EVALUATING THE DEER TRACK CENSUS METHOD USED IN THE SOUTHEAST

by

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ABSTRACT

An evaluation of published work on the deer track count census method indicates the popularly used 1:1 relationship between tracks across roads and number of deer on an area can be neither rejected nor accepted. The day-to-day variability in deer track crossings usually requires a large number of consecutive counts to detect changes in populations. Procedures for determining the required number of counts are presented.

A perennial problem confronting game technicians is that of obtaining an accurate population census of wildlife. The deer track count method, commonly employed in the coastal plain of the Southeast, is a census technique that is in obvious need of careful analysis and possible refinement. A critical evaluation is required to determine its limitations as an estimator of animal numbers or to relegate it to more appropriate uses, if possible, such as an index to population changes or as a "show me" type indicator of animal presence. This paper examines the results and conclusions of earlier reports published in the Southeast on the deer track count census method and makes recommendations for using the technique.

TRACK COUNTS TO DETECT POPULATION SIZE

Although tracks have been used by primitive man and modern hunter to detect the presence of animals, it was not until 1951 that a technical report (Wright 1951) was published in eastern United States demonstrating how deer tracks could be used to estimate population size. The use of the track count method to give accurate estimates of deer populations in the Southeast has been a subject of controversy since Tyson (1952) first investigated the technique. Tyson calculated, theoretically, that if the "normal average" daily range of deer was 640 acres, the number of deer crossings per linear mile of road should equal the density of deer per square mile. Because average daily range was difficult to obtain, Tyson attempted to determine, by comparing number of tracks with number of animals observed during drives on the same areas, the relationship between the two methods. Tyson's conclusions were as follows: "By paired comparisons there was no difference at the 90 percent level between the number of deer found per square mile by the drive method and the number of tracks per mile," and "it is doubtful if the 1:1 ratio between tracks and deer will remain constant throughout the year even on the same areas." Many biologists have used this 1:1 relationship as a standard, much as the figure of 13 pellet groups per deer per day has been accepted (may not be applicable in the Southeast) as the standard basis for pellet group counts.

We subjected Tyson's 1952 deer drive and deer track count data (Tyson 1959) to a linear regression analysis, testing the regression of the number of deer track crossings on the number of deer counted during the drives. We then calculated a t value to test the null hypothesis that the true slope of the regression line is equal to one. The t test was not significant at the 5 percent level of significance. Consequently, we failed to reject Tyson's reasoning that a 1:1 relationship existed. However, no accurate evalution of this relationship was possible from Tyson's data because tracks and deer were counted during different months and the technique was based on only one set on observations per mile which failed to take into account day-to-day variability. Only by taking repeated measurements and comparing these with a known population can the technique be properly evaluated.

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Downing et. al. (1965) tested the track count by comparing a known deer population with the number of daily crossings in a 746-acre enclosure. Daily counts were quite variable, and further analysis showed that the correlation coefficient ($r=+0.20$) was extremely weak. Brunett and Lambou (1962) compared the number of crossings made by deer against known populations (2, 4, and 8 deer in three 160-acre enclosures) and concluded that "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."

It is apparent that the principal weakness of the track count method is the day-to-day variability of track crossings per mile. Any given mile of transect may have a high number of crossings one day and a low number the next. This variability must be compensated for by taking enough consecutive counts to narrow this margin of error to within reasonable limits.

SAMPLING PROCEDURES TO DETECT POPULATION CHANGE

In using the track count method to detect changes between years, the following formula from Steel and Torrie (1960:154) is suggested:

$$r \geq \frac{2(t_0 + t_1)^2 S^2}{2}$$

r = number of replicates per year
S^2 = estimate of experimental error
= true difference to be detected
t_0 = t value associated with Type I error
t_1 = t value associated with Type II error
(t_1 equals tabulated t for probability 2 (1-P) where P is the selected probability of detecting if such a difference exists.)

When attempting to detect a difference in deer numbers between years, experimental error S^2 may only be obtained by making an analysis of variance of 2 or more years of comparable data. To illustrate this procedure, an analysis of variance was performed on 29 consecutive track counts taken in the Marine Corps Supply Center enclosure, Albany, Georgia, during October of 1960, 1961, and 1962. The deer population level was the same during each count, yet the variation in track crossings between the counts (experimental error) was so high that the formula indicated 37 replications per year would be necessary to detect a 20 percent change in population size at the 5-percent level of significance. One reason for the large variance, and consequently large sample size requirement, was the small number of crossings (19 to 66) counted per day.

No accurate estimate of how many consecutive deer track counts to make is possible until the second year of sampling has been completed. We know of no statistically sound method for selecting the proper sample size based on 1 year's data, yet some decision must be made about how many samples to take. Obviously, it is impossible to go back in time to take additional counts if the first year's sampling is inadequate. However, the formula $N = \frac{S^2 t^2}{d^2}$ from Snedecor (1950:456-458) may be used as a rough estimator, where:

N = number of samples required.
s = standard deviation of the daily total (variance).
t = normal deviate at confidence limit level and degrees of freedom (based on initial sample size).
d = margin of error (arithmetic mean of the daily total times designated percent accuracy).

The primary use of the formula is in determining sample size needed to predict the mean within certain limits of probability. We applied this formula to the 17 counts made in October 1961 at Albany, Georgia, and found that the estimated 37 counts needed to estimate the mean within 10 percent at the 5-percent level of significance is identical to the number of annual counts necessary to detect a change of 20 percent between years. Thirty-seven counts seems to be an impractical requirement. This number might have been reduced, however, if the daily tally had been larger.

The following example shows the effect of larger daily counts on sample size. Analysis of unpublished data from the Citrus Wildlife Management Area in Florida showed that where only 9 miles of road were surveyed (126 to 207 crossings per day), 21 consecutive counts would be required to predict the mean within 10 percent at the 5-percent level of significance. If the count were extended to 18 miles (230 to 364 crossings per day), however, only 13 counts would be required.

If statistical analysis of 2 or more years' data shows no difference between years, it must be concluded that no change, within the limits of sampling intensity, has taken place. When conducting track counts, the following two factors will have to be assumed for any 1 year's count: the deer population has not undergone a change between counting days, and no unusual disturbance affecting deer movement has occurred. If habitat conditions or seasons change, counts may not be comparable.

CONCLUSIONS

Before any reliance can be placed on the track count census method, enough counts will have to be taken to compensate for day-to-day variability. This may, in some instances, be more than is practical. However, when it is possible to take the required number of samples, the technique may: (1) Detect population changes if there are no distributional changes in the herd, and (2) demonstrate deer presence to the public. On a number of occasions in Florida, sportsmen claiming there were few deer on a particular area have been shown otherwise by the use of track counts. Unnecessary restrictive measures were therefore squelched before they were enacted into law. Track counting is a practical, though time-consuming, technique. Under ideal conditions, one man can count twenty 1-mile transects per day. Where populations are high, only a small number of daily counts may be needed.

LITERATURE CITED

Brunett, Louis E., and Lambou, Victor, W. 1962. A test of track counts as a measurement of deer population size. Proc. 16th Annu. Conf. Southeast. Assoc. Game and Fish Com. pp. 29-31.

Downing, Robert L., Moore, William H., and Kight, Joe. 1966. Comparison of deer census techniques applied to a known population in a Georgia enclosure. Proc. Southeast. Game and Fish Comm., Tulsa, Okla. pp. 26-30. Reprint.

Snedecor, G. W. 1950. Statistical methods. Iowa State Press. Ames, Iowa, 485 p.

Steel, Robert G. D., and Torrie, James H. 1960. Principles and procedures of statistics with special reference to the biological sciences. McGraw-Hill Book Company, Inc., New York, N. Y. pp. 481.

Tyson, Edwin L. 1952. Estimating deer populations from tracks. Proc. Southeast. Assoc. of Game and Fish Comm., Savannah, Ga. (Mimeographed 15 pp.)

———— 1959. A deer drive vs. track census. Trans. N. Amer. Wildl. Conf. 24:457-464.

Wright, Charles W. 1951. Roadside track counts as a census method for white-tailed deer in southern New Jersey. U. J. Division of Fish and Game, Trenton, N. J. 1-12 pp. Mimeographed.