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Abstract: Coyotes (*Canis latrans*) and pronghorn (*Antilocapra americana*) have co-existed for thousands of years, but in today's production-oriented society the pronghorn may need some help periodically. Although pronghorn numbers have rebounded dramatically since the early 20th century, continued management of this species is necessary and may include "management" of its primary predator, the coyote. Pronghorn defense mechanisms offer protection from predators, but the coyote's hunting strategies overcome these mechanisms The Trans-Pecos region of Texas holds the greatest numbers of pronghorn in the state. Ranchers in the Trans-Pecos can use predictors, such as rainfall; strategies, such as proper livestock stocking rates and pasture deferment; and tools, such as predator control, to help manage pronghorn populations in the presence of coyotes.

Coyotes and pronghorn have co-existed in North America since the Pleistocene epoch In this co-evolutionary process, each of these species has evolved behavioral, morphological, and physiological mechanisms which allow both the predator and prey species to survive. However, with the influence of human expansion and associated impacts, it has become necessary to implement management practices which enhance pronghorn survival.

In the Trans-Pecos of Texas, most of the emphasis in pronghorn management has been toward population manipulation through hunting, water distribution and fencing improvements, and predator control. In recent years, predator control has been a controversial subject, largely because of the increased influence of groups concerned for the "rights" of animals The necessity of predator control in healthy prey populations also has been questioned by many in the scientific community.

The purpose of this paper is to investigate the overall relationship between the pronghorn and coyote in the southwestern United States. Hunting and survival mechanisms, and management of the pronghorn-coyote interaction will be discussed. Specific emphasis will be placed on the Trans-Pecos region of Texas

Historical perspective

The return of the North American pronghorn to much of its native range has been a success story in modern wildlife management. Estimates of pronghorn numbers prior to European settlement range from 40 to 60 million animals. However, with the arrival of settlers and more efficient methods of hunting, fueled by market demands of consumers in more populated areas, pronghorn populations in the United States declined to approximately 10,000 animals by 1900 (Yoakum 1980). By 1924, populations had increased to about 24,000, largely the result of a greater emphasis on conservation. Since that time, through proper management and translocation practices, pronghorn populations in the United States have increased to over 800,000 animals (V W Howard, New Mexico St. Univ., pers commun 1990).

Some southwestern pronghorn populations have undergone similar fluctuations, while others have not fared as well For example, American pronghorn (*A. a. americana*) populations in northern Arizona have fluctuated as described above, with major declines in the late 19th and early 20th century, and subsequent increases to a relatively stable number Conversely, those subspecies in more severe, arid regions such as the Peninsular pronghorn (*A. a. peninsularis*) of southern California and Baja California, and the Sonoran pronghorn (*A. a. sonoriensis*) of the Sonoran Desert region, have never recovered from the original declines and are currently listed as endangered Still others, such as the pronghorn of the Trans-Pecos region of Texas, which occupies overlapping ranges of both the American pronghorn and the Mexican pronghorn (*A. a. mexicana*), have maintained relatively stable numbers throughout these time periods.

The Trans-Pecos historically has been a stronghold for pronghorn populations in Texas. With the advent of the cattle industry, and subsequent installation of watering facilities in the late 1800s, many marginal areas became productive habitats for pronghorn and other wildlife species. This, coupled with the predator control efforts and protection provided by some concerned ranchers of the early 1900s, resulted in increased numbers of Trans-Pecos pronghorn from 1924 to 1939, when herds in other parts of the state remained relatively static (after suffering severe declines in earlier years).

Trans-Pecos herds were healthy enough to permit translocation of over 4,000 animals to other parts of the state from 1939 to 1956. Overall, Trans-Pecos pronghorn levels remained relatively stable from the late 1950s to the early 1990s with intermittent, long-term droughts causing the most severe fluctuations (Hailey 1986).

Pronghorn defense mechanisms

The pronghorn has evolved several defense mechanisms which enhance survival, especially as it relates to predation. Most of these mechanisms are further enhanced by, and have naturally evolved in, the open, expansive habitats preferred by pronghorn. In adults, speed may be the most important defense against predation Adult pronghorn can reach 40 mph with relatively little effort, and speeds in excess of 50 mph are not uncommon. Pronghorn have extremely acute vision at long distances and the large, protruding eyes located on the side of the head enhance peripheral vision as well. A white rump patch which flares up when the animal is alarmed provides a visual signal to other pronghorn when danger approaches Another alarm signal, the "cough", provides an auditory signal for other animals in the group. In close encounters with predators, pronghorn will also use their horns for defense, although all females do not grow horns

Strategies or mechanisms to prevent depredation of young pronghorn include both inherent morphological and physiological characteristics as well as behavioral responses of both fawns and adults. In pronghorn fawns, 4 basic strategies are effective in preventing predation: (1) cryptic coloration or camouflage, (2) lack of early scent gland development, (3) ability to lie motionless for long periods of time, and (4) selection of proper concealment in bedding behavior (Alldredge et al. 1991).

Pronghorn dams also employ strategies for protection of young such as (1) leaving fawns bedded in isolation for relatively long periods of time, resulting in less likely attraction of predators, (2) cleaning of young to eliminate fecal and urinary odors, (3) simple protective behavior involving attacks of predators by dams (and bucks), and (4) visual and auditory alarm responses as mentioned above.

Herd characteristics which enhance survival include grouping behavior when danger approaches and synchronization of fawning dates. Grouping behavior tends to enhance survival by reducing the probability of individual animals being depredated. Synchronization of birth is thought to reduce predation of newborns (Rutberg 1987) through (1) "swamping" (ie. large numbers of young born in a short period of time exceed the nutritional demands of the predator population), (2) group defense (maternal protective instincts are compounded by groups of dams with fawns), and (3) the "confusion" factor (i.e., the ability of the predator to select a specific target may be reduced in a group of dams with fawns, rather than isolated fawn/doe pairs).

Coyote hunting strategies

Although the evolved defense mechanisms of pronghorn are many and varied, coyotes have responded with hunting strategies which enhance their ability to capture pronghorn, especially fawns. Coyotes may hunt individually, in pairs, or in small family units.

When hunting individually, a coyote may employ 2 primary methods. The first, I refer to as the "-search and destroy" tactic in which an individual coyote will, apparently somewhat methodically, search an area until a prey species is found and attacked This is particularly effective on newborn fawns exhibiting cryptic behavior (lying motionless).

The second method used by individual coyotes involves seeing or smelling the fawn and simply stalking and/or chasing it. In selecting prey by age, sex, or health status, an individual coyote is more likely to select smaller or weaker individuals (fawns,

seldom does, and very infrequently bucks), because coyotes are simply not equipped physically to effectively kill larger animals in an efficient manner. In selecting smaller prey species, individual coyotes are less likely to be discriminatory and more likely to be opportunistic

Coyotes also hunt in family units (i.e., packs) and in this style of hunting, attacks on larger animals are more likely. In pack behavior, coyotes may hunt by either stalking or pursuit, but generally pursuit of prey is most common. It is often suggested that coyotes will use a "relay" technique in which they alternate amongst each other to progressively wear down the prey animal. Based on the relative "intelligence" of coyotes and numerous personal communications with witnesses of this behavior, I am convinced that the coyote is capable of such teamwork.

A form of stalking is also exhibited by family units of generally 3 to 5 animals in which the coyotes surround the prey species and gradually close in to overwhelm the prey with sheer numbers. In general, coyote packs are most likely to capture smaller, weaker, or lame individuals, however healthy adults are also susceptible.

One other hunting behavior exhibited by coyotes, specifically on pronghorn, may indicate an ability to use a "tool" of sorts to aid in capture Coyotes have been observed in the Trans-Pecos "herding" pronghorn to fences, which the pronghorn will not cross if the fence is made of net-wire In this way, the coyote may actually be using the fence to facilitate capture

Pronhorn defense vs. coyote strategy

In the evolutionary and annual battle between coyotes and pronghorn, the "victor" varies among years, climatic regimes, and habitat types. The relationship between coyotes and pronghorn is extremely complex and is affected by such factors as the previous and current year's precipitation, available hiding cover, nutritional status of the dam, forage availability, alternative prey species, and other factors.

Research conducted on the effect of coyote predation on pronghorn populations generally has indicated that coyotes are very effective predators of pronghorn fawns during their first 30 to 60 days of life (Autenreith 1982, Barrett 1984, Hailey 1986). Coyote predation was the primary cause of low fawn survival on Anderson Mesa in Arizona (Neff et al. 1985), and increased fawn survival was attributed to coyote control (Smith et al. 1986). In a southeastern Colorado study, coyote predation was believed to be responsible for 71% of fawn mortality (Gese et al 1988) Mortality of radio-equipped fawns in Montana was 90 and 93% in 2 separate years in 1 portion of the National Bison Range; coyote predation was the primary cause of death (Corneli 1979). Fawn survival rates in southeast New Mexico were 14% greater in 2 of 3 years in a coyote-controlled versus non-controlled area (Larsen 1970). Other studies have also have shown evidence of coyote predation on pronghorn fawns varying from 12 to 31% of known fawn mortality (Barrett 1978, Beale 1978, Bodie 1978).

Trans-Pecos pronghorn predation

In the Trans-Pecos, predation of adult pronghorn is uncommon primarily because those predators commonly occupying pronghorn habitat (coyotes, bobcats, golden eagles) are largely incapable of killing adults. Mountain lions, although certainly capable of stalking, capturing, and killing pronghorn, do not tend to occupy the same habitat Additionally, diseases and parasites do not commonly affect Trans-Pecos pronghorn seriously because of the arid climate (Hailey 1986, Canon 1993).

Thus, with the absence of these sources of mortality, adult pronghorn in the Trans-Pecos have a high probability of living a relatively long life, except in long-term drought situations. Such droughts can result in large losses in isolated pronghorn herds (Buechner 1950, Hailey 1986) and can be especially detrimental where net-wire fences do not allow free movement of these herds

Pronghorn fawns in the Trans-Pecos, as in other areas, are highly susceptible to predation In a study conducted in Hudspeth County of the western Trans-Pecos, 81% of 101 radio-equipped fawns were killed by predators over 3 fawning seasons Sixty six fawns were killed by coyotes, 6 by mountain lions, 5 by bobcats, and 4 by golden eagles (Canon 1993). Eighty percent of depredated fawns were killed within the first 30 days of life and 95% within

the first 60 days of life, supporting the notion that the most critical period for pronghorn is the first 30 to 60 days of life.

Coyotes were especially efficient at finding and capturing fawns, both individually, and in pairs or family units. All of the hunting strategies described previously were witnessed by the author at some point during the 3 years except the "relay" technique, which probably wasn't necessary on fawns The "search and destroy" tactic appeared to be the most common, based on the number of times coyotes were seen (Canon 1993).

Denning pairs of coyotes appeared to be particularly effective at finding and destroying fawns. Fawn remains were found near the 3 dens that were found, and the radio transmitters were near 2 of them. In "Buckhorn" valley, the center of which contained a coyote den during one of the fawning seasons, 5 fawns were killed in 1 night and several others over the course of the fawning season; (the night after we found the den, the pups were moved by the pair to another "undisclosed" location) After losing several fawns in another area, a radio transmitter was found next to an active den close to the center of the area.

Transient coyotes also appeared to be attracted to the area during fawning season based on the number of coyote sightings during the peak fawning period. Coyote scats on roads also were more frequently noted during this time period

Fawn habitat

In the Hudspeth County study (Canon 1993), fawn habitat was investigated by measuring a series of 23 micro- and macro-habitat characteristics on over 600 fawn bed-sites, and comparing these to the same characteristics on 225 randomly-selected sites. These habitat characteristics also were compared between surviving and non-surviving fawns. The purpose of the habitat evaluation was to identify characteristics of preferred bedding sites, and which of these resulted in greater fawn survival

Several of the habitat characteristics differed between actual and randomly chosen bed-sites, indicating that certain vegetative and physical characteristics were selected by fawns for bedding, rather than random selection. The comparison of most interest, however, was that between surviving and non-surviving fawns. Only a few of the 23 characteristics measured were different between these 2 groups Brush density was greater ($P<0.06$) at bed-sites of survivors than non-survivors. Surviving fawns bedded more often ($P<0.05$) in the flatter terrain where rock cover was inherently less.

Perhaps the most important variable in terms of immediate hiding cover for bedded fawns was the measurement "nearest concealing cover" (NCC). Because fawns tended to bed with their back to a vertical object (clump of grass, shrub, cacti, yucca, rock), I measured the distance from the bed-site to the closest object providing cover. Surviving fawns were more likely ($P<0.06$) to "select" bed-sites with greater immediate (close-range) hiding cover.

Although few of the habitat characteristics differed between surviving and non-surviving fawns, we found that surviving fawns were more likely to bed in flatter areas with greater brush cover (providing more cover in the surrounding macro-habitat), and closer to a tall plant or object (providing more cover in the immediate micro-habitat). Bed-sites next to clumps of taller grasses and yuccas appeared to be favored. Although grass cover in the area surrounding the bed-site was not considered an important factor separating surviving and non-surviving fawns, taller grasses did appear to provide hiding cover As part of the Chihuahuan Desert region, grass cover was extremely variable on the study area. Relative to fawn fate, grass cover was essentially identical among survivor bed-sites, non-survivor bed-sites, and random sites

Management of pronghorn-coyote interactions

The Trans-Pecos region, specifically that portion in the Chihuahuan Desert, does not provide the type of low shrub cover found in most pronghorn habitat in the western U.S However, pronghorn fawn survival in the Trans-Pecos can be enhanced when micro- and macro-habitat cover is available. Micro- and macro-habitat cover may be provided by brush and taller grasses, as in the Hudspeth County study (Canon 1993), or any combination of short- and long-range cover which serves to conceal fawns from predators, primarily coyotes.

Although brush provided macro-habitat cover in that study, such cover can be provided by tall, bunch-type grasses as well. Livestock management practices which promotes taller grasses will allow more compatible co-existence of pronghorn and livestock. Periodic and timely deferment of livestock from known, preferred pronghorn fawning habitat will produce the type of taller, bunch-type grasses that provide better fawning areas.

Unfortunately, the weather of the Chihuahuan Desert is too variable and alternative strategies may be necessary in times of prolonged drought. In order to survive such drought periods, ranchers in this part of Texas may not have the luxury of deferring livestock (primarily cattle in the Trans-Pecos) from fawning habitat. When the grass gets short, and the rain has not come, the rancher has 2 options, either sell (usually in a down market) or move them where there is still some grass left. This situation has occurred over the last couple of years in west Texas

In terms of pronghorn populations, poor nutritional status of adults resulting from the lack of forage, scarce cover remaining in preferred fawning habitat and subsequent poor fawn crops, and other factors, have resulted in substantial declines in Trans-Pecos pronghorn populations Texas Parks and Wildlife surveys show a gradual decline from a high of almost 15,000 pronghorn in the Trans-Pecos region in 1992 to barely half that (7,525) in 1995 (Richardson 1994, M. Hobson, Texas Parks Wildl. Dept., pers. commun) Although a couple of good precipitation years can this decline, a recovery from a decline of this magnitude will take some time

In such situations, on both a local and regional scale, 1 alternative strategy is coyote control. An investigation of pronghorn fawn crops over an 8-year period on University of Texas Lands properties in the Trans-Pecos (S. Sullenger, U.T Lands, unpubl data; Canon 1993) revealed that intensive, relatively short-term control of coyotes in the 2- to 3-month period prior to and during fawning season can result in major increases in the number of fawns surviving beyond the critical 30- to 60-day period following birth

Aerial surveys on the Double U and Baylor ranches in Hudspeth County showed large increases in fawn crops in the first few years following initiation of coyote control (S Sullenger, U.T Lands, unpubl data). Although coyote control continued after these initial years, the effectiveness of control efforts declined. Subsequently, fawn crops began to decline as well, from a high of 61% on all of U.T. Lands in 1985, to a low of 16% on the same areas in 1990.

On the Baylor Ranch, 1990 estimated fawn crops were down to 10%. In early 1991 and again in 1992, the Baylor Ranch hired a trapper to supplement the annual helicopter gunning provided by U.T Lands. The resulting intensive control efforts yielded 78 and 104 coyotes prior to and during the 1991 and 1992 fawning seasons. Fawn crops subsequently increased to 61% and 75% in 1991 and 1992 respectively (approximately 6- and 7-fold increases, respectively, compared to 1990 estimates)

Although increased precipitation in 1991 and 1992 undoubtedly aided in this increase, on the nearby Double U Ranch, where coyote control efforts remained similar to previous years, fawn crops only increased from 16% in 1990 to 35% and 30% in 1991 and 1992, respectively (approximately 2-fold increases each year compared to 1990)

On U T Lands overall, fawn crops increased from 16% in 1990 to 43% and 40% in 1991 and 1992 respectively. (Much of this increase was the result of the large increases from the Baylor Ranch.)

It is apparent, therefore, that timely and intensive coyote control can substantially increase pronghorn fawn crops However, such control efforts are not necessarily required on an annual basis. Further investigation of the effects of precipitation on fawn crops on U.T. Lands revealed that 54% of the variation in current-year fawn crops ($P< 05$, $r^2=0.54$, $y = 0.08 + 2\ 97x$) can be explained by the previous year's precipitation total (Canon 1993) In other words, there is a fair correlation between current year's rainfall and next year's pronghorn fawn crop. Thus current-year precipitation may serve as a predictor of sorts to determine the need for coyote control prior to next year's fawning season

Management Implications

Current population estimates in the Trans-Pecos show the lowest total number of pronghorn since

before 1977 (Richardson 1994, M. Hobson, Tex. Parks Wildl. Dept., pers. commun.). Barring continued drought, ranchers in the Trans-Pecos may be able to hasten the recovery of these populations by initiating an intensive coyote-control program in the 2- to 3- month period prior to and during fawning season for at least 2 consecutive seasons. Such a program should be a 2- to many pronged approach (2 or more methods of control are employed) Coyote control is not a panacea for pronghorn populations, but it can be used to restore populations to former levels more rapidly

The following management recommendations are suggested:

(1) Proper stocking rates (of cattle, not sheep or goats in pronghorn habitat) will provide an adequate forage supply for pronghorn in most years, and ensure adequate nutrition for lactation. Stocking rates should be remain flexible in these arid environs.

(2) Defer livestock from pastures containing preferred pronghorn fawning habitat for a period long enough to provide hiding cover (tall growth of bunch-type grasses) for fawns. Continue deferment for 30 to 60 days beyond the peak of fawning season. Ideally, such deferment should be provided at least every 2 to 3 years

(3) Monitor annual rainfall to aid in determining the necessity for coyote control the following year If this year's rainfall is well below average, coyote control is recommended prior to (and possibly during) the following fawning season. (The assumption here is that next year's rainfall will be better, which is not always the case of course.)

(4) In declining populations, or in populations below the estimated carrying capacity, intensive coyote control (as above) may speed recovery, or growth, to desired levels "Intensive" control must effectively reduce coyote populations until at least 30 days after the peak of fawning season

(5) In most "normal" years, coyote control is probably not necessary except for the control of specific depredating individuals

Literature Cited

Alldredge, A.W., R.D. Deblinger, and D. J Peterson. 1991. Birth and fawn bed site selection by pronghorns in a sagebrush-steppe community. J. Wildl Manage. 55:222-227.

Autenreith, R.E 1982. Pronghorn fawn habitat use and vulnerability to predation. Proc. Pronghorn Antelope Workshop 10:112-131.

Barrett, M W. 1978. Pronghorn fawn mortality in Alberta. Proc. Pronghorn Antelope Workshop 9:429-444.

_____. 1984. Movements, habitat use, and predation on pronghorn fawns in Alberta. J. Wildl. Manage. 48:542-550.

Beale, D.M. 1978 Birth rate and fawn mortality among pronghorn antelope in western Utah. Proc. Pronghorn Antelope Workshop 8:445-448

Bodie, W L. 1978. Pronghorn fawn mortality in the Upper Pahsimeroi River drainage of central Idaho. Proc Pronghorn Antelope Workshop 8:417-428

Buechner, H 1950 Life history, ecology, and range use of the pronghorn antelope in Trans-Pecos, Texas. Amer. Midl. Nat 43:257-354

Canon, S.K 1993. Fawn survival and bed-site characteristics of Trans-Pecos pronghorn Ph D. Thesis, Texas Tech Univ., Lubbock. 133pp.

Corneli, P S. 1979. Pronghorn fawn mortality following coyote control on the National Bison Range. M.S. Thesis Univ Montana, Missoula. 69pp.

Gese, E M., O J Rongstad, and W.R. Mytton 1988. Relationship between coyote group size and diet in southeastern Colorado J. Wildl Manage. 52:647-653

Hailey, T L. 1986. A handbook for pronghorn antelope management in Texas. Texas Parks Wildl Dept. FA Rep. Ser. No. 20. 59pp.

Larsen, P 1970. A six year study of antelope productivity and survival in southern New Mexico. Proc. Antelope States Workshop 4:97-103.

Neff, D.J., R.H. Smith, and N.G. Woolsey. 1985. Pronghorn antelope mortality study. Final Rept. Ariz. Game and Fish Dept.Fed. Aid Proj. W-78-R. 22pp.

Richardson, C. 1994. Big Game Research and Surveys. Performance Report. Texas Parks Wildl Dept. Fed Aid Proj. W-127-R-2

Rutberg, A.T. 1987. Adaptive hypotheses of birth synchrony in ruminants: an interspecific test. Am. Nat. 130:692-710.

Smith, R.H., D.J. Neff, and N.G. Woolsey. 1986. Pronghorn response to coyote control--a benefit:cost analysis. Wildl. Soc. Bull. 14:226-231.

Yoakum, J 1980. Habitat management guides for the American pronghorn antelope. U.S. Dept. Int , Bur. Land Manage. Tech. Note No. 347. 77pp.