A TEST OF TRACK COUNTS AS A MEASUREMENT OF DEER POPULATION SIZE *

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ABSTRACT

Three 160 acre deer enclosures were stocked with 2, 4, and 8 deer respectively. Track counts were made simultaneously on prepared surfaces in the enclosures. It was found that the track counts were not directly proportional to population size. Thus it appears that track counts are not a valid measurement of population size, if a linear relationship through the origin between population size and number of tracks is assumed. The track counts were able to detect that there were differences in population size, but it did not tell us the magnitude of this difference.

INTRODUCTION

The number of deer tracks on prepared surfaces, roads and fire lines are often used to obtain information pertaining to the abundance of deer, population differences between areas, indication of reproduction ,and trends in population. The objective of this study was to determine if track counts are a valid measurement of population size for known populations of deer, assuming a linear relationship through the origin between number of deer and number of tracks made.

Conclusions drawn by the various investigators, relative to the utility of track counts data are varied. Lay (1962) states "So many variables are involved such as weather and changing food habits, that I doubt any simple formula can be worked out for estimating density from track counts. However, we like track counts for trend information, and they are much better than nothing as an index to densities." Webb (1962) reports on a track count study that attempts to associate the number of tracks observed on 2¼ miles of roads with the estimated deer population of a 365 acre study area as determined by quarterly deer drives. He also attempted to associate track counts made along the same roads with a fluctuating deer population as determined by the variances in the egress and ingress of deer to the study area during successive 24 hour periods. Webb states that the data collected indicates that no association can be made between track counts and actual deer populations. Tyson (1959) compared deer drive data with track counts and found that there was a definite relationship between deer tracks across roads and populations. In Louisiana deer tracks are counted on some game management areas for five days in July of each year to obtain a trend in population and an index of reproduction.

PROCEDURE

In Winn Parish three 160 acre deer enclosures (3,300 by 2,112 feet) were constructed and were stocked at the rate of two, four and eight deer per enclosure during April, 1961. The presence of the deer was verified by a drive census during January, 1962. The enclosures are located in the loblolly pine (*Pinus Taeda*), shortleaf pine (*Pinus echinata*), hardwood timber type of Central Louisiana. The terrain of the enclosures ranges from rolling hills to flat bottoms of the small intermittent streams which cross the area. The soils range from fine to very fine sandy loams. Each enclosure has a road winding across the narrow dimension.

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Three areas were selected to be as nearly alike in habitat characteristics as possible. A 33 1/3 foot track counting strip, beginning at the enclosure fence, was prepared at each end of the road. Along the road 15 strips, 100 feet long were established.

Each counting strip was disked lightly two to four times in order to get the soil in the desired condition. The tracking surface was smoothed with a five and one-half foot grader blade behind a farm tractor. In some places the smoothing was done with a garden rake.

When making track counts, only tracks that crossed both side boundaries of the tracking strip were counted. If the tracks entered or left from the end of the strip or if the tracks entered the strip from one side and left from the same side the tracks were not counted. It was originally planned to obliterate the tracks each day as they were simultaneously counted in each enclosure, with the exception of Friday when the tracks would be left and all tracks counted on Monday. After beginning the track counts, it was found that rain frequently obliterated the tracks over the weekend; therefore, it was decided to leave the tracks to accumulate for a longer period during the week. Some counts were made after as much as a 96 hour exposure.

RESULTS AND DISCUSSION

From July 17 through September 5, 1961, 29 counts of tracks were made on the prepared strips. (Table 1). Weather and various other factors should influence deer movement. Since the counts were made at approximately the same time (in not more than a three hour period) and the length of time that deer could make tracks on the strips was the same, it is expected that these factors should have the same influence on deer movement within each enclosure. It has often been assumed that the number of tracks are directly proportional to the number of deer on an area. Therefore, if track counts are a valid measurement of population size (assuming a linear relationship through the origin between number of deer and number of tracks made) we would expect 2/14 of the total number of tracks for all three enclosures observed at any given time to be observed in the enclosure with 2 deer and 4/14 and 8/14 in the enclosures with 4 and 8 deer respectively.

Chi-square values were calculated for the discrepancies between the observed and expected number of tracks for each of the 29 observations. The sum of these 29 chi-square values was highly significant (Table 1). Therefore, we accept the alternate hypothesis that the deviations from the hypothetical are (with no distinction being made for excess or deficit), more than can be accounted for by chance. A pooled chi-square was also highly significant, which shows that the total number of tracks deviate from the hypothetical more than can be accounted for by chance. A heterogenity or interaction chi-square was calculated by subtracting the pooled chi-square value from the sum of the chi-squares. The heterogenity chi-square was highly significant. The heterogenity chi-square measures the inconsistency of the oscillations above and below the

TABLE 1

Total number of deer tracks observed for 29 observations in enclosures containing a known number of deer and chi-square test of significance for discrepancies between observed and expected number of tracks assuming a linear relationship through the origin between population size and number of tracks.

Number of deer in enclosure	*Total number of tracks for 29 observations*	*Expected number of tracks*
2	11	56.1
4	74	112.2
8	308	224.4
Total Number 14	393	....
x^2	d.f.	p. level
Sum of 197.77	58	<0.005
Pooled 81.97	2	<0.005
Heterogenity 115.80	56	<0.005

nypothetical. Therefore, we accept the alternate hypothesis that the deviations are not consistently more or less than the hypothetical values.

Since the chi-square tests were significant and the discrepancies were large, we concluded that the track counts were not directly proportional to population size assuming there were no significant bias in the data. Thus, it appears that track counts are not a valid measurement of population size, if a linear relationship through the origin is assumed. It was of special interest that the deviations from the expected were not consistent in any direction. A preliminary plot of the pooled number of deer tracks for the three deer herds on log-log graph paper seemed to indicate that the relationship between population size and number of tracks might be exponential. However, a plot of the individual observations were extremely variable. This is expected in light of the significant heterogenity chi-square. The pooled data contains evidence about the hypothetical ratios only if the individual samples are homogeneous as is evident by a small or non-significant heterogenity chi-square.

Surely, there is some type of relationship between track counts and population size; however, the form of this relationship is not at all evident from the data. It should be mentioned that with only three levels of population size, it would be very hard to determine the exact form of this relationship. This relationship would have to be known before track counts could be used as a measurement of population size. It was evident to us from these data, that deer track counts are so variable, that even if the exact form of this relationship was known, that it is doubtful that they would be of much practical use, with the sample sizes normally used in making deer track counts, to estimate the size of deer populations. It should be pointed out, that by grouping the observations by data observed, we believe that we have removed much variability which is inherent in deer track counts. In many instances this could not be done. Webb (1962) in his study of the validity of deer track count data, concluded, "It appears that uncontrollable factors, or combinations of factors, that affect deer movements exist in such great numbers as to preclude their insolation and to make any reasonable accurate estimate of the exact deer population through the use of track counts as an index".

Sign tests were made for the comparison of the number of tracks between (1) the enclosures stocked with two and four deer, (2) the enclosures stocked with four and eight deer and (3) the enclosures stocked with two and eight deer. The number of tracks were paired by day observed. All sign tests were significant at a probability of .05 or less. Therefore, at the level of population differences in the enclosures, the track counts at the sample sizes used were able to detect that there were differences in population size but such a test does not tell us the magnitude of these differences. However, in many cases, where track counts have been made they are used as a measurement of population size and not for comparison purposes.

Also very often it would be impossible to pair track count observations. It appears that some type of paired comparison (sign test, t-test, etc.) with track counts could be used to determine if there was a significant difference between two populations; however, we don't know of what magnitude this difference would have to be for a given sample size to detect a difference. We believe that in a test of this nature the probability of committing a Type 11 error (Type 11 error is to accept the null hypothesis when it is false) would be great with the sample sizes normally used in taking deer count tracks unless the difference between the two populations is relatively large.

LITERATURE CITED

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