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HABITAT REQUIREMENTS OF BREEDING SCALED QUAIL IN TEXAS

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Abstract: Habitat variables were correlated with scaled quail (*Callipepla squamata*) whistle counts on 133 (24-km) random transects in Texas. Whether or not a particular habitat variable was correlated with whistle counts appeared to depend upon abundance and distribution of other habitat types and structural features. If ≥1 requisite for quail survival and reproduction (food, water, cover, nest sites) was limited, habitat types and structural features were usually positively correlated with whistle counts ($P < 0.10$). Conversely, abundant habitat types which did not provide all of these requisites were usually negatively correlated with whistle counts ($P < 0.10$). Correlations indicated breeding scaled quail selected the more dense, shorter shrub habitats. Mesquite (*Prosopsis* spp.) habitats were especially important to scaled quail in the Trans-Pecos region.

Key words: breeding, *Callipepla squamata*, habitat, scaled quail, Texas.

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Few studies have been conducted on breeding habitat requirements of scaled quail. Schemnitz (1961, 1964) and Snyder (1967) found scaled quail used numerous man-made structures including corrals, feedlots, buildings, farm machinery, old car bodies, post piles, cattle guards, windmills, and culverts as nest sites. Scaled quail used more open areas in the spring and summer with a wide variety of nesting sites (Schemnitz 1961). Snyder (1967) found scaled quail seek brush for shade in the summer and require an abundance of seed-producing forbs. Wallmo (1957) noted that no single plant species or group of species were essential components of scaled quail habitat in Texas. Campbell et al. (1973) observed that densities of scaled quail were highest on moderately grazed ranges which supported a variety of forb species for food and a moderate amount of brush for cover. Dense, unbroken stands of grass or brush without abundant forbs supported few scaled quail (Campbell et al. 1973). Hammerquist-Wilson and Crawford (1987) noted scaled quail selected sparse vegetation with shrub overstory.

Campbell et al. (1973) used calling scaled quail males as an index to relative abundance in New Mexico. Similar roadside counts of whistling bobwhite have been used as an estimate of relative abundance (Bennitt 1951, Elder 1956, Rosene 1957, Norton et al. 1961). If the number of males heard whistling within a radius of 0.8 km is an index to relative abundance (Baxter and Wolfe 1973), it should be possible to determine which habitat parameters are associated with varying scaled quail densities. Habitat parameters associated with high densities could then be used as a guide to habitat management for scaled quail. The objective of this study was to determine habitat parameters that relate to scaled quail densities as estimated from road transect whistle counts in Texas.

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METHODS

Habitats intersected by state (total length = 24 km) and the first 24 km of federal mourning dove call-count transects within the 10 ecological areas (Gould 1975) of Texas were classified and inventoried between 20 May and 10 June 1976 from within a vehicle using methods previously described (Grue et al. 1976). Habitats were classified into 1 of the following types based on canopy height, composition, and spatial distribution: barren, cropland (grain, nongrain, forage, plowed ground), pasture and fields, shrub savannah, shrub parkland, shrubland, brush parkland, brushland, savannah, parkland, woodland, orchard, forest, or urban (detailed descriptions are in Grue 1977). Shrub savannah, shrub parkland, and shrubland containing >49% mesquite also were classified as mesquite-shrub savannah, mesquite-shrub parkland, and mesquite parkland, respectively. Habitat types containing trees (savannah-forest) were separated further based on whether the canopy was primarily (>74%) deciduous (including mesquite), mesquite, coniferous, or mixed, and the presence or absence of understory.

We also enumerated structural features within habitat types (structures or characteristics other than height, composition, and spatial distribution of the canopy) that others (reviewed by Reid [1977]) have suggested may be important as nest sites, song posts, or sources of food or grit for breeding scaled quail. Within this category we included the number of fences, shrubrows, windbreaks, powerlines, roads, and railroad rights-of-way, and whether or not these structures paralleled or intersected the transects. The number of edges (an abrupt change in the physiognomy of the vegetation excluding ecotones), permanent water sources, buildings, washes, livestock feeders and feedlots, gravel pits, and irrigation and oil pumps; the presence of snags; and the type of surface and width of the shoulder on the survey route also were noted. The position of some structural features relative to the whistle transects was recorded because those that paralleled the survey route may have provided more nesting or calling sites per unit area than those that intersected the transects. In addition, structural features (e.g., fences and roads) that intersected the survey routes may have been indicative of habitat fragmentation or differential land use and, therefore, habitat diversity. The number of irrigation and oil pumps was included because the former may have been associated with sources of water and the latter was associated with clearings within the homogeneous shrublands of west Texas. The type of road surface on survey routes was recorded because the amount of grit, wind-blown seeds, and water runoff associated with different road surfaces may vary. We estimated the width of the shoulder on survey routes because highway rights-of-way may support vegetation important to nesting quail.

The habitat on both sides of each transect was surveyed starting 0.8 km before the first stop and ending 0.8 km after the fifteenth stop. State call-count routes consisted of only 15 stops, so only the first 15 stops of the federal routes (20 stops) were used. The linear distance of each observation of a habitat type intersecting a survey route was measured to the nearest 0.02 km.

Through the cooperation of the Texas Parks and Wildlife Department, scaled quail whistle counts were obtained for the transects. Each transect was surveyed 3 times between 20 May and 10 June 1976 (Dunks 1975). Whistle-count data were collected at 1.6 km intervals (stops) along each transect, beginning 0.5 hour before sunrise and ending 1.5 hours after sunrise. An audio count was made of the total number of quail heard whistling during a 3-minute period at each of the 15 stops along each transect. Whistle counts were not conducted if it was raining or the wind speed was greater than 3 on the Beaufort Scale.

Habitat variables significantly ($P < 0.10$) correlated with whistle counts were identified from a matrix of product-moment correlation coefficients (Barr and Goodnight 1972). Correlation analyses were conducted within ecological areas using mean whistle counts for each transect. Habitat interspersion and diversity (Shannon-Wiener Index; Shannon 1948) indices for each transect also were included as habitat variables. An index to minimum habitat interspersion (Grue 1977) based on the number of habitat types present within a transect, as well as presence or absence of each habitat type within adjacent 1.6-km intervals, was used. Crop categories were not included in the interspersion and diversity indexes because it was not possible to include cropland as a whole, and divisions thereof, within 1 index.

Table 1. Transect whistle counts for scaled quail by 10 ecological areas of Texas, 1976.

Ecological area	No. transects	Whistle counts $\bar{x}^a$	SD	Low	High
Pineywoods	9	0	0.0	0	0
Gulf prairies and marshes	6	0	0.0	0	0
Post oak savannah	9	0	0.0	0	0
Blackland prairies	10	0	0.0	0	0
Cross timbers and prairies	17	0	0.0	0	0
South Texas plains	18	2	3.8	0	14
Edwards plateau	18	5	8.3	0	32
Rolling plains	23	4	7.1	0	30
High plains	14	3	4.7	0	22
Trans-Pecos	9	10	5.0	0	19

[a]Mean rounded to nearest whole bird.

RESULTS AND DISCUSSION

The average number of scaled quail heard whistling per transect was calculated for each ecological area (Table 1). Whistle counts were not heard in the 5 eastern ecological areas and, therefore, these areas were eliminated from further analyses. Whistle counts were highest within the Trans-Pecos and lowest on the South Texas Plains.

South Texas Plains

Edge (-0.29), intersecting powerlines (-0.39), shrubrows (-0.33), dirt road surfaces (-0.30), and buildings (-0.31) were structural features negatively correlated with scaled quail whistle counts. These structural features were associated with the eastern edge of the South Texas Plains that consisted primarily of cultivated crops. The western portion supported scaled quail populations and was dominated by large ranches with severe brush problems.

Parallel fences (0.30), windbreaks (0.29), and snags (0.37) were positively correlated with scaled quail whistle counts. These structures may have provided sites for nests and song posts. Stebler and Schemnitz (1955), working in Oklahoma, recorded 3.1% of 1,233 observations of scaled quail in shelterbelts. Schemnitz (1961) found scaled quail in Oklahoma utilized a variety of nesting sites.

There was a significant correlation between cropland and edge ($r = 0.67$). The negative correlation of these variables with scaled quail whistle counts indicated an overabundance of cropland on transects with low whistle counts. Indeed, sorghum (-0.28), cropland (-0.33), grain crops (-0.33), wheat (-0.26), and plowed land (-0.30) along with mixed mesquite tree parkland (-0.30) were habitat types negatively correlated with whistle counts. Urban habitats (0.28), shrub savannah (0.31), shrubland (0.37), brushland (0.35), and brush with mesquite (0.39) were positively correlated with scaled quail whistle counts. These data suggest scaled quail preferred the shorter and/or more dense vegetation types for nesting. Campbell et al. (1973) reported brush was an important vegetation type for scaled quail and from a management standpoint, brush clearing should be discouraged. However, few scaled quail could be supported in dense unbroken stands of brush (Campbell et al. 1973).

Edwards Plateau

Scaled quail whistle counts were negatively correlated with edge (-0.47), intersecting fences (-0.49), water sources (-0.31), and buildings (-0.37), whereas washes (0.36) and intersecting railroad rights-of-way (0.47) were positively correlated. Habitat diversity (-0.58) and interspersion (-0.62) also were associated with low scaled quail whistle counts. The variables negatively correlated with scaled quail whistle counts were associated with the more human populated eastern portion of the Edwards Plateau, where scaled quail were absent. Washes and railroad rights-of-way may have been correlated with high scaled quail densities because the vegetation bordering these areas was taller and more dense than that of surrounding areas, providing better nesting cover.

Cropland (-0.29), deciduous savannah (-0.40), deciduous parkland (-0.53), mixed mesquite parkland (-0.29), deciduous woodland (-0.35), deciduous woodland without understory (-0.35), mixed mesquite woodland (-0.26), and mixed woodland without understory (-0.35) were negatively correlated with whistle counts. High whistle counts were associated with shrub savannah (0.47), shrubland (0.48), and mixed mesquite shrubland (0.32). These data suggest scaled quail were selecting shrub vegetation types and avoiding those types where vegetation height was excessive. Wallmo (1957) observed scaled quail were intolerant for woodland habitat where the height and density of trees became excessive.

Rolling Plains

Structural features positively correlated with scaled quail whistle counts included washes (0.54), width of road shoulder (0.40), and asphalt road surface (0.38). Parallel windbreaks (-0.27) and gravel road surfaces (-0.34) were associated with low scaled quail whistle counts. Vegetation bordering washes was generally taller and more dense than in surrounding areas and may have provided nesting cover. Wide rights-of-way along asphalt surface roads may have provided nesting cover. Grasses along these road shoulders tended to be taller due to rain runoff than in adjacent pastures heavily grazed by cattle. Gravel road surfaces were associated with farming areas where the land was cultivated up to the road surface. Scaled quail density was low in areas with windbreaks that were associated with cultivated lands.

Scaled quail whistle counts were high within shrub parkland (0.45), shrubland (0.50), mesquite shrubland (0.46), and areas devoid of vegetation (0.52). Whistle counts were low within pasture (-0.25) and deciduous savannah (-0.24). Areas devoid of vegetation may have provided dusting spots for scaled quail. Data suggest scaled quail preferred the more dense stands of shrubs as nesting sites and avoided deciduous savannah, a taller, more open habitat type.

High Plains

Intersecting shrubrows (0.78), parallel shrubrows (0.78), intersecting powerlines (0.36), parallel powerlines (0.34), and intersecting roads (0.37) were associated with high scaled quail whistle counts. These features may have created breaks in cropland areas providing nesting cover. Over 76% of the High Plains was cropland (Grue 1977).

Irrigation and oil pumps (-0.37), dirt road surfaces (-0.39), number of water sources (-0.34), and presence of water (-0.37) were negatively correlated with scaled quail whistle counts. Dirt road surfaces associated with farm areas were cultivated to the road edge and provided little if any cover for quail. Irrigated cropland with permanent water in irrigation ditches may have accounted for some of the negative correlation of irrigation pumps and the presence of water with whistle counts. Wallmo (1957) observed that in large, continuous irrigation districts, scaled quail were effectively eliminated. However, noise generated by irrigation and oil pumps may have interfered with whistle-count surveys and added to this negative correlation.

Sorghum (0.79), plowed land (0.48), shrubland (0.57), mixed mesquite parkland (0.57), and mixed mesquite woodland (0.75) were positively correlated with whistle counts, whereas grain crops (-0.44) and wheat (-0.40) were negatively correlated. Scaled quail appeared to select shrub habitat types within this ecological region. Shrubland, mesquite shrubland, and mesquite woodland comprised less than 1% of the total land area intersecting the whistle-count transects, and thus appeared to be important as nesting cover. These areas were interspersed within areas of cropland. Wheat, which dominated the grain crops in this area, was "green" at the time surveys were conducted and offered little food for quail, whereas sorghum fields had stubble and waste grain from the preceding year and provided some food. Plowed land represented newly planted sorghum and cotton fields and may have provided a food source prior to plowing.

Trans-Pecos

Whistle counts were positively correlated with parallel powerlines (0.34), irrigation and oil pumps (0.37), plowed land (0.39), and mixed mesquite shrubland (0.55). Shrubland without mesquite (-0.46) was associated with low scaled quail whistle counts. Irrigation and oil pumps, parallel powerlines, and plowed land may have created breaks in the shrubland. These breaks may have provided preferred nesting and/or feeding sites for scaled quail. Schemnitz (1961) reported scaled quail in Oklahoma utilized more open areas in the spring and summer. Schemnitz (1961) and Snyder (1967) found that scaled quail in Oklahoma and Colorado, respectively, utilized numerous manmade structures as nest sites. Areas around irrigation and oil pumps may have been used in this manner. Mixed mesquite shrubland was the only mesquite habitat type present in the Trans-Pecos. This habitat type comprised greater than 20% of the total land area intersecting the whistle-count transects. Mesquite appeared to occur in the lower, more moist area of the Trans-Pecos and may have provided more food plants than did the shrubland areas.

Significance of Correlations

Correlation analyses between habitat parameters and whistle counts within the 5 ecological areas of Texas in which whistles were heard indicated density of breeding scaled quail was correlated with habitat parameters that provided adequate food, cover, and nest sites. Habitat types which provided 1 or more of these requisites differed between ecological areas and appeared to depend on the kind, amount, and distribution of habitat types and the structural features associated with them. If any habitat type or structural feature providing 1 or more of these requisites was limited, it was usually positively correlated with whistle counts. Conversely, an excess of a habitat parameter which did not provide all these requirements was usually negatively correlated with scaled quail density. This is illustrated by the positive correlation between cropland and call counts in the Trans-Pecos and the negative correlation between this habitat type and call counts on the High Plains. In the Trans-Pecos, nesting substrate was abundant, whereas sources of food and water were generally restricted to cultivated areas. Cropland comprised less than 1% of the Trans-Pecos (Grue 1977). The opposite was true on the High Plains, where food and water were more abundant (cropland comprised more than 76% of the area), but nest sites within woody vegetation were limited.

By chance ($P < 0.10$), some spurious correlations between habitat variables and whistle counts may have surfaced in our study. We also recognize that significant correlations do not necessarily represent causation. This is illustrated by the positive correlation of irrigation and oil pumps with whistle counts in the Trans-Pecos. We do not suggest that these structures are needed by breeding scaled quail. However, the presence of irrigation pumps suggest that sources of food (cropland) or water were nearby; cropland was positively correlated with whistle counts in this ecological area. Oil pumps were often associated with the only clearings in the extensive shrublands in the Trans-Pecos and growth of grasses and forbs on the disturbed areas may have provided food for nesting quail. That mourning dove (*Zenaida macroura*) call counts also were positively correlated with irrigation and oil pumps within the Trans-Pecos (Grue et al. 1983) suggests the correlation was not spurious.

Comparisons Between Ecological Areas

Shrubland appeared to be the most important habitat type associated with scaled quail whistle counts. It was positively correlated with whistle counts in all regions except the Trans-Pecos. In the Trans-Pecos it was negatively correlated; however, this is misleading. In the Trans-Pecos, shrubland comprised greater than 50% of habitat types intersecting the transects, and whistle counts along these transects averaged twice those of any other ecological area, indicating the importance of shrubland. Schemnitz (1961) observed that plants having a shrubby growth form were used frequently by scaled quail and provided the overhead shelter that was apparently essential to quail welfare. Wallmo (1957) noted the majority of scaled quail habitat in Texas was characterized by low shrubs. Schemnitz (1961) noted where suitable shrub cover was lacking or very restricted, scaled quail made use of man-made structures. He further stated that shrubs and man-made structures were essential components of the regional habitat of quail in Cimarion County, Oklahoma. Stebler and Schemnitz (1955) observed that habitat constituting the shrub lifeform and certain kinds of artifacts usually found around farmsteads comprised the regional habitat of scaled quail.

Shrubland was negatively correlated in the Trans-Pecos not because it was unimportant, but because mixed mesquite shrubland associated with wetter areas was of even greater importance to scaled quail populations. It stands that shrubland is the 1 most important habitat type for scaled quail. Changes in this type such as openings created by man or diversity created by nature only add a more positive effect to scaled quail numbers. However, if these changes are too great, populations decrease.

LITERATURE CITED

Barr, A. J. and J. H. Goodnight. 1972. A user's guide to the statistical analysis system. Dep. Stat., N.C. State Univ., Raleigh. 260pp.

Baxter, W. L. and C. W. Wolfe. 1973. The interspersion index as a technique for evaluation of bobwhite quail habitat. Pages 158-165 *in* J. A. Morrison and J. C. Lewis, eds., Proc. First Natl. Bobwhite Quail Symp., Okla. State Univ., Stillwater.

Bennitt, R. 1951. Some aspects of Missouri quail and quail hunting, 1938-1948. Mo. Conserv. Comm. Tech. Bull. 2. 51pp.

Campbell, H., D. K. Martin, P. E. Ferkovich and B. K. Harris. 1973. Effects of hunting and some other environmental factors on scaled quail in New Mexico. Wildl. Monogr. 8. 47pp.

Dunks, J. H. 1975. Statewide mourning dove research; Job 1: density, distribution, and movement; Texas. Perf. Rep., Fed. Aid Proj. W-95-R-10. 9pp.

Elder, J. B. 1956. Analysis of whistling patterns in the eastern bobwhite, *Colinus v. virginianus* L. Proc. Ia. Acad. Sci. 63:639-651.

Gould, F. W. 1975. Texas plants--a checklist and ecological summary. Tex. A&M Univ., Agr. Exp. Stn., College Station. MP-585/Rev. 121pp.

Grue, C. E. 1977. Classification, inventory, analysis, and evaluation of the breeding habitat of the mourning dove (*Zenaida macroura*) in Texas. PhD Thesis, Tex. A&M Univ., College Station. 187pp.

_____, R. R. Reid and N. J. Silvy. 1976. A technique for evaluating the breeding habitat of mourning doves using call-count transects. Proc. Annu. Conf. Southeast. Assoc. Game and Fish Comm. 30:667-673.

_____, _____ and _____. 1983. Correlation of habitat variables with mourning dove call counts in Texas. J. Wildl. Manage. 47:186-195.

Hammerquist-Wilson, M. and J. A. Crawford. 1987. Habitat selection by Texas bobwhites and chestnut-bellied scaled quail in south Texas. J. Wildl. Manage. 51:575-582.

Norton, H, W., T. G. Scott, W. R. Hanson and W. D. Klimstra. 1961. Whistling-cock indices and bobwhite populations in autumn. J. Wildl. Manage. 25:398-403.

Reid, R. R. 1977. Correlation of habitat parameters with whistle-count densities of bobwhite (*Colinus virginianus*) and scaled quail (*Callipepla squamata*) in Texas. MS Thesis. Tex. A&M Univ., College Station. 101pp.

Rosene, W. Jr. 1957. A summer whistling cock count of bobwhite quail as an index to wintering populations. J. Wildl. Manage. 21:153-158.

Schemnitz, S. D. 1961. Ecology of the scaled quail in the Oklahoma panhandle. Wildl. Monogr. 8. 47pp.

_____. 1964. Comparative ecology of bobwhite and scaled quail in the Oklahoma Panhandle. Am. Midl. Nat. 71:429-433.

Shannon, C. E. 1948. A mathematical theory of communication. Bell Syst. Tech. J. 27:379-423, 623-656.

Snyder, W. D. 1967. Experimental habitat improvement for scaled quail. Colo. Game, Fish and Parks Dep. Tech. Publ. 19. 64pp.

Stebler, A. M. and S. D. Schemnitz. 1955. Habitat description and the life-form concept. Proc. Okla. Acad. Sci. 36:154-157.

Wallmo, O. C. 1957. Ecology of scaled quail in west Texas. PhD Thesis, Tex. A&M Univ., College Station. 134pp.