTING PROCEDURE

Eight of the larger organized hunting clubs in the state granted written permission to collect female deer from property leased by them. Thirty-nine (39) of the specimens were taken from these lands and twenty-one (21) were killed on game management areas or refuges operated by the Mississippi Game and Fish Commission.

Mississippi has operated under a "bucks only" law for thirty-one (31) years. During this period many large hunting clubs have seen their deer herds increase tremendously and accredit the increase largely to the total protection of females. Obviously, many of these sportsmen have been strongly opposed to "doe killing." Because of such opposition, proper deer herd management has not been applied even on state game management areas. The Leaf River Game Management Area in Perry County is an example. For several years a serious over-population of deer has been known to exist on the area, but no action has been taken to reduce the herd because of local opposition to a "doe season."

One would think, therefore, that a study of this type, embracing the killing of female deer, would have met with much popular opposition. Nothing could be farther from the truth. We were, of course, criticized by a few local elements in the state and even by one or two uninformed personnel of the department. Generally speaking, however, we could not have wanted better cooperation. Interest in the study was so keen in some counties that on one occasion we autopsied deer at 11:30 P. M., with over twenty-five (25) sportsmen waiting to observe the procedure. In one county, where collecting was entirely on large private holdings controlled by organized clubs, it was necessary to inform these clubs beforehand exactly where we intended to collect deer and at what central point they would be autopsied. This was done to minimize the number of sportsmen traveling the woods roads in search of us.

Figure 1. Mississippi deer collecting sites.



This interest was encouraged by holding demonstrations in the field with freshly killed deer. Sportsmen watched with interest the removal of the reproductive tract, stomach contents, lower jawbone, and other tissue samples. Uteri were opened in the field so hunters might closely observe a deer fetus. These demonstrations provided an excellent means of explaining and demonstrating the objectives of the study.

I accredit this popular interest and cooperation to (1) careful planning, (2) good publicity, (3) co-ordinated field work, and (4) a great deal of patience in explaining the reasons for such a study both to organized clubs and private individuals.

#### FIELD PROCEDURE

With the exception of two specimens, one found freshly dead from malnutrition and another killed by an automobile, all does were shot with rifles ranging in caliber from .22 to .30-06. Thirty-seven (37) specimens were taken nocturnally with the aid of headlights. Others were killed, usually in the late afternoon, on management area or refuge food plots.

Within four hours after death the reproductive tract was removed *in toto* and placed in 10 percent formalin. Additional specimen or tissue collecting consisted of the lower jawbone, udder, stomach contents, and parasites when these could not be positively identified in the field. Blood samples were taken but most of these hemolized and were unfit for serological study.

Reproductive tracts were subsequently examined in the laboratory at the Copiah County Wildlife Management Area. Fetuses were removed and aged according to the method described by Cheatum and Morton (1946). Ovaries were grossly examined for corpora lutea (Brown, 1957).

Notes pertaining to each specimen were recorded in the field on prepared data forms. A duplicate of this form is found in Figure 2. Figure 3 is a duplicate of the form used to record information obtained from the laboratory procedure.

This report is based on sixty (60) female specimens; six juvenile non-gravid fawns and fifty-four (54) pregnant adults. It represents the work of one year for a three-year project.

#### BREEDING DATES

Table I summarizes breeding dates for the state as a whole and shows breeding dates in north Mississippi as compared with those in the southern region of the state.

The peak of successful breeding for Mississippi does was found to occur during the two-weeks' period, December 18 to December 31. Over 66 percent of the 1960 sample had bred during the month of December. The earliest breeding date found was December 5 and the latest was February 24.

TABLE I  
BREEDING PERIOD FOR 54 GRAVID DEER COLLECTED IN MISSISSIPPI 1960

Breeding Period	% Does Bred Statewide	% Does Bred N. Mississippi	% Does Bred S. Mississippi
December 4-17	29.6	42.8	7.7
December 18-31	37.0	48.6	7.7
January 1-14	13.0	5.7	23.1
January 15-28	7.4	2.9	15.4
Jan. 29-Feb. 11	11.2	...	38.4
February 12-25	1.8	...	7.7

Does in north Mississippi bred approximately one month earlier than those in the southern portion of the state. Cheatum and Morton (1946) noted that white-tailed deer in northern New York breed a week earlier than those in southern New York. The peak of successful breeding in New York occurs between November 10 and November 23, a month earlier than what is apparently the peak in Mississippi. The difference is probably due to climatic factors. Mississippi does not experience the severe winters that occur in New York. Photoperiodism has been reported as an important factor in determining dates

of breeding in deer and other animals (French *et al.*, 1960). Earlier breeding in Northern white-tailed deer insures that fawns will appear in early summer and in ample time to acquire adequate growth and development to withstand the severe winters characteristic of the Northern United States.

FIGURE 2  
FORM USED TO RECORD FIELD NOTES ON INDIVIDUAL SPECIMENS  
REPRODUCTIVE DATA FORM (FIELD NOTES)

Specimen Number.....  
Date..... County..... Location.....  
Time Killed..... Method of Collecting.....  
General Condition.....  
Fat Present... (Indicate Yes or No) ... Inside Body Cavity..... On Heart.....  
Around Kidneys..... Around Hips..... Outside of Ribs..... Elsewhere (State).....  
Condition of Bone Marrow.....  
Sample of Stomach Contents Collected?..... Lower Jawbone Collected?.....  
Blood Sample Collected?..... Other Tissue Samples Collected?.....  
(State what tissue).....  
Number of Fawns Following.....  
Live Wt. (lbs.)..... Hog Dressed Wt. (lbs.)..... Dressed weight plus hind feet (lbs.).....  
Reporter.....

PARASITES

Nasal botfly larva: Present..... Number..... Absent..... Not Checked.....  
Liver Fluke: Present..... Number..... Absent..... Not Checked.....  
Stomach Worms: Present..... Number..... Absent..... Not Checked.....  
Lung Worms: Present..... Number..... Absent..... Not Checked.....  
Body Worms: Present..... Number..... Absent..... Not Checked.....  
Ticks: Present..... Number..... Absent..... Not Checked.....  
Others.....

REMARKS

FIGURE 3  
FORM USED TO RECORD LAB NOTES ON INDIVIDUAL SPECIMENS  
REPRODUCTIVE DATA FORM (LAB NOTES)

Specimen Number.....  
Date..... Reporter.....  
Number of Embryos..... Sex of Embryos (1)..... (2)..... (3).....  
Length of Embryos in Millimeters (1)..... (2)..... (3).....  
Weight of Embryos in Grams (1)..... (2)..... (3).....  
Average Length of Embryos in Millimeters..... Average Weight of Embryos in Grams.....  
Width of Skull in Millimeters (Fetuses) (1)..... (2)..... (3).....  
Average Width of Skull in Millimeters.....  
Age of Embryos in Days..... Date Doe Bred..... Date Fawn would have dropped.....  
Number of *Corpora Lutea* . . . Right Ovary..... Left Ovary.....  
Total Number of *Corpora Lutea*.....  
Agglutination Test on Blood Sample for Brucellosis.....  
Agglutination Test on Blood Sample for *Leptospira pomona*.....  
Complete Identity of Parasites and Authority.....

REMARKS

There is presently no clear explanation for the difference of almost a month between the peak of breeding in north Mississippi and the peak in south Mississippi. Subsequent collecting will likely provide some answers. Only thirteen (13) gravid tracts are available from the southern region at this time. The differences in breeding dates may be attributed to differences in habitat (bottom-

land hardwoods vs. long-leaf pine type), hunting methods (use of dogs vs. still), climate, or a combination of these and other factors.

As further evidence of breeding differences, we have generally observed that male white-tails in northern Mississippi shed their antlers about three weeks earlier than do those in the southern portion of the state.

#### DATES OF FAWN DROP

Fawn drop dates were established by using a gestation period of 202 days. Severinghaus (Personal Correspondence, 1960) reviewed all literature available to him. He found 202 days to be the average.

The earliest birth date was found to be June 25, and the latest was September 14. September 14 represents a late birth but jawbones collected from illegally and accidentally killed fawns in south Mississippi have indicated births as late as November. In February, 1960, I mailed C. W. Severinghaus (New York Conservation Department), approximately seventy (70) Mississippi deer jawbones of all ages. These jawbones were compared with known aged jaws available to Severinghaus and an estimated age was assigned to each. If "jawbone aged fawns" can be depended upon to establish birth within monthly limits, then some fawns are dropped the year-round in Mississippi. However, I have found no such indications from collecting pregnant deer. McDowell (Personal Correspondence, 1960), cautioned against using "jawbone aged fawns" to establish even the month of birth.

TABLE II  
FAWN DROP PERIOD FOR 54 GRAVID DEER COLLECTED IN MISSISSIPPI 1960

<i>Fawn Drop Period</i>	<i>% Does</i>	<i>% Does</i>	<i>% Does</i>
	<i>Dropping Fawns</i> <i>During Period</i> <i>Statewide</i>	<i>Dropping Fawns</i> <i>During Period</i> <i>N. Mississippi</i>	<i>Dropping Fawns</i> <i>During Period</i> <i>S. Mississippi</i>
June 23-July 6 .....	25.9	34.3	7.7
July 7-July 20 .....	38.9	57.1	..
July 21-August 3 .....	14.8	5.7	30.8
August 4-August 17 .....	7.4	2.9	15.4
August 18-August 31 .....	11.1	..	38.4
September 1-September 14 .....	1.9	..	7.7
TOTAL .....	100.0	100.0	100.0

Apparently, some fawns do appear exceptionally early and some exceptionally late. I have observed spotted fawns in Jefferson County (southwestern Mississippi) in January, and reports of spotted fawns are not at all uncommon during the December-January gunning season in south Mississippi. On February 2, 1958, a fawn no more than one week old was found by loggers in Jefferson County.

Table II summarizes the fawn drop data for the 1960 sample of gravid does. According to this sample, fawns are dropped in Mississippi over a period of about eighty-one (81) days but 42.6 percent of the does give birth during the fourteen (14) day period between July 6 and July 19. Field work in July and August, 1960, further substantiated these observations.

#### SEX RATIO IN UTERI

Eighty-one (81) fetuses were collected. Sixty-four (64) were developed enough to record sex. Twenty-seven (27) were males and thirty-seven (37) were females, a sex ratio of 73:100. Poor nutrition of deer has been supposed to have an effect on the sex ratio of fawns at birth (Severinghaus and Cheatum, 1956). But I have found no evidence to indicate that seriously over-browsed ranges produce a larger number of females in uteri. Evidence to date seems to indicate that the adult sex ratio may directly or indirectly effect the sex ratio of unborn fawns. It has been proven in the rabbit (domestic) that the sex ratio is related to the chronological order of the service of the male; in the first group serviced there is a preponderance of males, and then an increasing preponderance of females. Dahlberg and Guettinger (1956) believed that an

even sex ratio in adults would produce an excess of male fawns. A moderately unbalanced ratio in adults would produce an even sex ratio in fawns, and a great excess of females in the adult segment would produce an excess of female fawns. Brunett (1958) has suggested that the seriously distorted fawn sex ratio in Tensas Parish, Louisiana, may be attributed to a preponderance of females in the adult population.

Ten gravid does were taken from the seriously over-browsed "Merigold Range" in north Mississippi. Twenty-three (23) were collected in the same county (Bolivar) from the Catfish Range,\* a 20,000-acre block on which the deer population is approaching a crowded situation, but, unlike Merigold, has not yet experienced winter mortality (malnutrition).

The sex ratio in uteri from Merigold was equal while the ratio in uteri from Catfish was preponderantly in favor of females (54:100). Observations, counts, and kill records substantiate the fact that bucks are not adequately harvested on Merigold. The adult sex ratio probably approaches one male per two or three females. Conversely, Catfish hunters crop their bucks more closely. Very nearly 75 to 80 percent of the antlered males are harvested from the Catfish Range annually. I would estimate that the Catfish herd's adult sex ratio was very near one male per eight (8) to twelve (12) females during the 1959-1960 breeding season.

The preponderance of females in uteri from Catfish may have been either directly or indirectly caused by the distorted adult sex ratio. The average age of gravid does might also exert some influence. Future collections should shed some light on these assumptions.

#### AGE OF DOE AS RELATED TO NUMBER AND SEX OF PROGENY

Each doe was aged according to tooth development and wear in the lower jaw. The method has been described by Severinghaus (1949).

Four does estimated to be in the 1.5 year old age class were collected. These animals had probably bred for their first time. All would have given birth to a single fawn. Only ten (10) of the sixty (60) does were estimated to be 5.5 years of age or older. Insufficient samples preclude any general statements for does older than 4.5 years of age.

In my somewhat limited sample, twins were more common in the 2.5 and 3.5 year old animals than in those 4.5 years of age. Table III shows age of doe as related to number and sex of fetuses.

TABLE III

Age Class of Doe in Years	AGE OF DOE AS RELATED TO NUMBER AND SEX OF FETUSES				SEX OF FETUSES					
	No. Does in Age Class	No. Carrying Twins	No. Carrying Single Fawn	Males	Twins Fem.	Opposite Male	Single Fem.	Sex Unknown Twins	Single	
	1½	4	—	4	—	—	—	1	2	—
2½	17	12	5	3	3	3	1	3	3	1
3½	12	7	5	—	3	3	2	1	1	2
4½	12	4	8	1	1	2	3	3	—	2
5½	1	—	1	—	—	—	—	1	—	—
6½	3	1	2	—	—	—	2	—	1	—
7½	3	2	1	—	2	—	—	—	—	1
8½	1	—	1	—	—	—	1	—	—	—
9½	1	1	—	—	—	1	—	—	—	—
TOTALS	54	27	27	4	9	9	10	10	5	7

Fetuses were removed from the uterus and carefully examined. No prenatal mortality was detected. Apparently, all fetuses were normal and in good health at the time of the doe's death.

Eighty-one (81) fetuses were removed from fifty-four (54) gravid does, an average of 1.5 fetuses per pregnant doe.

\* The "Catfish Range" as referred to in this article includes that land in Bolivar County leased by the Catfish Point, Huntington Point, and Delta Pine Hunting Clubs.

Corpus luteum counts were possible with ovaries from forty-eight (48) reproductive tracts. The number of corpora lutea, grossly identifiable in a cross-section of the ovary as relatively large, oval shaped, yellowish-brown pigmented bodies, is indicative of the total number of eggs ovulated by the doe at the estrus period in which conception occurred. An average of 1.60 corpora lutea per gravid doe and 1.46 fetuses per gravid doe (48 observations) indicated that the reproductive rate of these females was operating at 90.9 percent of its potential capacity. This figure indicates that for each doe that bred successfully, 90.9 percent of the eggs released during the estrus period in which conception occurred developed successfully into embryos.

The 9.1 eggs per 100 that did not become embryos may represent resorption, failure of sperm to reach egg, failure of the fertilized ovum to implant, or a combination of these factors (Brown, 1957).

Most studies have shown that does produce slightly more ova than embryos during the estrus period in which conception occurs (Taber, 1953; Cheatum and Morton, 1946; Bischoff, 1958).

The greatest number of corpora lutea scars observed in any one pair of ovaries was three; however, no triplet fetuses were observed.

The number of fawns following was recorded for thirty-seven (37) of the does collected. An average of 1.16 fawns per doe was recorded as following these thirty-seven (37) does. The same does were carrying an average of 1.46 fetuses each (1.5 year old does were excluded since they had probably bred for the first time). We hope that when larger samples are available records of this type will give us some indication of postnatal fawn mortality.

Triplet fawns are apparently uncommon in Mississippi. In two years I have seen only seven does with three fawns following. These, however, were general observations. During fifteen (15) days of deer collecting in Bolivar County, I observed an average of slightly over 240 deer per day. Only four does (over 3,700 observations) were noted to have three fawns following. Most of the Bolivar County deer range is seriously over-browsed.

#### MINIMUM AND MAXIMUM BREEDING AGES

No evidence has been found to support the popular opinion that "old does" do not breed. One animal 9.5 years of age, killed on the Leaf River Game Management Area, would have given birth to twins. An 8.5 year-old doe killed in Bolivar County would have given birth to a single fawn.

All adult does collected were pregnant. Some attempt was made, however, to kill only does with fawns following. This obviously gave us a sample from the breeding population only, but was the best method to prevent the killing of antlerless males (in spite of this precaution, 13 antlerless males were mistakenly shot).

Five female fawns (ages 6 to 7 months) were killed. None were pregnant, but three of these deer killed in March did show some ovarian activity. It is possible that some members of this age class breed uncommonly late, but at the present time I am of the opinion that few, if any, Mississippi does breed during their first rutting season.

A doe killed in April and estimated to be 15 months old was not gravid but did show ovarian activity. This was an exceptionally small animal (live weight—57 pounds) for 15 months of age. Possibly the animal's tooth development was abnormally advanced.

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### ABSTRACT

This paper represents a progress report on studies of deer reproduction in Mississippi. One year's work on the three-year study has been completed.

During February, March, and April, 1960, sixty (60) female deer were collected from five of the state's ten physiographic regions. Fifty-four (54) of these does were pregnant adults and six were non-gravid fawns.

Over 66 percent of the deer had bred during the month of December; thirty-seven (37) percent bred during the two-week period, December 18 to December 31. There was a difference of almost a month between the peak of successful breeding in north Mississippi and the peak in the southern portion of the state.

Birth dates would have ranged over a period of eighty-one (81) days (June 25-September 14), but 42.6 percent of the sample would have given birth during the 14-day period between July 6 and July 19.

Eighty-one (81) fetuses were collected from fifty-four (54) gravid tracts, an average of 1.5 fetuses per pregnant doe.

Sixty-four (64) fetuses were developed enough to determine sex. There were twenty-seven (27) males and thirty-seven (37) females, a sex ratio of 73:100.

An average of 1.60 corpora lutea per gravid tract and 1.46 fetuses in the same tracts (48 observations) indicated that the reproductive rate of these females was operating at 90.9 percent of its potential capacity.

No evidence of prenatal mortality was observed.

Twin fawns were more common in the 2.5 and 3.5 year-old animals than in those 4.5 years of age.

Apparently few, if any, Mississippi does breed during their first rutting season.

No evidence was found to support the popular opinion that "old does" do not breed.

Some evidence is presented that seems to indicate that the adult sex ratio influences the sex ratio of fetuses in uteri. No evidence has been found to indicate that does on seriously over-browsed ranges produce more females in uteri than males. However, where the adult sex ratio was distorted in favor of does, the sex ratio in uteri was preponderantly in favor of females.

## SOIL BANK EVALUATION IN KENTUCKY <sup>1</sup>

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### INTRODUCTION

Shortly after the initiation of the Federal Soil Bank Conservation Reserve program, field observations on contracted lands began to reveal questionable elements relative to wildlife benefits. Few farmers had adopted wildlife (G) practices, and instead most contracted for ordinary vegetative cover (A-2)

<sup>1</sup> A contribution of Kentucky Federal Aid Project W-38-R.