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BOBWHITE WHISTLING ACTIVITY AND POPULATION DENSITY ON TWO PUBLIC HUNTING AREAS IN ILLINOIS

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Abstract:

Eight years of data from 2 public hunting areas in southern Illinois demonstrate high multiple correlations (r = 0.97 and 0.84) for prebreeding densities and call indices with the prehunt densities of bobwhites (*Colinus virginianus*). Models derived from multiple correlation analyses produced satisfactory predictions of prehunt densities. The average number of calls per stop was the key element in the predicting model. The number of whistling cocks heard per stop is of limited value as an index because of difficulty in determining numbers when more

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than 7 whistling cocks are within hearing. The models for the 2 areas appear different, but this possible difference cannot be satisfactorily confirmed on the basis of data for only 8 years.

This paper discusses the correlation between audio-census indices and fall population densities of bobwhites on 2 public hunting areas in southern Illinois during 1964-71. In Illinois, counts of whistling bobwhites have long been used as indices of summer abundance (6). Norton et al. (5) evaluated published data relating to the use of whistle counts as indices of fall quail populations from Missouri, Indiana, South Carolina, Alabama, Iowa, and southern Illinois and concluded (p 403): "In the several sets of data we examined, there was little indication that year-to-year changes in numbers of whistling cocks in summer was predictive of autumn populations, and hence only a relatively small portion of the variance could be explained."

The data evaluated by Norton et al. (5) used the number of individual males whistling as the basis for their predictions. In our analysis, we have evaluated the number of bobwhite calls per listening stop and the prebreeding census data, as well as the numbers of whistling cocks, as bases for predicting fall populations.

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Methods

Data on quail population density and whistling were collected on Stephen A. Forbes State Park (2,930 acres), Marion County, Illinois, and on Sam Dale Lake State Park (1,300 acres), Wayne County, Illinois. Detailed descriptions of these areas and the management programs employed for upland game have been published (2). Upland game management on these areas has remained unchanged except for the incorporation of a 260-acre portion of the Dale area in 1970 and a 250-acre segment of the Forbes area in 1968 into a sharecropping program including corn (Zea mays), soybeans (Glycine max), and wheat (Triticum aestivum). The Dale area is located in a more extensive area of high-quality quail range than is Forbes. The Forbes area is surrounded on 3 sides by relatively flat, gray-prairie cropland that is devoid of the brush and woodlands essential for quail habitat of high quailty.

Audio-Censuses

Audio counts of quail were made at approximately weekly intervals along a standardized route on each area from mid-May to mid-July during 1964-71 (Table 1). The censuses began at sunrise on mornings when the wind velocity was less than 7 mph and the cloud cover was less than 75%. Counts of 2-minutes duration were made at each stop. The number of bobwhite calls, and as many of the individual whistling cocks as could be distinguished, were recorded. It was difficult to identify the number of calling cocks when more than 7 individuals were whistling, as was frequently the case. When there were more than 7 cocks whistling, we recorded the count as 7-plus cocks, along with the total number of calls. We concentrated on counting accurately the total number of calls. Actively calling cocks whistle every 12-20 sec or 6-10 times per 2 min, with each call lasting about 2 sec. When more than 7 whistling cocks are within hearing distance, calling is virtually continuous.

The census route of 6.25 miles, including 6 equidistant stops, on the Dale area was established along the public road bordering the area. The census route measured 6.14 miles on the Forbes area, with 2 stops located on the public road that bordered the park and 6 equidistant stops along the main park road. Thus, on a portion of the census route on Forbes and along the entire route at Dale, whistling quail both on and adjacent to the study areas were recorded during the audio-censuses. No distinction was made as to the location of whistling cocks relative to boundaries of the areas.

Population Estimates

The areas were censused during early November (prehunt), early January (posthunt), and early March (prebreeding), with bird dogs to locate coveys of quail. Harvest data were recorded at compulsory hunter check stations located on each area. Two methods were used to derive estimates of the prehunt populations: (1) prehunt censuses, using bird dogs, and (2) adding the numbers of birds harvested to the posthunt census figures obtained after the hunting season. The latter method was considered more reliable during periods of high population densities. However, both methods tend to underestimate the population, the first because of missed coveys and the second because of known crippling losses and natural mortality. Under low densities, census data can be adjusted for coveys that are routinely observed but missed during the census; this adjustment is not possible at high densities.

Analysis of Data

Census data were evaluated using multiple correlation analysis performed by computer facilities of the University of Illinois, Urbana. In the analysis, the estimates for the prebreeding census, average whistle counts, and average numbers of whistling males were treated as independent variables and the prehunt population estimates as the dependent variables.

Findings

Although data for only 8 years (Table 1) were available for analysis, it is obvious from the single-factor correlation coefficients that call counts have been closely correlated with prehunt quail density, particularly on the Dale area (Table 2). Multiple correlation coefficients indicated that about 94% of the annual fluctuation in the prehunt population estimates for quail on the Dale area and 71% for the

Forbes area were associated with changes in the prebreeding census and audio indices.

The unstandardized regression coefficients for the 3 independent variables (Table 2) appear different for the 2 areas. Tests of differences between areas for the 3 independent variables failed to reject the hypothesis of no significant difference. However, because the analysis was based on data for only 8 years, it is not fitting that we proceed on the assumption that no significant difference existed, or that if a difference existed, it was of no real consequence.

Models for predicting prehunt quail density from prebreeding census and audio counts were derived from the analysis. For the Dale area the prehunt quail density is predicted as:

$$\hat{Y}_{Dale} = 15.934 - 0.42848X_1 + 2.9593X_2 - 10.269X_3$$

and for the Forbes area:

$$\hat{Y}_{Forbes} = 4.9003 + 0.82404X_1 + 0.64895X_2 + 0.33379X_3$$

where X_1 is the number of bobwhites per 100 acres in the prebreeding population, X_2 is the average number of quail calls per 2 min on the audio-census of quail, and X_3 is the average number of whistling males per 2 min.

There was good agreement between quail densities predicted using the above models and the densities estimated from censuses of the 2 areas (Table 3).

Discussion

In a discussion of the reproductive calls of the bobwhite, Stokes (10) noted that the bobwhite call is purely sexual in function, unmated males and those separated from their mates for several hours use the bobwhite call, and the female "hoy-poo" call elicits bobwhite calls from males. The duration of the intervals between successive whistles by an individual male probably varies as a function of the motivational influences.

Some investigators (1,9) reported that summer whistling cocks represent surplus (nonmated) males. Our observations, as well as those of Rosene (7) and Kabat and Thompson (4), suggest that both mated and unmated cocks whistle during the period of calling. Observations of cock-hen pairs along the census routes near the listening stops indicated that these males did not whistle. We believe that the majority of cocks whistling during the period from late May to mid-July were those whose mates were tending nests--probably incubating. This contention is supported by data obtained from juveniles (ages were determined by wing molt) taken by hunters. The majority of juveniles harvested during the first 7 days of each hunting season were from nests that were incubated from the first week of June to the third week of July (Ellis, unpublished data).

The close correlation between whistle counts and the abundance of quail in the fall suggests that fall populations depend primarily on the number of birds available during the breeding season. No tendency towards inversity, as demonstrated for Wisconsin quail (3), was noted in this study. We believe, as does Rosene (8), that the audio-censuses reflect the quality of nest cover on an area and that variations in nest success and juvenile mortality are minor factors in determining year-to-year fluctuations in quail numbers in the fall. Thus, winter survival of quail and winter carrying capacity appear critical in quail management on the Dale and Forbes areas.

At this time, we can only hypothesize why other workers have not found strong correlations between audio counts and quail abundance in fall. One possibility is that reproductive success of quail on private land is more variable than on managed public hunting areas. Another possibility is that the quail harvest size often used as an index to quail abundance in fall is influenced by factors such as crop harvest and weather during key segments of the hunting season and thus is a biased index of quail density.

The lack of a stronger correlation between the prebreeding and prehunt censuses is also a puzzle. One possibility is a reorientation of quail in April and early May to better nesting situations and in response to social interactions involved with the breakup of coveys. This idea supports the concept that calling activity reflects the quality of summer range (that is, the quality of available nesting cover), whereas the prebreeding census reflects the quality of winter range.

Use of the prebreeding estimates and the average numbers of whistling cocks did little to increase the accuracy of our predicting models. If the objective for conducting spring and early summer censuses of bobwhites is primarily to predict fall populations and harvest, there appears to be little reason to census prebreeding populations or, under situations of high density, to attempt to determine numbers of whistling cocks during routine call counts. However, if data on prebreeding populations and whistling cocks are readily available, it is only logical to include them in a predicting model.

The matter of whether the unstandardized regression coefficients differ significantly among areas is of considerable importance. If they do not, it will ultimately be possible to develop a single predicting model that will allow prehunt quail densities to be estimated for an area by using only standardized audio counts made on that area. A single predicting model would have great utility in both management and research.

If the relationship between audio counts and prehunt populations differs among areas, or changes over a period of years on a particular area, it will be necessary to develop predicting models for individual areas and perhaps refine them on an annual basis. Several more years or data and information from other areas are needed before final decisions can be made on techniques for predicting prehunt quail density from audio counts. However, for now, we conclude that on public hunting areas in Southern Illinois, carefully standardized call counts will provide reliable indices to the relative abundance of bobwhites in the fall on the area censused.

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Table 1. Summary of quail census estimates and audio indices for the Dale and Forbes areas, 1964-71.

Year	(1) Prebreeding census	(2) Avg. calls per stop	(3) Avg. whistling cocks per stop	(4) Prehunt census
Dale area				
1964	4.3	20.0	4.9	26.9
1965	3.8	15.4	3.9	18.5
1966	3.5	21.6	4.6	29.7
1967	7.8	28.3	5.5	36.4
1968	9.4	29.9	5.2	49.7
1969	12.7	29.0	5.3	41.7
1970	10.0	27.1	5.4	37.1
1971	10.5	25.5	5.7	27.4
Forbes area				
1964	5.3	12.1	3.9	18.2
1965	3.4	5.7	1.5	9.4
1966	1.9	8.0	2.3	14.2
1967	4.9	17.4	4.0	27.1
1968	4.8	27.6	5.2	33.3
1969	7.3	26.9	5.0	26.1
1970	4.6	18.5	4.2	23.3
1971	3.1	21.4	4.8	16.3

Table 2. Summary of results of multiple correlation analysis using (1) the prebreeding census, (2) average calls per stop, (3) average number of calling males with (4) prehunt census as the dependent variable. Data are from the Dale and Forbes areas, 1964-71.

Area	Forbes	Dale
Single factor correlation	(1) 0.61907	0.65551
	(2) 0.83206	0.90146
	(3) 0.79447	0.57654
Multiple correlation	0.84346	0.96968
F Ratio for multiple "r" (df = 3,4)	3.28707	20.99257
Standard error of estimate	5.5731	3.1657
Unstandardized regression coefficient	(1) 0.82404	-0.42848
	(2) 0.64895	2.9593
	(3) 0.33379	-10.269
Standard error of unstandardized regression coefficient	(1) 1.6439	0.63383
	(2) 0.78415	0.51192
	(3) 4.8023	3.9673
Standardized regression coefficient	(1) 0.17132	-0.15286
	(2) 0.67408	1.54519
	(3) 0.05600	-0.61132
Standard error of standardized regression coefficient	(1) 0.34178	0.22611
	(2) 0.81451	0.26730
	(3) 0.80570	0.23618
Dependent variable intercept	4.9003	15.934
t = Regression coefficient/standard error	(1) 0.50126	-0.67602
	(2) 0.82758	5.78075
	(3) 0.06951	-2.58841

Table 3. Summary of estimated prehunt quail density on the Dale and Forbes areas, 1964-71, with the density of quail predicted on the basis of multiple correlation analysis of the prebreeding and audio censuses. Density is expressed as quail per 100 acres.

Year	Forbes Estimated	Forbes Predicted	Dale Estimated	Dale Predicted
1964	18.2	18.4	26.9	23.0
1965	9.4	11.9	18.5	19.8
1966	14.2	12.4	29.7	31.1
1967	27.1	21.6	36.4	39.9
1968	33.3	28.5	49.7	47.0
1969	26.1	30.0	41.7	41.9
1970	23.3	22.1	37.1	36.4
1971	16.3	12.0	27.4	28.4