

MICHIGAN DEPARTMENT OF CONSERVATION
Game Division

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Further Studies of Deer Census Methods in the Rifle River Game Area

Introduction

The Rifle River Area is a seven-square-mile research unit of typical Michigan deer cover, located in the northeastern part of the lower peninsula. This area was the site of a deer census method study during the fall of 1953, which was continued in the fall of 1954 and is the subject of the present report. The 1953 study was written up under Game Division Report No. 2020, dated July 28, 1954.

The study area is enclosed, except for one entrance, and all hunters are required to report at a checking station upon entering and leaving the area. In this way, records of hunting pressure, game take, biological information and other data have been compiled since the study area was set up in 1945.

Methods

Six census methods were studied: Walking strips, shining, track counts, drives, the DeLury method and sex and age ratios. Strip counts were made by walking established lines through the different cover types in proportion to their occurrence in the study area, and recording the observed distance to each deer flushed, the cover type it flushed from, and certain other pertinent information. The lines were walked several times before and after the hunting season.

Shining counts were made by three men from a pickup truck on all roads in the study area (closed to public use at night) at a speed of about 10 miles per hour. Two sealed-beam spotlights were operated--one from the rear of the pickup, the other from the right-hand cab window. The third man drove and recorded, so that the other two would be free to make as complete a count as possible on both sides of the road. Distances from the observer to the deer were estimated to the nearest ten yards with regular checks by pacing. The type of cover in which each deer was observed was recorded as either open, upland wooded, or lowland wooded (swamp), because of the effect of cover density on visible range. Several pre-season track counts were made by counting nightly crossings made on certain road segments which could be easily worked with a spring-tooth harrow. Post-season counts were not made because the roads were frozen and snowfall was too irregular for consistent counts.

Data for the DeLury method were collected by recording daily hunting pressure and kill information. Further breakdown of the data was not attempted because results of the 1953 study indicated that there was no advantage in doing so.

Sex and age ratios were collected before and after hunting season by observations made in the strip and shining census methods. Binoculars were used to aid in identification.

Deer drives were made on three different areas of upland cover by placing watchers in strategic positions to count deer as they were driven out by a line of drivers.

Analysis of Data

In analyzing the strip census data, four alternatives were used to obtain population estimates. The Hayne (1949) modification of the strip method gives the highest estimates, and the method devised by Kelker (1945) gives the lowest. Hayne's method computes a population density for each flushing distance and adds them to get the total population estimate. Kelker's method applies the population density observed within a strip of known width, in which it is assumed that all deer are seen to the area as a whole. The effect of density of cover on observed flushing distances was corrected by computing a population for each of the three general types (open, upland wooded and lowland wooded).

Two variations of the King (1937) method were also used. In one, the doubled average of all flushing distances was used to determine the width of strip on which all observations were made. The total number of deer seen are then assumed to constitute the population of this strip, and the same density is applied to the area as a whole. The other variation of the King method computes a population as above for each cover type, and these are then combined in the same proportion as the cover types occur on the study area. An estimate is also made by using the ratio of deer seen per mile before and after the hunting season. Population estimates and confidence limits for each method are listed in Table I.

Table I
Population Estimates and Confidence Limits for Strip Census Methods

Method	Pre-Season* Estimate	Confidence Limits	Post-Season* Estimate	Confidence Limits
Hayne	31	± 48%	12	± 65%
King	23	± 44%	10	± 53%
King (by cover types)	27	± 37%	10	± 58%
Kelker	14	± 50%	5	± 90%
Deer per mile	27	± 100%	--	--

*Deer per square mile

The techniques applied to the strip census data were also used to convert shining information into population estimates, except that the King method was applied by cover types only. Table II shows the results of the shining techniques.

Table II
Population Estimates and Confidence Limits for Shining Census Methods

Method	Pre-season* Estimate	Confidence Limits	Post-Season* Estimates	Confidence Limits
Hayne	58	± 29%	24	± 36%
King (by cover types)	46	± 29%	22	± 37%
Kelker	30	± 29%	12	± 38%
Deer per mile	27	± 69%	--	--

*Deer per square mile

No population estimate could be made directly from 1954 track counts because of the lack of post-season data. A comparison of the pre-season counts, however, with the 1953 pre-season counts on the same road segments shows a 30 per cent drop in activity. Since the 1953 pre-season population was estimated at 40 to 45 deer per section, this would indicate a comparable population of 30 for 1954.

DeLury's (1947) methods of correlating hunting success with cumulative kill and plotting the logarithm of catch per unit of effort against cumulative effort were used to estimate the pre-season buck population. This is computed at 38 by the former and 6 by the latter method for the entire study area.

Since the known buck kill was 37, a pre-season estimate of only 6 is unreasonable, and an estimate of 38, although possibly correct, seems somewhat low. However, a kill of 6 bucks per section with a deer population of 30 per section, would indicate a sex ratio of at least 1 buck:4 other deer. An increase of 1 buck per section would jump the ratio to 1:3.3. It is improbable that a ratio larger than 1:3 existed before the season.

Sex and age ratios were found to be practically useless because of limited post-season observations. One equation, however, which requires only age ratios before and after the hunting season was found to give a reasonable estimate of the pre-season population, as follows:

$$P = \frac{J_2 K - K_J}{J_2 - J_1} \quad (\text{Petrides, 1949})$$

$$= \frac{(.55)(82) - 19}{.55 - .41} = 30/\text{mi}^2$$

where J = proportion of juveniles in total population

K = kill

Subscripts 1, 2, J = pre-season, post-season, juveniles respectively

Drives on three areas totalling .85 square mile indicate an early November population of 64 deer per section this year, compared with 60 per section counted in October 1953 on two of the same drive areas (totalling .393 square mile). The drive areas are composed of aspen (66%), oak (27%), and coniferous swamp (7%).

Conclusion

The results of the 1954 strip census techniques duplicate closely the estimates made by the same techniques in 1953. In both studies the Hayne modification gave the highest estimates and had the highest standard error. The King method as ordinarily used gives the lowest estimate (except Kolker's method in 1954) and has the second smallest standard error. The King method applied by cover types yields estimates most comparable to those of other methods and has the lowest standard error in both studies. The Kolker method, which was not applied in the 1953 study, underestimates the 1954 population both before and after the open season.

In comparing the results of the two years' studies, it seems that the strip census technique most accurate and consistent in its estimates is the King method applied by cover types.

Shining estimates by the King method tend to overestimate the population in both 1953 and 1954. The reason for the overestimate in 1953 was thought to have been caused at least in part by using perpendicular distances from shining routes to deer in determining the effective width of strip. In 1954, the distance from observer to deer was used, but the estimates still seem to be too high.

Kelker's method applied to the shining data, however, yields estimates very similar to the King (by cover types) strip census results and compares very closely with results of other methods. Pre-season and post-season estimates by the Kelker method compare favorably with the known kill in both 1953 and 1954.

The Hayne modification consistently offers higher estimates than any of the other methods. Deer shined per mile before and after the season when correlated with the known kill yields a pre-season estimate comparable with the Kelker estimate, but is subject to a very high standard error.

Pre-season track counts on the same routes seem to correlate well with the population density from one year to the other. Reasonably consistent post-season counts, however, could not be obtained in the 1953 study because of the very low population and no counts at all were made in 1954 because of weather conditions. In view of this, it may be concluded that the usefulness of track counts is limited to a population index, since post-season counts cannot be relied upon.

DeLury's regression of hunting success against cumulative catch estimates the pre-season buck population at one animal more than the known kill in both the 1953 and 1954 study. Although very high hunting pressure was exerted on the study area both years, it seems unlikely that such a high percentage of the bucks could be taken. Since this method requires a good sex ratio to be used to estimate total deer numbers, its use as an extensive population technique is rather limited.

Sex and age ratios obtained from different sources in the 1953 study were found to indicate different herd compositions. For this reason only the two better sources (strip and shining counts) were used and the ratios obtained by them were nearly the same. Observations of bucks, however, did not occur at a rate consistent with the number that must have been present to provide the open season kill. This lack of buck observations definitely reduces the value of the sex ratio method in determining deer populations. Age ratios, however, give a reasonable pre-season estimate for 1954.

The 1953 drives indicated a population comparable to the estimates obtained from other census methods used in the study. The 1954 drives, however, resulted in a number considerably higher than what could be considered a reasonable estimate in view of the results of the other census methods.

The reason for the high estimates by this year's drives may be the result of a chance occurrence of more deer on the drive areas at the time of the drives, or because of an exaggeration of the number of deer seen by the participants in the drives.

Since most of the participants had experienced the same censuses the previous year, and all seemed sufficiently aware of the correct procedure for counting deer, it does not seem likely that the apparent inflation of deer numbers was a result of deliberate exaggeration.

The estimates made by the drives and most of the other census methods differ by about 100 per cent. A discrepancy of this size, however, is commonly observed in the results of almost any of the census methods when repeated samples are taken of presumably, the same population.

It may therefore be stated that to obtain a conclusive estimate of the deer population of a given portion of the Rifle River Area by the drive method, more than one sample should be taken from that area.

Summary

The census techniques found to be most consistent and which agree best with known data are the King strip method by cover types and Kelker's method adapted to shining data. Track counts and deer seen per mile of strip walking or shining may be useful as indices. It would appear that the method most applicable to censusing deer over large areas would be the Kelker shining method, since it would not require as much effort as strip walking to sample all types of cover.

Drives may provide accurate deer numbers for a given area at a given time but this method is probably subject to sampling error, as are all other census methods used in this study.

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