Range, Movements and Habitat Use by Bobwhites in Southeastern Louisiana Pinelands

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Abstract: Radio-tagged northern bobwhite (*Colinus virginianus*) were monitored from November 1978 to April 1979 to determine their ranges, movements, and habitat use in pine (*Pinus* spp.) and mixed pine-hardwood habitats not managed for quail. Minimum ranges varied from 18.4 to 58.4 ha. Average daily straight-line distance movements were 272 m in winter and 185 m in spring. Ranges were greater, but movements were similar to those reported for forest habitats managed for quail. Fifty-three percent of telemetric fixes were within 50 m of an edge, with clearcuts and bottomland transition zones preferred over road edges. Food-searching seemingly dictated the movements of the quail.

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Historically, northern bobwhite have been associated with agricultural practices that provide quality habitat in the form of well-dispersed small woodlands, pastures, and crop fields. A reduction in farmland, conversion of row cropland to pasture, and clean-farming techniques have reduced the availability of quality bobwhite habitat in the South (Sorrow and Webb 1982). Bobwhites now primarily occur in pine and mixed pine-hardwood forests. Habitat requirements of bobwhite in Southern pine forests managed for quail have been previously investigated (Stoddard 1931, Casey 1965, Rosene 1969, Landers and Johnson 1976); however, habitat requirements in unmanaged pine and mixed pine-hardwood forests have not been identified. Consequently, we studied the winter and spring range, movements, and habitat use of bobwhite in unmanaged woodlands of southeast Louisiana.

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Methods

The study was conducted in southeastern Louisiana in northern St. Tammany Parish. The region has broad flats and depressed areas with acidic soils. A subtropical climate prevails with abundant rainfall, moderate winters, and warm, humid summers. Vegetation is characteristic of the longleaf pine (*P. palustris*)—bluestem (*Andropogon* spp.) range (Grelen and Duvall 1966).

Two adjacent tracts of land were used. One was a 1,154-ha mixed loblolly (*P. taeda*)—slash (*P. elliotti*) pine stand and the other consisted of 3,108 ha of mixed longleaf-slash pine. Pines on the tracts were 20–35 years old. Neither tract had been prescribe burned within the previous 2.5 years, and midstory hardwood encroachment was evident. Hardwood bottoms were scattered throughout the region. Bobwhite and white-tailed deer (*Odocoileus virginianus*) were hunted intensively in both tracts during the open season.

Each tract was divided into 2 study areas. The loblolly-slash pine tract contained study areas Loblolly1 and Loblolly2. Loblolly1 (207 ha) contained 153 ha (74% of the study area) of pinelands, a 37-ha (18%) clearcut, and 17 ha (8%) of bottomlands and roads. The vegetation in the clearcut was typical of a 3- to 4-year-old successional stage in the longleaf pine-bluestem range. The bottomlands contained the sweetbay (*Magnolia virginiana*)—swamp blackgum (*Nyssa sylvatica* var. *biflora*)—redbay (*Persea borbonia*) association described by Eyre (1980). Loblolly2 (304 ha) included 164 ha (54%) of pinelands, a 100-ha (33%) clearcut, and 40 ha (13%) of bottomlands, a road, and an old cattle-resting area. The clearcut was approximately 3 years old and also supported vegetation typical of the longleaf pine-bluestem range. Vegetation in the bottomland was smaller than that on Loblolly1, denoting a younger growth stage.

The longleaf-slash pine tract included sites Longleaf1 and Longleaf2. These areas lacked distinct timber openings and contained a greater density of hardwoods than the Loblolly sites. Longleaf1 (121 ha) contained 111 ha (92%) of pines. Two bottomland areas (11 ha or 8% total) on Longleaf1 supported sweetbay-swamp blackgum-redbay vegetation. Longleaf2 (98ha) included 87 ha (89%) of pines divided by a draw and a road into almost equal-sized portions of pineland. Bait sites for capturing bobwhite were established on each study area in places such as firelands and dusting sites. A mixture of equal amounts of whole corn, field-grade wheat, milo, and Japanese millet was used as bait. Birds were trapped using Kniffin modified-funnel traps (Reeves et al. 1968) as described by Menasco (1980). Trapping occurred intermittently from 2 November 1978 to 6 April 1979 for 696 trap-days. Traps were checked once each afternoon. The sex and age of each captured bobwhite were recorded. Birds identified as ≤ 150 days of age were classified as juveniles; all others were recorded as adults. We attempted to radio-tag 1 adult male, 1 adult female, 1 juvenile male, and 1 juvenile female on each study area to diminish sex and age biases.

Bobwhites were radio-tagged according to the method described by Brander (1968). Transmitters weighed an average of 7.2 g and had ranges that varied from 0.3–0.8 km. A 12-channel VHF receiver manufactured by Wildlife Materials, Inc., Carbondale, Illinois, and a 3-element, hand-held, directional antenna made by Telonics, Inc., Mesa, Arizona, were used to monitor radio-tagged birds.

Quail locations were obtained by triangulation of radio-telemetry fixes. Telemetry readings were taken from 6 November 1978 to 12 April 1979 for 1 day per week during a 12-hour surveillance period (0600 to 1800 hrs). This surveillance period was split into 3 4-hour intervals: 0600–1000, 1000–1400, and 1400–1800 hrs. These time intervals correspond with major periods of bobwhite activity (Rosene 1969:92–93): early morning—0600–1000 hrs—when birds are moving from roosting sites to feeding areas; midday—1000–1400 hrs—when feeding and resting; and late afternoon—1400–1800 hrs—when they move from feeding areas to roosting sites. Radio fixes of all monitored birds were made during each time interval.

The minimum-area method (Mohr 1947) was used to evaluate bobwhite ranges of individuals. Ranges were adjusted for 2% triangulation error. Straight-line distance movements (Kurz and Marchinton 1972) between roosting and feeding sites were recorded also. Chi-square tests (Siegel 1956:42–47, 104–111, 175–179) were used to compare quail ranges and movements. Statistical significance was accepted at the 0.05 probability level.

Results and Discussion

Sixty-eight bobwhite were captured (3% trapping success) during the trapping period: 48 were leg-banded and 16 were radio-tagged. We disregarded the original objective of radio-tagging 4 quail of specific age and sex on each study area due to the low trapping success. The age and sex of radio-tagged quail were: 2 adult males—Loblolly2; 1 adult male—Longleaf1; 1 adult female in each study area; 3 juvenile males in Loblolly1; 1 juvenile male in Loblolly2, Longleaf1 and Longleaf2; and 1 juvenile female in Loblolly2, Longleaf1 and Longleaf2. A total of 341 telemetric fixes was recorded for all monitored bobwhite: 105 during early morning, 112 during midday, 124 during late afternoon. Weekly movements of individual birds were monitored from 2 to 22 weeks.

Coveys of more than 3 birds seldomly were flushed on the study areas. Bobwhites appeared to be conducting daily activities dispersed in small groups of 1 to 3 birds. Previous researchers such as Stoddard (1931:169) and Rosene (1969:90–91) have reported covey sizes of 10 to 30 birds. The small covey sizes on our study areas may reflect less than optimal distribution and availability of food sources in forest habitats not managed for quail.

Significant variation existed among range sizes for bobwhite on all study areas ($x^2 = 10.132$, df = 3, $P < 0.01$) (Table 1). The greatest disparity in quail ranges was on the Longleaf tract. Longleaf1, which supported quail with the greatest range (58.4 ha), was prescribe-burned in January 1979 and litter, small understory growth, and larger shrubs were removed in the burn. The vegetation during the trapping period was typical of early successional longleaf pine-bluestem association. The density of this vegetative cover was considered sparse relative to the other study areas, and this probably served to increase the size of the quail range. Conversely, Longleaf2, which supported quail with the smallest range (18.4 ha), had an understory that was relatively dense with seed-producing plants such as *Panicum* spp. and *Andropogon* spp. The dense cover and abundant food source undoubtedly contributed to quail having to forage less widely for their basic requirements.

We expected ranges of adults and juveniles to be similar because both age groups are usually found in the same covey and conduct the same activities (Rosene 1969:90). This was not the case, however. Significant variation existed among ranges of adults ($X^2 = 32.206$, df = 3, $P < 0.001$) (Table 1) but not among ranges of juveniles ($X^2 = 3.482$, df = 3, $P > 0.1$). Variation among the adult ranges might be attributed to differences in habitat quality with birds on less optimal sites such as Longleaf1 having to range farther than birds on sites such as Longleaf2 to find sufficient food. The trend in juvenile ranges on the study areas roughly followed that of adults, but to a lesser degree. The relative lack of variation among the ranges of juveniles implies that the juveniles conducted their daily activities in the same area, but independent of the adults. The adult and juvenile ranges are larger than most previously reported (Lehmann 1946; Rosene 1969:88–89; Crim and Seitz 1972).

Ranges of individuals during the 3 time intervals were calculated for bobwhite on each study area (Table 2). Early morning ranges averaged 23.3 ha (SE = 6.2) and generally were smaller than midday ($\bar{x} = 26.5$ ha; SE = 4.3) and late afternoon ($\bar{x} = 32.6$ ha; SE = 6.3) ranges. No significant difference in range size was found

Table 1. Mean minimum ranges for adult and juvenile radio-tagged bobwhite on 4 study areas, November 1978 to April 1979, St. Tammany Parish, Louisiana.

Study Area	Age	Number of Quail	Minimum Range (ha)
Loblolly1	Adult	1	19.1
	Juvenile	3	37.8
Loblolly2	Adult	3	35.4
	Juvenile	2	37.5
Longleaf1	Adult	2	58.4
	Juvenile	2	41.2
Longleaf2	Adult	1	18.4
	Juvenile	2	26.4

Table 2. Mean minimum ranges (ha) of radio-tagged bobwhite during 3 time periods on 4 study areas based on weekly and intermittent observations between November 1978 to April 1979, St. Tammany Parish, Louisiana.

		Time of Day (hrs)							
	Number of	0600–1000		1000–1400		1400–1800		Total 0600–1800	
Study Area	Quail	#fixes	ha	#fixes	ha	#fixes	ha	#fixes	ha
Loblolly1	4	17	18.0	20	22.1	31	30.4	68	36.9
Loblolly2	5	41	20.0	47	35.5	47	33.8	135	42.4
Longleaf1	4	25	41.5	27	31.7	27	48.3	79	68.0
Longleaf2	3	20	13.5	20	16.6	19	17.8	59	29.0

among these 3 time intervals on any study area (Loblolly1: $X^2 = 3.396$, df = 2, $P > 0.10$; Loblolly2: $X^2 = 4.855$, df = 2, $P > 0.06$; Longleaf1: $X^2 = 3.439$, df = 2, $P > 0.10$; Loblolly2: $X^2 = 0.617$, df = 2, $P > 0.70$). Rosene (1969:88) stated that ranges seem to depend on the distribution of food and cover. This distribution remains constant throughout the day; therefore, it is not surprising that early morning, midday, and late afternoon ranges were similar in size.

Straight-line distance movements are indicative of the lengths of travel from roosting sites to midday resting sites and then from midday resting sites back to roosting sites. Seasonal variation existed among the straight-line distances on the 4 study areas. From December 1978 to February 1979, average movements were 272 m (SE = 18) (Table 3). The chi-square value among the study areas for the winter distances was $X^2 = 18.530$, df = 3, $P < 0.001$. As with the mean minimum ranges discussed above, the movements exhibited by bobwhite can be related to habitat quality. Longleaf2, with an understory considered more optimal for quail than the habitat on other study areas, supported quail having the smallest average straight-

Table 3. Seasonal distance movements between roosting and midday sites for radio-tagged bobwhite on 4 study areas, December 1978 to April 1979, St. Tammany Parish, Louisiana.

	Average Distance (m)	
Study Area	Roosting Site to Midday Site	Midday Site to Roosting Site
Winter		
Loblolly1	330.6	264.7
Loblolly2	257.1	229.5
Longleaf1	313.2	332.9
Longleaf2	191.4	255.2
Spring		
Loblolly1	41.6[a]	27.7
Loblolly2	281.8	273.9
Longleaf1	265.4	272.2
Longleaf2	124.8[a]	194.2

[a]Data represents 1 observation.

line distance movements. Winter-time distances from roost sites to midday sites and from midday sites to roost sites averaged 273 m (SE = 31) and 271 m (SE = 22), respectively. Significant variation among the study areas was found in both distance groups (roost-midday: $X^2 = 43.37$, df = 3, $P < 0.001$; midday-roost: $X^2 = 21.593$, df = 3, $P < 0.001$). From March to April (spring), average movements in were 185 m (SE = 38) and significant variation was exhibited among the study areas ($X^2 = 16.108$, df = 3, $P < 0.001$). Mean distances were 178 m (SE = 58) and 192 m (SE = 58), respectively, from roosting sites to midday sites and from midday sites to roosting sites. Significant variation also existed in these distance groups (roosting-midday: $X^2 = 223.361$, df = 3, $P < 0.001$; midday-roosting: $X^2 = 209.056$, df = 3, $P < 0.001$). The smaller average distances in spring compared to winter can be attributed to greater availability and abundance of food on the study areas. Straight-line distance movements for bobwhite in this study were similar to those reported for areas managed for quail (Lehmann 1946; Loveless 1958; Smith et al. 1982; Yoho and Dimmick 1972).

Bobwhites were highly selective in their use of habitat (Table 4). On Loblolly1 and Loblolly2, 63% (129) of the telemetric fixes were in clearcuts, though clearcuts represented only 23% (78 ha) of these study areas. Clearcuts were used primarily for calling sites, feeding and roosting. Forest use by bobwhite varied according to contiguous habitat types. On the loblolly-slash pine areas where forest adjoined clearcuts, clearcuts were preferred. On the longleaf-slash pine areas where clearcuts or large openings were not available, the forest was used randomly. On all study areas, bottomlands were used for escape and roosting cover. Edges played an impor-

Table 4. Habitat availability and selection by radio-tagged bobwhite on 4 study areas, November 1978 to April 1979, St. Tammany Parish, Louisiana.

Study Area	Habitat Type	Area (ha) and (%)	Number and (%) of Observed Fixes	Number of Expected Fixes	χ^2 Value	95% CI
Loblolly1	Pinelands	153.2 (74)	12 (18)	50.4		$0.1 < P < 0.2$
	Clearcut	36.9 (18)	54 (79)	12.1	176.6[a]	$0.7 < P < 0.8$
	Draw/Road	16.6 (8)	2 (3)	5.5		$0.0 < P < 0.1$
	TOTAL	206.7	68	68.0		
Loblolly2	Pinelands	164.2 (54)	30 (22)	72.9		$0.2 < P < 0.3$
	Clearcut	100.3 (33)	75 (56)	44.5	55.1[a]	$0.5 < P < 0.6$
	Draw/Road	39.5 (13)	30 (22)	17.5		$0.2 < P < 0.3$
	TOTAL	304.0	135	134.9		
Longleaf1	Pinelands/Draw W	39.1 (27)	12 (15)	21.0		$0.1 < P < 0.2$
	Pinelands/Draw E	72.0 (49)	36 (46)	38.6	11.0[a]	$0.4 < P < 0.5$
	Draw/Road	36.2 (25)	31 (39)	19.4		$0.3 < P < 0.4$
	TOTAL	147.3	79	79.0		
Longleaf2	Pinelands W	40.3 (41)	27 (46)	24.1		$0.4 < P < 0.5$
	Pinelands E	47.1 (48)	19 (32)	28.2	9.6[a]	$0.3 < P < 0.4$
	Draw/Road	11.1 (11)	13 (22)	6.6		$0.2 < P < 0.3$
	TOTAL	98.5	59	58.9		

[a]Highly significant difference ($P < 0.01$).

tant role in daily bobwhite activities. Fifty-three percent (N = 180) of all telemetric fixes were within 50 m of some edge. Based on the percentage of telemetric fixes within 50 m of an edge, edges associated with clearcuts (43% of fixes) and bottomlands (36%) were used more often than edges associated with roads (21%). This was probably attributable to what appeared to be less food and cover being provided along roads.

Conclusion

Our findings indicate that bobwhite may require relatively large ranges in the pinelands of southeast Louisiana to meet basic requirements. We believe that food searching dictated the movements, ranges and habitat use more so than the need for roosting and escape cover. Further knowledge of quail foods, movements, and ranges in southeast Louisiana would be vital to management of this species.

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