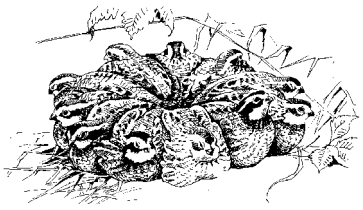

RESULTS OF FALL COVEY COUNT SURVEYS ON SELECT WMA TRACTS - 2022

INTRODUCTION

Reliable estimates of wildlife populations and population trends are essential in assessing the effects of management activities on target populations. Reliable estimates of populations may also be used in estimating harvest rates and refining hunting regimes for specific areas.

Historically, many techniques have been used to estimate bobwhite quail populations and population trends. These methods have included spring call counts by whistling males, mark-recapture techniques, flush counts, covey maps, brood surveys, harvest data, and age ratios. With the possible exception of mark-recapture techniques, these methods are poor estimators of fall populations, lacking accuracy and predictive ability of hunting success.

For quail, fall population (coveys) is the estimate of greatest interest, as this estimate is the best indicator of reproductive success, brood survival, and habitat suitability. Covey calls have long been recognized by quail hunters and quail researchers as a valuable technique for locating fall coveys. However, until recently covey calls had never successfully been used to estimate quail density as important parameters such as calling rate (percentage of coveys calling) had not been determined. Research conducted through North Carolina State University and Tall Timbers Research Station using radio-marked coveys has allowed calculation of calling rates and defined the most important variables affecting calling rates. As a result, fall covey counts are now being utilized by many researchers and state wildlife agencies as estimates of fall quail populations.

Fall covey count surveys are conducted annually on select Wildlife Management Areas (WMAs) as an estimate of fall quail populations. Surveys are conducted by personnel from the DNR Wildlife Section, the South Carolina Forestry Commission, the USDA Forest Service, the U.S. Fish and Wildlife Service, National Park Service, and volunteers. These surveys are intended to serve as a fall population monitoring technique for assessing quail populations, tracking population trends, and assessing the effectiveness of management practices conducted on select WMAs under intensive quail management.

METHODS

The Technique: Bobwhites emit a loud, clear whistle or series of whistles characterized as a "covey call" or "scatter call" and described phonetically as the "koi-lee" call. This call is given in early morning, likely as a territorial call between adjacent coveys. Typically, only one or two birds from an individual covey will call. Calling rates have been demonstrated to be a function of covey density, and are highest and most predictable in early fall when coveys are still forming and establishing their winter ranges. Table 1 illustrates calling rates as a function of calling coveys heard per observer. Counts are conducted between October 15 and November 25, with peak calling typically occurring approximately 25 minutes before official sunrise. Calling rates

and number of calls per covey are highest on clear, calm, high barometric pressure mornings. Dramatic changes in barometric pressure, cloud cover, and strong winds negatively affect calling rates, and covey counts should not be conducted when one or more of these conditions are present.

Covey counts are conducted by observers stationed at pre-selected listening posts at least 45 minutes prior to official sunrise. All observers are given the opportunity to become familiar with the covey call by listening to a recording of the call prior to conducting the survey. Observers record all coveys heard calling and plot calling coveys on a circular plot map. Time of first call, number of coveys seen, and other observations are also recorded. In order to minimize double-counting of coveys, observers are stationed at least 1000 yards apart. At this spacing, each observer has a 500-yard listening radius, equivalent to a circular area of 160 acres. Observers remain posted until 15 minutes after official sunrise. A post-survey briefing of all observers is conducted to delineate locations of calling coveys and eliminate possible double counts of individual coveys.

Population estimates and indices are constructed as follows:

coveys heard + coveys seen = **Coveys Counted**

coveys heard/calling rate = **Survey Area Covey Estimate**

(coveys heard/calling rate) / % acreage surveyed = **Total Area Covey Estimate**

(coveys heard + coveys seen) x 12 birds/covey = **Minimum Population Estimate (MPE)**

coveys heard/calling rate x 12 birds/covey = **Survey Population Estimate (SPE)**

[(coveys heard/calling rate) / % acreage surveyed] x 12 birds/covey = **Total Population Estimate (TPE)**

Table 1: Calling rate (number of coveys calling/total coveys) of bobwhite quail coveys in relation to number of coveys heard by individual observers in fall covey count surveys (from NCSU/TTRS research).

Calling Coveys Heard	Calling Rate
1-2	0.55
3-4	0.65
5-6	0.83
7-8	0.90
9-10	0.95
11-13	0.97
$\geq$ 14	1.00

Assumptions: As with any survey or census technique involving wildlife populations, there are several important assumptions that must be met to ensure accuracy and reliability of the technique and the resultant population estimates. Assumptions inherent in the technique as it has been utilized in this instance are as follows.

1. Observers can accurately identify and separate all individual calling coveys.

2. No coveys are double counted.

3. Quail covey density is uniform across the entire tract and unsuitable habitat is excluded from the total population estimate.

4. An average fall covey is comprised of 12 birds.

Assumption (1) was likely met regarding identification of calling coveys, as all observers were trained using recorded covey calls. Patterns of calling have been remarkably consistent as reported by observers, and observers are confident in their abilities to identify calling coveys. Separating calling coveys may be more difficult at higher densities (> 7 coveys/station), and observers are instructed to be conservative in their counts if doubt exists as to the exact number of coveys calling.

Assumption (2) is controlled through attempts to eliminate double-counted coveys through debriefing of observers following each survey and attempts to space observers > 2 listening radii apart. By using aerial photographs or sketch maps to identify coveys in common between observers, it is believed that double counted coveys were accounted for in the final calculations. Proper spacing between observers taking into account variable listening radii for different habitat types will further reduce the problem of double counting of coveys.

Assumption (3) is undoubtedly violated in the calculations of total population estimates for these surveys. Listening posts were selected in order to give maximum coverage to the surveyed area and were not stratified by habitat type. However, if the areas surveyed are fairly uniform in habitat characteristics, bias imparted through violation of this assumption should be minimal. This assumption can be better controlled in future surveys by stratifying observations by habitat types and constructing population estimates based on densities and areas for the varying habitat types within a given area.

Assumption (4) is a commonly held assumption among Southeastern quail biologists and, if biased, likely yields a conservative population estimate in most years.

2022 Survey: Between October 18, 2022 and November 17, 2022 fall covey count surveys were conducted on nine WMA's and the five bobwhite quail focal areas in South Carolina. The WMA's surveyed included the Indian Creek Restoration Area (October 18), McBee WMA (October 24 and 25), Canal WMA (November 9), Draper WMA (October 26), Webb Center WMA (November 17), Marsh WMA (November 3), Bonneau Ferry WMA (October 26), Bordeaux WMA (November 2) and Delta South WMA (October 28). The focal areas surveyed included the Indian Creek focal area (October 20 and 27), Oak Lea focal area (October 21), Carolina Sandhills focal area (October 18, 20, and November 8), Kings Mountain National Military Park (October 26), and the Webb Center focal area (November 3).

Results and associated calculations for all surveys conducted in 2022 are included in Table 2, Table 3, and Table 4.

Table 2. Covey counts and covey estimates for SCDNR WMA tracts surveyed using the fall covey count technique, 2021-2022.

Year	Area (# Observers)	Coveys Counted	Survey Area Covey Estimate	Area*	Total Area Covey Estimate
2021	McBee WMA (9)	42	44	1.13	39
	Webb Ctr. WMA (8)	1	2	0.41	4
	Bonneau Ferry WMA (4)	0	0	0.12	0
	Indian Cr. (USFS) (20)	30	30	0.70	43
	Canal WMA (2)	0	0	0.28	0
	Marsh WMA (8)	0	0	0.98	0
	Draper WMA (6)	3	5	1.19	4
	Delta WMA (12)	16	16	0.82	19
	Kings Mountain (5)	0	0	0.32	0
	Bordeaux WMA (6)	8	10	0.31	31
	Prices Landing (6)	0	0	0.09	0
	Webb Ctr. Focal Area (4)	0	0	0.24	0
	Webb Ctr. Ref. Area (4)	0	0	0.22	0
	Oak Lea Focal Area (5)	2	4	0.36	10
	Oak Lea Ref. Area (5)	1	2	0.26	7
	Indian Creek Foc. Area(5)	13	13	0.30	45
	Indian Creek Ref. Area(6)	6	7	0.35	21
	C. Sandhills Foc. Area(5)	11	11	0.30	37
	C. Sandhills Ref. Area(4)	0	0	0.27	0
2022	McBee WMA (9)	37	37	1.13	33
	Webb Center (9)	2	4	0.46	8
	Bonneau Ferry WMA (6)	0	0	0.18	0
	Indian Creek (21)	12	12	0.74	17
	Canal WMA (5)	0	0	0.70	0
	Marsh WMA (8)	1	2	0.98	2
	Draper WMA (5)	7	8	0.99	8
	Delta WMA (12)	6	11	0.82	13
	Bordeaux WMA (6)	8	9	0.31	28
	Kings Mountain (5)	0	0	0.32	0
	Webb Focal Area (3)	0	0	0.18	0
	Webb Ref. Area (5)	0	0	0.27	0
	Oak Lea Focal Area (5)	8	9	0.36	24
	Oak Lea Ref. Area (5)	2	4	0.44	8
	Indian Creek Foc. Area(5)	5	6	0.30	20
	Indian Creek Ref. Area(6)	3	5	0.35	13
	C. Sandhills Foc. Area (8)	4	6	0.48	13
	C. Sandhills Ref Area (4)	0	0	0.27	0

*Approximate percentage of total quail habitat within listening radii of observers during fall covey counts.

Table 3. Population estimates of bobwhite quail on SCDNR WMA tracts as estimated from fall covey count surveys, 2022.

Year	Area	Acreage*	MPE	SPE	TPE
2022	McBee WMA (9)	1270	444	444	396
	Webb Ctr. WMA (9)	3156	24	48	96
	Bonneau Ferry WMA (6)	5364	0	0	0
	Indian Cr. (USFS) (21)	4543	144	144	204
	Canal WMA (5)	1140	0	0	0
	Marsh WMA	1300	12	24	24
	Draper WMA (6)	806	84	96	96
	Delta WMA (12)	2328	72	132	156
	Bordeaux WMA (6)	3058	96	108	336
	Kings Mountain	2528	0	0	0
	Webb Ctr. Focal Area (4)	2718	0	0	0
	Webb Ctr. Ref. Area (4)	2972	0	0	0
	Oak Lea Focal Area (5)	2202	96	108	336
	Oak Lea Ref. Area (5)	1828	24	48	96
	Indian Creek Foc. Area(5)	2683	60	72	240
	Indian Creek Ref. Area(6)	2728	36	60	156
	C. Sandhills Foc. Area(5)	2645	48	72	156
	C. Sandhills Ref. Area(4)	2399	0	0	0

Table 4. Density estimates of bobwhite quail on SCDNR WMA tracts from fall covey count surveys, 2022.

Area	Estimate	Density: Birds/Acre	Density: Acres/Covey
McBee WMA	MPE	.35	34
(1270 acres)	SPE	.35	34
	TPE	.31	38
Webb Ctr. WMA	MPE	.01	1578
(3156 acres)	SPE	.02	789
	TPE	.03	395
Bonneau Ferry WMA	MPE	.00	0
(5364)	SPE	.00	0
	TPE	.00	0
Indian C. (USFS)	MPE	.03	379
(4543 acres)	SPE	.03	379
	TPE	.04	267

Canal WMA	MPE	.00	0
(1140 acres)	SPE	.00	0
	TPE	.00	0
Marsh WMA	MPE	.01	1300
(1300 acres)	SPE	.02	650
	TPE	.02	650
Draper WMA	MPE	.10	115
(806 acres)	SPE	.12	101
	TPE	.12	101
Delta WMA	MPE	.03	388
(2328 acres)	SPE	.06	212
	TPE	.04	194
Bordeaux WMA	MPE	.03	382
(3058 acres)	SPE	.04	340
	TPE	.11	109
Kings Mountain	MPE	.00	0
(2528 acres)	SPE	.00	0
	TPE	.00	0
Webb Ctr. Focal Area	MPE	.00	0
(2718 acres)	SPE	.00	0
	TPE	.00	0
Webb Ctr. Ref. Area	MPE	.00	0
(2972 acres)	SPE	.00	0
	TPE	.00	0
Oak Lea Foc. Area	MPE	.04	275
(2202 acres)	SPE	.05	245
	TPE	.13	92
Oak Lea Ref. Area	MPE	.01	914
(1828 acres)	SPE	.03	457
	TPE	.05	229
Indian Creek Foc. Area	MPE	.02	537
(2683 acres)	SPE	.03	447
	TPE	.09	134
Indian Creek Ref. Area	MPE	.01	909
(2728 acres)	SPE	.02	546

	TPE	.06	210
C. Sandhills Foc. Area	MPE	.02	661
(2645 acres)	SPE	.03	441
	TPE	.06	203
C. Sandhills Ref. Area	MPE	.00	0
(2399 acres)	SPE	.00	0
	TPE	.00	0

Observers were asked to record the time of the first call heard at each listening post. Call initiation for the ninety-five calling coveys in the 2022 surveys ranged from forty-seven minutes to five minutes before official sunrise, with the average time of call initiation at twenty-six minutes before official sunrise.

DISCUSSION

Minimum population estimates (MPE), survey population estimates (SPE), and total population estimates (TPE) were calculated for all areas surveyed. These estimated were constructed from coveys counted, survey area covey estimates, and total area covey estimates as described previously. Of these estimators, the MPE should provide the least biased estimate, as it is an actual census of calling coveys, subject only to observer bias. Therefore, the MPE should function as a reliable index of preseason quail populations.

The survey population estimate (SPE) is likewise an unbiased estimator based upon the robust calling rate model developed in the course of the NCSU/Tall Timbers research project. For purposes of these surveys, number of calling coveys per listening post was "averaged" for all observers for each individual survey, and a single calling rate was used to determine the SPE for each area. Stratifying areas by habitat type and calculating individual calling rates for each habitat type may yield a more precise estimate for a given area. Acreage calculations used in calculation of the total population estimate (TPE) for each area were somewhat crude, and therefore the TPE is the least reliable of the three estimators. Acreages were calculated by overlaying circular listening radii on scale maps of the areas and measuring the amount of "unsurveyed" area. Location of listening posts, vegetative characteristics of the habitat, natural sound barriers, and auditory disturbance affect listening radii and make determination of actual surveyed areas difficult. The TPE is also most susceptible to bias imparted from the violation of Assumption 3, as quail habitat and quail densities are likely not uniform across most areas. This bias would be more pronounced on areas that have a larger land area and greater variability of habitat types than on smaller, more uniform areas and on areas where only a relatively small percentage of the habitat is covered during the survey.

While calling rates are considered to be highest and most consistent during the period from October 15 to October 31, there is evidence that calling rates remain at a level to allow covey count surveys for an extended period beyond the recommended dates. Researchers at the University of Georgia indicate that

calling rates remain fairly stable throughout the month of November with a precipitous decline in calling rates occurring around December 1 (Rick Hamrick - UGA, pers. comm.). This expanded window of survey dates should allow greater opportunity and flexibility for scheduling fall covey counts to take advantage of favorable weather conditions for conducting surveys. However, since the calling rate models were developed using calling rates for the period October 15 - October 31, cooperators should attempt to conduct fall covey counts during this period when possible.

Recommendations: The fall covey count technique should be continued in 2023 on the WMAs and focal areas surveyed in 2022. In order to validate the fall covey count technique, additional indices such as flush counts, mark-recapture, bird dog surveys, and hunter success should be used. Cooperators should strive for consistency in survey methodology, utilizing permanently marked listening posts, trained observers, and consistent survey dates for individual sites. The Florida model of fall covey counts may be evaluated on one or more WMA. In an effort to get replication on all survey points, Florida allows surveyors to pick and choose three survey dates during the survey period. This allows multiple counts at specific survey points during a season but does not require survey participants to be present on the same day.

Additional recommendations for improving the efficiency and accuracy of the survey are:

(1.) Conduct surveys only on days of suitable weather conditions (clear, calm, steady barometric pressure).

(2.) Obtain a recent color infra-red aerial photograph of the area to be surveyed prior to establishing listening posts or conducting covey count surveys.

(3.) Survey as much of the total tract area, or as much of the suitable quail habitat within a tract, as possible. This reduces bias associated with extrapolation of population estimates to areas not surveyed.

(4.) If quail habitat suitability varies dramatically across a given tract, all different habitat types on the tract should be sampled.

(5.) Listening posts should be identified and marked prior to the day of the survey (PVC pipe and reflective tape works well for marking listening posts). For long-term monitoring, listening posts should be physically marked, identified on maps, and GPS coordinates obtained for each location. Listening posts should be located using a scale map and an overlay of listening radii to achieve maximum coverage and reduce overlap between auditory radii. In order to achieve maximum coverage, listening posts should be located $\geq$ l listening radius from boundaries, except in cases of irregular boundaries or narrow property configuration. Listening posts should be located $\geq$ 2 auditory radii apart to minimize possibility of double-counting coveys. Number of observers and locations of listening posts should be standardized from year-to-year to ensure maximum value of the technique as a quail population index.

(6.) Use a compass to define directional bearing of calling coveys from location of observer. This information will be beneficial in detecting double-counted coveys.

(7.) Meet with all observers as a group following completion of the survey, summarize data and locate calling coveys on an aerial photograph. Double-counted coveys should be identified and subtracted from total number of calling coveys before submitting data.

(8.) Use other indices such as a flush count or a bird dog survey as soon as possible following completion of covey counts to validate results of covey count survey.

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