A PATTERN TO QUAIL IRRUPTIONS IN THE ROLLING PLAINS OF TEXAS

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Abstract: Bobwhite populations along the western periphery of their range are characterized by irruptions ("boom-bust" population changes). While biologists agree that weather (i.e., precipitation) is involved, the causal mechanism(s) is (are) unclear. I discuss Jackson's (1964) observations about population irruptions in this region and elaborate on how such habitat changes may interact with predation as an explanation. The interaction of drought, grazing practices, rainfall, broomweed and predators can provide a logical explanation of quail irruptions in this area.

Bobwhites exhibit irruptive ("boom and bust") population growth over most of their semiarid ranges in Texas (e.g., Rolling Plains) (Figure 1). Such erratic population swings have been the focus of many studies in an effort to determine the causal agent(s). Recently, Bridges (1999) used various drought indices (e.g., Palmer Modified Drought Index) to explain up to 90% of the annual variation in bobwhite numbers for South Texas. But biologists cannot agree on the causal mechanism, i.e., how does drought affect reproduction and/or survival in order to produce such pronounced population variations in successive years?

Biologists have evaluated several theories of how rainfall influences quail abundance (e.g., Campell et al. 1973, Giuliano and Lutz 1993). Such theories have addressed (1) nutrients in the diet (vitamin A [Lehman 1953] and phosphorus [Cain et al. 1982]), (2) hormonal influences via phytoestrogens (Cain et al. 1987) or non-specific stressors (Radomski 1997), (3) breeding physiology (Koerth and Guthery 1991), or (4) more indirect effects through habitat change (Schemnitz 1993) or some aspect thereof (e.g., insect availability [Roseberry and Klimstra 1984:112]).

Jackson (1962) characterized bobwhite irruptions in the lower Rolling Plains of Texas as an interaction among drought, livestock grazing practices, plant succession and periodic episodes of heavy rains. His explanation of the situation may be described as a 5-step process.

1. A drought of several years, coupled with livestock overgrazing, depletes much of the habitat, hence most of the bobwhite population. The relict population of bobwhites survives in what I refer to as "honeyholes", i.e., those "source" habitats that provide relatively drought-resistant habitats. These bobwhites "are in a sense selected stock and to a degree adapted to a lack of cover" (Jackson 1962). I refer to them as "Yogi Quail" (i.e., they're smarter than you're average quail) and suggest that they are disproportionately adult birds.

2. A year of average rainfall promotes secondary succession on the bared soils, resulting in expanses of annual forbs (e.g., doveweed, buffalobur) useful to quail. The habitat is "functional [but] unstable." The nutritional situation is good and the predator population has lagged during the dry years. Bobwhites undergo a "lateral" increase and occupy sites across the landscape.

3. A year of excessive rainfall breaks the drought. The landscape is now covered with a dense canopy of common broomweed which provides excellent winter ground cover yet is open at quail-level for easy travel. "Now the range is all bobwhite habitat as regards cover" (Jackson 1962). The quail increase is rapid (a "vertical" increase).

4. A year of normal rainfall follows with good moisture carryover from the previous year. The bobwhite population explodes and occupies all marginal habitats (even roadsides). Meanwhile plant succession has advanced to a stage less desirable to bobwhites (e.g., mostly grasses) and the quail population is left "out on a limb" and probably competing for food with an irruptive rodent population.

5. The bobwhite population crashes if food or cover fails before spring. Dry years set in and continue. Conditions revert again to phase 1.

Jackson used bobwhite population irruptions in 1942 and 1958 as the basis of his observations. His data were based largely on hunting preserve records on number of quail harvested. It is not possible to compare abundance bobwhite population indices available today, i.e., Breeding Bird Survey data (Sauer et al. 1997), with the relative abundance levels observed by Jackson (1962). Breeding Bird Survey data suggest the largest bobwhite irruption in the Rolling Red Plains (generally synonymous with Jackson's Lower Rolling Plains) from the period 1966-96 occurred in 1967 (Figure 1). While irruptions have occurred several times since then, none have approached 1967 levels.

The 1987 irruption is the one that most hunters of "my" era use as a benchmark. This irruption conforms very well to Jackson's "model." Dry conditions prevailed from 1983-84, and the range conditions were deplorable. Accentuating the dilemma for quail was the bitter cold winter of 1983-84. Bobwhites were (apparently) absent from many of my favorite haunts in southwestern Oklahoma (Harmon County). I estimate that bobwhites made up less than 20% of the quail population during the 1984-85 hunting season; scaled quail comprised the remainder. Rains fell in the fall of 1984 and resulted in a "good" broomweed stand in 1986. The lateral increase occurred. More rains fell in 1986 and resulted in a bumper broomweed year in 1987. The vertical increase occurred and a banner quail year was the result.

A review of Jackson's "model"

Now, let's dissect Jackson's observations and see what new or different connotations might be placed on how quail responded to these environmental stimuli. Some of the following comments can be substantiated, others are conjecture on my part.

Let's start with the drought year. Quail populations are low and intuitively represent a corps of quail who have experienced "survival of the fittest." These survivors possess greater adaptive skills than their deceased cohorts, either in the presence of natural enemies or quail hunters. Hunters bemoan that quail are notorious runners, flush wild and are otherwise more elusive than normal. I submit that, when flushed, such quail are "low" flyers, atypically hugging the brush. In my opinion, such behavior reflects harassment from accipiters (e.g., Cooper's hawk). The situations have selected for "Yogi quail."

Now for the lateral increase. Improved conditions allow the survivors to "recolonize" more marginal habitats, but nesting success is generally low because of a lack of suitable nesting cover (either perennial bunchgrasses or prickly pear). Perhaps bobwhites that select for prickly pear as a nesting habitat fare better than those in the recovering bunchgrasses (e.g., Slater 1996). Perhaps nesting conditions improve during the latter half of the summer (as nesting cover improves) and an August hatch yields an "average" quail year.

The vertical increase is promoted by a year of dense broomweed. The carpet of broomweed transforms all the range into "usable space" (Guthery 1997). The broomweed, more than any other plant as far as I'm concerned, "predator proofs" the winter quail population, resulting in higher carryover of breeding birds. Broomweed seeds, albeit small, offer a high energy diet that helps increase winter survival. At least some (perhaps many) of the breeding quail produce multiple broods. If weather conditions promote 2 successive broomweed years, the quail population booms.

Caveat emptor; the speculation on my part increases as I weave the role of predators into the equation.

During the second year of the broomweed, grasses are increasing, as are rodent populations (e.g., cotton rats). The blanket of cover is tenuous now, imperiled by either rodents or livestock (both of whose numbers have likely built over the last year). Bobwhite populations become more vulnerable to a host of predators, including hunters. If it stays dry, the next year's nesting habitat is more depleted, and more fragmented, thus allowing predators to be more efficient in their searches.

It is likely that the predator populations have increased, lagging some time behind their heretofore abundant prey. Sometimes a rabies or distemper outbreak helps curb their numbers, or in previous years a fur market might take its toll. But the predators (e.g., striped skunks, raccoons) in the Rolling Plains are adaptable generalists. Perhaps their populations don't decline as the prey base does; perhaps they switch to buffer items like prickly pear tunas, peanut hay, deer supplements or scavenge carcasses along the roadside.

Supposedly, predator populations, acting either singly or collectively, don't depress bobwhite numbers. However, predators have their greatest depressing effect when predator populations are high relative to their prey, or what is sometimes referred to as the "predator pit" (Krebs 1996). And that's where we're at in several regions of Texas (e.g., Edwards Plateau, Cross Timbers).

Ode to broomweed

I submit that the most visible herald of a banner quail year in the Rolling Plains is a "broomweed" year. And, while the broomweed seeds can be a major diet item during such years, I suspect broomweed's major contribution to quail is by making virtually all the range landscape "usable space" (Guthery 1997). Guthery argues that quail populations are increased by increasing the quantity of habitat, not the quality.

A dense canopy of broomweed probably provides a measure of predator-proofing for bobwhites that is unavailable during other phases of Jackson's model. Several studies (Roseberry and Klimstra 1984, Giuliano and Lutz 1993) suggested that the best predictor of bobwhite abundance is the previous year's abundance. This suggests that some quail management dogma (e.g., "you can't stockpile quail") is malarkey. Broomweed probably helps increase overwinter survival thereby increasing density of birds available for the breeding season.

In summary, I propose that the ultimate effect of rainfall for quail may simply be an increase in herbaceous cover that provides a strategic advantage to the prey, be they cotton rats or bobwhites. Better survival of breeding birds, coupled with higher nesting success, may provide the mechanism to put the "boom" back into quail crops. Oddly enough, it may be the droughts for which we should be thankful, for they may be as important to the boom-bust phenomena as the "wet" years. The drought "cocks the hammer" for quail booms (i.e., bares the soil) and the rain pulls the trigger.

LITERATURE CITED

Bridges, A.S. 1999. Abundance of northern bobwhite and scaled quail in Texas: influence of weather and landscape-cover change. Thesis, Texas A&M University, College Station.

Cain, J.R., S.L. Beasom, L.O. Rowland, and L.D. Rowe. 1982. The effects of varying dietary phosphorus on breeding bobwhites. Journal of Wildlife Management 46:1061-1065.

Cain, J.R., R.J. Lien, and S.L. Beasom. 1987. Phytoestrogen effects on reproductive performance of scaled quail. Journal of Wildlife Management 51:198-201.

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. Wildlife Monograph 34.

Giuliano, W.M., and R.S. Lutz. 1992. Quail and rain: what's the relationship? Pages 64-68 in K.E. Church and T.V. Dailey, eds. Quail III: national quail symposium. Kansas Department of Wildlife and Parks, Pratt.

Guthery, F.S. 1997. A philosophy of habitat management for northern bobwhites. Journal of Wildlife Management 61:291-301.

Jackson, A.S. 1962. A pattern to population oscillations of the bobwhite quail in the lower plains grazing ranges of northwest Texas. Proceedings Southeastern Association Game and Fish Commissioners 16:120-126.

Koerth, N.E., and F.S. Guthery. 1991. Water restriction effects on northern bobwhite reproduction. Journal of Wildlife Management 55:132-137.

Krebs, ,C.J. 1996. Population cycles revisited. Journal of Mammalogy 77:8-24.

Lehman, V.W. 1953. Bobwhite populations and Vitamin A. Transactions North American Wildlife Conference 18:199-246.

Roseberry, J.L., and W.D. Klimstra. 1984. Population ecology of the bobwhite. Southern Illinois University Press, Carbondale.

Sauer, J.R., J.E. Hines, G. Gough, I. Thomas and B.G. Peterjohn. 1997. The North American Breeding Bird Survey Results and Analysis, Version 96.2. Patuxent Wildlife Research Center, Laurel, MD.

Schemnitz, S.D. 1993. Scaled quail habitats revisited - Oklahoma panhandle. Pages 143-147 *in* K.E. Church and T. V. Dailey, eds., Quail III: national quail symposium. Kansas Dep. Wildl. and Parks, Pratt.

Slater, S.C. 1996. An evaluation of prickly pear (*Opuntia* spp.) as a predator deterrent in nest site selection by northern bobwhite (*Colinus virginianus*). M.S. Thesis. Angelo State University, San Angelo, Texas.