

the entire area. Conversely, to the Game and Fish Commission is entrusted the administration of a hunting ground unsurpassed in the State. We have every reason to believe that this happy state of symbiosis will prosper indefinitely.

## SESSION ON FOREST GAME

### FERTILITY AND REARING SUCCESS MEASUREMENTS OF VIRGINIA'S DEER HERDS

By STUART P. DAVEY

*Game Research Biologist, Virginia Game Commission*

#### INTRODUCTION

The growth of a deer herd and more particularly the numbers of deer that can be harvested annually therefrom depends entirely upon the fall rearing success of the doe deer in that herd. Whether the level of this fall rearing success is due to the level of fertility in the doe or whether it is due to losses after conception calls for investigations of fertility and rearing success at several periods during the year. In Virginia, deer numbers have increased greatly the past ten years. The variation in the degree of success, however, in some of the areas stocked combined with the knowledge that herd control was a growing necessity brought forth the study of deer in 1952. This paper will report upon one phase of that continuing work.

#### OBJECTIVES

The objectives under this phase of the study were threefold. First, it was necessary to find whether the low rearing success of several areas was due to the level of fertility or whether it was due to illegal kills and predation. Secondly, it was desirable to find the simplest method for determining the rearing success of a particular herd; *i. e.*, whether by observation, kill ratios or doe age classes in that harvest. Thirdly, with the advent of antlerless seasons, it was necessary to have better knowledge of the total deer dynamics and the possibilities of the herds as to the severity of harvest that they could stand without detriment to the breeding stock. These objectives have been pursued over the past four years.

#### METHODS

The data were collected during several periods of each year. Doe deer age classes were determined by the method of tooth development and wear (Severinghaus, 1949). The reproductive tracts were examined and fertility measurements made using the methods as described by Cheatum (1949). Fetus counts were taken from pregnant doe deer during the regular harvest periods or from those killed by accidental and illegal means.

Rearing success as herein used is expressed as the number of fawns per 100 doe deer of all ages in the fall months. There were three main types of measurements made in rearing success. First, observations were made by field personnel as to the number of fawns seen with single does and also the total ratio as to fawns per 100 doe deer. During the harvest periods, two more measurements were possible. One was simply the ratio of fawns taken per 100 doe deer. The other involved the distribution of doe age classes; the distribution in the kill being compared with the theoretical age class distribution in herds of varying rearing success.

In the measurement of fertility it was found necessary to devise a means of expressing the occurrence of corpora lutea and its pigmented scars in a manner that would more nearly represent the total doe population. In other words, the reproductive tract samples were very seldom, if ever, in the true ratios of their age classes in that herd. For that reason, the results from the various

areas were based upon similar distributions of doe deer age classes; that being 30% fawns, 20% yearlings and 50% adults. Before giving a sample of this method, expansion of several points are in order.

It is true that doe deer age class distribution depends upon the past rearing success of those doe and not upon the mortality factors affecting them. It is also true that herds of doe deer with the better rearing success would have the higher ratios of young animals. For that reason the distribution selected (30% fawns, 20% yearlings, 50% adults) gives more spread than actual among the various herds; *i. e.*, a doe herd with a rearing success in the fall of 100 fawns per 100 doe would have about 50 doe fawns per 100 doe and the theoretical age class distribution becomes 33% fawns, 22% yearlings and 45% adults. The opposite is true for herds with low rearing success in that fawns would compose less than 30% of the doe population and the adults more than the chosen 50%. The system therefore gives the herd with high rearing success a little too much credit and the herds with low fertility too little credit for their number of adults, which are of course the main source of fawn production.

This use of three main categories in doe age classes seemed logical since major fertility differences are usually found in these groups. The fawns may or may not breed at all, the yearlings usually do but at a lower rate than the adults—who actually produce the majority of each annual fawn crop.

It would also be pertinent at this time to recognize that any such work as this with deer age classes is based upon several assumptions that are open to criticism. It is possible that rearing success may be highly variable from one year to the next. There is question as to whether the age classes are all equally available to sight or to the gun. There is also the thought that the hunter may be selective even in antlerless seasons, *i. e.*, perhaps not taking the fawns. There is no doubt basis for these criticisms but experience with the data brings doubt as to their validity. The consistency of the data from an area minimizes great fluctuations in rearing success. In addition to this, even with the errors apparent in the aging technique, the close fitting of the age class distribution of doe deer with the theoretical as concerns rearing success and the same with adult bucks as concerns mortality factors precludes much variation in the availability of the animal or the selection by a large group of hunters. Known exceptions exist and they were not unexpected; *i. e.*, fawns and yearling bucks are more vulnerable to the gun on opening day and in a herd of bucks where the yearlings have very short spikes (practically buttons) that age class gives way to the two and one-half year olds in predominance.

An example is given below to explain how the figures were determined in so far as percentage of doe deer with corpora lutea and pigmented scars in the various areas. In this case, the sample is composed of 10 sets of ovaries from each of the main age class categories. The percentage of occurrence of scars in each sample is multiplied by the numbers of doe in that age class (on the basis of 100 doe) the product being the numbers of doe in that age class that conceived. The product of this number and the mean occurrence of scars gives the total estimated conceptions per category. The sum of the three age classes gives the grand total for each 100 doe deer of that herd. The sum of those conceiving giving the number per 100 or percentage. Thus in the example, for each 100 doe deer of all ages it would be estimated that 64 conceive a total of 100 fawns for a mean conception of 1.56. If the distributions of age classes were not taken into account, the assumption would be that 18/30 or 60% conceived at a mean rate of 1.50 (27/18) for a total of 90 fawns.

#### AN EXAMPLE OF MEAN SCAR COMPUTATION

Age Class	Dist. Per 100 Doe	Per Sample	% With Scar	No.	Mean	Total
½	30	10	1/10—10%	3	1/1—1.00	3.00
1½	20	10	8/10—80%	16	11/8—1.38	22.00
2½ plus	50	10	9/10—90%	45	15/9—1.67	75.00
	100			64		100.00
				64/100—64% conceiving		
				100/64—1.56 mean conception		

TABLE I  
 FERTILITY AND REARING SUCCESS MEASUREMENTS OF VIRGINIA'S DEER HERDS  
 (Per Each 100 Doe Deer, All Ages)

COUNTY	Est. Max. Concept. (1)	% With Corp. (2)	Mean Corp.	% With Scars (3)	Mean Scars	Mean Fetus Count	Mean Fawns With Doe (4)	Fawns Per 100 Doe Observed	Fawns Per 100 Doe Killed	Fawns Per 100 Doe Age (5)	Est. Fall Rearing Success	% Est. Maximum Concept.
P. Geo.	137	72%	1.88 (29)	83%	1.65 (29)	1.63 (8)	...	...	100	...	100/100	73%
Halifax	120	70	1.63 (13)	70	1.71 (13)	1.66 (3)	...	...	100	...	100/100	83
Ch. City	101	63	1.97 (13)	63	1.59 (13)	1.66 (6)	...	...	...	...	90/100	90
Augusta (SE)	97	12	1.00 (40)	67	1.45 (40)	...	1.06	70	81	80	80/100	83
York (USN)	88	52	1.20 (88)	63	1.39 (88)	1.42 (12)	...	...	82	80	80/100	91
J. City	86	70	1.91 (13)	65	1.33 (13)	1.73 (15)	...	...	...	...	90/100	100(6)
Warwick	84	70	1.51 (37)	60	1.40 (37)	1.33 (15)	...	...	...	...	70/100	83
Augusta (NW)	83	42	1.17 (10)	51	1.63 (10)	1.75 (4)	...	72	72	72	70/100	84
Shenandoah	79	48	1.90 (28)	62	1.27 (28)	2.00 (3)	...	65	106	100	80/100	100(6)
Wise-Scott	74	10	1.24 (29)	55	1.34 (29)	1.50 (6)	...	...	100	65	65/100	88
Bath (West.)	68	8	1.50 (15)	55	1.23 (15)	...	...	58	53	50	55/100	81
Smyth	61	65	1.28 (14)	42	1.46 (14)	...	1.71	75	72	100	70/100	100(6)

(1) Based upon product of % with scars and mean scar--maximum conceptions.  
 (2) Percent with corpora lutea, all ages, distributed as 30% fawns, 20% yearlings, 50% adults.

(3) Percent with pigmented scars, same basis as (2).

(4) Mean number of fawns seen with single doe.

(5) Obtained by comparison of sample age class distribution with theoretical.

(6) Due to kill trends, these counties believed to have better rearing success than indicated.

## RESULTS

With the methods described above twelve areas of the state were studied. Complete information has not been available in some areas. Since many of the doe were shot before estrus the figures for the mean scar measurements and the percentage with scars is the more valuable, especially in several western counties. In Table I the areas are ranked in decreasing value of estimated maximum conceptions per 100 doe deer of all ages. Comparisons are possible here among the various fertility and rearing success measurements. The fetus counts were usually from small samples. Also included are the final estimates of fall rearing success based upon all information. It appears that 80-90% of the fawns conceived live to be 5-6 months old.

Only three main categories of the findings will be discussed here: those areas with rearing success of between 90-100 fawns/100 doe, those with rearing success of about 70/100 and finally those with low rearing success of about 50-60/100.

The areas with the best rearing success are located in the eastern sections of the state and the deer are living, largely, on good agricultural lands. This is the only area in the state where fawns have been found to breed to any extent. In this section usually all of the adults show corpora lutea that average 1.6 to over 1.9 and scars and fetus counts that have means of between 1.6-1.7. Fall rearing success in these areas is about 100 fawns/100 does, near tops for the white-tailed deer.

Those herds that have rearing success of about 70 fawns/100 doe seem to be most prevalent in Virginia. Most of the mountain counties and the poorer range in the east such as on several overused military areas fit this category. In this group, between 60-70% of all deer conceive with a mean conception of 1.4-1.6. This group is not at the peak but offers great possibilities for management.

The worst rearing success found to date in the state is between 50-60/100 doe. Here, only 50-60% of the deer breed and have a mean conception of about 1.2. The area is one greatly overused by deer and one of the old original deer ranges in the state. This area in Bath County never lost its deer. Several other areas in the state give promise of ending up the same way if the warning is not heeded.

## SUMMARY AND CONCLUSIONS

Over the past four years, fertility and rearing success measurements were taken in twelve sample areas in Virginia. Fertility measurements were based upon reproductive tract analysis. Rearing success was based upon field observations, kill ratios and doe deer age class distributions. All doe herds sampled were placed on an equal basis in so far as age class distribution for fertility analysis; *i. e.*, 30% fawns, 20% yearlings and 50% adults.

Definite correlations were found between areas of high fertility and high rearing success. Like correlations being found between areas of low fertility and low rearing success. In all areas, approximately 80-90% of the estimated maximum number of conceptions per 100 doe deer of all ages gave that areas fall rearing success.

In the measurement of fall rearing success, all methods gave promise. It was found that field observations called for great expenditure of time and results depended upon the individual. The ratios of fawns to doe in the fall harvest appeared to be reliable if the shooting took place some day other than the opening one; this method was also the simplest. Finding rearing success of a herd through distribution of all doe age classes was believed accurate if large samples were available (15-20% harvest).

The levels of rearing success determined have assisted greatly in guiding management recommendations as to the level of harvest to aim for. Even in the areas of lowest rearing success 20% of the doe population can be lost annually without detriment to the next year's fall population; in the best areas, this percentage increases to 33%. In terms of harvest this means that the minimum goal should be equal numbers of antlered and antlerless (60% bucks—40% does). In the better areas twice as many antlerless as antlered should be and can be taken; this giving approximately equal sex ratios.

## ACKNOWLEDGEMENTS

Acknowledgements and thanks are due all field forces of the Virginia Commission of Game and Inland Fisheries for their assistance in data collection. Special thanks are due the District Game Biologists for their interest, cooperation and work in getting the information that is getting the job done; that being the full harvesting of Virginia's deer herds.

## LITERATURE CITED

- Cheatum, E. L. The Use of Corpora Lutea for Determining Incidence and Variations in the Fertility of White-Tailed Deer. *Cornell Vet.* 39(3):282-291. July, 1949.
- Severinghaus, C. W. Tooth Development and Wear as Criteria of Age in White-Tailed Deer. *J. Wildlife Mgt.* 13(2):195-216. April, 1949.

## PINE PLANTATIONS IN HARDWOOD STANDS BENEFIT WILDLIFE

(An example of timber and wildlife management coordination)

By J. N. VAN ALSTINE

*Staff Assistant, in Charge of Timber Management, Jefferson National Forest  
Roanoke, Virginia*

There are about 15,000 acres of poor site hardwoods on the New Castle District of the Jefferson National Forest on Big Stony Creek, Giles County, Virginia. The wildlife on this area, as on the rest of the Jefferson National Forest, is managed jointly under a cooperative agreement between the Jefferson National Forest and the Virginia Commission of Game and Inland Fisheries. The timber stands consist chiefly of poor quality scarlet, chestnut, white and red oaks, red maple, hickory, black gum, with some yellow poplar, pitch and white pine and hemlock. The stand ranges in age from 25 to 50 years and from 30 to 70 feet in height and 4 to 16 inches DBH. The work described in this paper was undertaken as a wildlife habitat improvement measure. It was proposed as an experiment by the State Game Biologist.

Judging from the stumps, the original stand consisted chiefly of white pine and chestnut. These stands were cut about 1900 and since that time and up to 1930 burned every few years. These fires resulted in elimination of white pine and conifers over much of the area and have helped the growth of the poorer species of hardwoods.

The canopy is closed and with the exception of scattered patches of laurel and rhododendron along the streams, there is little cover for deer and forest game species. Approximately 85% of the area has no ground vegetation. There is a lot of land like this on the Jefferson National Forest.

It is generally recognized that young conifer stands provide good cover for game and hardwood sprouts furnish excellent deer browse.

Early in 1949 a strip 60 to 100 feet in width and one-half mile in length was clear cut in the hardwood stand on Big Stony Creek. Most of the timber was of small size and had no commercial value at that time. It was piled in windrows in the clearing and allowed to decompose. It has long since disappeared. At the same time 2,500 red pine, white pine and Norway spruce were planted. In the following three years 2,300 more red and white pine were planted. All of the planting was done with a spacing of 6 x 6 feet and a total of five acres were planted. Areas covered with winddowed slash and areas too rocky to plant were allowed to revert to hardwood sprout growth. The purpose of this work was to provide both cover and browse.

Hardwood sprout growth rapidly took over the plantations so they were released in 1949, 1950, 1951, 1952 and again in 1956. Probably the 1956 release could have been omitted on part of the area. It is hoped this will be the last