# COYOTES AND UPLAND GAMEBIRDS

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***Abstract:*** That coyotes (*Canis latrans*) destroy nests and individuals of bobwhites (*Colinus virginianus*) and wild turkeys (*Meleagris gallopavo*) is well documented. In many situations, however, the removal of coyotes would have little observable effect on gamebird recruitment and population dynamics. This counterintuitive result occurs because (1) renesting reduces the hen failure rate and (2) loss sources other than coyotes become stronger when coyotes are removed from a predator-prey system.

Coyotes destroy nests of northern bobwhites and wild turkeys Coyotes also depredate adult quail and turkeys. One automatically assumes, therefore, that removal of coyotes would increase production and survival of these gamebirds. The assumption is not necessarily correct.

My purpose is to review selected literature on the relationship between gamebird populations and coyotes in Texas and elsewhere. I will focus on the nesting season and show nest depredation by coyotes and other predators accounts for a substantial percentage of nest losses. Then I will review field research that compared quail and turkey abundance on areas with and without suppression of coyotes and other predators. These results will show that intensive predator control may increase standing populations of wild turkeys, but that it has little if any effect on quail populations. Finally, I will discuss theoretical circumstances that lead to counterintiutive outcomes when a predator species, such as the coyote, is removed from a predator-prey system.

## Nest loss

Lehmann (1984:91-93) determined the fates of 532 bobwhite nests. He collected data during 1936-1952 in the Coastal and Rio Grande Plains of Texas. The first point to make about Lehmann's results is that they are biased high, because he did not use appropriate statistical procedures. Nevertheless, his results provide an overall picture of nest depredation.

Forty-five percent of Lehmann's (1984) sample nests hatched successfully and 55% were destroyed by some agent. Predators caused 84% of the losses, i.e., about 46% of nests in the sample were depredated. Coyotes were responsible for 36% percent of nests destroyed by predators, which amounted to about 17% of all nests.

Vangilder (1992) summarized nest success rates for different races of wild turkeys. Success rates ranged between 31-62%. The bulk of nest failures were due to predators, but in some cases coyotes were not involved in nest depredations.

On the Welder Wildlife Refuge near Sinton, Texas, predators destroyed 12 of 31 radio-tagged hens and all of 10 nests initiated by radio-tagged hens (Ransom et al. 1987). Ransom et al. concluded predation limited juvenile recruitment and, hence, predation kept wild turkey populations at low levels in the study area

## Effects of predator control

Beasom (1974) analyzed the effects of intensive predator control on bobwhite and turkey populations in the eastern Rio Grande Plains. He removed 188 coyotes, 120 bobcats (*Lynx rufus*), 65 raccoons (*Procyon lotor*), 46 striped skunks (*Mephitis mephitis*), and 38 other mammalian predators from a 9-square mile area over 2 years. His results indicated moderate gains in the abundance of bobwhites and strong increases in turkey production as gauged from poult:hen ratios.

Guthery and Beasom (1977) conducted a

similar study in the western Rio Grande Plains. They took 132 coyotes, 18 bobcats, 15 raccoons, 22 striped skunks, and 40 other mammalian predators from a 6-square mile area This intensive level of control had no effect on population trends and abundance of scaled quail (*Callipepla squamata*) and bobwhites.

**Predation and gamebird population dynamics**

Results of the studies cited above lead to the notion that suppression of coyotes and other predators may or may not affect the abundance of gamebirds. The failure of predator suppression to increase gamebird populations is counterintuitive, because of the documented heavy losses of gamebird nests and to a lesser extent adult birds. Removal of a major loss source should reduce losses and thereby increase abundance. In this section, we explore reasons for the counterintuitive outcome

*Renesting*. Both turkeys and bobwhites may renest if a clutch is destroyed. Turkeys are weak renesters compared to bobwhites, which may lay 3 to 4 nests in an attempt to hatch at least 1 nest. Renesting has the effect of reducing the hen failure rate while the nest failure rate remains constant Consider flipping a coin. If you want to get 1 head you have a much better chance in 3 flips than in 1 flip. The chance of a head on 1 flip is 0.5, but the chance of at least 1 head in 3 flips is 0 875. From Lehmann's (1984) data with a nest failure rate of 0.55, the hen failure rate is 0.17 and the hen success rate is 0 83, given 3 nesting attempts. This means that 83% of hens would be expected to hatch a brood, even though more than half of all nests are destroyed.

Turkeys are less likely to renest if a first nest is destroyed. This means that the nest failure rate is approximately equal to the hen failure rate. Weak renesting behavior of turkeys is 1 reason why suppression of coyotes and other predators may increase poult:hen ratios, as observed by Beasom (1974). Turkey counteract lower production rates with higher annual survival rates than bobwhites.

*Competing risks* Suppose we study a predator-prey system and measure with high accuracy the loss rates owing to different predator species; e g., coyotes destroy 10% of nests, raccoons 10%, skunks 10%, and snakes 10%. Now suppose we remove skunks from the system We *do not* save 10% of nests by taking skunks out of the system. Rather, we save some smaller fraction of nests (say 2%) because those nests not destroyed by skunks become available to coyotes, raccoons, and snakes. The percentage of nests taken by coyotes, raccoons, and snakes would increase with the removal of skunks. These competing risks provide the general expectation that a nest saved from 1 predator does not necessarily mean the nest will be successful. The general expectation means there is not a 1:1 relation between predator suppression and nest success We might expect, for example, that 4 or 5 or 6 of every 10 nests saved from loss to a particular agent would eventually result in chicks or poults

*Combined effects of renesting and competing risks.* Here we set up a predator-gamebird system and isolate the effects of coyote predation. The background circumstances are as follows: nonpredation losses account for 15% of nests if no predators are present; noncoyote predators destroy 50% of nests if no coyotes are present and no nests are lost to other causes. We will model the system with variable rates of coyote predation where there are no other predators and no other loss sources The above circumstances may be combined under the union rule of probability and we can isolate and estimate the effects of coyote predation on hen failure rate

In the system described above, removal of all coyotes would yield about a 60% hen failure rate for turkeys (1 nesting attempt) and a 20% hen failure rate for bobwhites (Fig. 1). Note that as the coyote predation rate increases, the hen failure rate increases at a lower rate. This occurs because, somewhat ironically, an increasing coyote predation rate reduces the predation rate of other predators.

Figure 1 reveals that in a reasonable range of expected coyote predation rates on nests (0 to 20%), the effect of coyote predation on the hen failure rate is low Analysis of fall age ratios and percent summer gain in populations under different rates of coyote predation supports the above assertion. For quail and turkeys, there is little difference in recruitment whether coyote predation is low (0%) or high (20%) (Table 1) in the system we have created.

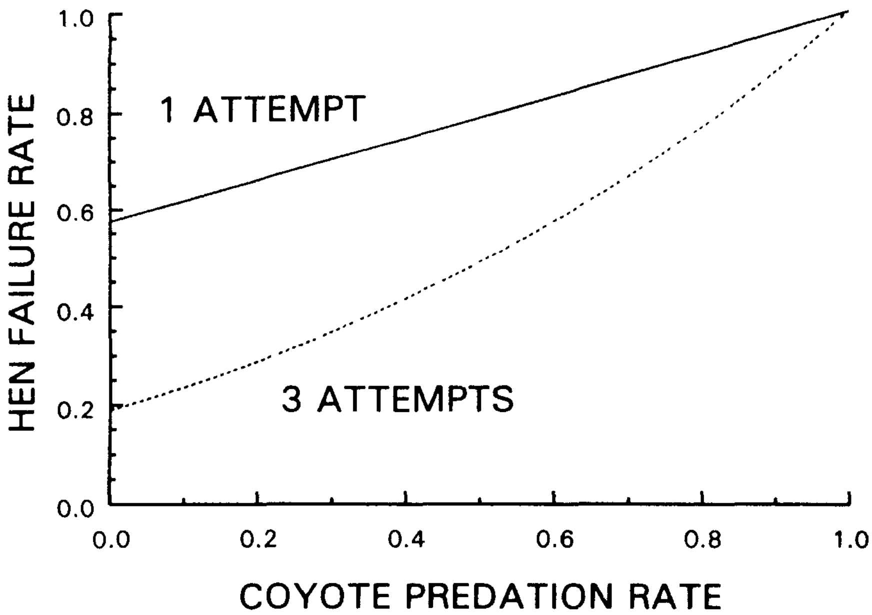


Fig. 1. Relationship between hen production failure rate and coyote predation rate with renesting efforts and competing risks present. The curve for wild turkeys is approximated under 1 nesting attempt and the curve for bobwhites under 3 nesting attempts. See text for explanation and definition of competing risks.

Table 1. Modeled responses of bobwhite and wild turkey population variables to different coyote predation rates. Number of nesting attempts is given in parentheses.

| Coyote predation rate[a] | Bobwhite (3 attempts) | | | Turkey (1 5 attempts) | | |
|---|---|---|---|---|---|---|
| | J/A[b] | PSG[c] | Survival (%)[d] | J/A | PSG | Survival (%) |
| 0 00 | 3 96 | 174 | 20.2 | 2 76 | 107 | 26.6 |
| 0 05 | 3 85 | 167 | 20.6 | 2 64 | 101 | 27.5 |
| 0 10 | 3.73 | 161 | 21.1 | 2.52 | 94 | 28.4 |
| 0.15 | 3 62 | 155 | 21.7 | 2.39 | 87 | 29.5 |
| 0.20 | 3.49 | 147 | 22.3 | 2.27 | 80 | 30.6 |

[a] *Rate of nest destruction by coyotes in the absence of all other causes of nest loss.*
[b] *Age ratio in juveniles/adult 6 months after the first egg of the nesting season is laid.*
[c] *PSG = percent summer gain in abundance.*
[d] *Annual survival rate that will lead to population stability given recruitment.*

The general findings on nests would also hold for coyote predation on adult birds, i.e., the existence of coyote predation must reduce losses to other causes and, conversely, the removal of coyote predation would increase losses to other causes.

**Discussion**

Natural systems, including predator-prey systems, are quite complex. This very complexity tends to stabilize systems by virtue of biological checks and balances such as competing risks. Whereas I reviewed the effects of renesting and competing risks, other balances exist. For example, suppression of coyotes tends to increase their productivity (larger litter sizes, better pup survival) Coyote suppression may also remove competition for non-coyote predators and result in increased density for these species Prey species may be resilient to predation by virtue of density-dependent production and survival. This means that as the density of a prey species declines, its survival and production rates increase

Whereas we seek general principles of wildlife management in general and predator-prey management in particular, we must be aware of special exceptions to general outcomes. Processes in nature are intrinsically variable; this variability insures different effects of coyote predation on bobwhite and turkey populations at different times and places. Places may have special properties that render general expectations invalid. For example, intensive agriculture may force predators and prey to use the same isolated tracts of permanent cover. This may result in higher than normal predation and rates and may render predator suppression a viable alternative for increasing gamebird abundance.

Let me conclude this discussion with an observation on the truth of the following statement. "*Suppression of coyotes and other predators increases abundance of gamebirds.*" In a simple world, we could say the statement is true or false, however, the world is not simple. So in any situation the statement is likely to be true to some extent and false to some extent. The role of the wildlife manager is to *scientifically* determine (no art, please) the truthfulness and falseness of the statement under a particular set of circumstances, and to apply predator management according to scientific analysis and well-defined management goals

**Literature Cited**


Beasom, S L 1974. Intensive short-term predator removal as a game management tool. Trans North Am Wildl. Conf. 29·230-240.

Guthery, F. S., and S L. Beasom. 1977 Responses of game and nongame wildlife to predator control in south Texas. J Range Manage. 30:404-409.

Lehmann, V W 1984. Bobwhites in the Rio Grande Plain of Texas. Texas A&M Univ Press, College Station. 371pp.

Ransom, D , Jr., O J. Rongstad, and D. H. Rusch. 1987. Nesting ecology of Rio Grande turkeys. J. Wildl. Manage. 51:435-439.

Vangilder, L. D. 1992. Population dynamics. Pages 144-164 *in* J G. Dickson, (Ed.) The wild turkey Stackpole Books, Harrisburg, Penn