

A herd of bighorn sheep is captured in motion, running up a steep, rocky hillside. The sheep are in various stages of their run, with some leading and others following. The terrain is rugged, with sparse, dry vegetation and scattered rocks. The lighting suggests a bright, sunny day, casting shadows on the ground. The overall scene conveys a sense of natural energy and movement in a wild, mountainous environment.

# *The* Bighorn

SPRING - SUMMER  
2021

>>> PUBLICATION OF THE TEXAS BIGHORN SOCIETY

Restoring Bighorn Sheep to their Native Ranges in Texas, and Ensuring the Viability of their Habitat



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# Bighorn

The official magazine of the Texas Bighorn Society  
Advertising Rates Effective 1-1-2009  
Bighorn is published 3 times annually

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Photo by Mike Pittman

Spring-Summer 2021

# BIGHORN





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# Howdy, New Members!

On behalf of the current members, the TBS Officers & Directors, and all the Texas Bighorn Sheep your patronage will go to support, we'd like to welcome you to our organization! We appreciate your support and look forward to seeing you at the next TBS event!

## individual

Paul Bacchus	Atticus Freeland	Ted Little
Joseph Barbnecht	Chris Gilbert	Jim Pickett
Brandon Bredemeyer	Jamie Hallmark	Jennifer Rinn
Travis Brown	David Harrell	Jeff Sherman
Brant Buchanan	Raymon Hedges	Noble Smith
Matt Caswell	James Hodges	Scott Walter
Andrew Costello	Jonathan Hoffman	Nathanael Watson
Will Ellison	Carl Keller	J.D. Wilbanks
Matt Etheredge	John Landgraf	Ryan Young
	William Lane	

## three year membership

George Cherry	Will Nichols	Jose Antonio Vallina
Jim Higdon	Coleman Pittillo	Christopher White
Mark Mehaffey	William Smith	Carter Young

## student

Adrian Alvarez	Juliette Garza	Cezanne Lossing-Cann
Kianna Burtle	Olivia Gray	Annelisa Martinez
Nathan Derr	Amanda Jackson	Joshua Robledo
	Matthew Johnson	

## life

Dean Davis	Mike Hydrick	Robert Patton
Louise Davis	Rob Marek (upgrade)	Daniel Wilcox

# \*please,

Help us stay current with your address and email information! Contact Kathy Boone if you have moved, changed email addresses, or have questions about your membership. She can be reached at: [membership@texasbighornsociety.org](mailto:membership@texasbighornsociety.org) or 806.745.7783



# A LETTER FROM THE **PRESIDENT**

“ TBS Members,

It has been great to see everyone in person again! It started with a very successful Work Project on the Red Rock Ranch in March. We built two mountaintop guzzlers and a third on the ground which were made possible through generous contributions from the Lubbock Sportsman’s Club Chapter of the Dallas Safari Club, the BOLD Charitable Foundation and a grant through the Wild Sheep Foundation from Cabela’s/Bass Pro. There were over 100 volunteers and TBS would like to extend a special thanks to all that helped. Rains came shortly after completion of the guzzlers and currently the tanks have more than 500 gallons of water each. Lots of sheep have been seen at the guzzlers.

TBS also helped sponsor the 57th Meeting of the Desert Bighorn Council on April 7-8, which was hosted by the Texas Parks and Wildlife Department. Because of Covid, it was a virtual event and Froylan Hernandez did an outstanding job as the Moderator of the entire conference. Each speaker did a great job, from the Keynote Address by Carter Smith to all the research presentations. You should go to [desertbighornCouncil.com](http://desertbighornCouncil.com) and watch it all.

We just completed our 32nd Roundup and it was a huge success! Besides having a great time, we raised a lot of money for the Desert Bighorn Sheep in Texas. There were several member awards that were recognized. Clay Brewer received the inaugural Dallas Safari Club “Trailblazer in Conservation Award”, Bonnie McKinney received the Texas Parks and Wildlife “20 Wild Women of Texas” award for the top women in conservation in the history of Texas, Kai and Janet Buckert received the 2020 “TBS Conservation Partner” award, Ernie and Louise Davis received the 2021 “TBS Conservation Partner” award and the “President’s Award” was dedicated to the memory of Dr. Bob Dittmar, Dewey Stockbridge and Brandon White. Claiborne Myers was presented a Life Membership for the outstanding job he did on the video of this year’s work project. It was shown at the Roundup. If you haven’t seen it, go to the TBS website and watch it.

Congratulations to Gene Holloway for being drawn for the TBS custom rifle by Horizon Firearms. Also, congratulations to Whitney Leavell for being drawn for the Desert Bighorn Sheep hunt on the Red Rock Ranch this year.

Again, thanks to everyone for your continued hard work and dedication to support the Texas Bighorn Society and the conservation of Desert Bighorn Sheep in Texas.”



Sam Cunningham, President  
Texas Bighorn Society





# EDITOR'S *letter*



Bonnie McKinney  
Editor, *The Bighorn*

What a whirlwind year this has been! TBS kicked off the year to a great start with the annual work project at the Red Rock Ranch owned by Ernie and Louise Davis, 3 guzzlers were built and despite dust storms and winds there is more water on the mountains for bighorns. Many thanks to Claiborne Myers, John Meyer and Dirk Parks, they took so many great photos. I hope you all enjoy the selection. The cover of the magazine is a great photo by Mike Pittman.

Annual Roundup was a huge success and everyone enjoyed returning to Tapatio Springs. It was wonderful to see everyone after we have all been cooped up for a year due to Covid. Old friends and new, and lots of great visits. Congratulations to the raffle winners: Desert Bighorn Sheep Hunt at Red Rock Ranch- Whitney Leavell and the TBS Horizon Custom Raffle-Gene Holloway.

This issue is jam packed with research project updates from Texas Tech University, Texas A&M University, and Borderlands Research Institute-Sul Ross State University, I hope you can all make time to read these articles about field research being conducted on Texas bighorns.

Sadly, another long time TPWD employee passed away, we extend our condolences to the family of Ray Watley. Many TBS members knew Ray for years, he was a great guy and spent countless hours working on the desert bighorn sheep program from the Black Gap WMA to the Sierra Diablo WMA.

Hoping everyone has a great summer.

*Bonnie McKinney*

Bonnie McKinney, Editor  
El Carmen Land & Conservation Co, Wildlife Coordinator  
Cemex USA-Texas



*Photo by  
Bonnie McKinney*



# This & That

## TBS BOARD AND GENERAL MEMBERSHIP MEETING SUMMARY MARCH 2021

*by Curt Brockmann, Secretary*

The Texas Bighorn Society (TBS) March 2021 Board meeting was held on March 11, at the Van Horn, Texas Convention Center in conjunction with the annual work project. The meeting was called to order by Sam Cunningham, President. The minutes of the August 2020 Board meeting were approved. Kathy Boone, Treasurer provided a financial report, which was approved. The Board also passed several interim votes to fund items such as a Wild Sheep Foundation (WSF) research project and a Texas Parks & Wildlife Department (TPWD) water improvement project.

Robert Joseph announced that TBS currently has 793 members, which includes 418 Life Members. The Board discussed the upcoming annual "Roundup," which will be held June 11-12 at Tapatio Springs Resort near Boerne, Texas. There were also discussions on the location of the Roundup 2022 being held in the Dallas-Fort Worth area.

Emily Wright and Rachael Wiedmeier provided quarterly Texas Tech University Research Project updates. They discussed progress on collecting historic DNA samples from desert bighorn sheep, which they can determine genetic similarities as well as differences. They also discussed the most commonly shared bacteria between aoudad and desert bighorn sheep.

Froylan Hernandez (TPWD) provided a desert bighorn sheep program update. He discussed the bighorn survey results and herd health. TPWD did not complete the full annual surveys in 2020 due to the tragic helicopter accident. They hope to resume aerial surveys this fall. Travis Bryan, Wildlife Technician at Black Gap Wildlife Management Area presented a summary of bighorn sheep translocations, which included information on the bighorn numbers according to sex, age and release methods.

The following day the General Membership meeting was held; Ace High, Terry Rathert, Walker Netherton and I, were elected as Directors. After the General Membership meeting the Directors elected the following officers: Sam Cunningham-President, Ace High-Vice President, Kathy Boone-Treasurer, and myself Secretary.

It was good seeing everyone again and talking with many of you at the Work Project. I hope all is well. Take care, and I hope to see you soon.

### **REMINDER TO ALL TBS MEMBERS:**

**TBS uses "mail chimp" service to email our members upcoming news and events. If you are one of our long-time members please make sure we have your most recent and up-to-date email address.**

**Please send to:  
info@texasbighornsociety.org  
or call 806-745-7783**



IN MEMORY OF

# MARION RAY WATLEY

January 11, 1939

to

May 12, 2021



Ray Watley & Dr. Bob Glaze - 1985 Sierra Diablo Pens -Photo M. Pittman

Marion Ray Watley passed away peacefully with his loving wife by his side on May 12, 2021 at 12:52 p.m. He lost his hard fought battle with a lengthy illness and dementia in Pecos, Texas.

Ray was born in Silverton, Texas on January 11, 1939. His mother passed away when he was eighteen months old and his biological Aunt Julia Stewart and her husband Jeff Stewart, took him to Marathon, Texas to live. They were Mother and Daddy to Ray. Charlie Brittain Parker, twelve years old, continued to live in Silverton with his grandmother.

Ray was a heavy equipment operator, a trucker, and his love was working as a Wildlife Technician. He worked as a trapper for the U.S. Government Game and Fish program for five years in Pinto Canyon at the foot of the Chinati Mountains, south of Marfa, Texas. In 1965, he went to work for the Texas Parks & Wildlife Department as a Wildlife Technician on the Black Gap Wildlife Management Area in southeast Brewster County. Ray worked on the desert bighorn sheep restoration program, mule deer hunts, trapping predatory animals, and maintaining miles of the area roads and hunting/fishing camps.

In 1972 Ray moved to the Sierra Diablo Wildlife Management Area north of Van Horn, Texas where another desert bighorn brood pasture had been built. He worked with the public hunts, bighorn sheep, mule deer and pronghorn surveys and game birds. He was instrumental in the day to day operation of the Sierra Diablo bighorn pens. Ray retired from Texas Parks & Wildlife in 1993 to work on his and his son's trucking business.



Ray Watley & Tim Bone -Photo M. Pittman

Ray lived in Van Horn with his wife Rebecca (Becky) Ann Welch Watley. They were married on February 14, 1959 in Marfa, Texas. Ray was preceded in death by his biological father, Robert Watley, Julia and Jeff Stewart and his brother Charlie Parker. He is survived by his wife Becky of 62 years, sons Alen Ray, Stewart James (children Garrett and April), Mark (wife Pam, and children Danielle and Jackson Ray), and three sister-in-laws.

The Memorial Service for Ray was held on May 30, 2021 at Van Horn, Texas.



# ANNUAL WORK PROJECT MARCH 2021 RED ROCK RANCH, VAN HORN, TX



*Photo Credits: Claiborne Myers, Dirk Parks,  
Bonnie McKinney & John Meyer*











PERENNIAL PRODUCTIONS



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# USE OF ANCIENT DNA AND GENETIC VARIATION TO CHARACTERIZE POPULATION STRUCTURE, CONNECTIVITY, AND SYSTEMATIC STATUS OF TEXAS BIGHORN SHEEP

by Emily Wright, Doctoral Student  
Texas Tech University, Department of Biological Sciences



Over the last year, significant progress has been made in the characterization of the structure and subspecific status of bighorn sheep in Texas. I was able to secure a total of 23 bone, horn, and skin clip samples from TBS members (keep them coming!), Guadalupe Mountains National Park, Smithsonian, and others. I have been able to extract DNA and amplify a mitochondrial gene from several of these bone samples. Based on preliminary phylogenetic results, it appears that pre-extirpated Texas bighorn sheep represent a 'desert-like' subspecies rather than the Rocky Mountain subspecies. Although this result was suspected, these analyses are definitive.

The collection of contemporary samples obtained from live-captures in collaboration with Texas Parks and Wildlife Department, hunter-harvest, and loans from California Department of Fish and Wildlife has allowed us to also examine the current population structure of Texas bighorn sheep and potentially describe the genomic variation of Texas bighorn. Although we are still waiting on data and more analyses need to be performed, a trend seems

apparent. The bighorn populations west of a longitude of 104 degrees (Sierra Diablo, Beach, Baylor, and Van Horn Mountains) are similar in the nuclear genome to populations in Arizona whereas the bighorn populations east of a longitude of 104 degrees (Elephant Mountain and Black Gap Wildlife Management Area, Dove Mountain and Basse-Maravillas Gap) are similar in the nuclear genome to populations in Nevada. Unique signatures of bighorn sheep located in the Van Horn and Dove Mountain and Elephant Mountain WMA are of interest and do not have any signatures that are characterized by the bighorn individuals from Arizona, Nevada, or Mexico populations. Further, two timeframes of data for Elephant Mountain WMA (2000 vs 2016-2021) indicate there was a shift in genotypes at some point. More sampling of bighorn from different regions may provide clarification. These preliminary genomic results seem promising- I look forward to continuing this research and diving deeper into the genomic signatures that make Texas bighorn unique!

Guns Up!

Emily Wright





# EVALUATING HABITAT AND DIET OVERLAP BETWEEN AODAD, DESERT BIGHORN SHEEP AND MULE DEER IN THE TRANS-PECOS

*by Daniel Wilcox, Masters Degree Student  
Olivia Gray, Masters Degree Student  
Borderlands Research Institute, Sul Ross State University*



In the past several decades, Texans have come to feel the impacts of invasive species in all corners of the state. From plants, to birds, to mammals, invasive species cause concern among ecologists and landowners alike for the potentially damaging effects of our new wild residents. In the United States, invasive species account for over \$120 billion per year in economic loss, mainly in agricultural damages such as crop loss and competition with livestock. Invasive species have both direct and indirect effects on native wildlife populations as well. Resource competition between native and invasive species and the introduction of novel diseases by invasive species are just some of the many ecological ramifications of invasive species, but raise some of the biggest concerns for our state. Given the size and diversity of our Texas landscapes, we are host to an equally diverse suite of invasive wildlife. In the Trans-Pecos, aoudad is one of the most prominent invaders.

Native to Northern Africa, aoudad were originally introduced to Texas in the mid 20th century

to provide additional hunting opportunities in areas with few deer or other game species. Since then, aoudad have adapted incredibly well to harsh conditions and rough terrain of the Trans-Pecos. The ruggedness, altitude, and low precipitation rates of their native range are quite similar to those of the Trans-Pecos. The first introduction in Texas occurred in 1957-58 when approximately 44 aoudad were released in Palo Duro Canyon. By 1999, reports indicated upwards of 20,000 aoudad throughout the state. Females can be sexually mature at 19 months old with a gestation period of only 22 weeks and often produce twins. Reproduction at such a young age, coupled with a shorter pregnancy and common twinning, could result in population growth rates upwards of six times that of desert bighorn sheep populations and twice that of mule deer. The suitability of Texas habitats and their high reproductive rate allow aoudad populations to expand rapidly. As aoudad expand into the Trans-Pecos, they increasingly come into contact, and may



conflict, with desert bighorn sheep and mule deer.

Both desert bighorn sheep and mule deer are species of conservation concern in Texas. Habitat loss, unregulated hunting, and the introduction of livestock diseases led to the decline of mule deer and the complete extirpation of desert bighorn sheep in the Trans-Pecos. Fortunately, restoration efforts beginning in the mid 1900's were successful in reestablishing both species to healthy population sizes across their historic range. Unfortunately, at roughly the same time these restoration efforts began, aoudad populations expanded into the Trans-Pecos. The similarity in anatomy and native ranges between aoudad, desert bighorn sheep, and mule deer suggests that aoudad may share many habitat preferences and behaviors with our two native species. If this is the case, then it is likely that aoudad competes with desert bighorn sheep and mule deer for resources. In a desert climate with an already scarce supply of food, cover, and water, this scenario could compromise the success of restoration efforts for our native species.

Although we have reasons to suspect these species compete, we do not know to what degree aoudad populations affect our native species. Biologists first voiced concerns about aoudad effects at the 1978 Desert Bighorn Council meeting. However, that call was largely unanswered, despite a few studies conducted in the 1970s-1980s. Studies conducted during this era mainly occurred in Palo Duro Canyon. These studies include investigating



group and population dynamics of aoudad, parasite and disease transmission to mule deer, and a brief examination of diet. While important, this information is limited and is not adequate for informed management decisions because of the limited range at which these studies were performed as well as the unknown complexity of interactions with native species. As populations of aoudad grow throughout this region, more research must be conducted to identify life history traits, how aoudad use this landscape, and the effect these invasive species have on Texas' native ungulate populations. Borderlands Research Institute and the Texas Parks and Wildlife Department are working to understand the interactions between desert bighorn sheep, aoudad, and mule deer in this region of Texas so that management goals can be more specific, measurable, and effective at promoting our native species.

We will first address the question: How similar are aoudad habitat preferences to those of desert bighorn sheep and/or mule deer? Because they occupy the same region, this must be true at some level. However, how each species uses habitats within the region will affect how much their ranges overlap, affecting how much they might compete. To answer this question, we have placed over 100 GPS collars on individuals of all three species in the Van Horn





Mountains, outside Van Horn, Texas. These collars record where each individual is every 2.5 hours over a 2 year study period. At each of the 9 GPS points taken per day for each individual, we use satellite data to determine habitat conditions at each point. This allows us to see how each species prefers/avoids habitat metrics such as elevation, slope, shrub cover, ruggedness, water, etc. Using this data, we can then compare behaviors among the species to determine if there is overlap in preference for one or many of these resources. We can then use this overlap to determine where and how intensely these species might compete.

The second question will address: How similar are aoudad diets to desert bighorn sheep and/or mule deer? While there is already some information about the diets of all three ungulate species individually, there is no information on the overlap of diet when all three species coexist on the landscape. When species coexist, they modify how they use resources to limit competition. However, this is not always possible when the variety of available resources is small, leading to declines in one or both species. This is especially important in arid areas like the Trans-Pecos because low rainfall limits the abundance of quality forage for much of the year. We seek to understand how dietary overlap changes throughout the year by

collecting fecal samples of each species monthly over a year. Once fecal samples are collected in the field, we can identify vegetation particles within them in the lab. This allows us to determine the composition of each species' diet and the overlap among species throughout the year. Much like the answer to the previous question will show *where* competition is most intense, this work can show *when* it could be most intense.

In combination, the answers to these questions will allow managers to target management actions in specific places, at specific times, to achieve specific results. We will estimate when, where, and the degree to which habitat preference and diet overlap among the 3 species. With this information, managers could focus on habitat enhancement, aoudad removal, or other appropriate actions to reduce overlap in crucial resources and alleviate competitive effects. Given the logistic and financial challenges present when coordinating native species restoration, habitat improvement, and aoudad control efforts, it is critical to know when and where to focus those efforts. Thus, data from projects like this are enormously helpful to assure the long-term success of desert bighorn sheep and mule deer restoration efforts.



# MICROBIOME RESEARCH UPDATE

by Rachael Wiedmeier, Masters Student  
Texas Tech University,  
Department of Biological Sciences

It has been a busy but successful spring 2021 so far! We have been gearing up to send out water sampling kits to some of the landowners, following up on some of the more recent work we have done on water samples from 2020. We were fortunate enough to get to test a few different water sources across the Van Horn Mountains and Black Gap WMA, along with a few other locations as well. The type of testing we have done so far has focused upon identifying the microbiomes in bighorn sheep and aoudad, where we have been trying to identify specific bacteria that are a part of the pneumonia complex which is a common mortality factor for bighorn sheep throughout their geographic range. Beyond finding and identifying those specific bacteria, this type of analysis allows us to see if any other problematic bacteria that are flying under the radar! So far, we have discovered *Mycoplasma ovipneumoniae*, a bacterium well-known to cause pneumonia in bighorn sheep, in a water source – which is the first time we are aware in which *M.ovi* has been detected in water. This has spurred further testing of water sources out there for sheep, in case they are possible transmission locations for the pneumonia complex. I have a running list of water kits to send to landowners but if anyone is interested in helping us out, please feel free to contact me (contact information below) and I will send you a water testing kit! Without the help of our private landowner partners, TBS members, and Texas Parks and Wildlife Department staff this discovery would have never been made, so we are so thankful for all your help and participation in the sampling efforts!

We have also started working on collecting and analyzing water samples from the TAMU project at Mason Mountain. These samples will go through the same microbiome testing to look for pathogenic bacteria and pneumonia complex members as part of the Texas Tech, Texas A&M, and TPWD Collaboration. We will also be receiving nasal and throat swabs for microbiome testing as well, so we are very excited about all the upcoming data we will be getting!

Besides all of that, I am busy trying to wrap up my Master's work and complete my thesis this summer, which means more time on the computer and less time on the mountain unfortunately! But I am so thankful for all the help TBS has provided me over the past few years and I cannot express my gratitude enough to all of you. I hope the summer is treating everyone well and you are all enjoying some well-deserved relaxation and fun!

Wreck 'em!

Rachael Wiedmeier  
Cell: 605-391-3535  
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# AODAD CAN CARRY DANGEROUS LUGGAGE FOR DESERT BIGHORNS

by Logan Thomas, Doctoral Student  
Texas A&M University, Cook Wildlife Lab



Conserving a species, of course, requires understanding fundamental aspects like habitat requirements, behavior, reproduction, predation, and diet. These aspects are especially important when the species has highly specific requirements to live their everyday lives-as an ecological “specialist” so to speak. For many species, addressing these aspects alone may get you pretty close to reaching management goals, but how does wildlife management adapt when you throw in challenges in wildlife health?

Aldo Leopold, the father of modern wildlife conservation, wrote in his book *Game Management* that “the role of disease in wildlife conservation has probably been radically underestimated”. Bighorn sheep provide an excellent example of a species whose conservation, while also heavily driven by traditional aspects of wildlife management like habitat quality, is greatly impacted by diseases. While a variety of diseases are becoming increasingly important to Bighorn sheep conservation, none are as evident or severe as pneumonia.

Pneumonia in Bighorn sheep has dramatic, yet varying effects on populations with mortality rates ranging from 30 to 90%. This is only the first “punch” that a pneumonia outbreak delivers to Bighorn sheep populations. In many cases, Bighorn sheep populations and those of other species can recover from even large mortality events. But, in Bighorn sheep pneumonia, a second punch is delivered. When mature ewes survive and recover from a pneumonia outbreak, some become long-term carriers of respiratory pathogens and can readily transmit them to their fellow ewes as well as their lambs. Lamb mortality rates from pneumonia can be highly variable as well with 20 to 100% mortality observed. While some outbreaks don't kill many lambs initially, these chronically infected ewes can infect their lambs for several years following exposure to respiratory pathogens. Because lamb survival is considered one of

the most variable and influential factors for Bighorn sheep population outlook, this second punch delivered from pneumonia outbreaks is difficult to manage.

While we know some common culprits and patterns, pneumonia in Bighorn sheep is a complicated phenomenon involving a myriad of factors that vary widely across outbreaks in different herds across their range. The common patterns we see involve one or many pre-disposing factors that allow bacteria to set up shop and cause disease. They can take the form of viruses, environmental or physical stressors, and even other bacteria. The pre-disposing factor with the strongest association with pneumonia in Bighorn sheep is the presence of a bacteria called *Mycoplasma ovipneumoniae*, often referred to simply as “Movi”. Movi does not cause pneumonia on its own, but instead changes the way the upper respiratory tracts functions. It is this change that allows other bacteria to invade and cause disease. The bacteria that end up causing most of the damage can be diverse as well. Some are bacteria commonly encountered in the soil that are easily cleared from the upper respiratory tract under normal circumstances. Other bacteria involved in pneumonia are those that normally live in the lungs of healthy Bighorn sheep that usually cause little to no issues-referred to as “commensals”. Regardless of where the bacteria are coming from, Movi allows these bacteria to set up shop and ultimately cause disease.

It is a known fact that domestic sheep and goats-the “Old World” *Caprinae* species- commonly harbor and transmit Movi, as well as some problematic commensal bacteria discussed above. Efforts in the western U.S have



focused on decreasing/eliminating contact between domestic Caprids and Bighorn sheep. These efforts have been successful and should continue to be a management priority for Bighorn sheep. But another threat to these efforts has been brewing in the southwest U.S since the 1950's- prolific populations of Aoudad.

Aoudad were introduced to Texas in the mid 1950's for hunting opportunities. However, it did not take long for feral populations to establish from subsequent introductions and captive escapes. Today, the state-wide Aoudad population in Texas is estimated at no fewer than 20,000 and Texas Parks and Wildlife estimates that at least 5,000 of these Aoudad live in the Trans-Pecos area where they might interact with Bighorn sheep. Not only are Aoudad capable of reproducing up to twice each year with a notable twinning rate, but they also have broad, expansive diets that overlap with preferred plants of Bighorn sheep. If these ecological concerns don't have you at least intrigued, sit tight. Recently, the Texas Department of Parks and Wildlife detected Aoudad sheep that were naturally exposed to Movi. This raised concerns that Aoudad may act like the old world *Caprinae* species in their ability to transmit Movi and other pneumonia-causing pathogens and also prompted a study to investigate these concerns. The goals of our study were to determine if Aoudad can carry and transmit Movi and other pathogens associated with pneumonia, to see how long they were capable of doing so, and to describe the effects these pathogens have on Aoudad themselves.

Three groups of Aoudad were brought to Texas A&M University's veterinary medical research park and experimentally exposed to only Movi, Movi plus commensal bacteria, or nothing to serve as a control. Each week, we would capture the animals and take samples to see how the various pathogens were behaving in the Aoudad. The results were not ideal. We found that all the Aoudad became infected when experimentally exposed and were able to carry pathogens for at least 50 days after exposure. Infection with pathogens that cause pneumonia in Bighorn sheep did not consistently cause disease in Aoudad. Even after the Aoudad developed antibodies to help fight off Movi, we continued to detect it on our samples, indicating that they were still contagious. Worse was the discovery that the unexposed Aoudad group tested positive for Movi- indicating that they were naturally infected by the exposed Aoudad in the neighboring pens. Overall, the experiment provided convincing evidence that Aoudad can carry and transmit

Movi and other pneumonia pathogens from animal to animal for extended periods of time. This prompted immediate action from Texas Parks and Wildlife to determine the effects that infected Aoudad could have on Bighorn sheep.

Ongoing research is aimed at investigating how indirect and direct contacts with infected Aoudad affect Bighorn sheep. This study is focused on how artificial water sources may serve to bring Aoudad and Bighorn sheep closer together on the landscape where disease transmission may occur from animal to animal or through sharing water at guzzlers. While the results are not finalized and caution should be used at this time, we have cursory evidence that both direct and indirect contacts between infected Aoudad and uninfected Bighorn sheep can cause lethal pneumonia in Bighorn sheep. The next steps for our research team involve using mathematical model, and disease surveillance data from Texas Parks and Wildlife to estimate and demonstrate the risk that infected Aoudad present to Bighorn sheep on the free range. Additionally, much work is needed to expand our efforts of detecting infected Aoudad on the landscape to inform wildlife management. Concurrently, we will continue to work with Texas Parks and Wildlife and landowners to collaborate and promote increased sampling efforts and possible methods to exclude/ reduce use of guzzlers by Aoudad while maintaining their use by Bighorn sheep.

The road to conserving Bighorn sheep is becoming more complicated and will require more connection, collaboration, and teamwork than ever before. The community of Bighorn sheep conservationists is strong, and I believe we can face these challenges together as we continue to adapt to a reality where Aoudad will likely persist in the southwestern U.S.





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