DEER BEHAVIOR AS IT EFFECTS SEX AND AGE RATIO COUNTS

by

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INTRODUCTION

The white-tailed deer (Odocoileus virginianus) is considered the most popular big game animal in North America (Gabrielson, 1965:vii). This very adaptable animal offers an enormous economic, recreational, and esthetic value to all Americans. Growing populations of both deer and hunters have accentuated the need for more intensive management of the white-tailed deer. In order that a deer population be managed intensively, better techniques must be developed and applied to obtain a better understanding of the behavioral and biological characteristics of populations.

Field counting is a technique having great potential in estimating the size and composition of a deer herd. However, Downing (unpublished) and Michael (1970) determined that there is rarely a period during summer and fall in which the two sex or different age classes of white-tailed deer are equally observable. While in some cases it may suffice to know the magnitude of these differences such as reported in the aforementioned papers, a determination of the reasons for these differences is also needed to improve our understanding of this phenomenon. Deer behavior, group size, and coloration may have different effects on observability according to various habitat conditions, and these effects must be thoroughly understood if relative observability is to be predicted for other habitats. Weather is also an ever-present factor to consider in planning and interpreting field counts. Indeed, an understanding of deer behavior and other variables affecting these counts is necessary if sex and age ratio data are to

be intelligently used to improve management of a deer herd or to explain the dynamics of a deer population.

The objectives of this study were 1) to determine some of the reasons why bucks, does, and fawns are not equally observable in summer and fall and 2) to suggest what is needed to improve the technique of field counting in the future.

LITERATURE REVIEW

Davis (1963) states that information concerning the seasonal variation in the habits and visibility of sex and age classes of deer is very valuable in planning and interpreting population index counts.

Hanson (1963), Wight et al. (1965), and Rupp (1966) all have stressed the importance of knowing to what extent and why these seasonal or monthly differences occur.

Downing (unpublished) has established that definite monthly variations exist in sex and age ratio counts of white-tailed deer. He also explained that in areas where field counts can be used, the potential usefulness of such counts to determine population size, adult sex ratio and fawn production is hampered by the lack of knowledge concerning reasons for these fluctuations. Michael (1970) also noted seasonal variations in sex ratio and group composition and suggested that the variation in group composition and size, which may affect observations, is due mainly to reproductive behavior. This is substantiated by Montgomery (1959) who found that adults tended to travel alone during the prefawning and fawning periods. Michael (1965) reported that tagged fawns spend most of their time bedded and seldom moved except when their mothers came to feed them, at least until two months of age. Hawkins and Klimstra (1970) showed that with the advent of fawning season, adult does became secretive and that their movements were significantly reduced from June through September because of fawn rearing activities.

In a preliminary study of the social organization of white-tailed deer, Hawkins and Klimstra (1970) emphasized that the frequency of association, group size and composition, movements and spatial relationships were all fixed traits characteristic of deer behavior. Regarding the reproductive behavior of bucks, they reported that in September bucks were seen alone more than with other bucks and that this trend continued through January. Thomas et al. (1965) stated that groups of normal males began to break up in October as they became aggressive toward one another. Downing et al. (1969) determined that bucks move considerable distances during the rut while does did not leave their ranges during the same period.

Jahn (1959) in Wisconsin and Bellis and Graves (1971) in Pennsylvania, felt that deer behavior was responsible for the seasonal differences in the number and sex ratio of road-killed deer. Jahn (1959) noted that comparison of the trend of deer road kills with that of other population indices, despite systematic corrections for variations in traffic pressure, indicated that road kill totals cannot be used as a precise index of annual changes in the deer population. Sex ratios of adult deer calculated from annual total road kills did not represent the status of the surviving portion of the herd. The vulnerability of adults to accidents with motor vehicles varied between months.

Severinghaus and Cheatum (1956) report that hunter kill data from an any-sex season suggests a preponderance of males to females which might not be representative of the actual population.

Dasmann and Taber (1956) discussed a detailed study of the seasonal variation in the behavioral habits and visibility of sex and age classes of black-tailed deer (Odocoileus hemionus columbianus). Results showed that the best seasons for counting were lage July and December when the deer are in family groups.

Research on variables other than deer behavior which affect population, sex and age ratio counts is also limited. Sparrowe and Springer (1970) said that generally fewer deer were seen during the summer season than winter because of denser vegetation. Michael (1965) concluded that in areas of dense vegetation, a large group of deer was more readily detected than a single animal. This indicates that group size as well as group composition, is an important variable to consider.

Next to deer behavior, weather components such as wind, rain, temperature, and cloudiness are variables which may influence sex and age ratio counts. Cook and Hamilton (1942) observed that deer concentrated in winter in areas where they found protection from the wind. Halloran (1943) observed his highest deer counts in Texas in open country where there was little or no wind. When there was a distinct air movement the deer tended to spend more time in the brush. Severinghaus and Cheatum (1956) described how 30 deer in Vermont moved from one slope that was being swept by a cold wind to another slope completely protected from this wind. On another occassion in western New York, the wind shifted from a warm southwest breeze to a cold northwest wind; deer exposed to this wind moved

eastward around the slope to a protected area.

Halloran (1943) using January as his study period for deer counts in Texas, showed a close correlation between temperature and the number of deer seen on morning counts. With an average morning temperature of 42°F., an average of 11.6 deer were seen. When the temperature ranged between 44 and 58°F., 28.5 deer was the average. During evening counts the temperature correlation was not so close, although more deer were seen on evenings of higher temperature. With a temperature range of 44 to 73°F., 50 or more deer were frequently seen. Townsend and Smith (1933) report that deer could be seen in greater numbers (in winter) on comparatively warm days, whether clear or cloudy.

Ruff (1938) added that deer may continue to feed throughout most of the day (in summer) during cool weather.

Carhart (1946) reported that on a rainy day deer will not move about much and are likely to bed in a protected spot until the rain or storm ceases. Severinghaus and Cheatum (1956) suggested that heavier storms or showers seem to drive deer to the shelter of the woods.

In summarizing, Michael (1970) said that monthly variations in sightings of deer occur due to contrasting behavior of sex and age classes; however, there is a paucity of data showing the magnitude of these specific differences.

THE STUDY AREA

Location

This research project was conducted in southwestern Virginia at the Dublin Arsenal of the Radford Army Ammunition Plant located in Pulaski County near Dublin, Virginia. (Fig. 1).

Description

The Dublin Arsenal is a 2,040-acre tract of land enclosed by a 7-1/2-foot high chain-link fence topped with barbed wire to a total height of 8 feet. The area is divided into three main watersheds: Sawmill Hollow, Hazel Hollow, and M-1 Hollow (Fig. 1). The main intensive study area chosen comprises most of the Sawmill Hollow watershed located in the northern end of the Arsenal. Downing and McGinnes (1969) described the same habitat as primarily rolling, abandoned pastureland with occasional cutover woodlots, scattered red cedars (Juniperus virginiana), and several young shortleaf pine (Pinus echinata) plantations. An elaborate, intricate, and extensive paved road system affords excellent visibility of over 90% of the area.

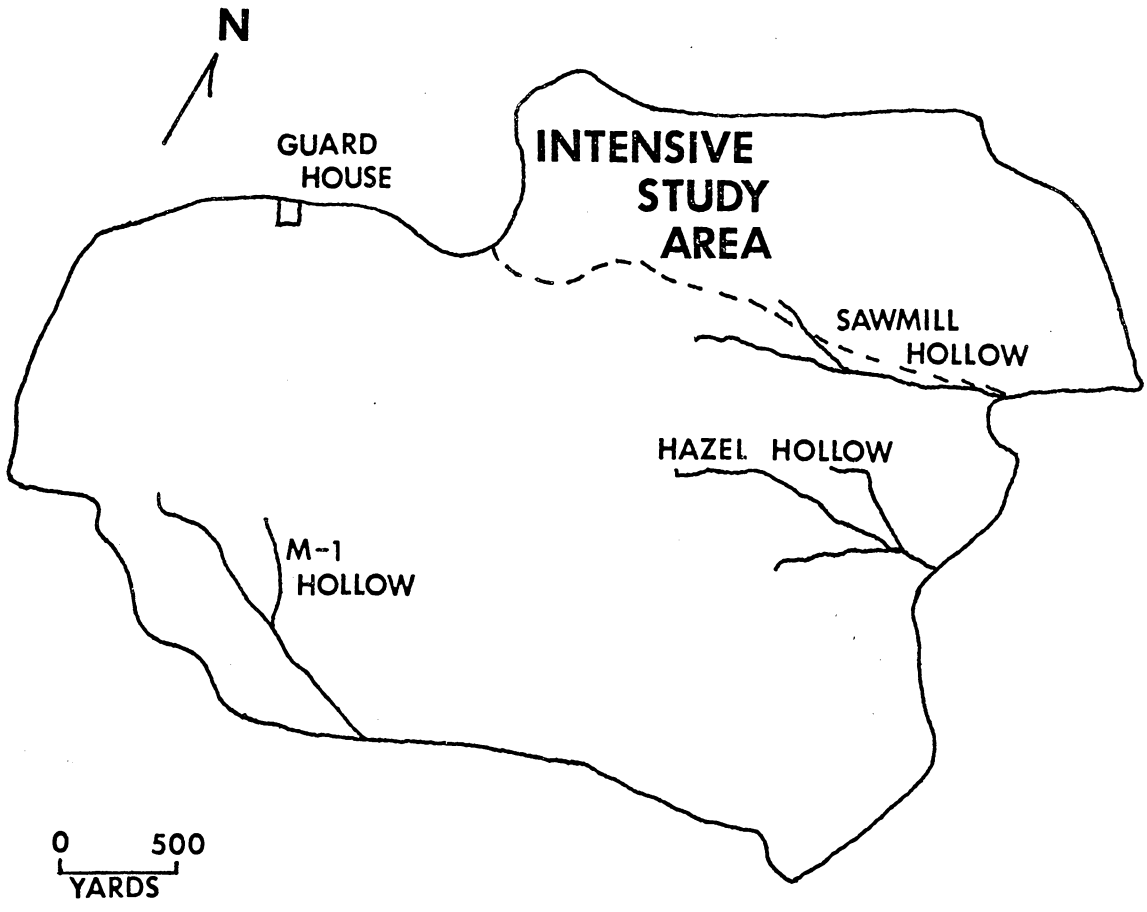

Fig. 1. Map of Study Area, Radford Army Ammunition Plant, Dublin, Virginia, 1971.

METHODS AND PROCEDURES

Tagging Methods

In May and June, 1971, 43 fawns were captured and ear tagged with color-coded streamers in a manner described by Downing and McGinnes (1969). Fourteen (14) bucks were also tagged using a Cap-Chur gun firing a plastic Pneu-dart (Liscinsky, et al. 1969) loaded with succinylcholine chloride. The bucks were tagged intermittently through August for the purpose of conducting Lincoln Index Estimates of population size. Since a satisfactory proportion of does had previously been marked, it was not necessary to tag more does for the Lincoln index, but several does were marked to provide additional marked doe-fawn pairs. When marking was completed, approximately 30% of the Dublin Arsenal herd had been tagged.

The actual data collection period encompassed six months, July to December. The study was divided into two phases, a Whole Area Study and an Intensive Study.

Whole Area Study

The procedures used for the whole area counts correspond to those used by Mr. Robert L. Downing on the same area in 1970. Four morning and four evening counts of all visible deer in the Arsenal were made by vehicle between the 10th and 20th of each month, July

through December. The counting route chosen was approximately 21 miles long and included the area of intensive study. Each deer seen with the naked eye was further scrutinized with the aid of binoculars and spotting scope to determine if it was a buck, doe or fawn. Group composition and size of group were also recorded.

During September, October, November, and December 1971, sixteen (16) Lincoln Index estimates stratified by bucks, does, and fawns were made during counts.

It is important to note here that during both the Whole Area Study and the Intensive Study, counts were not taken during fog, heavy rains, winds exceeding 15 mph, or any period of extremely inclement weather. However, weather data including temperature, wind velocity, and cloud cover were recorded and analyzed to see what percent of the variation in counts could be attributed to these variables even though they were not extreme conditions.

Intensive Study

A standard driving route was established through the intensive study area located in the northern end of the Arsenal. This driving route included the home ranges of eight marked bucks, eight marked does, and their eight marked fawns. The home ranges of the marked bucks and does had previously been determined by Mr. Robert L. Downing, based on extensive observations. An intensive search for the marked deer was conducted during the first two hours of light and the last two hours before dusk for three days between the 10th and 20th of

each month, July through December. The hours chosen correspond to the prime feeding hours of deer. During November, observations were made during three such ten day periods. The first period from October 28-November 7 was denoted as the 1st November study period; the period from November 10-November 19 as the 2nd November study period; and the period from Novmeber 21-November 30 as the 3rd November study period. This was done in an attempt to examine any behavioral modifications due to the rut.

A 20-power spotting scope and a pair of 7 x 50 binoculars were used to search out the animals. The vehicle was stopped and the spotting scope was used whenever possible to scan each bluff or vista. The binoculars were used to identify the marked animals seen at closer ranges.

"According to Darling (1937:21), an observor of deer or similar animals shoudl not fall into the error of thinking that ground can be thoroughly scanned through binoculars. The field looks good but the eye misses many animals. The telescope only should be used for this purpose; the ground being covered inch by inch."

Three complete passes were made over the driving route in each two hour period, meaning that each deer had a chance of being observed six times daily. The general activity of each marked animal was recorded, including number of times observed, location, time, group size, and group composition.

The purpose of the intensive area counts was to provide a standard of comparison; a series of counts in which every deer not

lying down was presumably seen. Comparison of these counts with whole area counts could then be made to indicate what sizes of groups or types of deer were being missed by the naked eye on whole area counts.

Data Analysis

Whole Area Study

Means and their associated confidence intervals were presented graphically to show the monthly variations in observability between bucks and does, bucks and antlerless deer, and fawns and does. Duncan's New Multiple Range Test was used to determine if there was any significant difference between monthly means in counts of bucks per 100 does and bucks per 100 antlerless deer.

Data concerning the monthly variation in group size were also expressed graphically. The graph was drawn to depict the mean number of deer per group per month. A chart was used to show monthly variations in group size of deer, expressed as a percent of the total number of groups.

An analysis of variance was used to determine if there was any significant difference between the number of deer seen on morning or evening counts.

Weather variables which included temperature, cloud cover, and wind velocity were analyzed by computer using the BMD02R stepwise regression analysis program which utilized number of deer seen per counting period as the dependent variable. This program was used to ascertain what correlation might exist between the independent variables of temperature, cloud cover, and wind velocity and the dependent variable mentioned above.

Intensive Study

Intensive Study information concerning number of sightings for marked bucks, does, and fawns was tabulated for each month and presented graphically for comparison and possible explanation differences in observability between these groups.

The effect of group size on observability was examined graphically through a comparison of the results of all counts from the Intensive Study with those of the Whole Area Study. This graph shows what percent each different sized group makes up of the total number of groups in each area, as a means of determining what size groups were overlooked most frequently on whole area counts.

RESULTS

Whole Area Study

The total number of deer seen on whole area counts during eight counting periods was 10,826. The 1971 deer population based on Lincoln Index estimates was 426 animals. This included 110 bucks, 200 does, and 116 fawns, which can be expressed as 55 bucks per 100 does, 35 bucks per 100 antlerless, and 55 fawns per 100 does. The sex ratio of bucks per 100 does in field counts showed extremes of 68:100 in July and 42:100 in December (Fig. 2). The ratio of bucks per 100 antlerless was also highest in July at 62:100 and lowest in December at 27:100 (Fig. 3). Figure 4 shows fawns per 100 does to be lowest in July at 11:100 and highest in December at 56:100.

The number of deer per group (2 or more) per month varied slightly with a high of 4.10 occuring in December. The total number of groups observed was 2,844. The mean group size for groups of two deer or more was 3.26. When single deer were included, the means group size became 2.51. Table 1 shows the most common group size on the Arsenal to be 2 - 5 deer. These comprised approximately 50% of all groups. Variations in sightings of single deer indicate that group composition changed throughout the study. Single bucks made up 15.6% of total groups while single does made up 18.7% of total groups. Single bucks were most common in November while single does were most commonly observed in July. Doe-fawn pairs were seen

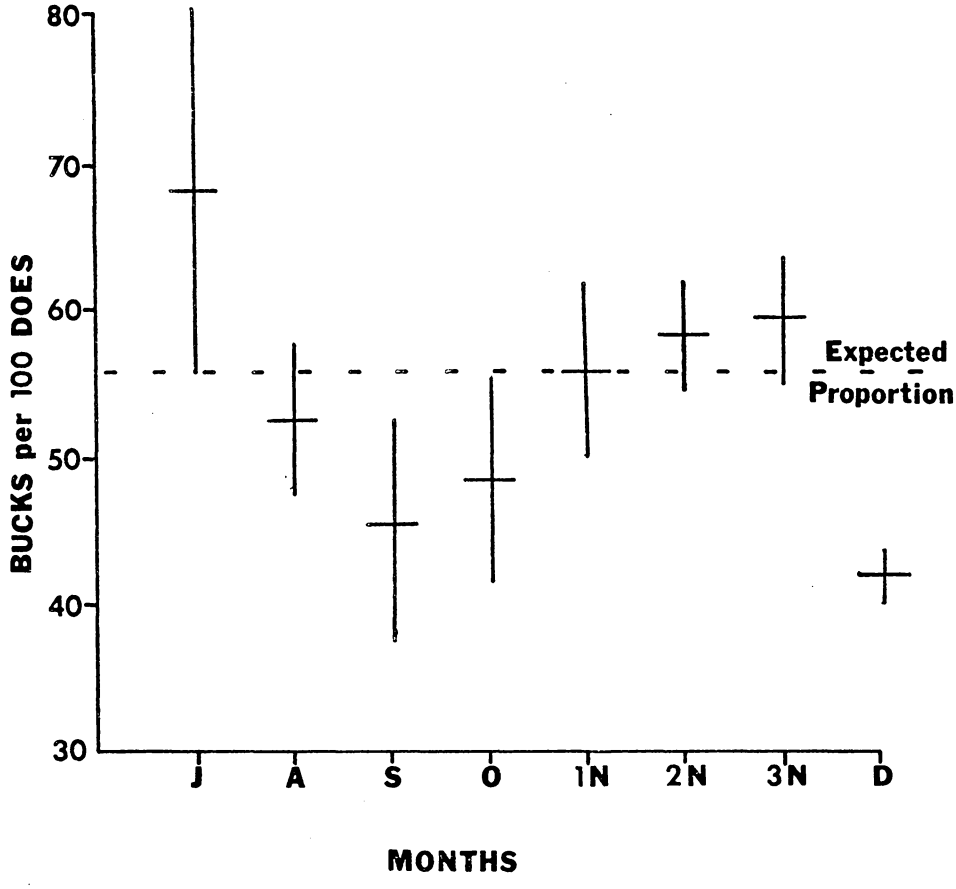

Fig. 2. Means and Confidence Intervals (P>.95) for Counts of Bucks Per 100 Does, Radford Army Ammunition Plant, Dublin, Virginia, 1971.

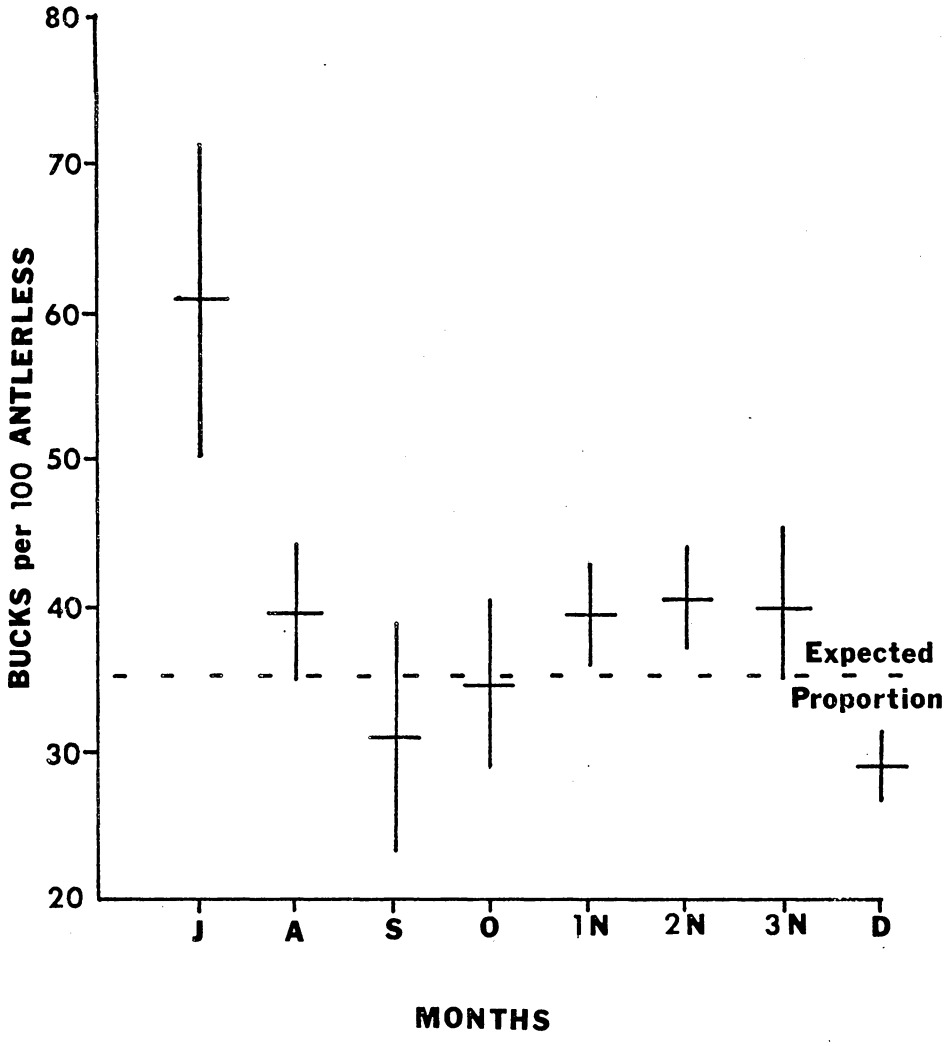

Fig. 3. Means and Confidence Intervals (P>.95) for Counts of Bucks Per 100 Antlerless Deer, Radford Army Ammunition Plant, Dublin, Virginia, 1971.

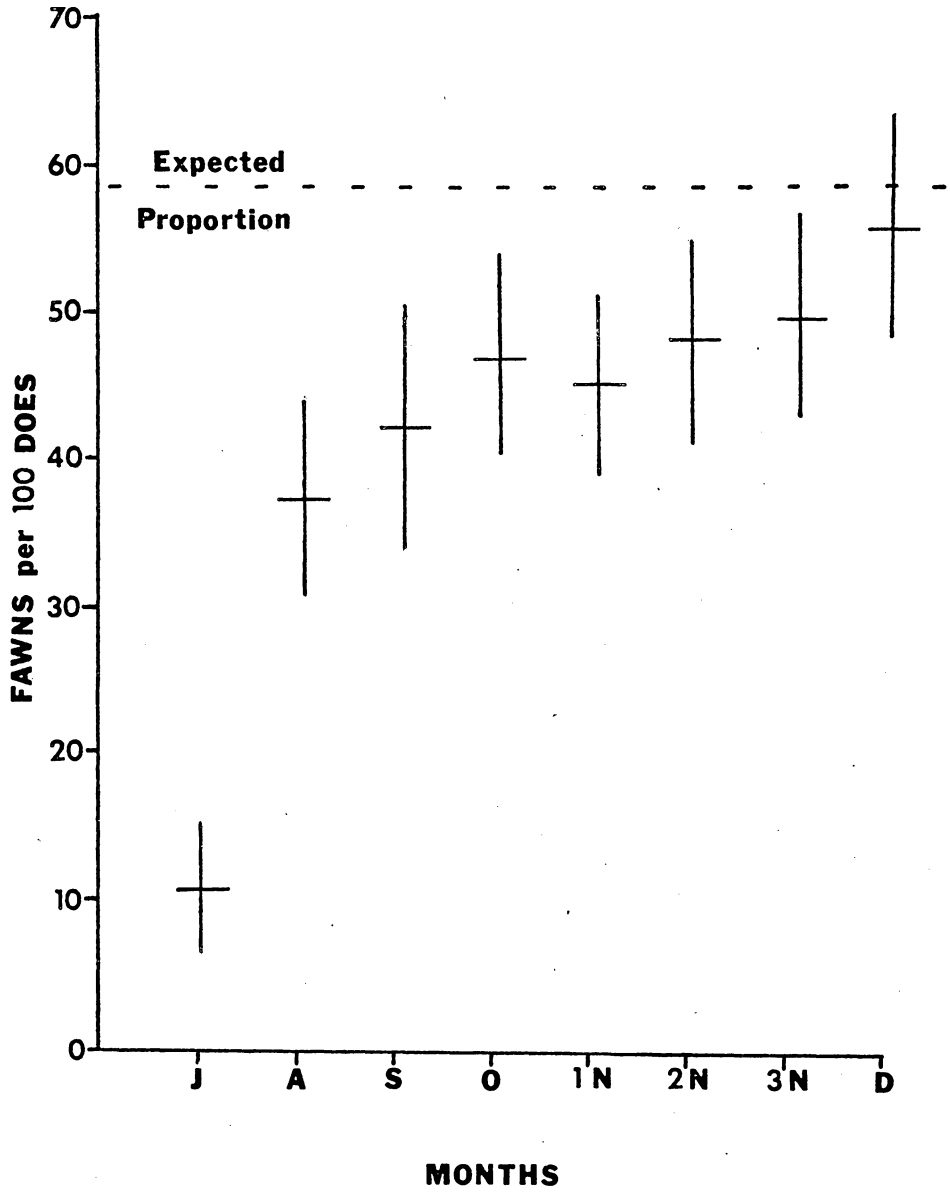

Fig. 4. Means and Confidence Intervals (P>.95) for Counts of Fawns Per 100 Does, Radford Army Ammunition Plant, Dublin, Virginia, 1971.

Table 1. Monthly Variations in Group Size of Deer Expressed As a Per Cent of the Total Number of Groups, Radford Army Ammunition Plant, Dublin, Virginia, 1971.

	SINGLE DEER			DOE FAWN PAIRS	NUMBER OF DEER PER GROUP		
	BUCK	DOE	FAWN		2-5	6-10	11-20
July	16.6	38.7	.4	5.6	36.3	2.4	0
August	10.2	19.7	1.4	14.5	46.0	7.1	1.1
September	11.7	16.0	.9	14.6	48.9	6.9	1.0
October	17.4	11.3	1.4	10.9	51.6	6.6	.8
November I	18.8	16.2	1.1	14.2	44.1	5.0	.6
November II	14.7	15.3	.8	9.8	53.4	5.7	.3
November III	20.9	23.3	2.3	12.2	38.1	3.0	.2
December	14.6	9.2	.9	11.0	49.4	11.7	3.2
	$\bar{x}$=15.6	$\bar{x}$=18.7					

at a fairly even rate from September thru December; however, these pairs made up a very low percentage of total groups in July due to the small number of fawns active during July. The largest sized groups of deer occurred in December.

An analysis of variance showed that there was no significant difference between the number of deer seen on morning and evening counts.

Duncan's New Multiple Range Test (Table 2) indicated that there were many combinations of months in which buck-doe counts were not significantly different from each other. These months were August and September, August and October, August and mid-November, September and October, September and December, October and mid-November, and October and December. July, however, was significantly different from all other months. Results for counts of bucks per 100 antlerless deer closely followed that of bucks per 100 does. Again, Duncan's New Multiple Range Test (Table 3) indicated that August and October, August and mid-November, September and October, September and December, October and mid-November, and October and December were not significantly different. Again, July, was significantly different from all other months.

Table 2. Summary of Monthly Differences in Counts of Bucks Per 100 Does as Determined by Duncan's New Multiple Range Test, Radford Army Ammunition Plant, Dublin, Virginia 1971.

	JULY	3 NOV.	2 NOV.	1 NOV.	AUG.	OCT.	SEPT.	DEC.
				-BUCKS/100 DOES				
MEANS	68.50	59.00	57.75	55.88	53.50	48.50	43.50	42.25

Means not underscored by the same line are significantly different ($P<.05$).

Table 3. Summary of Monthly Differences in Counts of Bucks Per 100 Anglerless Deer as Determined by Duncan's New Multiple Range Test, Radford Army Ammunition Plant, Dublin, Virginia, 1971.

	JULY	2 NOV.	3 NOV.	AUG.	1 NOV.	OCT.	SEPT.	DEC.
				BUCKS/100 ANTLERLESS				
MEANS	61.75	39.50	39.50	39.25	38.62	33.12	30.62	27.38

Means not underscored by the same line are significantly different ($P<.05$).

Intensive Study

The total number of observations on the 24 marked deer in the intensive study area, which included eight marked bucks, eight marked does, and eight marked fawns, was 1,284 out of 3,294 possibilities. Marked does being seen 517 times, marked fawns 431 times, and marked bucks 336 times. The only period during the six-month study when the individually marked bucks were seen more often than the individually marked does was July. Otherwise, does were seen more times than bucks every month. Sightings of marked bucks did not vary much over the study period, reaching a high in early November and in mid-November. Does were generally seen more frequently as the season advanced. Fawns were also seen at an ever increasing rate, but fawns were always seen less frequently than does, especially in July and August. Fawns were seen at very nearly the same rate as does during the last three counting periods. A summary of the monthly variation in sightings of marked deer is presented in Figure 5.

Figure 6 indicates that the results concerning the effect of group size on observability were not at all significant when the Intensive Study was compared to the Whole Area Study. This will be discussed more thoroughly in the Discussion Section.

Weather Variables vs. Number of Deer Seen

Regression analysis of the number of deer seen each morning

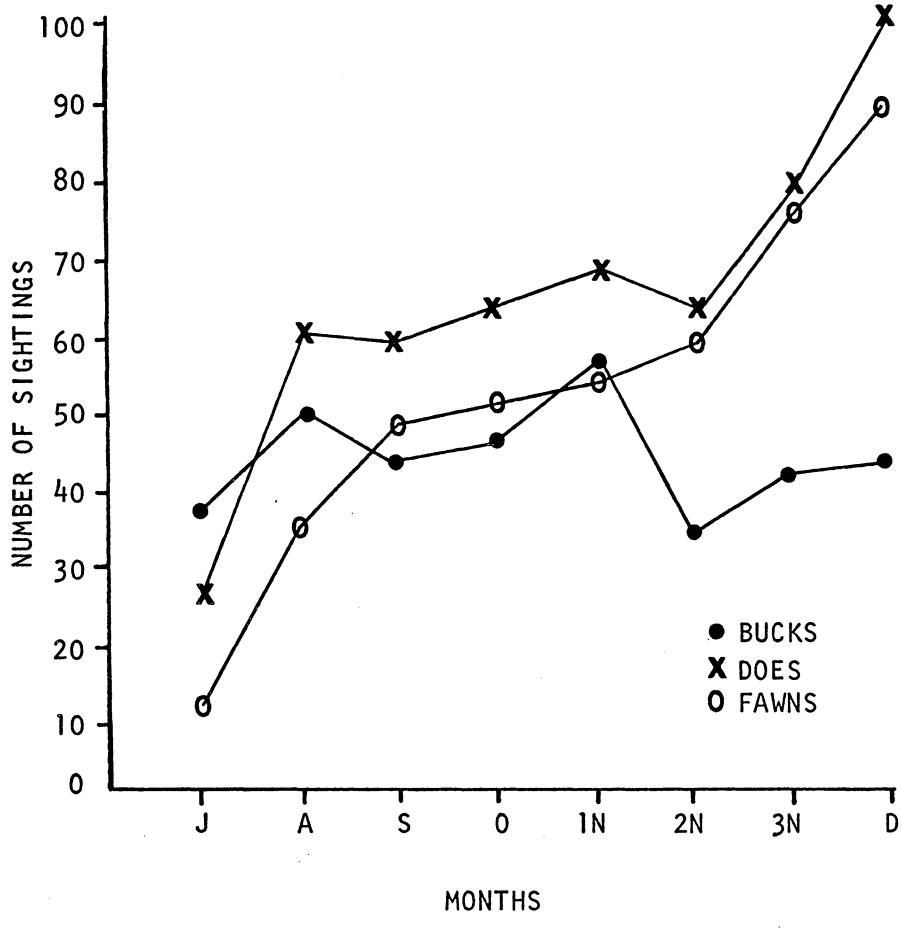

Fig. 5. Monthly Variation in Sightings of Eight Marked Bucks and Eight Marked Does and Eight Marked Fawns, Radford Army Ammunition Plant, Dublin, Virginia, 1971.

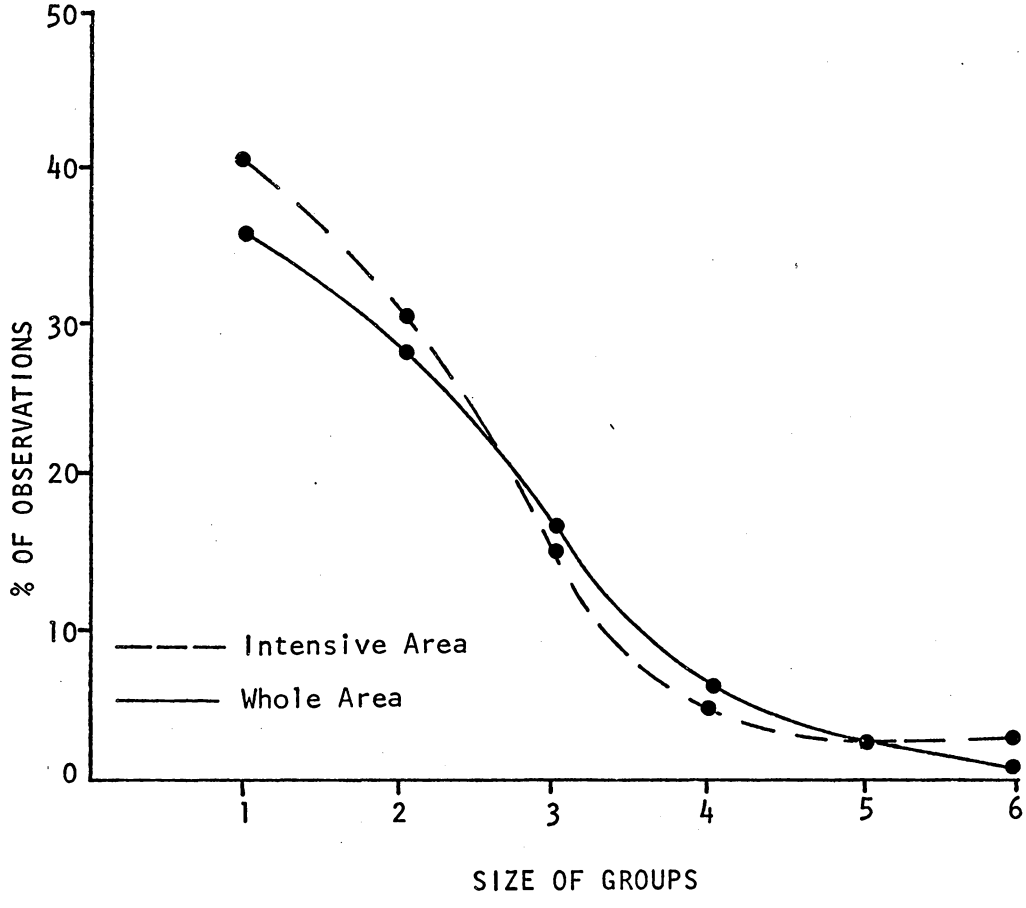

Fig. 6. Group Size as a Percentage of Observations of the Total Number of Groups on Both Study Areas, Radford Army Ammunition Plant, Dublin, Virginia, 1971.

and evening, and associated temperature, wind velocity, and cloud cover values of those periods, revealed a correlation coefficient of .36 for temperature, .02 for cloud cover, and .01 for wind velocity. Among weather variables, only temperature seems to be correlated to the number of deer seen per count, and then not significantly so by most standards.

DISCUSSION

General Pattern of Observability

The high ratio of bucks per 100 does observed on whole area counts during July (Fig. 2), is confirmed by the intensive area counts (Fig. 5) as being the result of unequal feeding time rather than missed observations. The fawning and post-fawning season seems responsible for this phenomenon because fawns are still quite small in July and their mothers are keeping them concealed as much as possible. In performing this function, does are themselves being seclusive to avoid detection of their young as evidenced by the fact that the eight marked does in the Intensive Area were seen less often in July than in any other month. This supports Hawkins and Klimstra's (1970) report that with the advent of the fawning season in June, adult does became more secretive, being sighted about half as often from July to August as from April to May. In August, does became much more active and were seen at a higher rate than bucks (Figs. 2 and 5). During September, October, and the 1st. November period, bucks were seen at a lower rate, both in whole area and intensive area counts. Both sexes were seen at the same rate during the 2nd. November period on whole area counts. The reason for the low number of sightings (31) of marked bucks during the rut can be explained by the fact that three bucks moved out of their normal home range in search of does and thus were not present for observation in the Intensive Study Area. As the peak of the rut began to diminish

during the 3rd. November and the December periods, does became exceptionally active (Fig. 5). Marked bucks, however, did not increase at the same rate. The apparent discrepancy between whole area counts (Fig. 2) and intensive area counts (Fig. 5), during these two periods, can be explained by the fact that not only had three marked bucks not returned to their normal range, but the recorded number of observations on three other marked bucks was quite low, indicating that these animals too were under the influence of the rut, and frequently left the Intensive Study Area. Downing et al. (1969) stated that mature bucks moved considerable distances during the rut and at 2-1/2 years of age 60% of the bucks studied moved outside their normal range.

By August, fawns are approximately two months old, much larger and stronger, and are capable of keeping up with their mothers for longer periods of time. Michael (1965) stated that fawns in Texas began accompanying their mothers when approximately two months old. Until that time they spent most of their time bedded and seldom moved except when nursed by their mothers. Figure 4 (Whole Area Study) and Figure 5 (Intensive Area) show that Virginia fawns are seen at an ever increasing rate all the way through December. The increase in fawn sightings was greater than the incrase in doe sightings in the latter months of the study. Fawns were usually seen with their mothers in November and December, and this is evident in Figure 4 when, in November and December, Whole area counts of fawns per 100 does most nearly met the expected proportion.

Intensive Area results agree favorably, showing a definite upward trend in the number of sightings of marked fawns, as well as marked does, during the same two periods. Hawkins and Klimstra (1970) stated that doe-fawn pairs seemed to progress from complete isolation of the fawn to an occasional observation of the two together, to eventually almost all sightings of the doe and fawn together.

The unusual growth of grass throughout the Arsenal may be responsible in part for the lower number of sightings of deer in July. The grass was extremely tall due to the 7.82" of precipitation that fell on the area between May 25 and June 30, 1971. This compares with 1.44" during the same period in 1969 and 3.58" in 1970. As this grass matured and its seed heads collapsed, there was a sharp rise in the number of observations of does and fawns in November and December.

Monthly Variations in Group Size and Composition

Data collected and analyzed show that the group size of deer varies monthly (Table 1). It follows then that group composition is also affected. Many of these changes can be attributed to some facet of reproductive behavior. As previously mentioned, the high point of rutting activity takes place in the middle of November. From September through November single bucks were seen at an increasing rate, from 11.7% of all groups to 20.9%. Hawkins and Klimstra (1970), in Illinois, found that beginning in September bucks were seen alone more than with other bucks. They also stated that this

type of behavior reflected antagonism during the mating season and a preference for traveling alone while searching out sexually receptive does. Thomas et al. (1965) also reported that male groups began to break up in October as they became antagonistic toward one another. However, an apparent contradiction was noted because the peak of the rut was marked by a reduction in numbers of single bucks. This can be explained by the fact that at this time, a substantial number of single bucks were seen with or near a doe and thus were not recorded as single bucks but as buck-doe groups. This would then account for the high percentage (53.4%) of the deer occuring in groups of 2-5 deer during the rut. Otherwise, the smallest mean groups occurred in the other two November study periods (1st and 3rd) when bucks were still engaged in rutting but fewer does were receptive, and in July when does were most seclusive because of the fawning season. Indeed, single does comprised 38.7% of all groups of deer in July which was the highest percentage for single does over the entire six months. On the other hand, doe-fawn associations were at their lowest (5.6%) in July, but again fawn rearing behavior is responsible because few fawns were strong enough to be active at this time.

The largest grouping of deer during the six months study took place in December when 11.7% of all groups included 6-10 deer and 3.2% included 11-20 deer. Much of this increase in group size occurs because an attractive food supply is available in an area. However, Dasmann and Taber (1956) call such groups, which usually

occur in winter, "random associations."

The average number of deer per group, excluding singles, when compared on a monthly basis reached a high of 4.10 in December, well above the overall mean of 3.26, and this agrees favorably with the results in Table 1, indicating that deer on the Arsenal begin to group up for the winter months.

Effect of Group Size on Observability

As stated in the Results section, the effect of group size on observability was not at all significant when the Intensive Study results were compared to the Whole Area results (Fig. 6). The percent of deer occuring singly in the Whole Area Study was only slightly less than in the Intensive Study. This indicates that not many singles were missed on whole area counts. All larger groups had virtually the same percentage of the total in both areas. Indeed, when considering small group sizes of deer, there was no noticeable difference in observability between the Intensive Study Area where deer were "intensively" sought out from a stationary vehicle, and the Whole Study Area where observations were made by the naked eye while driving at a low speed. So, in this particular research, group size of deer had no effect on observability. Indications are that time would only be wasted by stopping and searching out deer when the majority of single deer could be seen with the naked eye and ratios would remain the same.

Effect of Weather Variables on Observability

The regression analysis program used to analyze the weather variables of temperature, cloud cover, and wind velocity and their possible correlation with number of deer seen indicated that only temperature had any positive correlation and that r value was only .36. R values for wind velocity (.01) and cloud cover (.02) were so low that they need not be discussed any further.

Both Chapman (1939) and Halloran (1943) report seeing more deer in the daytime when the sky was overcast. However, Behrend (1966) and Progulske and Duerre (1964) said there were no marked trends in deer activity due to changes in cloud cover.

Temperature, like wind velocity, at its extremes appears to be highly correlated with deer activity. Banasiak (1957) stated that deer activity decreased under conditions of high or cold winds, low temperatures, and storms. Behrend (1966) reported that in the Adirondacks, of the measured weather variables examined, only maximum daily temperature proved to be significantly correlated to deer activity. The lack of positive association between other weather factors is certainly not conclusive, but Behrend thought it very unlikely that factors other than storms and high winds influence activity significantly. Peterson (1969) also felt that only extremes of snow, wind, and temperature could alter normal deer activity significantly.

Indeed, the failure of the weather variables tested here to explain a larger proportion of the variation in total deer seen may

be attributed to the fact that these counts were only made on "good" days when extreme weather conditions did not exist. For example, counts were never made when wind velocity exceeded 15 mph. In this respect, a high degree of correlation was not anticipated.

If neither intensive searching, time of day, nor weather variables affect the ratios of deer observed, the only option left available to the counter is to conduct counts during the months when counts will be most representative of the sex ratio and various age classes. The following discussion includes a determination of the best months to make sex and age ratio counts in southwestern Virginia.

Sex Ratio Determination

Figure 2 indicates that August, October, and the three periods in November were the only months in which the expected ratio of bucks per 100 does was included in the sample confidence intervals. Therefore, if an actual sex ratio determination is desired, counts should be made in August or the period from October 10th to November 30th. Downing (pers. comm.) recommended that counts of bucks per 100 does be made in November based on a two year study in which the confidence interval for November was found to include the expected proportion of bucks per 100 does in both years.

Fawn-Doe Counts

Figure 4 presents means and confidence intervals for counts of

fawns per 100 does. Here, the only month in which the sample confidence interval included the expected ratio of fawns per 100 antlerless was December. This then, would indicate that the best period for making fawn-doe counts is December. However, at this time the fawns are most difficult to distinguish from adult does because they have lost their spots and are almost as large as yearlings. Therefore, considerable practice and experience would be required to make accurate fawn-doe counts in December and such counts should only be entrusted to workers who have "grown up" with the current crop of fawns.

Change in Ratio Estimators

One of the requirements of change in ratio estimators of population size is that there must be comparable periods both before and after the removal of an easily recognized type of animal in which the proportion of this particular animal can be determined accurately. Hunting of the white-tailed deer, particularly bucks, takes place in most eastern states in November and the early part of December. It is necessary to have two periods, one before and one after the hunting season, in which deer are equally observable in order to determine population size. Duncans New Multiple Range Test (Steel and Torrie 1960) (Table 2) illustrates that there are many combinations of months in which buck-doe counts are not significantly different from each other. However, since the hunting season for deer is usually restricted to late November and December, only those months which do not differ from December are suitable for consideration.

Therefore, September and December, and October and December are the only suitable counting months.

Since fawns are easily mistaken for does and yearlings in December, it might be more useful to make counts of bucks per 100 antlerless deer instead of bucks per 100 does. Duncan's New Multiple Range Test (Steel and Torrie 1960) (Table 3) shows possible useful monthly combinations which are not significantly different from each other to also be september and December, and October and December.

SUMMARY AND CONCLUSIONS

The 1971 white-tailed deer population on the Dublin Arsenal of the Radford Army Ammunition Plant, was estimated at 426. There were 200 does, 110 bucks, and 116 fawns. The actual ratio of bucks per 100 does was 55:100, of bucks per 100 antlerless 35:100, and fawns per 100 does, 58:100.

Bucks were seen at about the same rate throughout the summer and fall. But because does and fawns are very seclusive in July, bucks were seen at the highest rate of any class during that month. Beginning in August, when fawns were two months of age, both does and fawns became more active and does, at least, were seen at a higher rate than bucks throughout the remainder of the study. Fawns were never seen at as high a rate as does, but approached this rate in December. Doe-fawn pairs were observed most frequently in November and December because by this time fawns were large enough and also strong enough to keep up with the does at all times. Single bucks were most common in November due to the rut and single does in July due to the fawning season. The number of deer per group per month reached a high of 4.10 in December when the largest feeding groups occured, drawn together by attractive food supplies in certain areas.

In considering the Whole Area counts as the observed distribution of group sizes, and the Intensive Area counts as the actual, no difference was found between the two areas to substantiate a positive effect of group size on the observability of deer. Even though marked deer were intensively sought out with telescope and binoculars

on the Intensive Area, these counts were very similar to those of the Whole Area, indicating that few deer were missed with the naked eye. Also, there was found to be no significant difference in number of deer observed between early morning and late afternoon counting periods.

Data on temperature, cloud cover, and wind velocity was only gathered on "good" days. Despite this, a regression analysis between the three weather variables and number of deer seen indicates that temperature is positively correlated with number of deer seen, but this correlation is weak; r=.36. Wind velocity and cloud cover could not be significantly correlated with the number of deer observed in this study.

Indeed, the time of year seems to be the only option left available for the counter to consider in order to obtain representative sex and age ratio information. The best month for making a sex-ratio count was November. The best combination of months for change in ratio estimation of population size was found to be September and December or October and December. Fawn-doe counts are best made in December, although it can be difficult to distinguish fawns from yearlings.

RECOMMENDATIONS

1. If change in ratio estimators are to work for deer, counts must be made during two months when deer exhibit equal behavior. In the study, in southwestern Virginia, these months were determined to be September and December or October and December. This may be applicable to most northeastern states.
2. The best month for making a sex ratio count is November.
3. Fawn-doe counts should be made in December if fawns can be distinguished from yearlings or does.
4. Additional research is desirable to determine the effects of hunting on deer behavior and observability.

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DEER BEHAVIOR AS IT EFFECTS SEX AND AGE RATIO COUNTS

by

Robert J. Poux, Jr.

ABSTRACT

The 1971 white-tailed deer population on the Radford Army Ammunition Plant, Dublin, Virginia, was estimated at 426. There were 200 does, 110 bucks, and 116 fawns.

Bucks were seen at about the same rate throughout the summer and fall. Since does and fawns are very seclusive in July, bucks were seen at the highest rate of any class during that month. In August, when fawns were two months old, both does and fawns became more active and does were seen at a higher rate than bucks throughout the remainder of the study. Fawns were never seen at as high a rate as does, but approached this rate in December. Doe-fawn pairs were observed most frequently in November and December because by this time fawns were large and strong. Single bucks were most common in November due to the rut and single does in July due to the fawning season.

Since neither intensive searching, time of day, nor weather variables affected the ratios of deer observed, the only option left available to the counter was to conduct counts during the months when counts were most representative of the sex ratio and various age classes.

The best month for making a sex-ratio count was November. The best combination of months for change in ratio estimation of population size was found to be September and December or October and December. Fawn-doe counts are best made in December.