National Quail Symposium Proceedings

Volume 2 Article 14

1982

Reproductive Success and Broad Survival of Bobwhite Quail as Affected by Grazing Practices

Ruben Cantu
Texas A&I University

Daniel D. Everett
Texas A&I University

REPRODUCTIVE SUCCESS AND BROOD SURVIVAL OF BOBWHITE QUAIL AS AFFECTED BY GRAZING PRACTICES

RUBEN CANTU, Caesar Kleberg Wildlife Research Institute, College of Agriculture, Texas A & I University, Campus Box 218, Kingsville, TX 78363
DANIEL D. EVERETT, Caesar Kleberg Wildlife Research Institute, College of Agriculture, Texas A & I University, Campus Box 218, Kingsville, TX 78363

Abstract: A radio telemetry study of 76 nesting and brood rearing bobwhite quail (Colinus virginianus texanus) hens was conducted during 1980 and 1981. Four study sites with different habitats and cattle grazing intensities were used. The 1980 breeding season was hot and droughty. Nine nests were found and three clutches of eggs hatched. There was a 1:3 adult to juvenile ratio in fall shot birds, and 66 percent hatched after 1 September following the rains of Hurricane Allen on 9 August. The 1981 breeding season was wet with average temperatures. One nest was found and seven broods were known to have hatched. Examination of quail wings showed a 1:5 adult to juvenile ratio, with 69 percent of the juvenile birds hatched prior to July 16, 9 percent in the latter half of July, 10 percent in August, 9 percent in September, and 2 percent in October. Seven unsuccessful nests were found. Five were destroyed by predators and two were abandoned. Chick mortality was 49 percent within the first two weeks of life in nine broods. Thirty-eight of 76 radio tagged hens were killed during the reproductive seasons. Reproductive success was highest during the wetter breeding season and highest in pastures that were moderately grazed and in good range condition.

South Texas bobwhite quail (Colinus virginianus texanus) populations are unstable. Wet years producing "bumper" crops of quail followed by a drought year may result in a low population. Variability in yearly population sizes is largely dependent upon land management practices and weather conditions affecting quail prior to and during the reproductive season (Lehmann 1946, Kiel 1976). Measurements of the reproductive capabilities of the bird have not accounted for the dramatic increase in population size during favorable years. It is difficult to get a true picture of summer population dynamics from data collected the following winter. The difficult parameters to measure are post hatching mortality rates and hen mortality. With the aid of radio telemetry, an intensive study of individual nesting and brooding hens was conducted during the 1980 and 1981 reproduction seasons. The specific objectives of this study were

(1) to determine reproductive success and chick survival of the bobwhite quail as related to grazing practices and land management;
(2) to determine habitats used by bobwhite hens for brood rearing;
(3) to determine the mortality rate of quail hens during the nesting season; and
(4) to document the occurrence of quail hens hatching a second brood.

We would like to thank Robert King, manager of the Mariposa Ranch, and Cliff Lincecum, Cameron Iron Works' Hollywood Hunting Camp Manager, for their cooperation. We also thank the Caesar Kleberg Wildlife Research Institute for funding.

STUDY AREA

This study was conducted in Brooks County, located within the Rio Grande Plain resource region in south Texas, on the Miller and Mariposa Ranches, 1.25 km west and 4.35 km southeast of Falfurrias, respectively. The substrata of Brooks County is a sandy loam soil similar to many coastal counties of Texas. Soils are moderate to deep, up to 203 cm, and well drained. The topography is nearly level to moderately sloping.

The average annual temperature is 22.6 C; the climate is a warm, temperate, subtropical type with dry winters and hot humid summers. The average rainfall is about 61.3 cm, with extreme fluctuations between years. Rainfall records show variations from 22.7 cm in 1917 to a high of 140.0 cm in 1967. Of the years of recorded

rainfall, 33 percent are shown to be droughty (Anonymous 1981). Occasional hurricanes, usually occurring in August or September, can deluge areas with 25.4 cm to 50.8 cm of rain in a matter of days, and spring and summer rains do not always occur (Kiel 1976).

Four pastures, i.e., Fruta, Justo, Rodeo, and Pita, with different vegetative composition and grazing histories were used as study sites. The Fruta pasture (568 ha) has sandy and loamy sand range sites, of an open grassland type, dominated by threeawns (Aristida spp.) and dotted with clumps of mesquite (Prosopis glandulosa) and granjeno (Celtis pallida). It has been continuously grazed by cattle since 1953 at a high stocking rate of 4.3 ha per animal unit and was in poor range condition. Range condition relates the current condition of the range to the potential of which the particular area is capable (Stoddart et al. 1975). Stocking rate is the area of land that the rancher allotted for each animal unit for the extent of the grazing period. A light stocking rate allows more hectares of grazing land per animal unit than a high stocking rate. An animal unit is the amount of forage needed to sustain a 1000 lb cow with a calf at her side for six months without a downward trend in range condition. The Justo pasture (1,380 ha) had a combination of sandy flat, sandy, and loamy sand range sites in low-fair range condition. Range sites were dominated by dense mesquite and mixed brush, threeawns, and gulf cordgrass (Spartina spartinae). The Justo pasture was rootplowed in 1975 but not raked. This pasture was continually grazed at a high stocking rate of 3.3 ha/au. The Rodeo pasture (1575 ha), a loamy sand range site, was once dominated by mixed, dense brush in poor range condition. Root-plowing, raking, and re-seeding to kleingrass (Panicum coloratum) in 1975 changed range condition from poor to good. Thirty percent of the brush was removed and the remaining 70 percent was left in random locations, clumps, drainage areas, and draws as cover for wildlife. This area has been moderately grazed at 6.5 ha/au in a continuous grazing system. The Pita pasture (894 ha) was a sandy hill range site in good condition. The plant community was an open grassland dotted with clumps of mesquite and live oak (Quercus virginiana). Tall and midgrasses were dominant and included little bluestem (Schizachyrium scoparium), indian grass (Sorghastrum nutans), and thinseed paspalum (Paspalum setaceum). Prior to May 1981 grazing was moderate at a stocking rate of 5.5 ha/au. In the summer and fall of 1981 the pasture was lightly grazed at 17.8 ha/au.

MATERIALS AND METHODS

Bobwhite quail were captured before the nesting season with Stoddard type quail traps (Wilbur 1967). An equal number of quail hens were caught on each study site, fitted with six g radio transmitters, and tracked daily. During the summer of 1980, 10 solar powered and 20 battery powered transmitters were used. In 1981 we used 30 solar powered transmitters. Telemetry equipment included a vehicle mounted, omni-directional, whip antenna; a directional three element hand held yagi antenna; and a portable 20 channel radio receiver. All locations of radio-tagged hens were plotted on aerial photographs of the study area to determine movements, ranges, and habitat preferences. When a nest of an instrumented hen was found, a detailed description of the nest, nest site, and surrounding vegetation was made.

Chick loss rates were determined by counting the chicks with each instrumented hen weekly or more often after hatching until combination of broods, or death of the hens or chicks made this determination impossible.

Brooding ranges were determined by the minimum area method (Mohr 1947). Estimates of ranges were determined only for those hens that were located on at least five different occasions.

Predators destroying quail nests and preying on radio tagged hens were identified from field sign left at the nest site or from carcass remains. Working transmitters from hens killed by predators were fitted on other hens to monitor a maximum number of birds throughout the reproductive season.

Bobwhite quail wings were obtained from hunters on the study areas for determination of adult to juvenile ratios and for back calculation of hatching dates of juvenile birds (Rosene 1969).

RESULTS

Reproductive Success

The 1980 breeding season was hot and droughty, with 4.4 cm of rain from January through April. The first substantial rainfall (5.0 cm) came on 8 May. Rains between 9 May and 8 August totalled 14.9 cm. Hurricane Allen, 9 August, dumped 32.5 cm of rainfall.

Forty-one hens were radio tagged in 1980; nine nests were found and three clutches of eggs hatched, 7 and 11 July and 24 September. Seven nests were found in June, one in July, none in August, and one in September. Quail wings obtained from hunting camps on the study areas showed a 1:3 adult to juvenile ratio. Thirty-four percent of the juvenile birds were over 150 days of age and hatched prior to mid-August. Back calculation of hatching dates for the remaining juveniles showed that 63 percent hatched in mid-September, and 3 percent in October. The September hatch followed the rains of Hurricane Allen on 9 August.

Five of 10 radio-tagged hens in the Rodeo pasture (moderately grazed, good range condition) nested, but only 1 of 14 radio-tagged hens nested in the Justo pasture (overgrazed, poor range condition). The Fruta pasture (overgrazed, poor range condition) had 3 birds nesting of 12 that

were radio-tagged. No nests were found after Hurricane Allen due to loss of radio-tagged hens and failure of battery powered transmitters.

The 1981 breeding season was wet with average temperatures. Rainfall from January through September 1981 was well above normal with 2.6 cm recorded in February and 19.2 cm in August.

Thirty-five hens were radio-tagged in 1981. Only one nest was found because the solar powered transmitters failed to function while a hen was in dense cover, especially while a hen was sitting on a nest. Seven broods were known to have hatched; one in May, three in June, two in July, and one in August. The latest hatch was 7 August. Wings obtained from hunters showed a 1:5 adult to juvenile ratio. Sixty-nine percent of the juveniles were over 150 days of age and hatched prior to 16 July; 9 percent hatched in the latter half of July, 10 percent in August, 9 percent in September, and 2 percent in October. The latest bird hatched about 16 October.

The Rodeo pasture (good range condition) and the Justo pasture (poor range condition) were used as study sites in both years of the study. Twelve hens were monitored in the Rodeo pasture and two were found with broods. Ten hens were monitored in the Justo pasture and two were found with broods.

The Fruta pasture was not used as a study site in 1981. Only two hens were caught during four weeks of trapping this pasture. The pasture was apparently so overgrazed during the 1980 drought and the following winter that there was little nesting cover and the quail hens moved elsewhere during the spring covey break-up. The Pita pasture (lightly grazed, good condition) was added in 1981 to replace the Fruta pasture. Thirteen hens were radio tagged there and three broods were found.

Nests and Nest Losses

Eight nests of radio-tagged hens were found in which incubation of eggs had begun. Two other nests with eggs were found but were destroyed before they could be incubated. The eight complete clutches averaged 12.0 eggs and ranged from 9 to 18 eggs. One renesting effort was noted in which a hen's initial clutch had 15 eggs and her second clutch had nine eggs.

Forty eggs were found in three successful nests. Three eggs each in two of the successful nets were pipped, but ants (Solepopsis spp.) entered the eggs and killed the chicks.

Seven unsuccessful nests were noted. Five were destroyed by predators and two were abandoned. Field sign at the nest sites indicated that coyotes (Canis latrans) destroyed four nests and a skunk (Mephitis mephitis) destroyed another. Lehmann (1946) reported that most nest predation in south Texas was due to coyotes (80-83 percent), skunks (15 percent), and snakes (1 percent).

The two abandoned nests were in the early stages of incubation. One of the abandoned nests was a renesting attempt. Neither of the two hens attempted to renest after abandoning its nest. At the time of abandonment, there had been no rainfall for a month and maximum daytime temperatures averaged 37.4 C. Stoddard (1931) believed that few bobwhite nests are voluntarily abandoned, but abandonment may be due to some environmental disturbance. Klimstra (1950) noted that during periods of hot weather, incubating birds may abandon nests due to the excessive heat.

Chick Survival

During this study there was a 49 percent chick loss within the first two weeks of life. Data on chick mortality was collected from nine broods of radio-tagged hens during the summers of 1980 and 1981 . Chick loss rates were recorded for five broods from the date of hatch, two broods starting at two weeks of age, one brood starting at three weeks of age, and one brood starting at six weeks of age.

During the dry summer of 1980, two broods were observed from their dates of hatch. One brood of 10 chicks was lost entirely before two weeks of age; the remaining brood of 11 lost four chicks in two weeks and then only one chick up to 30 days of age, after which the hen was found dead and the location and fate of the brood could no longer be determined.

Seven broods were observed and followed during the summer of 1981. Three broods of 6, 12, and 16 chicks were lost within one week after hatching. The four other broods were from two to six weeks of age when observation began. After two weeks of age, chick loss was minimal with two chicks lost from one brood during its third week of life, and one chick lost per week after two weeks of age for the remaining three broods. Causes of chick loss were difficult to determine. Two broods, 12 and 16 chicks, were lost at three and five days, respectively. Both broods were in the Pita pasture (lightly grazed, good range condition), hatched during a period of heavy rains, and were lost during the same 24-hour period. Another brood, five days of age, was abandoned by the hen when she was flushed by the researcher.

Chick losses were higher in the Justo pasture (overgrazed, poor range condition) than in the Rodeo pasture (lightly grazed, good range condition) during both years of study. In the Justo pasture, one entire brood was lost within two weeks of age and two broods lost one or two chicks between two and four weeks of age. Three broods were tracked in the Rodeo pasture. One brood of 11 chicks had lost four chicks by two weeks of age and lost only one from then until 30 days of age. One brood lost one chick between six and seven weeks of age, and there was no chick loss from another brood between two weeks and 30 days of age.

Brood Rearing Habitat

Brood rearing habitat was determined for two broods in 1980 and seven broods in 1981. Cover used by brooding hens and chicks was dependent on the time of day. Most activity of hens with chicks occurred from about 0900-1100 hrs and 1500-1800 hrs. During these hours, hens led chicks into grassy, weedy areas of sparse to medium density with 15-70 percent bare ground. Areas too uniform in thickness (> 85 percent plant cover) were usually avoided.

Radio-tagged hens with chicks were found in protective cover from about 1100 hrs to 1500 hrs. This cover was usually a mesquite and mixed brush overstory, offering shade and protection, and an understory of short grasses, weeds, and debris with about 80 percent bare ground. Three brooding hens used the cover of large mesquite trees and granjeno surrounding natural ponds. Edges and breaks in vegetative pattern were very important. All radio locations of hens with broods were within 10 m of breaks in the vegetative pattern such as ranch roads and cattle trails. Activity patterns and the structure of brood rearing habitat were similar on all study areas. Brood ranges averaged about 0.8 ha.

Hen Mortality During the Nesting Season

Seventy-six quail hens were monitored during the study period and 38 mortalities noted. There were 44 percent and 57 percent losses of radio-tagged hens during the 1980 and 1981 seasons, respectively. Three hens died in May, 17 in June, five in July, eight in August, two in September, none in October, and one in November. Only one hen was known to have been incubating, and two hens had broods when they died. Predation was the major cause of hen mortality. Predators implicated by field sign and actual observations were coyotes (10), hawks (9), and Texas Indigo snake (1) (Drymarchon corias erebennus). One hen was killed when a tractor and mower ran over her, and another died from capture and handling stress. Twenty-eight hens were being monitored before Hurricane Allen. After its passage, five were found dead and five others had disappeared.

Second Broods

There was no evidence of second broods during the study period. Hens that lost their broods entirely did not nest again, and hens with broods were not found to leave them and nest again. Stanford (1972) documented 19 cases of second brood attempts in feral and penned wild bobwhites; of these, 14 were successful in hatching a second brood. Evidence of second broods in other species of quail has been found by Francis (1965) in California quail (Lophortyx californicus) and by Gullion (1956) in Gambel's quail (L. gambelli).

DISCUSSION

In south Texas, ranges almost devoid of quail in dry years have high populations during years of above average rainfall, providing that protective cover exists. The challenge for the manager is to be able to create habitat conditions such that huntable quail populations are produced during dryer years. Lehmann (1946) first pointed out that the keys to high quail reproduction in this area were rainfall and proper grazing management. His studies showed that quail preferred to nest in grasses nine inches tall or higher, which indicates range under light to moderate grazing activity. Our study indicates that pastures with a moderate level of cattle grazing have a higher number of birds nesting and better chick survival than overgrazed pastures in poor range conditions. Limitations of existing telemetry equipment handicapped data gathering especially for nesting studies. Battery powered transmitters lasted only 60-90 days and, therefore, did not span enough of the reproductive season to follow individual hens throughout; solar powered transmitters failed to function while birds were in deep shade, as when on a nest. The solar powered transmitters worked well in 1980 when cover was thin, but in 1981, higher rainfall produced denser nesting cover.

Kabat and Thompson (1963), Fatora et al. (1966), and Simpson (1976) found that quail chick mortality rates were highest within the first two weeks of life and then level off to about two to three percent per week into the fall. The present study bore this out and indicated that chick survival was better in pastures in good range condition than in those in poor conditions. Vagrancies of the weather still come into play, even in good brood habitat, as pointed out by the loss of chicks less than five days old during heavy rain showers.

In the present study, woody cover for shade and protection in close proximity to feeding areas was of paramount importance to broods. In addition, a high percentage of bare ground was essential for movements and feeding, as was the presence of trails and roads.

Mortality of hens during the reproductive season was high and may to some extent explain both the higher number of adult males than females in fall shot birds and the high numbers of juveniles per adult hen in fall shot birds. Kiel (1976) reported 10 to 14 young per female in south Texas and noted that such ratios could be attained by persistent renesting and high survival of young. Loss of adult hens would also contribute to a high ratio of young per adult hen.

CONCLUSIONS

Reproductive success of the bobwhite quail is dependent on the weather and man's management of rangeland. Quail in pastures that have light to moderate grazing pressures and are in good range condition have better reproductive success (numbers of hens nesting, successful nests, and higher chick survival) than do quail in pastures that are overgrazed and in poor range condition. High rainfall during the breeding season tends to

offset somewhat the negative effects of overgrazing, but rainfall in south Texas is sporadic; management to offset drought conditions should be practiced at all times.

LITERATURE CITED

Anonymous. 1981. U.S.D.A. Soil Conservation Service. Falfurrias, Texas.

Fatora, J. R., E. E. Provost, and J. H. Jenkins. 1966. Preliminary report on breeding periodicity and brood mortality in bobwhite quail on the AEC Savannah River Plant. Proc. Ann. Conf. Southeast. Assoc. Game and Fish Comm. 20:146-154.

Francis, W. J. 1965. Double broods in California quail. Condor 67:541-542.

Gullion, G. W. 1956. Evidence of double-brooding in Gambel's quail. Condor 58:232-234.

Kabat, C., and D. R. Thompson. 1963. Wisconsin quail, 1834-1962: population dynamics and habitat management. Wisconsin Conserv. Dept. Tech. Bull. No. 30. 136pp.

Kiel, W. K., Jr. 1976. Bobwhite quail population characteristics and management implications in south Texas. Trans. N. Am. Wildl. Conf. 41:407-420.

Klimstra, W. D. 1950. Bobwhite quail nesting and production in southeastern Iowa. Iowa State College J. Sci. 24:385-395.

Lehmann, V. W. 1946. Bobwhite quail reproduction in southwestern Texas. J. Wildl. Manage. 10:111-123.

Mohr, C. D. 1947. Table of equivalent populations of North American small mammals. Am. Midl. Nat. 37:223-249.

Rosene, W. 1969. The bobwhite quail, its life and management. Rutgers Univ. Press, New Brunswick, NJ. 418pp.

Stanford, J. A. 1972. Second broods in bobwhite quail. Pages 21-27 in J. A. Morrison and J. C. Lewis, eds. Proc. 1st Natl. Bobwhite Quail Symp., Okla. State Univ., Stillwater.

Simpson, R. C. 1976. Certain aspects of the bobwhite quail's life history and population dynamics in southwest Georgia. Georgia Dept. Nat. Resour. Game and Fish Div. Tech. Bull. WL 1.

Stoddard, H. L. 1931. The bobwhite quail--its habits, preservation and increase. Charles Scribner's Sons, NY. 559pp.

Stoddart, L. A., A. D. Smith, and T. W. Box. 1975. Range management. 3rd Ed. McGraw-Hill Book Co., NY. 532pp

Wilbur, S. R. 1967. Live-trapping North American upland game birds. Bur. Sport Fish. and Wildl. Special Sci. Rept., Wildl. No. 106, Washington, D. C.