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Coyote Predation on a Texas Goat Ranch

Dale A. Wade and Guy E. Connolly*

Coyote predation has long been a serious cause of loss for sheep and goat producers in Texas. A recent study was conducted to determine the economic impact of predation on one Texas goat operation, and to experiment with reducing predation losses with a new control tool — the toxic collar.

*Wildlife specialist, Texas Agricultural Extension Service, The Texas A&M University System, San Angelo, Texas, and wildlife research biologist, U.S. Fish and Wildlife Service, Denver Wildlife Research Center, Twin Falls, Idaho. (Photographs by the authors.)

A general announcement was made during the annual Sheep and Goat Raisers Association convention in July 1979 of the need for toxic collar test sites in Texas. Mr. and Mrs. Charles Howard volunteered to cooperate in field tests of the collar.

When the authors met with Charles and Faye Howard in late July, coyotes were killing one or more Angora goats a day on their ranch near Meridian. The Howards have raised goats since 1965, but predation did not reach catastrophic levels until early 1979. By April 1979,

coyotes were regularly killing goats of all ages and small kids were being taken by foxes as well. Therefore, it was necessary to remove the goats from large, brushy pastures to smaller fields from which they could be gathered and penned each night.

Coyote predation continued during daylight hours. Even though 2,400 acres of range were available, excessive predation eventually forced confinement of about 800 goats to a single, 24-acre pasture of sudangrass by day and a small corral each night. Despite efforts to reduce

predation, losses continued almost daily through July. Ten fresh coyote kills were documented during the week before July 23, when the toxic collar tests began. In early August, the Howards decided to sell the goats if predation could not be brought under control by September 1.

Economic Losses High

In collecting field data on efficacy of the toxic collars, all observed goat mortality — from predation and other causes — was recorded. Coyote predation as a cause of death was established from tooth puncture wounds in skin and bones, hemorrhage around tooth marks and tracks at kill sites. From these loss data and other ranch records, direct and indirect economic impacts of predation on this goat enterprise for the production year ending September 30, 1979 were estimated (Table 1). This goat operation was nearly annihilated by coyotes in 1979, with recorded predation deaths comprising only a fraction of the total economic loss.

Unusually close confinement during spring and summer to protect the goats from predators resulted in severe parasite infestations which caused the death of approximately 90 adult goats and an unknown number of kids. Many more adult goats became unthrifty and had to be sold at a loss. This parasite problem was alleviated in late summer by repeated drenching and by moving the goats back to large pastures as coyote predation was gradually reduced. Large losses from parasites and complications, forced sale of goats at a loss and reduced mohair production from goats surviving predation were important manifestations of indirect economic loss from predation. However, the greatest single cost was the loss of nearly all kids born in 1979.

Kid Crop Hit Hard

The number of spring kids taken by predators could not be determined because many simply disappeared; thus, these losses are included in indirect costs. With the careful management in effect before, during and after kidding, the Howards normally could have expected at least 240 kids from approximately 300 breeding nannies. Only 27 kids actually sur-



Mr. and Mrs. Charles Howard examine the remains of a coyote that died after killing a collared goat and biting the collar.

Table 1. Estimated costs of predation on angora goats at the Howard Ranch, Meridian, Texas, October 1, 1978 — September 30, 1979.

| | |
|---|----------|
| Direct Costs | |
| 91 adult goats killed and loss of mohair | \$ 9,282 |
| 15 large kids (born fall 1978) killed and loss of mohair | 1,365 |
| Cost of travel to pen goats; 147 days | 1,470 |
| Ranch expenditures for direct control of predators | 2,520 |
| Subtotal | \$14,637 |
| Indirect Costs from Unusual Confinement | |
| Loss of adult goats to parasites/complications | \$ 5,400 |
| Loss on adult goats sold because of parasites/complications | 3,600 |
| Decreased adult mohair production | 4,100 |
| Loss of kids born spring 1979 and mohair from them | 13,419 |
| Veterinary fees and drugs | 823 |
| Subtotal | \$27,342 |
| Total Costs: Direct and Indirect | \$41,979 |
| Less expected, normal loss of adult goats, kids and mohair | 6,360 |
| Net Cost of Excessive Predation | \$35,619 |
| Total Income from Goats in 1979 (approximate) | \$28,000 |

vived, so it was estimated that predators killed or otherwise caused a loss of 213 kids.

Other major indirect costs of predation resulted from reduced personal attention to other phases of the Howards' livestock/farming opera-

tion and inability to use all available goat range. In the absence of excessive predation, they would have bought 500 additional goats, which would have substantially increased net profits relative to management costs.



Coyotes usually kill goats by biting the larynx region of the throat, immediately back of the jaw. The damaged jawbone on the left indicates evidence of predation. A normal jaw is shown on the right.



The toxic collar was not punctured on this goat that was attacked from the rear by a coyote. Similar rear end attacks have occurred in other collar tests in Texas, Idaho and Montana.

The authors estimated that indirect costs of predation on the Howard ranch totalled \$27,342. Added to \$14,637 in direct losses and costs, the total cost of predation was \$41,979. The Howards would have expected a normal loss of about \$6,360 in the absence of excessive predation, leaving an increased loss of \$35,619. Total income from goats in 1979 amounted to only about \$28,000; thus, the Howards' predation costs exceeded total income by about \$7,600. No self-supporting livestock operation could persist for long in the face of such high losses.

Wild Prey Abundant

Why was coyote predation on the Howards' goats worse in 1979 than in previous years? The wild prey base was not formally measured, but an abundance of cottontail rabbits, black-tailed jack rabbits and other small animals was observed on all three test sites. White-tailed deer also were abundant, although their numbers were somewhat reduced from previous years. Local ranchers reported coyotes to be more abundant in 1979 than ever before and expressed concern about coyote predation on deer. Five freshly-killed whitetail deer were found during this study.

It appears that excessive coyote predation on goats was not due to scarcity of natural prey. Rather, the abundant natural prey supported a large coyote population, and some of the coyotes preyed on goats at will.

Toxic Collars Used

The toxic collar is a new tool to selectively kill coyotes that attack



The remains of a toxic-collared goat show that the collar was torn and punctured by coyote teeth.

sheep or goats. The livestock neck collars contain Compound 1080 solution, and coyotes that attack collared sheep or goats usually bite through the collars and swallow lethal amounts of the toxicant.

The toxic collar was developed by Roy McBride, Alpine, Texas. McBride, a former U.S. Fish and Wildlife Service employee, obtained a patent on the toxic collar principle in 1974. The design has been modified substantially by U.S. Fish and Wildlife Service predator researchers at the Denver Wildlife Research Center. These modifications were achieved in cooperative work with McBride, who currently manufactures the collars being used by the Fish and Wildlife Service under the EPA Experimental Use Permit. Present field tests in Texas are a joint venture of the Texas Agricultural Extension Service and U.S. Fish and Wildlife Service, with the assistance

of ranchers and the Texas Rodent and Predatory Animal Control Service.

To use toxic collars on the Howard ranch, all goats were gathered from pastures where coyotes had been killing. Twenty to 50 goats were collared and put back in the pasture, while all uncollared goats were penned at night or moved to another pasture. In all three tests, coyotes attacked collared goats within a few days or weeks. Through November 1979, 25 collared goats were attacked and 20 attacks resulted in punctured collars. Based on U.S. Fish and Wildlife Service tests with captive coyotes, it is believed that every punctured collar resulted in death of the attacking coyote.

In the first test, no kills occurred during the first few nights, probably because of the sudden increase in human activity resulting from daily monitoring of the collared goats. However, two collared kids were

Table 2. Predation losses on Howard Ranch, Meridian, Texas, in relation to use of toxic collars in 1979.

| | Number of Goats Killed by Coyotes ¹ | | | | | |
|----------------------|--|---------------------------------------|----------------------------------|---------------------------------------|----------------------------------|---------------------------------------|
| | Test 1 Beginning July 23 | | Test 2 Beginning August 12 | | Test 3 Beginning August 15 | |
| | Goats without collars | Goats with ² collars | Goats without collars | Goats with ² collars | Goats without collars | Goats with ² collars |
| One week before test | 10 | -- | 3 | -- | 4 | -- |
| 1st week of test | 3 | 2 | 1 | 0 | 3 | 0 |
| 2nd week of test | 1 | 0 | 0 | 3 | 5 | 3 |
| 3rd and 4th weeks | 1 | 4 | 0 | 0 | 7 | 1 ³ |
| 2nd month of test | 5 | 5 | 0 | 0 | 5 | 3 |
| 3rd month of test | 5 | 0 | 0 | 0 | 1 | 0 |
| 4th month of test | 3 | 4 ⁴ | 0 | 0 | 0 | 0 |
| Totals | 28 | 15 | 4 | 3 | 25 | 7 |

¹Verified kills only. Additional losses probably occurred.

²Each collar was punctured by attacking coyote(s) unless otherwise noted.

³Collared nanny attacked from rear; collar not broken.

⁴Three collared wethers killed with bites to rump or hind legs; collars not broken. One goat carcass was found some 2 weeks after death; it appeared to have been killed. Collar was missing, with no evidence to indicate whether or not it was broken.

killed during the fifth night and both collars were punctured.

Following a brief lull in predation, the remaining collars were removed, but were soon put back into service when killing resumed. Four collared kids were killed on the night of August 11, with all four collars punctured. There was another brief lull in predation. From late August through November, collars were in the field continuously. From tracks and scats, it was established that coyotes frequented the test pastures regularly even after 11 or 12 killer coyotes had been removed by toxic collars.

As shown in Table 2, predation continued at a reduced rate (relative to that before the test) through the first 4 months of the first test. The collars proved ineffective against at least one coyote that killed from the rear rather than with the normal throat hold. Between October 22 and November 7, two uncollared and three collared goats were killed in this fashion. Because these collared and uncollared goats all exhibited similar wounds, it appears that the coyote was not deliberately avoiding the collars. Several coyotes have been removed with traps and M-44's from this test site since November 7, and no more rear end attacks have been recorded.

The second test yielded more

clearcut results on the effectiveness of the toxic collar than the first test. The second test started after three uncollared wethers were killed in 3 nights. For the next 5 nights, uncollared wethers were penned each night and collared goats were left outside the pen. No kills occurred and no signs of coyote presence were found. Then, all goats were left out day and night in the hope that, if coyotes attacked, they would select collared kids. All kids at this location had collars. Three collared goats were taken 3 to 5 nights after penning was stopped, and all three collars were punctured. The last collared goat kill in this test was on August 22. No further kills have been found at this test site, although there are still coyotes in this area.

Tests Show Results

The third test started after several wethers and billies had been killed in a few days' time. This test took place on two adjacent 600-acre pastures. Attempts to pen all 470 uncollared wethers and billies each night were impractical because of pasture size and density of brush. Therefore, the large flock was moved periodically from one pasture to the other, leaving behind only collared goats where coyotes had recently killed. With this tactic, six toxic collars were bitten by coyotes and total kills dropped from

19 during the first month of the test to eight in the second month and one in the third month.

Compound 1080, the toxicant used in these tests, typically requires 1 to 2 hours to produce symptoms of intoxication in coyotes, and 4 to 8 hours or even longer to cause death. These time intervals permit coyotes to travel long distances before they succumb to toxicant received from collars. Therefore, it was not expected that many carcasses of coyotes taken with the collars would be recovered. In the third test, however, the remains of three poisoned coyotes were found.

Causes of death for these animals were established by presence of pink dye from the collars on their teeth. All were mature adults. Based on tooth wear, one was approximately 3 years old and the others were much older, perhaps 6 to 8 years. These coyotes obviously had escaped intensive application of other control measures. The toxic collar is believed to be effective against some cautious and wary coyotes that are all but immune to other methods.

In the third test, as in the first test, several goats were attacked from the rear. That last of these aberrant attacks was recorded in mid-September, and the problem coyote(s) could have been taken later, either with a toxic collar or by other control techniques that were in use concurrently.

Collar Effectiveness Proven

Based on U.S. Fish and Wildlife Service tests with captive coyotes, and the frequency and location of coyote attacks on collared goats, the authors estimate that 17 goat-killing coyotes were removed with toxic collars in the three tests through November 1979. Predation declined on all three test sites and stopped completely in one test. Even though the collars were supplemented with other techniques of coyote removal, none of the test ranches were kept free of coyotes for more than a few days. It appears that coyotes removed from goat ranches were rapidly replaced by immigrants from surrounding range where predator control is light or non-existent. Under these circumstances, toxic collars will

be most effective when coyote numbers are kept as low as possible by other methods. Collars are especially helpful when several coyotes are killing in the same flock.

Toxic neck collars are ineffective against coyotes that attack goats at body sites other than the neck. Such coyotes obviously must be taken with other methods, such as traps, M-44 devices or shooting.

In these tests, as in earlier work by the U.S. Fish and Wildlife Service, certain disadvantages of the toxic collar have become apparent. One is the need to sacrifice collared goats or sheep to take problem coyotes. But, in the flocks described here, goats were being killed in large numbers regardless of whether or not they had collars. Depredating coyotes are often hard to take by any method, and the sacrifice of one collared goat to take one problem coyote seems to be cost effective in serious predation cases. In the current tests, use of collars on Angora X Spanish goats rather than on more valuable purebred Angoras was found to be practical.

Other negative features of the toxic collar method are the need to manage both collared and uncollared goats so as to direct predation to the collared ones, and the need to check collars periodically to insure that they are not too tight or too loose. To aid routine checking of collared goats, it is helpful to offer them small amounts of grain or pelleted feed regularly. The collars then can be inspected more readily at close range.

Along with field tests to determine effectiveness of toxic collars in taking problem coyotes, the U.S. Fish and Wildlife Service also is carrying out laboratory studies of secondary poisoning hazards. Results to date indicate that the collar, as presently used with Compound 1080, presents little risk to nontarget animals. Some toxic collars have been lost, usually when coyotes scattered or obliterated carcasses of collared goats or sheep. Collars can be punctured accidentally on thorns or wire, but no human safety problems have been encountered.

Combination of Methods Needed

Throughout this study, the Howards employed both lethal (traps, M-44's) and nonlethal (night corral-

ling) predation control measures to keep goat losses as low as possible. Few coyotes were taken because they were extremely wary of traps and M-44's in pastures where goats were being killed. Beginning in late August, the Howards' efforts were augmented by Texas Rodent and Predatory Animal Control Service professionals who used traps, M-44's and firearms on ranches adjacent to the test sites. Some coyotes also were shot by deer hunters. These efforts collectively removed approximately 45 coyotes from the general vicinity of collar tests between late August and the end of November. It was impossible to determine how many of these were actually involved in predation on the Howard ranch.

The effectiveness of toxic collars in selective removal of killer coyotes has been confirmed in these and earlier tests. The collar is most useful in concert with other control methods; it is not seen as a replacement for other techniques. At this time, hazards of the 1080 collar to humans and nontarget animals appear to be minimal or insignificant, given the exercise of reasonable care. The sacrificial sheep or goats, however, are subject to extreme risk of death or injury from coyote attacks.

Although substantial effort is needed to use the toxic collar effectively and keep track of the collars, sheep and goat raisers who have cooperated in field tests have expressed a desire for collars to be made available for use by ranchers. Mr. and Mrs. Howard report that they would

have abandoned their goat operation this year had it not been for the effectiveness of toxic collars in removing problem coyotes. But, the Howards are still in the goat business and they now plan to purchase additional goats for brush control and to make full use of available range. They expect that more effective control of predation will permit them to realize a profit in 1980.

Need for Control Continues

In much of Texas, sheep and goats historically have been used to control brush and weeds while producing meat, wool and mohair. Millions of acres of Texas rangelands could benefit from goat use, but coyote predation is a major deterrent. Improved depredation control methods, including the toxic collar, would contribute toward growth and maintenance of viable sheep and goat industries in Texas and other states.

Based on research to date, the toxic collar merits consideration for widespread operational use in predation control. In the United States at present, the greatest current need and potential for use of toxic collars exists in Texas. Accordingly, Texas Department of Agriculture officials have indicated their intent to seek registration of the 1080 toxic collar with the Environmental Protection Agency for operational use in Texas. In preparing the application for registration, TDA will receive support and assistance from the Texas Agricultural Extension Service and the U.S. Fish and Wildlife Service.

Charles Howard inspects collared goats as they come up for feed.

