

# Mule Deer

# SUBSPECIES

## Nonsensical names or practical units of conservation and record keeping?

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### MEET THE SUBSPECIES

**Rocky Mountain Mule Deer**

(*Odocoileus hemionus hemionus*)

**Desert Mule Deer**

(*Odocoileus hemionus crooki*)

**Bura Mule Deer**

(*Odocoileus hemionus eremicus*)

**California Mule Deer**

(*Odocoileus hemionus californicus*)

**Southern Mule Deer**

(*Odocoileus hemionus fuliginatus*)

**Inyo Mule Deer**

(*Odocoileus hemionus inyoensis*)

**Peninsula Mule Deer**

(*Odocoileus hemionus peninsulae*)

**Tiburon Island Mule Deer**

(*Odocoileus hemionus sheldoni*)

**Cedros Island Mule Deer**

(*Odocoileus hemionus cerrosensis*)

**Columbian Black-tailed Deer**

(*Odocoileus hemionus columbianus*)

**Sitka Black-tailed Deer**

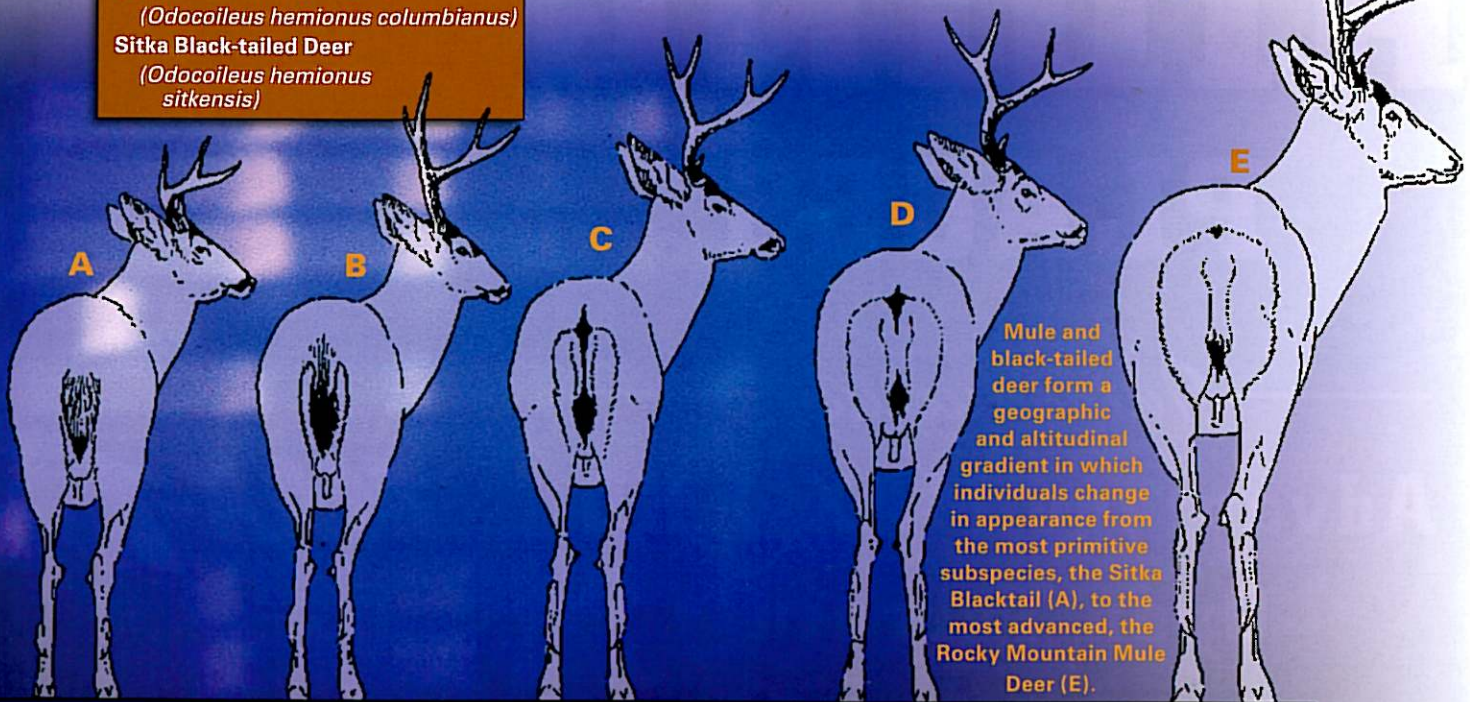
(*Odocoileus hemionus sitkensis*)

Throughout the geographic range of mule and black-tailed deer (*Odocoileus hemionus*), we see a lot of variation in body size, coat color, antler shape, behavior, and other attributes. For instance, mule deer in the southern latitudes are generally smaller in body size than those in the north, and those inhabiting the deserts appear lighter in color than those in heavily forested regions. The large degree of physical variation observed in mule deer led early naturalists to collect a mule deer here and a mule deer there from geographically distant areas and designate them as different species or subspecies because they differed slightly from one another.

### Meet the subspecies

From this sparse collection of deer, the geographic range of several mule deer subspecies was drawn somewhat arbitrarily. The purported differences between subspecies were often based on subjective opinions regarding characteristics or measurements of only one or a few specimens. In 1936 Ian McTaggart-Cowan, now an Emeritus Member of the Boone and Crockett Club, attempted to describe the general differences between the different "types" of mule deer. He concluded that no key could be constructed to differentiate between these types with certainty.

This original list of subspecies was altered a little by subsequent biologists to form the foundation for the mule deer subspecies we



recognize today. There have been 11 subspecies of mule and black-tailed deer reported in the last 70+ years.

### **What's in a name?**

These sometimes-arbitrary subspecies names have been repeated over and over in books, scientific papers, and magazines to the point that everyone assumes there is a solid scientific basis for these categories. One of the most frivolous subspecies assignments was the designation of a new Eastern desert mule deer different from the Western desert mule deer based on the antler shape of a single buck skull lying uncatalogued in a museum. The naturalist simply gave the new subspecies a name and drew a distribution for it on the map.

Subspecies' boundaries, when taken literally (as they usually are), frequently create a nonsensical pattern of geographic differences. For example, the map of mule deer subspecies indicates that mule deer in central Arizona are different than the mule deer in southern Arizona (deserts), but the same as those in the Yukon and Canada (Rocky Mountains). Such gross disparities, which challenge common sense, are not supported by any existing evidence.

In light of the uncertainty and confusion that current subspecies designations have produced, some have argued that it is time to discard subspecies names altogether. This would be throwing the baby out with the bathwater. It is meaningful to recognize some geographic differences for improved management, particularly if they provide a useful designation of a population that is physically or ecologically different. Rather than ignore local adaptations or disregard geographic differences, we should describe them accurately based on genetic relationships that show true relatedness and differentiation. Subspecies solidly based in science will be useful units of conservation in the future.

Recent advances in DNA analysis techniques now allow researchers to evaluate genetic data in ways that provide managers with meaningful ecological management units on an ecosystem scale throughout the range of a species. It is time we use these analytical tools to examine important Western big-game species so that a future course of intelligent management can be charted.

### **A Fresh Look At Mule Deer Subspecies**

Genetic studies require three basic components to get off the ground: money, samples, and a specific genetic test to use. Realizing the value of a genetic analysis of mule and black-tailed deer throughout North

America, the Boone and Crockett Club contributed about \$20,000 over two years to initiate the study. We used this investment to leverage more than \$70,000 more from other sources. Our growing coalition needs additional support to complete all the locations in our geographic analysis. With the interest expressed by several conservation groups, we hope to soon round out the funding package.

This evaluation of genetic differentiation will provide not only a basis for conservation efforts, but also help solidify the range of different "types" of mule and black-tailed deer for accurate records-keeping purposes. Beyond these immediate objectives, this research will also lay the groundwork for future work on other interesting aspects of North American deer.

More than 2,300 tissue samples already have been collected from mule and black-tailed deer throughout their entire range in North America, mostly from hunters who harvested deer during the normal hunting seasons. The entire sample set is not needed to answer the questions at hand, so we selected a subsample of 1,500 for inclusion in this analysis. Fifty-eight sites across North America encompassing all historically recognized subspecies were selected for the analysis. We have sampled all the major ecological regions supporting mule and black-tailed deer.

There are a lot of different ways to analyze DNA to answer many different questions. Some people think of "genetic analysis" as if it were a black box that you put samples in and out pops a tree diagram on the other end showing who is more closely related to whom. It is not quite that simple; you actually have to select the right test to get at the question you want answered.

### **Turning DNA into Data**

All genetic analyses are being done by Drs. Emily Latch and O. E. Rhodes, Jr. at Purdue University, recognized as one of the best genetic labs in North America. The first step in genetic analysis is to extract the DNA out of all the frozen tissue samples, and this has been done for the entire subset to be analyzed. The actual analysis will occur throughout this summer and winter. Two kinds of DNA will be analyzed in this study:

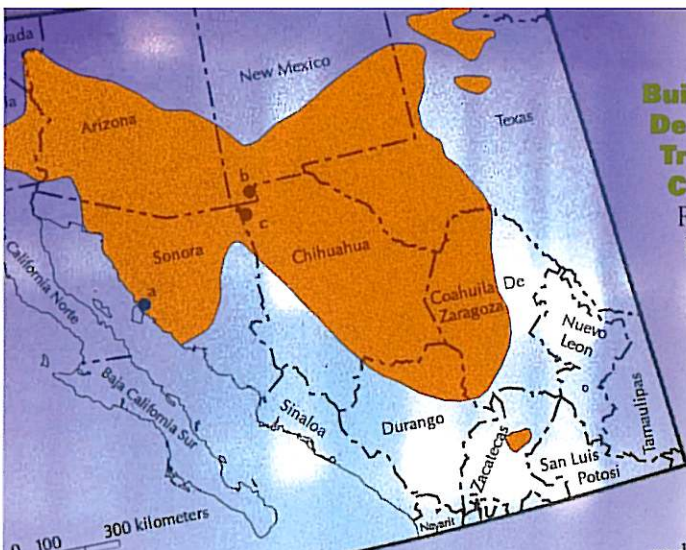


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mitochondrial DNA (mtDNA) and nuclear DNA (nDNA). Samples will be analyzed by sequencing a portion of the mtDNA and by using microsatellites to look at variation in the nDNA. Much preliminary work has been done to determine exactly what "genetic test" will yield the information we need. These tests have been fine-tuned further to ready them for the analysis of such a large number of samples. This preliminary testing phase was important to assure the actual analysis can occur with minimal problems.

### **Using Scientifically Based Subspecies As Units Of Conservation**

The mule deer subspecies currently rec-



**DESERT MULE DEER RANGE**

**Building A Solid, Defensible Basis For Trophy Record-Keeping Categories**

Record-keeping categories must be based on real and consistently diagnosed differences. It is particularly important that we evaluate the geographic distribution of black-tailed deer compared to mule deer in the Pacific Northwest. Clear delineation of the boundary between blacktails and mule deer is an issue that the Boone

and Crockett Club must address to maintain the integrity of the trophy records books. For example, deer harvested in the central portions of the northwestern states and provinces may be hybrid intergrades. This results in a situation where larger hybrids harvested in an area officially recognized as "blacktail" range have an unfair advantage over pure black-tailed deer entered. In this case, drawing lines based on "record-keeping purposes" rather than solid biological information may result in spurious records.

Fortunately, in the case of blacktail vs. mule deer, we already have a foundation of previous genetic research that indicates that blacktails and mule deer differ substantially in their mtDNA. This means we can immediately apply genetic tools to map the current distribution of each type of deer. Nuclear DNA can also be used for something called an assignment test, whereby a sample from an "unknown" deer can be assigned to either "blacktail" or "mule deer" with some level of probability.

In anticipation of addressing this issue, Club members and biologists have begun to collect samples more intensively where these two forms come together. Also, northwestern deer biologists have developed annotated maps showing areas of blacktail and mule deer physical differences. Using existing genetic tools, we can compare the current and presently proposed boundaries with the pattern of genetic differences in deer on the region. This will result in information that is directly applicable to records keeping and conservation of this species.

Unfortunately, the mule deer vs. blacktail boundary is not the only mule deer boundary that needs to be better defined. For instance, the Inyo, Burro, and desert mule deer, as well as numerous island populations of mule deer, are sometimes recognized as being different. It is important to know how many different defensible and well-documented forms of mule and black-tailed deer exist. Once this

species is evaluated objectively, we may find that some types of mule or black-tailed deer can be promoted as a destination for hunters in similar fashion to the sheep hunting world's "Grand Slam." The designation of a certain number of mule deer types will benefit the economy of those local areas. Mexico is home to most of the types of mule deer with the highest probability of showing differences. If some of these mule deer types are truly different, this will result in a tremendous opportunity for ranchers to diversify their income from the land. With income generated from hunting, these animals become an asset, and hunting in that area will be strongly promoted, opening new opportunities for mule deer hunting enthusiasts and conservation efforts.

We are attempting to resolve other issues with this research. For example:

Does the "Inyo Mule Deer" exist? Some experts recognize this deer as a distinct entity while others do not. The range is very restricted to eastern California, and not knowing the status of this deer places it in serious jeopardy of litigious assaults by anti-hunting factions.

The "Burro Mule Deer" in southwest Arizona, southeast California, and northwest Sonora is said to be different than other desert mule deer to the east. Some Mexican deer biologists believe that physical differences between desert mule deer in Chihuahua/Coahuila and those in Sonora are so great they should be recognized as different types.

The Peninsula mule deer in southern Baja California is mostly isolated from other mule deer and some of its physical characteristics, such as tail coloration, differ dramatically from mule deer in the northern part of the Baja Peninsula. These southern Baja mule deer may represent a different type of mule deer.

Three island populations of mule deer around the Mexican Baja Peninsula are isolated from the mainland. Some of these populations apparently have been separated from mule deer on the mainland since the late Pleistocene. These deer are undoubtedly different (as physical descriptions have indicated) from other mule deer. Two of these island populations of mule deer have been given unique subspecies names (Tiburon Is., Cedros Is.), but a third has never been described by science, and we have seven samples (San Jose Is.).

The question of whether the Boone and Crockett Club should establish a separate category for desert mule deer frequently arises. Since there is a category for desert whitetails (Coues'), it follows that desert mule deer might be broken into a separate

ognized have not helped us in delineating units of conservation and management. For instance, even the most recent textbooks contain the same stagnant, out-dated information about mule deer subspecies because no one has used the genetic techniques now available to examine relationships between mule deer in different areas. Authors of such texts repeatedly call for an investigation into the conflicting designations of mule deer subspecies. Such investigations are now within our reach, and genetic evaluations already have provided insights on the validity of subspecies for other large mammals such as pronghorn, bighorn sheep, elk, and whitetail deer.

If mule-deer type designations are to be of value in management, they must be based on genetic, ecologic, and physical differences between populations of deer. Thus, identifying the different types of mule deer that exist may be helpful in addressing not only the overall subspecies questions that currently cloud mule deer conservation and management efforts, but also may allow us to highlight unique problems that face animals in a localized geographic area. Clarification of the differences among mule deer types at higher levels of resolution (e.g., local versus regional) would increase our ability to develop specific management activities for target populations or regions that may be unnecessary in other parts of the species' geographic range. The identification of unique mule deer types would be invaluable for the initiation of management activities based on a biological rather than a political basis. Additionally, once a type of mule deer becomes specifically sought after by hunters, it will be seen as an asset and protected rather than poached by locals. Thus, this work could lead to positive changes in the conservation of mule deer in Mexico by offering real incentives for conservation.

category. Unquestionably, it would be difficult to delineate a desert form of mule deer, primarily because of the extent to which they are contiguous with other mule deer types. However, it would be useful to have some quantitative information with which to evaluate this question so we can provide reasonable answers and justification.

### **Other Benefits Of Genetic Research On Mule Deer**

Once genetic analyses are conducted, the data obtained can also be used to try to answer different questions. For example, we can evaluate different populations for evidence of negative genetic effects of population isolation and range fragmentation (such as inbreeding and genetic drift). We can look at the relatedness of deer within populations and compare that to the variation between populations. This may elucidate areas where fragmentation of the habitat by human or natural factors has resulted in a loss of genetic diversity. Identifying such areas or populations allows managers to use translocation as a potential tool for releasing a population from the depressive effects that losses of genetic diversity and/or inbreeding can have on survival and reproduction.

Genetic data can also help us protect lawful hunting of mule deer throughout their range by acquiring the knowledge needed to guard against unjust legal actions based on nonsensical subspecies designations. When variations of a species are given the status of a scientific name (like subspecies), the legal repercussions can overshadow questions of subspecies validity. This has happened when poorly defined subspecies were listed as "Endangered Species." Millions of dollars may be spent on populations that do not differ in any consistent way from populations in other parts of that animal's geographic range. Several currently described subspecies of mule deer are at risk of being used by anti-hunting groups to further infringe on our ability to legally hunt. The most obvious is the "Inyo Mule Deer" in eastern California. A court injunction could be granted by a sympathetic judge in California to stop the hunting of this deer until we "prove" hunting is not detrimental to its existence. The fact that these animals are thriving under the most successful system of wildlife conservation in the world is not always an adequate defense today.

This project also has implications for international wildlife management and

conservation efforts by providing a model for the objective evaluation of intraspecific variation in species with large geographic distributions. Many international conservation efforts for wildlife species are hampered by a lack of understanding of the geographic variation represented across a species' range. For instance, some species have geographic variants (subspecies) that are considered "endangered," while others are hunted. Little effort has been expended to find out how those subspecies really differ.

The Boone and Crockett Club has been a leader in wildlife conservation for more than 118 years, and it is fitting that the Club would be spearheading such a historic project. The money generously contributed by the Club was the catalyst that allowed us to get this project off the ground. This project is ambitious and of a scope and intensity unmatched in any other similar analysis of a wild species in North America. It will be seen as a model for state-of-the-art procedures in this arena. ■

*Jim Heffelfinger is a regional game specialist with the Arizona Game and Fish Department. This study on DNA differentiation of mule deer was initiated with support from the William I. Spencer Conservation Grants Program.*

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