ADAPTABILITY OF NORTHERN TECHNIQUES FOR RUFFED GROUSE CENSUS IN KENTUCKY

FREDERICK C. HARDY, Department of Fish and Wildlife Resources, Frankfort, Kentucky

Proc. Annu. Conf. Southeast. Assoc. Game & Fish Comm. 6:518-526

As a part of ruffed grouse *(Bonasa umbellus)* investigations conducted in Kentucky during the period 1949 - 1952, an effort was made to secure information on population levels and trends. To effect this objective four inventory methods or modifications thereof, commonly used in the Northern States, were tested for adaptability to local conditions.

METHODS

Six localities were selected for census studies. Four areas were located within range occupied by native grouse populations in Eastern Kentucky; two were located at the sites of recent introductions of Wisconsin grouse in Central and Western Kentucky. One Eastern Kentucky area was utilized for testing all techniques; the remaining areas were censused with one method only.

The Beaver Creek Wildlife Management Area, the area selected for the testing of all methods, contains three work units designed for the operation of the different techniques. A rectangular strip census area containing 1920 acres was established near the center of the management area and divided by grid lines into square forty-acre blocks. An area containing approximately 800 acres was located within the strip census tract and was used for area drumming site counts and nest and brood counts. A ten-mile roadside drumming count route was established on the management area, with portions of the route running through the 800 and 1920 acre tracts.

Ten-mile roadside drumming count routes were established on the 5 additional areas.

General location of study areas is shown in Fig. 1 and 2.

Direct Count Methods

An area drumming site count as described by Frank (1947) was used in estimating the number of ruffed grouse available for breeding on the 800 acre Beaver Creek study area. The method involves the association of all drumming activity heard with sites or territories comprising one or more drumming objects. The resulting total of active sites was used with an assumed 1:1 sex ratio in estimating the breeding population of the area. In applying the technique on Beaver Creek it was found necessary to continue observations throughout the season in order to reduce errors to a minimum. During the early part of each drumming season all drumming males were stalked in an effort to observe the drumming act or to flush the bird from the drumming object. Once the observer became familiar with initial drumming locations subsequent stalking was necessary only to detect expansion of the number of objects used within the site, and to confirm individuality from neighboring sites.

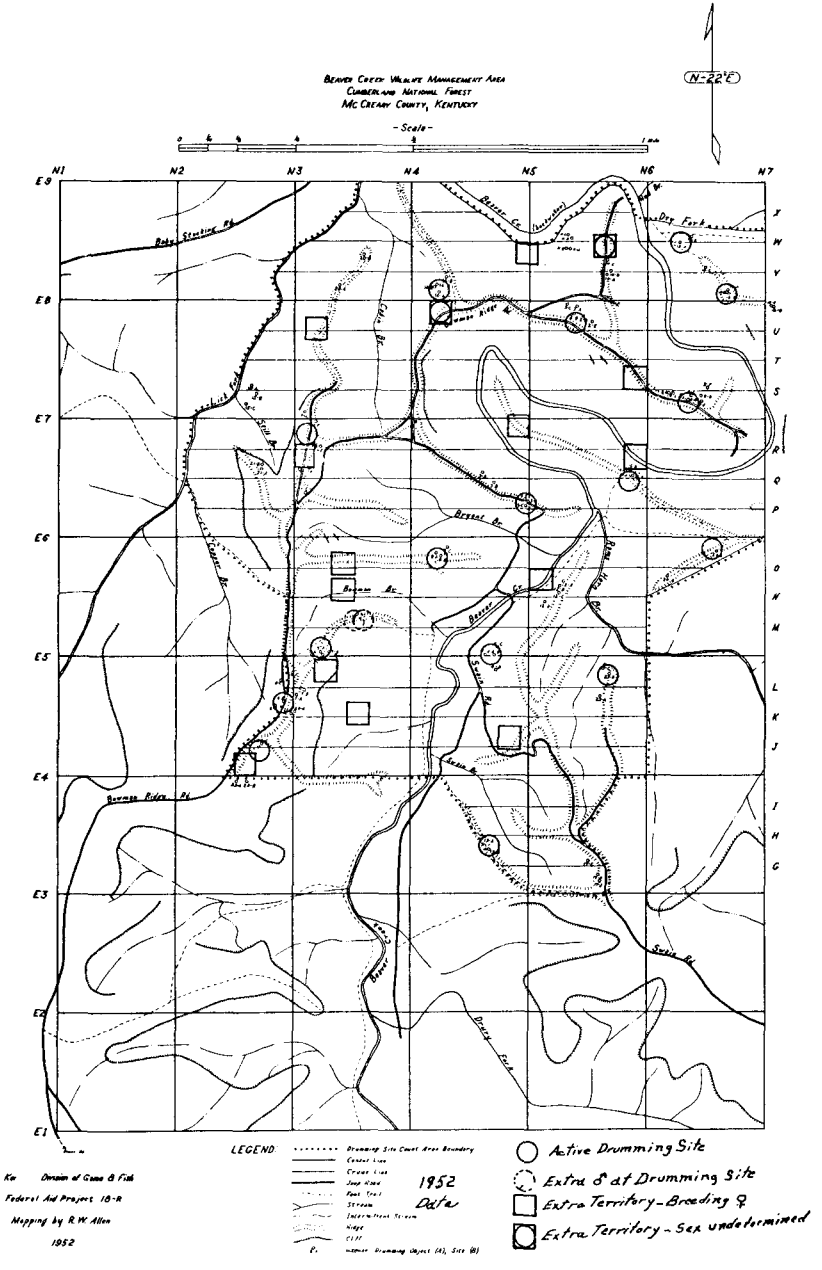

Fig. 1. Beaver Creek ruffed grouse study area (strip census and drumming site count area).

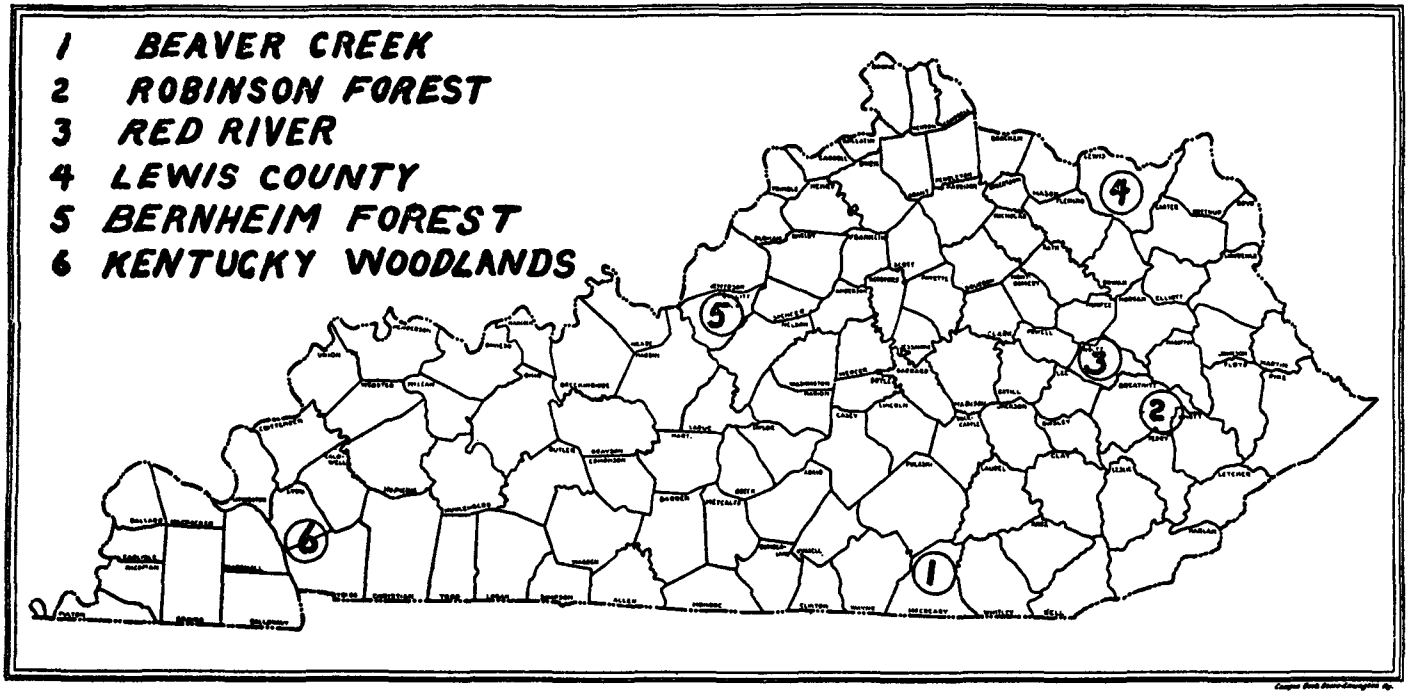

Fig. 2. Ruffed grouse roadside drumming counts, Kentucky, Spring 1952.

Mirror decoy box traps modeled after one described by Tanner and Bowers (1948) were used at all sites during the last two years of the study to check reliability of results of the drumming site counts.

In an effort to secure a total adult breeding population figure for a specified area, a method similar in principle to the territory count described by Bump et al. (1947), was used. The method, area adult territory count, as employed on the 800 acre Beaver Creek study area, involves the combination of two sets of data gathered during different parts of the breeding season. The bulk of male territories was recognized during the early spring as a result of the drumming site count described above. In addition, certain other "territories," including extra birds at drumming sites and birds identified as females by external characteristics, were recognized during this period. Female territory data were obtained later in the breeding season by continuous systematic coverage of the area with nest and brood cruises. By following this procedure the necessity of systematic cruising during the early spring was eliminated and, by the same token, birds encountered on summer brood cruises which could not be readily identified as females, could be ignored. The resulting composite figure is, of course, more indicative of spring population than those occurring at the end of the reproductive season.

Nest and brood counts were made by a crew, averaging 5 men, which walked parallel lines through the various work units comprising the study areas. A special effort to locate nests, as well as broods, was made during most of the 1951 season. A procedure, involving the use of a 20-foot walking interval, plus considerable cross movement to inspect tree bases and other objects, was followed. Since only one nest was found and since the area was covered an insufficient number of times, this procedure was deemed impractical for further use, and results of the count were considered incomplete. During the 1952 season (May 1 to September 18) crews, walking in relatively straight lines at intervals of approximately 40 feet, were able to completely cover the area 10 times. By using the latter procedure, adequate coverage of brood territories was obtained and 5 nests located.

Sampling Methods

The King strip census as described by Fisher (1939) was used, with certain modifications, in estimating spring populations on the 1920 acre Beaver Creek study area. Grid lines which divide the area into forties were walked by crews of from 3 to 15 men. Flushing distances of grouse encountered and total length of lines walked were used in determining the area sampled. In computing populations a formula, suggested by Hayne (1949), was used. The formula, which considers flushing distances individually rather than as an average, is as follows:

$$N_t = \frac{C}{2L}\left(\frac{F_1}{d_1} + \frac{F_2}{d_2} + \frac{F_3}{d_3} + \ldots + \frac{F_n}{d_n}\right)$$

N_t = Estimate of total population per unit area.
L = Length of observer's path.
$d_1 d_2 d_3 \ldots d_n$ = The various flushing distances observed.
$F_1 F_2 F_3 \ldots F_n$ = Numbers of animals observed to flush at the corresponding flushing distances.
C = Conversion factor where units are not comparable.

An automobile drumming count described by Petraborg (1949) was used in estimating density of drumming male grouse on areas larger than that used for the area drumming site count. The method consists of counting drummings heard at a series of stops made at one-mile intervals along motor roads during the peak of the spring drumming season. In applying the method in Kentucky, the suggested stop length of 4 minutes (average drumming interval) and audibility radius of one-quarter mile were used. The length of the route, however, was shortended from 15 to 10 miles. The area sampled by each route was computed as follows:

$\frac{1}{4}^2 \times 3.1416 \times 10 =$ square miles samplied in 10 stops.

RESULTS

Direct Count Methods

Area drumming counts were made on the 800 acre Beaver Creek study area during the spring seasons of 1949, 1950, 1951 and 1952. Results of these counts are shown in Table 1.

Table 1. Ruffed grouse area drumming counts on the Beaver Creek study area (800 acres), 1949 - 1952.

Year	Number Males	Acres Per Male	Acres Per Bird[a]
1949	18	44.7	22.3
1950	17	47.0	23.5
1951	18	44.7	22.3
1952	16	50.0	25.0

[a] Assuming a 1:1 sex ratio.

Distribution of drumming sites on the area during the spring of 1952 is shown on Fig. 1.

Spring drumming site counts have indicated little change in the breeding male population over the four-year period. The lowest figure, that obtained in 1952, was possibly influenced by the loss of two adult males in trapping accidents during the pervious fall.

Several possible sources of error in the use of the site count method, including both the relation of the count to the male population and the relation of the count as applied to the entire population, have become evident.

The chances of overlooking a site during a season-long study on an area of such small size apparently are very small. Such an error was made in 1949, however, when the site of sporadic drumming activity heard midway between two active sites was not located until summer. The individuality of the site was confirmed during the fall and following spring when drumming was heard simultaneously at the three locations.

The possibility of erroneously attributing individual site value to portions of the same male territory and the possibility of multiple use of individual sites was investigated through the use of mirror-decoy traps. Trapping operations during the spring seasons of 1951 and 1952, involving a total of 27 catches at 15 sites, revealed only two instances of one grouse using more than one site and in these

instances an extension of range to cover unoccupied territory was strongly indicated. On the other hand, one instance of multiple use of what had been considered one site since 1949 was recorded during the spring of 1952. From the data at hand, it appears that, normally, a drumming territory will be used actively at any one time during the spring by only one male and that where they occur cases of abnormal behavior are as likely to distort results in one direction as in the other. The high incidence of multiple use of sites, as indicated by fall trapping results, apparently disqualifies the drumming site count as a technique for estimating fall populations or for estimating over-summer survival of the spring male population. A total of 21 (15 adults and 6 birds of the year) males were taken in operations at 15 of the total 20 active sites found on the fall count of 1951.

Possibly the most serious error could arise from the use of an assumed sex ratio or a sex ratio derived from hunting season results. Despite the knowledge that, normally, adult grouse sex ratios tend to be equal, or that region-wide sex ratio data are available, the application of this information to any specific small portion of the region is not logically justified. If full advantage is to be taken of a method designed to give population estimates of a fairly high degree of accuracy, it follows that more specific means of measuring the remainder of the population is required.

From these data, it appears that the drumming site count is a fairly reliable method for measuring male populations on small areas in Kentucky. The method is not recommended as a sole technique for indicating total populations. The large amount of effort required to properly census a small area restricts the method's use to that of a research tool.

Area adult territory counts were conducted on the 800 acre Beaver Creek study area in 1951 and 1952. Results of these counts are shown in Table 2.

Table 2. Area adult territory counts on the Beaver Creek study are (800 acres), 1951 and 1952.

Year	Territories			Acres Per Bird
	Male	Other	Total	
1951	18	16 (8 [b]) [a]	34 (26)	23.5 (30.7)
1952	16	15 (13)	31 (29)	25.8 (27.6)

[a] Breeding females.
[b] Incomplete.

Distribution of the various territories recording during the 1952 season is shown on Fig. 1.

Use of the territory count on the Beaver Creek Area has resulted in two separate figures distinct from the male population figure obtained from the drumming site count. The figure resulting from season-long counts represents the total number of known adult birds in excess of the active males. Although there is a possibility that a few inactive or "extra" males were included, it was felt by the observers that a great majority of these territories represented female grouse. The figure resulting from observations of nests and broods represents the known breeding female population. Both figures are probably conservative, since all single flushes in the vicinity of drumming sites, and since observers have been reluctant to distinguish between brood flush sites not well removed from each other or separable on the basis of age or size differentials.

While the method is limited, in that counts both during the drumming season and during the brood cruise season may be incomplete, it is felt that season-long efforts will produce fairly accurate results on small areas. This method is probably the most effective technique available for intensive studies of population density and reproduction. Like the drumming site count, it is too time-consuming for region-wide application.

Sampling Methods

Strip censuses of the 1920 acre Beaver Creek study area were made twice each spring during the years 1950, 1951, and 1952. Results of the censuses and other pertinent data are shown in Table 3.

Table 3. Strip census results on the Beaver Creek study area (1920 acres), 1950 - 1952.

Year	Date	Length of Lines	Grouse Flushed	Flushing Distances	Est. Pop.	Acres Per Grouse
1950	March 28	141,680	3	27, 58, 155	18 (17.9)	106.8
	April 6, 7	143,380	6	211, 54, 66, 45, 94, 49	26 (26.5)	72.3
1951	March 28	139,920	6	62, 25, 30, 30, 62, 42	49	39.5
	April 3	139,920	4	55, 78, 30, 65	24	80.6
1952	March 26	133,440	3	21, 24, 87	31 (31.5)	60.9
	March 27	127,618	8	27, 27, 35, 41, 42, 25, 50, 55	67	28.6

Results of individual censuses made during the same season are highly variable, with variations of approximately 100 per cent being recorded in 1951 and 1952. The population variation indicated by 1951 and 1952 results are contrary to results obtained from the drumming site and total territory counts. The population figure obtained March 27 (28.6 acres per grouse) is the only one of six figures so far obtained which is comparable to those obtained through use of other methods.

The strip method, as used in Kentucky, is apparently valueless for obtaining a true population sample. In order to increase the chances of properly sampling low populations, it would be necessary either to substantially increase the census area or to repeat the census several times during a short period of time. Considering the large number of census takers required for operating each census within the confines of periods of consistent weather and ground conditions, such an operation would be impractical.

Roadside drumming counts were conducted on the Beaver Creek Management Area in 1951 and on the Beaver Creek and 5 other Kentucky areas in 1952. Since the peak of the drumming season had obviously passed before the 1951 count was made, results of the count have been disregarded here. Results of 1952 counts are shown in Table 4.

Population figures derived from the roadside drumming counts indicated densities as high as one bird per 20.2 acres in Lewis County and as low as one bird per 44.9 acres on Robinson Forest. No results were obtained on the release

Table 4. Roadside drumming counts in Kentucky, 1952.

Route	Drummings Per 10 Stops	Est. Acres Per Grouse [a]
Beaver Creek	20	31.4
Robinson Forest	14	44.9
Red River	22	28.5
Lewis County	31	20.2
Bernheim Forest	0	
Ky. Woodlands	0	

[a] Assuming a 1:1 sex ratio.

sites in Central and Western Kentucky. The population figure resulting from the Beaver Creek count was regarded as conservative since listening at three stops within the drumming site count area failed to show the high drumming incidence noted during work earlier in the season. Even so, results do not vary greatly from those obtained from the drumming site and total territory counts.

Serious errors resulting from the improper timing of the counts can be avoided by a few preliminary checks to determine the approach of the peak of drumming activity and by making the counts on several consecutive days until comparable results are obtained on at least two days. From the drumming season data available, it appears that satisfactory results can be obtained from counts made during the latter half of April in all parts of the state.

There is some evidence that the effective range of audibility is slightly less than one-quarter mile in the type of topography now occupied by grouse in Kentucky. The possible error involved in this case will apply in the same manner to each year's results and should not seriously effect the method's value for showing population trends. Since the range of audibility probably will vary more at individual sites due to atmospheric changes than between different sites due to other conditions, the operation of the counts on several days each season should appreciably reduce errors made in determining relative population densities on the various routes. Intensive studies to determine audibility ranges under different conditions on all census routes probably would not be justified.

The chief disadvantage of the method, as is true of the area drumming count, is that it samples only a portion of the population, while data to complete the population estimate must be secured either several months prior to or several months after the drumming data are obtained. The method has been used chiefly with hunting season sex ratios in the North. The low hunter kill factor in Kentucky makes the collection of this type of data, in usable quantities, impractical. The use of state-wide nest and brood information obtained by roadside brood counts and by incidental observations of nesting success and brood abundance and size by all wildlife personnel seems to offer the best chance of providing a reproductive factor to supplement the spring data and to provide year to year indices for showing grouse population trends. Such indices would be more applicable to the adjustment of open seasons than would indices based on hunting results of the previous year.

Of the methods tested, the roadside drumming count offers the best means of measuring grouse population levels on a region-wide basis. If properly conducted in all major types and supplemented by sufficient data of a general nature on

reproductive success, the counts can be effectively used as indices for showing population trends of grouse in Kentucky.

CONCLUSIONS

1. The area drumming site count is a fairly reliable method for measuring male ruffed grouse populations on small areas in Kentucky, but is not recommended as a sole technique for indicating total populations.
2. The adult territory count probably is the most effective technique available for intensive studies of population density and reproduction on small areas in Kentucky.
3. The strip census method, as used in Kentucky, is apparently valueless for obtaining true samples of the existing low populations. Expansion of the census operation to increase chances of obtaining truer samples would be impractical.
4. The roadside drumming count technique, if conducted during the spring drumming season peak and if supplemented by sufficient breeding success data, is an effective means of establishing indices of population trends.

LITERATURE CITED

Bump, Gardiner, Robert A. Darrow, Frank C. Edminster, and Walter F. Crissey. 1947. The ruffed grouse, life history, propagation, management. New York State Conservation Department, Albany, N. Y. 714-716.

Fisher, Lee William. 1939. Studies of the eastern ruffed grouse in Michigan. Michigan State College, Agric. Exp. Sta. Bull. 166 pp.

Frank, William John. 1947. Ruffed grouse drumming site counts. J. Wildl. Manage. 11(4): 307-316.

Hayne, Don W. 1949. An examination of the strip census method for estimating animal populations. J. of Wildl. Manage. 13(2): 145-157.

Petraborg, Walter H. 1949. Roadside drumming census of ruffed grouse. Eleventh Midwest Wildl. Conf., Madison, Wisconsin. Abs. mimeo.

Tanner, Ward D., and Glenn L. Bowers. 1948. A method for trapping male ruffed grouse. J. of Wildl. Manage. 12(3): 330-331.