CACTUS BOBS, BY BRETT JAMES SMITH

A Texas Quail Story

Research on bobwhites in Texas might hold promise for the future of the species.

by Ronald J. Kendall, PhD

My interest in wild bobwhite quail began when I was growing up in South Carolina, being mentored by my grandfather. He was an avid outdoorsman and had particular fondness for quail hunting and bird dogs. Following him through the fields and quail coverts of the Carolina Lowcountry made me want to also follow in his footsteps as a hunter. Over the years, my interest in bobwhites grew to include their ecology. I've made the study of *Colinus virginianus* my life's work.

In the 1960s and for decades prior, quail hunting opportunities in South Carolina and throughout the bird's range were nearly unlimited, but they're now diminished so that it's hard to find even a single wild quail in the Palmetto State. In fact, since the 1980s, bobwhites have been reduced, if not eliminated, from more than 90 percent of their original range. Among many theories of their decline, the most widely accepted is habitat degradation associated with urban sprawl, dramatic changes in agricultural practices, and greater difficulty in implementing quail-friendly land-management practices, such as prescribed burning. Along with that, predators that feed on quail have grown in number, particularly raptors, and others—feral hogs, coyotes, and armadillos, for example—have increased their range. The traditional practices of habitat management—planting food plots, prescribed burning, and even predator management, particularly controlling raccoons and skunks—have not been able to reverse the dramatic drop in bobwhite numbers.

Yet during the decades of the birds' demise, researchers and land managers kept preaching "habitat management." People just accepted it. Prior to this decade, most scientific studies of quail addressed either habitat loss or management, and possibly predators.

Texas is home to some the last significant populations of wild bobwhites in the United States. In my opinion, the Rolling Plains ecoregion of West Texas represents the Alamo of wild bobwhites and the hunting of them in the United States. If we're ever to restore wild populations, maintaining quail in Texas is imperative to not only Texas but also the rest of the country. If the habitat ever returns throughout the bobwhite's traditional range, Texas is about the only place where wild bobwhite populations are healthy enough to sustain a program of trapping and transplanting, similar to the methods used to restore wild turkeys.

In the last decade, Texas suffered a sudden loss in wild bobwhites. As a result, some of the research we're doing here in Texas might be shining light on other factors that contributed to the widespread loss of wild bobwhites.

In 1997, after nine years at Clemson University, where I was a professor of environmental toxicology, I took a position at Texas Tech University in Lubbock and was tasked with establishing a research institute and an academic program in the same discipline. One of the most attractive reasons for relocating to Texas from my home state was in fact the wild bobwhite quail hunting that the recruitment team talked up. I accepted the job offer.

In fall of 1997, in Borden County, which is part of the Rolling Plains ecoregion, I experienced some of the finest wild bobwhite hunting in my life. Soon thereafter, I purchased property southeast of Lubbock in Kent County. The place had great quail habitat and a healthy number of coveys. In early 1999, I established Big K Ranch, Ltd., which has served as my own field laboratory for wild bobwhite quail management, conservation, and hunting.

For 11 seasons, I had great hunting on the ranch. One memorable day my son, Ronnie, and I hunted one draw with a single setter. We moved 17 coveys of wild bobwhites in 90 minutes.

Heading into the fall of 2010, we expected another great year. That summer had brought good rains, which helped produce perfect habitat and so many quail broods that we worried we'd run over them. The operational phrase was "Drive slow and watch where you are going." Neighbors and fellow quail hunters from around the Rolling Plains also predicted a phenomenal hunting season. It did not materialize.

By August and September, our ranch manager, who was on the property daily, began noticing fewer and fewer quail, and by October, it was hard to find one at all. We had beautiful habitat—food and cover—including sunflowers, broom weed, and ragweed—but no wild quail. That is when I crossed a bridge in my scientific thinking. I began to believe that something other than loss of habitat had been contributing to the decline of quail.

After the decline in 2010 across the Rolling Plains,

PHOTOGRAPHY BY RONALD KENDALL JR.

A "covey" caller on top of the QuailSafe attracts birds to the site and delivers medicated feed that rids bobwhites of parasitic eye and caecal worms, which have caused dramatic declines in quail poplulations of western Texas.

which is an area approximately the size of Michigan, several subsequent hunting seasons were literally lost. This reversal of fortune, however, precipitated a large research study called Operation Idiopathic Decline (OID), which represented the largest quail-disease study ever supported in the United States. Key organizations, including the Rolling Plains Quail Research Foundation, Park Cities Quail Coalition, and Texas A&M University AgriLife Extension Service, put up funding to move OID forward. The operation comprised researchers from multiple universities who investigated viruses, bacteria, environmental contaminants, and parasites in wild quail across the Rolling Plains ecoregion of West Texas.

After thousands of work hours trapping, handling, and evaluating thousands of wild bobwhites, we concluded that parasitic infection was the most plausible cause of the die-off. We were particularly interested in two parasitic nematodes, the eyeworm (*Oxyspirura petrowi*) and caecal worm (*Aulonocephalus pennula*).

In March 2012, Rick Snipes, then president of the Rolling Plains Quail Research Foundation, asked me to take a leadership role in the research. This led to the establishment of the Texas Tech Wildlife Toxicology Laboratory (WTL). I took the position of leading the lab and transferred out as director of the Institute of Environmental and Human Health and chair of the Department of Environmental Toxicology.

Now, nearly eight years later, the WTL has conducted thousands of hours of field and laboratory research on parasitic infection of bobwhite quail. Our work has essentially allowed us to follow the science of parasitic infection, and to date, we have published more than 40 peer-reviewed research papers—many more are on the way through the findings that are being generated from our productive and very hardworking laboratory team. We have learned so much since we began this journey and we have more to uncover, but the scientific revelations that have unfolded are astounding.

The parasites we found in Texas quail are called helminths, or parasitic nematodes. We discovered that the eyeworm and caecal worm infect wild quail through an intermediate host, including certain species of grasshoppers, crickets, and beetles, which ingest parasite eggs passed in the feces of wild quail. In the intermediate host, the larvae develops to L3 larvae, which is the infective stage, in a matter of weeks. In turn, quail ingest the infective larvae when they eat these certain species of insects.

For the eyeworm, the L3 larvae exit the insect in the crop of the quail, migrate up the esophagus into the nasal sinus, and then into the eye compartment, where the larvae feed and grow to adults in just a few weeks. An adult female eyeworm in a bobwhite may be large enough to stretch across a penny, and they are egg-laying machines and may contain thousands of eggs, which ultimately are passed through the bird's GI tract via feces, making the eggs available to the insects—which explains why these infections can spread so quickly once wild bobwhites are infected. In fact, in one of our field studies, we had data showing relatively low infection rates in wild bobwhites that emerged into a pandemic, with more than 90 percent infection rates, in just a matter of weeks.

We now realize that the eyeworm is a long-lived

organism that likely remains in the quail's eye up until the death of the bird. Once infection levels exceed 20 eyeworms, we see extensive damage, particularly in the ducts in the rear of the eye. In our field collections, we have noted that infection levels of 40 adult eyeworms in a quail are rare because birds usually die, either from infestation or predation, before that number can accumulate.

We have investigated the molecular biology of the eyeworm and have determined that it is 96 percent related at the DNA level to the *Loa loa*, an eyeworm of Central Africa that can infect and can cause blindness in humans.

Once eyeworm infections reach extreme levels, quail begin to disappear—losses of 90 to 95 percent in a matter of months in our research transects has been observed. In addition, quail sustain some losses from vision impairment. I have read hundreds of reports of and seen with my own eyes quail flying into trees and buildings, killing themselves.

The caecal worm locates in the intestinal area of the quail's cecum, which helps break down fiber acquired from seeds. Our investigation revealed that it is more than 91 percent related on the DNA level to the ascarid or the roundworm that can infect dogs, and if left untreated in canines, it reduces energy and stamina, and can result in hair loss and death. We found that infection levels rarely exceed 300 caecal worms because we believe quail with that level of infection are generally dying.

These parasitic infections take their greatest toll on a quail's immune system, which makes the birds more susceptible to disease and predation.

Across the Atlantic, in Scotland, red grouse (*Lagopus lagopus scotica*) is a highly desired game bird, just like bobwhites. These birds are very close kin to willow ptarmigan and have often experienced extreme boom-and-bust cycles, such that in some years there was no red grouse hunting, which not only disappointed the hunters but also limited the resources for managing the moors for grouse and future hunting.

The red grouse is so important economically that a research team was formed decades ago to evaluate treatment of the bird. The researchers ultimately blamed parasitic infection for causing the downturn in populations, and blame fell specifically on caecal worms, although of a different genus. Ultimately, researchers found a drug treatment that could be administered in the natural behavior of the red grouse, which ingest grit each day to aid in digestion.

Scottish scientists identified a way to offer drug-treated grit to red grouse and found that within two generations of adults teaching the young to go to treatment sites, they were able to sustain active treatment, which reduced if not eliminated parasitic infection in the wild grouse. Among red grouse in Scotland, boom-and-bust cycles are a thing of the past, and nearly every year offers good red grouse shooting. This was a remarkable achievement by a Scottish research team led by Dr. Peter Hudson, with whom I had the pleasure of co-lecturing a quail-management symposium years ago at the Dallas Safari Club.

Once our team in Texas identified the impacts of parasites on wild quail, we concluded that we should follow the lead of Scottish researchers. In other words, we decided to implement science and technology to enhance quail conservation and not just employ the old tactics of "manage the habitat, and the birds will come."

After identifying parasitic infection in Texas quail and with the work of Scottish researchers providing inspiration, the WTL began evaluating methods of delivering a drug treatment to wild bobwhites that would exclude exposing the treatment to nontarget species.

We also began communicating in 2013 with the United States Food and Drug Administration (FDA) on the concept of developing a medicated-feed treatment for wild bobwhites at the landscape level. This was a relatively foreign concept for the FDA, since they do very little, if any, drug-registration work for wildlife. In fact, there was no registered drug treatment for wild birds of any kind.

We initially started with a small dog kennel that incorporated ground-entrance holes, which allowed quail to enter and leave the unit. We tried various attractors to encourage the quail to enter and found that an electronic digital quail covey call, invented by Ronnie and several colleagues, proved very effective. The system evolved through field trials, and what we have now is a highly specialized platform known as QuailSafe, which offers the medicated feed at the height of a quail, eliminating, for the most part, songbirds and any small mammals from exposure to medication. The treatment can kill all stages of caecal and eyeworm infection from infective larvae to adult worms.

The FDA was impressed with our preliminary results, which led to a series of meetings. In fall 2015,

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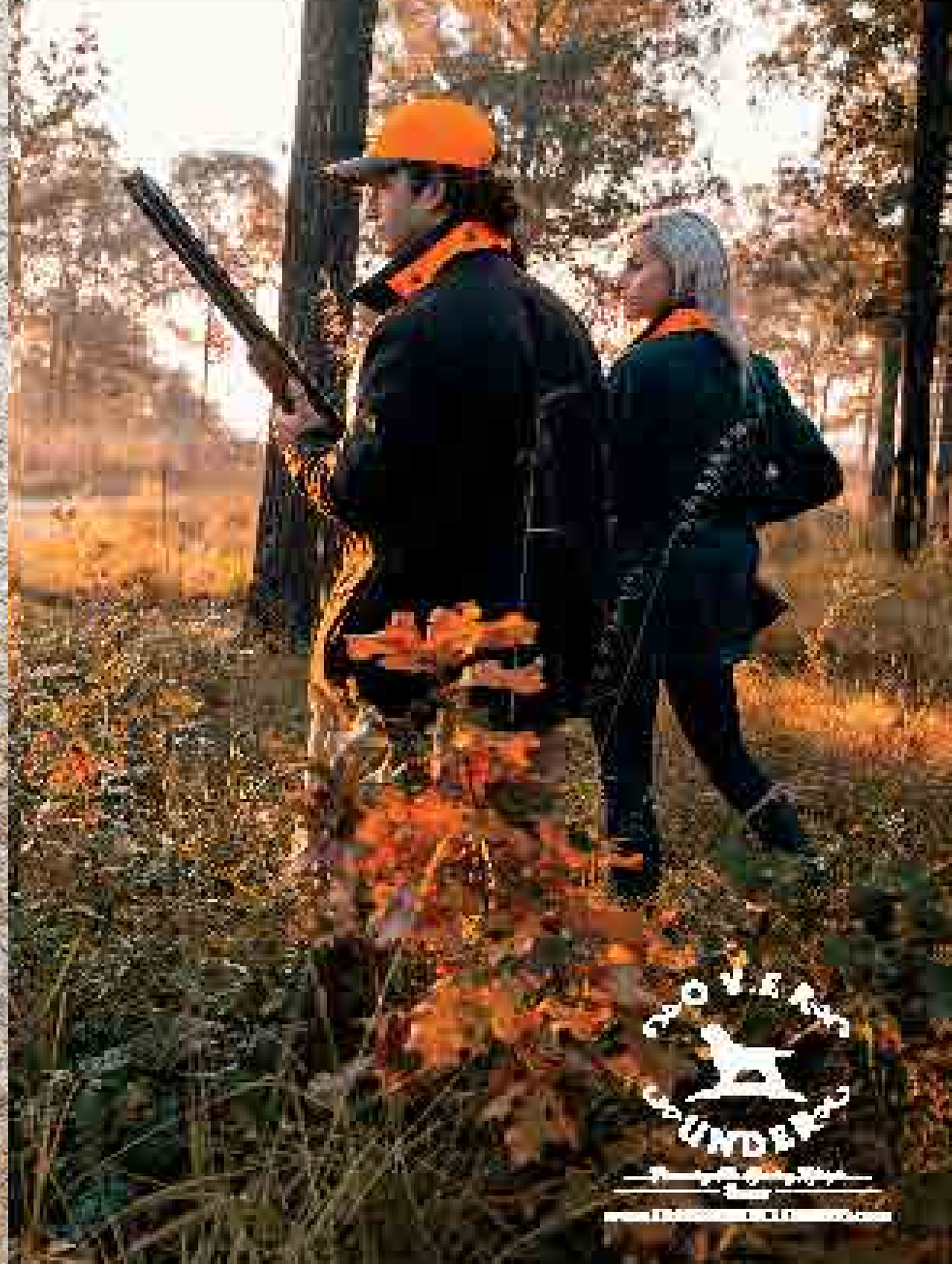

Texas Quail

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we began the process of registering our medicated feed treatment for bobwhite with the FDA. We are running several demonstrations with the medicated feed on various ranches at this time, and have seen significant success. Wild quail—bobwhite as well as native scaled (*Callipepla squamata*) or blue quail—can be easily treated for parasitic infection with medicated feed. This treatment is highly effective in significantly reducing, if not completely eradicating, parasitic infections. In fact, we have hard data showing that with only a week of ingesting the medicated feed treatment, the transfer of parasite eggs in quail feces can be completely eliminated, which breaks the life cycle of the deadly and destructive parasites.

Early in our research, I discussed with Rick Snipes that it would probably be impossible to treat all the wild quail on a property for parasitic infection. However, if we could treat a portion of the population, sustain them, and prevent losses of 90 percent as we saw in 2010, that should bode well for a better outcome in sustaining wild populations in terms of population statistics. In the regions of our demonstration ranches, some landowners have suffered losses of more than 90 percent, but populations began to rebound within a year or so instead of three to five.

We now have data to demonstrate that we can effectively treat wild bobwhite quail at the landscape level. We are still working out the details, but with the integration of the electronic quail-covey e-caller on the QuailSafe, a rancher with only one delivery system will be able to reach out 360 degrees for a quarter- to half-mile radius.

I will never argue that high-quality habitat, including feeding areas, nesting areas, and escape cover, is not critical for wild bobwhite quail management. It is not, however, the total solution, as demonstrated by a sustained 50-plus years of decline in the United States. Just as the farming industry, by the use of science and technology, has improved dramatically over recent decades—160 bushels of corn per acre is not that unusual these days, compared with less than 100 in the 1970s—why can't we think the same way with wild bobwhite quail management? We need to stop hanging on to the old dogma of "habitat only," which has proved insufficient and, in my opinion, has led to a dramatic decline of this iconic game bird.

I'm very appreciative of the organizations—such as the Rolling Plains Quail Research Foundation, Texas A&M University AgriLife Extension Service, Park Cities Quail Coalition, and Texas Tech University—that have provided significant support in the development of the science to conserve and sustain wild bobwhite quail and the hunting tradition for generations to come. ■

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