Abstract: Predators have become a scapegoat for declines in quail populations. Predation on quail nests has been proposed as a factor limiting quail abundance. Predators may affect individual birds, coveys, or even a local population. However, evidence indicates predators are not responsible for the long-term, continental scale decline in quail numbers. Nor do predators contribute substantially in year to year fluctuation in quail numbers. Evidence indicates that at the regional and national levels, changes in habitat appear to limit quail populations. Weather appears to control annual variations in local quail numbers.

In theory, predators can adversely affect quail populations in only 2 direct ways. First, they can prey on both young and adult quail. Second, they can feed on quail eggs. Indirectly, they can affect quail populations by praying (or not praying) on species that may be in competition with quail for limited resources. However, to show that predators have an adverse affect on quail populations, it must first be shown that quail numbers have declined over time and second that predation is the ultimate factor that limits quail population growth if numbers have declined. In this paper, I look at various factors proposed to limit quail population growth, summarize my understanding of each, and conclude with my thoughts on what ultimately limits quail populations in Texas.

Are Quail Populations Declining?

There is considerable evidence that quail populations are declining. In recent decades, nearly range-wide declines in the abundance of both northern bobwhite (Brennan 1991, Church et al. 1993, Brady et al. 1998) and scaled quail (Church et al. 1993) have been documented. However, analyses (Bridges 1999) of long-term trends in quail numbers in the South Texas Plains and Rolling Plains ecoregions (Gould 1975) of Texas indicated that northern bobwhite (Colinus virginianus) have shown no long-term trends in both areas. Whereas, scaled quail (Callipepla squamata) numbers have shown no long-term trend in the South Texas Plains, but have declined to near extinction in the Rolling Plains. Therefore, one can conclude that quail populations are declining over much of their range. However, is this due to predation?

Are Predators the Cause of the Quail Decline?

The scaled quail in the Rolling Plains has been the focus of an increasing number of studies in recent years, but the extent and causes of declines remain controversial. Nesting success is a possible factor. Nest predation accounts for the largest share of nest failures in quail nests (Hernandez 1999).

Nest predation may have reduced scaled quail numbers in the Rolling Plains. However, if predation is the cause of the scaled quail decline in the Rolling Plains then predators must not be affecting the northern bobwhite population in the same way they do the scaled quail population. In other words, predators are feeding on eggs, young, and adults of scaled quail more then they are feeding on northern bobwhite. This could be an indirect effect of predation (as mentioned above) where predators praying on one species reduce predation on a second species. If this is so for the Rolling Plains, then it must not be the South Texas Plains where both species have shown no long-term trend.

Rates of nest predation reported in some studies are so high that local populations would not be self-sustaining. Bowen et al. (1976) noted that investigator driving, or a combination of driving and walking, to nests increased predation rates on artificial ground nests. It is possible that high predation rates observed in many studies are due to the investigator's influence and do not reflect actual predation rates on nests not being studied. The importance of predation at the regional or continent-wide decline of northern bobwhite (Brennan 1991) is unknown, but there is clear evidence that landscape changes are part of the problem in Texas (Silvy unpublished data).

Effects of the Landscape

Bowen et al. (1976) and Lutz and Silvy (1980) noted that vegetation types that
had the densest vegetation experienced the least artificial nest losses. Horkel et al. (1978) noted that predation on artificial nests increased with proximity of nests to an artificial edge. Populations of many bird species nesting in fragmented landscapes (Urban and Shugart 1986) or near habitat edges (Temple and Cary 1998) suffer increased nest losses. Therefore, is predation the ultimate cause or only a proximate cause of these nest losses? If predation rates increase on lands that have been overgrazed (the lack of nest cover increased predation rates) or fragmented (caused by land subdividing, land clearing, cropping, etc), is the decreased nest success due to predators or by man? In this case predation would only be a proximate cause and not the ultimate cause.

Predators as the Proximate Cause

Okay, so predators are not the ultimate cause, however, they may be the proximate cause. Once quail numbers have decreased for whatever reason, predators may then be able to hold their numbers down indefinitely, eventually driving them to extinction. This is called the "predator pit hypothesis" (Messier 1994). Factors consistent with a predator pit theory include long-term low density of prey species, coupled with alternate prey availability (Carbyn et al. 1993:238). Essential to the predator pit hypothesis, is the assumption that predator removal would cause an immediate growth of a prey population (Messier 1994).

For predators to control quail in this manner, predators must be obtaining food from other sources when quail numbers are low, otherwise predators could not support their own populations. This is called prey switching in the scientific literature (Keith 1990). However, if these alternate prey species were so numerous, why were predators not concentrating on them in the first place? If not numerous, these alternate prey species would not support the predator populations at their existing levels, which would release quail from the predator pit. If predators could hold prey at low levels this should happen first with prey which produce few offspring each year (k-selected species; i.e., deer) and not quail which have the capability of producing many young each year (r-selected species). Because most grassland bird species are declining (Robins et al. 1989, Terborgh 1989, Bohning-Gaese et al.1992), predators would have to be holding them all in a "pit", thereby allowing even less choice of bird species for prey switching. For this to occur, rodents, rabbits, or other small mammals would have to be high populations. There is no evidence for long-term high population densities of these mammals, as these species tend to fluctuate annually (Keith 1990) as do quail (Bridges 1999). Because quail populations fluctuate annually, we have no evidence (quail are not held at low densities for long periods of time) for a "predator pit".

Well maybe predators cause the annual fluctuations that are observed in quail numbers. To show that predators are causing the annual fluctuations in quail numbers, one must show that predator densities fluctuate at the same time quail densities fluctuate. Then one must show that predators are causing fluctuations in quail abundance. Inherent in this argument is that predators have increased over the years due to low fur prices and decreased furbearer trapping. Less trapping of predators for their fur means more predators in the environment and therefore more nest predation. For this to be true there should be a correlation between fur trapping and quail densities. Fur prices have been depressed for several years in Texas, yet quail densities have continued to fluctuate (Bridges 1999).

In addition, studies (e.g., Keith 1990) on predator-prey relationships indicate that prey species control predator numbers and not the reverse. In Crissey and Darrow's (1949) classic study of snowshoe hares (Lepus americanus) on Valcour Island, New York, hares continued to cycle after predators had been eliminated from the island. Similarly, an introduced population of the snowshoe hares on Anticosti Island in Canada cycled in phase with populations on the mainland, in spite of the lynx (Lynx canadensis) being absent from the island (Elton and Nicholson 1942). It is clear that cycles are not brought about by the action of the predators (Dempster 1975). Lawrence and Silvy (1995), in a study designed to control nest predators of the endangered Attwater's prairie chicken (Tympanuchus cupido attwateri), noted increased nest success, but no increase in prairie chicken numbers during the spring census following 2 years of predator control in coastal Texas. Given that predators do not cause the annual cycles in quail numbers, what does?

Influence of Weather

Weather is known to influence abundance of quail species (Bridges 1999). Bridges (1999) used a 21-year (1978-98) Texas Parks and Wildlife Department data set to analyze the influence of weather (rainfall and drought index) on the abundance of northern bobwhite and scaled quail within 6 ecological regions of Texas. He concluded that wet weather conditions generally
resulted in increased abundance of both quail species. Correlations between quail abundance and weather conditions were stronger in drier as opposed to wetter ecological regions. It appears that weather is influencing yearly fluctuations in quail numbers. In fact, any quail manager would say, "I told you so."

Conclusions

The ultimate factor affecting long-term quail numbers is change in habitat at the regional and national levels with weather influencing year to year variation in local quail numbers. This is not to say that predators can not have an affect on individual birds, coveys, or even a local population. However, the above evidence indicates predators are not responsible for the long-term decline in quail numbers at the regional or continental spatial scale or a major contributor in annual fluctuations in quail numbers.

Epilogue

So maybe predators do not control quail densities and their annual fluctuations in numbers. However, "Every damn quail they eat could be taken by a hunter - so let's kill all the predators and shoot more quail." Given this was legal, could such a program be accomplished over a regional or continental scale? Even at a local scale, Lawrence and Silvy (1995) noted that control of meso-predators increased nest success, but reduced Attwater's prairie chicken population numbers the following year. To use one of Dr. Dale Rollins' favorite Leopold (1970:190) quotes: The last word in ignorance is the man who says of an animal or plant: "What good is it?" If the land mechanism as a whole is good, then every part is good, whether we understand it or not. If the biota, in the course of aeons, has built something we like but do not understand, then who but a fool would discard seemingly useless parts? To keep every cog and wheel is the first precaution of intelligent tinkering.

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Literature Cited

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