MANAGEMENT IMPLICATIONS OF DISEASE OF BIG GAME ANIMALS IN TEXAS[1]

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ABSTRACT

Disease as a limiting factor on big game populations has been long recognized but formal studies did not begin until 1963. Three diseases studied since that time are presented to demonstrate that intelligent management decisions can be derived from knowledge about the diseases. The three diseases discussed are theileriasis, bluetongue, and salmonellosis.

Disease has long been recognized as a limiting factor on Texas big game herds (Van Volkenberg and Nicholson 1943, Hahn 1945, Buechner 1950 and others). Large-scale white-tailed deer *(Odocoileus virginianus)* die-offs have been recorded frequently (Taylor and Hahn 1947, Taylor 1947, Hahn and Taylor 1950, Hahn 1945, Teer *et al,* 1965, Marburger and Thomas 1965).

These earlier workers were unfortunately ill-equipped to follow-up their superficial finds and suspicions. In the early 1960's two Texas biologists, Houston Green and Richard DeArment were involved in efforts to determine the effects of disease in white-tailed deer and pronghorns *(Antilocapia americana).* Despite lack of veterinary training, proper facilities, and limited funds they made some progress and served as a catalyst for future activity in this area.

In 1963, a formal joint project was initiated by the Texas Parks and Wildlife Department and the Department of Veterinary Pathology, Texas A&M University to study wildlife diseases. Texas' most important big game animal, the white-tailed deer, has received the bulk of the attention. However, mule deer *(Odocoileus hemiones),* pronghorn antelope, bighorn sheep *(Ovis canadensis),* and javelina *(Pecari tajacu)* as well as several exotic ungulates have also been studied.

These studies have revelated several disease syndromes that have important management implications. We will briefly review some of these — all of which are reported in detail elsewhere.

MATERIALS AND METHODS

Necropsies of subject animals were performed as generally described by Robinson (1964). Detailed histopathogical examinations were performed on each case. In addition, various microbiological, hematological, parisitological and serological techniques were utilized as appropriate in the diagnosis and investigation of spontaneously occurring wildlife disease.

RESULTS

In the course of the study to date some 450 field necropsies of big game animals have been performed. In addition, approximately 600 necropsies have been performed on game animals other than big game. These are not discussed here. Diseases found that have important management implications are described below.

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Theileriasis

Theileriasis is a disease of ruminants caused by hemoprotozoan organisms of the genus *Theilearia.* It is widespread in distribution and usually does not cause overt clinical signs in otherwise healthy animals that are maintained on an adequate nutritional plane. The species found in deer is classified as *Theileria cervi* (Schaeffer 1962) and was first noted in Texas deer near Sinton by Dr. T. E. Franklin in 1962. Kreier *et al.* described Theileria in deer in 1962.

During 1962, some 30,000 white-tailed deer died on a 350,000 acre area in the Central Mineral Region most within a 2-week period in late summer. It was felt that malnutrition was the "trigger" to the losses but a disease mechanism was suspected to be involved (Marburger and Thomas 1965). These losses occurred prior to establishment of the disease project. Theileria was diagnozed in a fawn in the fall of 1964. Many anemic, emaciated deer were observed in this same locality in the summer of 1965. Examination of blood films from selected animals of this type suggested a high incidence of infection by *Theileria* spp.

The symptoms of pronounced pallor, weakness, emaciation and anemia were identical to those of deer found dead or dying by Marburger and Thomas during the 1962 die-off. We suspected that Theileria was the disease agent they suspected of being involved.

Studies were initiated to determine the extent and the importance of the disease in Texas. Blood films were obtained from hunter killed deer in all Texas counties containing over 1,000 deer. Of 1,603 blood films, 939 (57 percent) contained *Theileria.* The occurrence of a high infection rate was correlated with dense deer populations (Robinson *et al.* 1967).

Infected deer on a high nutritional plane do not seem to be overtly affected by the disease. Lack of high quality nutrition appears to be a triggering mechanism that allows disease to develop into an acute stage. Deer subsisting on minimal diets are not physiologically equipped to replace blood loss, which can be, in theileriasis, as much as half of the packed cell volume of erythrocytes. When the infection is complicated by the presence of varying numbers of ecto- and endoparasites, the replacement of continued blood loss becomes a major physiological burden (Robinson *et al.* 1967). *Theileria cervi* was found to be transmitted by ticks (Kuttler *et al.* 1967). Efforts to transmit the organism to cattle, sheep and goats failed (Smith 1967).

This knowledge of the presence and effects of *Theileria* in Texas deer herds has a direct management implication. Deer herds, with high infection rates must not be allowed to reach or maintain levels where range depletion will lower the nutritional plane to the point where extreme weight loss occurrs. If that point is reached theileriasis may be expected to cause or contribute to large scale deer losses.

Bluetongue

Bluetongue is a viral disease which primarily affects domestic sheep but also is reported in goats and cattle. It is transmitted by insects of the *Culicoides* and affects the endothelial lining of small blood vessels, producing a variety of clinical signs (Stair *et al.* 1968).

During summer of 1965, several captive fawns being reared for experimental use became ill and were found to have severe cases of bluetongue. Since that time the disease has been identified in white-tailed deer in many different parts of Texas primarily affecting fawns 4-7 months of age. Many, but not all, infected deer recover.

Northern white-tailed deer imported into our research facility for experimental use were much more susceptible to the virus than our native deer. This would indicate that the problem is not a new one in that Texas deer have developed some resistance to the virus.

Desert bighorn sheep have also been found to have bluetongue. This subspecies was native to far-west Texas but probably became extinct in the 1950's.

In 1957, efforts began to re-establish bighorn sheep in the state. Stock was obtained from the Kofa range in Arizona and placed in a square mile enclosure on the Black Gap Wildlife Management Area near Marfa. The plan was to let the animals build up to a point where surplus animals could be released for stocking purposes (Hailey 1964).

Population build-up did occur (Hailey 1964) but occasional losses from unknown causes struck the sheep. Deaths were rapid and the animals had shown no previous signs of illness. Finally a ram was captured before death and delivered to Texas A&M for diagnosis. The animal expired before necropsy and bluetongue was found to be the cause of death. It was speculated that bluetongue may have been involved in the disappearance of the desert bighorn from Texas ranges as the disappearance coincided with appearance of domestic sheep on their ranges (Robinson *et al.* 1967).

If this supposition is true releases of bighorn sheep in areas where they might come in contact with domestic sheep might result in bluetongue infection in the bighorns. Several possible management approaches arise. The elimination of the *Culicoides* seems impractical as they reproduce in small collections of water and dissiminate rapidly under conditions favoring their reproduction. Large tracts of land must be available for the releases that are free of domestic livestock, particularly sheep, or intensive vaccination programs must be carried out in domestic livestock of the area.

Salmonellosis

Bacteria of the genus *Salmonella* affect a wide range of host species, causing serious, usually fatal infections — particularly in newborn animals. It is usually acquired by ingestion, and the organisms invade the bloodstream from the intestine, producing enteritis and septicemia. Bacteria eliminated in the feces are the means of transmission to other animals. These bacteria are capable of surviving for long periods of time in warm, moist organic material.

Deer management principles were first worked out for Texas deer in the Edwards Plateau section of the state (Hahn 1945, Teer *et al.* 1965). Experience showed that over-populations of deer were extremely difficult to control and that even with high harvests of antlerless deer only temporary herd reduction could be achieved.

When these ideas were transferred for utilization in southeast Texas areas they did not work. Counting on the same herd increment rates as had been encountered elsewhere, recommendations were made for equivalent rates of deer harvest — both males and females. However, the deer herds did not "bounce back" within 1 year; several years were required for the populations to regain the original level. Studies based on ovarian analysis and herd observation revealed that reproduction was high enough but that fawn survival was quite low.

Studies on the survival of fawns in this region were instituted. Fawns were captured at night through use of spotlights and dip-nets. The fawns were eartagged and a rectal culture was obtained from each animal. Positive cultures were sent to the State-Federal Animal Disease Laboratory, Phoenix, Arizona, for serological identification. Some 20-40 rectal cultures per year were taken for several years with the following results: 1966 - 43 percent positive for *Salmonella,* 1967 - 21.4, 1968 - 11.6, and 1969 - 18.1. Mortality among fawns for those years were: 1967 - 17.9 percent, 1968-31.3 and 1969 - 17.1.

Experimentally, innoculation of newborn fawns with these organisms has resulted in high mortality and temporary severe debilitation even in surviving animals. These direct losses and susceptibility, even of survivors, to additional disease problems and predation confirmed suspicions that this disease is an important factor in fawn mortality in southeastern Texas (Robinson *et al.* 1970).

This understanding of a limiting factor on herd growth makes it possible to adjust harvest rates to lowered herd increment rates. This factor must be considered in the management of this particular deer herd. It cannot sustain harvests such as those sustained by other herds in the state. High fawn losses to Salmonellosis are a fact of life for that herd. Without the knowledge of this disease fitting into the depressed increment rate of the herd it would be extremely difficult to make proper management decisions in regard to allowable harvest.

Other Diseases

Several other disease syndromes have been identified in big game animals in Texas, but their effects on populations has not yet been well-defined. These include anaplasmosis and babesiosis, two haemoprotozoan diseases somewhat similar to theileriasis (Robinson *et al.* 1968). Malignant catarrhal fever has been found in a white-tailed deer and several Axis deer *(Axis axis)* (Clark *et al.* 1970). An infectious pleuropneumonia was responsible for high morbidity and mortality in Thar *(Hemitragus* spp.).

DISCUSSION

The above examples show how disease syndromes can affect big game animals and demonstrate that the implications of disease must be considered in efficient management of these species. Anyone who works with wildlife disease investigation sooner or later hears this question from an administrator or sportsman — "So what if you find out there is a disease. Just what are you going to do about it? Round up the deer and give them a shot?" This clever comment is usually followed by some expression of amusement.

In the above examples there are four separate management actions that can be taken to enhance the welfare of the animals concerned without curing or treating the disease. In fact, in each case, it would not be possible to adequately make management decisions without knowledge of the disease problems involved.

Big game management in Texas is, almost without exception, an integral part of ranch and farm operations which frequently involves domestic livestock operations. In some of the diseases discussed above there are one or more domestic species that are also susceptible to the disease. The inter-specific relationships concerning the disease are not known. Such knowledge must be, and is, being developed. Lack of such knowledge could have serious consequences. It is not difficult to imagine that big game herds could be subjected to control measures because of lack of knowledge about the inter-specific relationships of a particular disease. Conversely, it is easy to visualize the failure of a disease control effort in domestic herds because wildlife was left out of consideration.

This area of study is still in its infancy and much is still unknown. Many animal species are known to be endangered by disease or medical problems (Loew 1970) and as more is learned about disease in wildlife populations, more information will be available on which to base big game management decisions.

LITERATURE CITED

Buechner, Helmut K. 1950. Life history, ecology, and range use of the pronghorn antelope in Trans-Pecos Texas. The Amer. Midland Naturalist. 43(2): 257-354.

Clark, K. A., R. M. Robinson, and R. G. Marburger. 1970. Malignant catarrhal fever in Texas cervids. (In press)

Hahn, H. C. Jr., and W. P. Taylor. 1950. Deer movements in the Edwards Plateau. Texas Game & Fish 8(2): 4-9.

———— 1945. The white-tailed deer in the Edwards Plateau Region of Texas. Texas Game, Fish & Oyster Comm., Austin, 52 pp.

Hailey, T. L. 1964. Status of transplanted bighorns in Texas. *In* Trans. Desert Bighorn Council, Las Vegas, Nevada. pp. 113-116.

Kreier, J. P., M. Ristic, and A. M. Watrach. 1962. *Theileria* spp. in a deer in the United States. Am. J. Vet. Research 23(94): 657-662.

Kuttler, K. L., R. M. Robinson, and R. R. Bell, 1967. Tick transmission of theileriasis in white-tailed deer. Bull. Wildl. Disease Assoc. Vol. 3: 182-183.

Loew, F. M. 1970. The Red Book — Wildlife in Danger. Book Review, J. Wildl. Dis. Vol. 6, No. 3.

Marburger, R. G., and J. W. Thomas, 1965. A die-off in white-tailed deer in the central mineral region of Texas. J. Wildl. Mgmt. 29(4): 706-716.

Robinson, R. M. 1964. The necropsy of the deer — a field manual. Texas Parks & Wildl. Dept. Austin. 10 pp.

————., T. L. Hailey, C. W. Livingston, and J. W. Thomas, 1967. Bluetongue in the desert bighorn sheep. J. Wildl. Mgmt, 31 (1): 165-168.

————., R. J. Hidalgo, W. S. Daniel, D. W. Rideout, and R. G. Marburger. 1970. Experimental salmonellosis in white-tailed deer. Path. Vet. 5: 164-173.

————., K. L. Kuttler, H. R. Emerson, L. P. Jones, and R. G. Marburger. 1968. Blood parasites in Texas deer. Trans. N. Amer. Wildl. Conf. 23: 359-364.

————., ————., J. W. Thomas, and R. G. Marburger. 1967. Theileriasis in Texas white-tailed deer. J. Wildl. Mgmt. 31(3): 455-459.

Schaeffer, W. F. 1962. *Theileria cervi* infection in the white-tailed deer *(Dama virginiana)* in the United States. Ph.D. Thesis, Univ. Illinois, Urbana. 104 pp.

Smith, J. P. 1967. Studies on transmission of a deer haemoprotozoan to domestic animals. M. S. Thesis, Texas A&M University. 37 pp.

Stair, E. L., R. M. Robinson, and L. P. Jones. 1968. Spontaneous bluetongue in Texas white-tailed deer. Path. Vet. 5: 164-173.

Taylor, W. P. 1947. Why deer are dying. Texas Game & Fish. 5(7): 17.

Taylor, W. P., and H. C. Hahn, 1947. Die-offs among the white-tailed deer in the Edwards Plateau of Texas. J. Wildl. Mgmt. 11(4): 317-323.

Teer, J. G., J. W. Thomas, and E. A. Walker. 1965. Ecology and management of the white-tailed deer herd in the Llano Basin of Texas. Wildl. Monograph 15, 62 pp.

Van Volkenberg, H. L., and A. J. Nicholson, 1943. Parasitism and malnutrition of deer in Texas. J. Wildl. Mgmt. 7(2): 220-223.