

KEEP TROPHY RECORDS HONEST: IDENTIFYING WHITETAIL/MULE DEER HYBRIDS

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Humans have always been fascinated by hybrids. Consider such classic monsters as Wolfman, Dracula, and Mothman—or heroes such as Spiderman, Batman, and Catwoman. This trend pre-dates Hollywood by millennia; the “Minotaur” in Greek mythology was half man and half bull. Our fascination with creatures that are half one thing and half another extends to wildlife. Early naturalists often described new animals as a combination of parts from animals already known to them. Even the mule deer was described by John J. Audubon in 1846 as having fur like an elk, but hooves like a whitetail.

White-tailed and mule deer distributions overlap in a large section of western North America. Where both are found, mule deer typically inhabit the higher mountain areas and whitetails occupy the lower valleys and river systems. This habitat preference is reversed in the southwest, however. Here Coues’ whitetails are found in the mountains, and desert mule deer occupy the lower-elevation valleys and foothills. Expanding and contracting distribution and abundance of these deer species, along with changing habitats and land-use practices, have altered the relationship between them. In some jurisdictions the two species coexist over extensive areas, bringing the animals near one another during the breeding season.

This article is the first in a series reporting several years of deer DNA research supported by the Boone and Crockett Club’s Conservation Research Grants Program and its partners. Watch for more of the research team’s findings in future issues of *Fair Chase*.

Analyzing a protein like serum albumin can show that an animal has either a “whitetail” band, a “mule deer” band, or both (indicating a first generation), but cannot accurately diagnose animals that are not 50:50.

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Whitetail

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Hybrid

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Mule Deer



White-tailed deer (left) have brown on the back side of their tails compared to the white rope-like tails with black tip of the mule deer (right).

LEFT: Notice the tiny white metatarsal glands of the whitetail are dwarfed next to the large brown tuft of the mule deer.



hybrid metatarsal gland

Meet the Parents

Mule deer differ from whitetails in several characteristics. However, these characteristics vary enough that interesting specimens sometimes emerge that cannot be quickly identified as one species or the other. When used individually, some identifying characteristics can be confusing or yield an incorrect identification. Most hunters focus on differences in tails and antlers. Although these characters are different between the species, they can't always be relied upon for a correct identification. Let's look at some key traits.

Tails. Whitetails have a wide, flattened tail that is broad at the base and narrower at the tip. The pure white underside that gives the species its name is contrasted by a darker back side. White-tailed deer tails are considerably longer than mule deer tails, and whitetails lack the large, conspicuous white rump patch that mule deer have. Mule deer tails appear cylindrical and hang like a short piece of white rope that is usually white on the back side with a distinctive black tip.

Antlers. These are just about the last thing you would want to base your deer species identification on. Both species show amazing variation in antler shape. Typical mule deer antlers have small brow tines, if they have them at all. The main beams sweep out and upward, forking once and then each fork divides again in mature bucks. In contrast, whitetail antlers have several antler tines that arise independently off a main beam that sweeps outward and forward from the bases. It is not uncommon to see whitetails with forked tines like mule deer, or young mule deer with all tines arising from the main beam. There is simply too much variation in antlers to serve as a reliable indicator of hybridization.

Ears. Huge 9½-inch ears are what gave the mule deer its name. Although the ears of whitetails are relatively shorter than those of mule deer, it is not always easy to judge ear length alone. The ears of a whitetail are generally two-thirds the overall length of the head (back of head to nose) while those of a mule deer are three-quarters the length of the head.

Preorbital Glands. Situated in the front corner of the eye, these glands differ considerably between the two species. In whitetails they appear as a small slit with a maximum depth of 3/8 inch. The larger glands in mule deer form a substantial pocket 3/4-inch deep.

Metatarsal Glands. The only physical feature useful to determine if a deer is a hybrid is the appearance of the metatarsal gland, located on the outside of the lower portion of the rear legs. This should not be confused with the tarsal glands on the inside of the legs. The metatarsal glands on mule deer sit high on the lower leg and are 4 to 6 inches long and surrounded by brown fur. On whitetails, this gland is at or below the mid-point of the lower leg, usually less than one inch, and surrounded by white hairs. A hybrid deer has metatarsal glands that split the difference, measuring between 2 and 4 inches and sometimes encircled with white hair. Although this is the only physical characteristic that can be used to accurately diagnose a hybrid specimen, it is difficult to see clearly through a rifle scope!



Metatarsal glands are diagnostically different between the small 1" white circles of white-tailed deer (top), the large 4-6" brown fur tufts of mule deer (middle), and those of hybrids that are intermediate in location and size (bottom).

The Lowdown on Hybrids

White-tailed and mule deer hybrids are extremely rare in the wild. However, the many barriers to interspecies mating may fail, allowing whitetails to successfully mate with mule deer. For the most part, the resulting offspring show characteristics that are intermediate between the two species. Facial features may be intermediate, but the tail is usually dark chocolate brown or black on top and white underneath. The tail of a hybrid looks very much like a

typical whitetail, but is usually longer and darker on the back side. Ears are normally larger than a whitetail and smaller than a mule deer. The preorbital gland in front of the eye is intermediate in depth or may be deep like a mule deer's. Antlers are typically more whitetail-like with antler tines arising from the main beam. Many hybrid antlers have "wavy" tines as if the antlers were receiving mixed signals about which direction to grow!

Hybrids have been reported from captive facilities, starting with the Cincinnati Zoo as early as 1898. Subsequent reports have come from North Dakota, Alberta, Arizona and other places. Researchers in Tennessee successfully produced whitetail/black-tail hybrids in captivity. Having animals of known parentage in captivity allowed researchers to study and describe the characteristics and behavior of hybrids, which helps us know what to look for in the wild. These early captive situations also showed that male hybrids are usually sterile, as is typical in



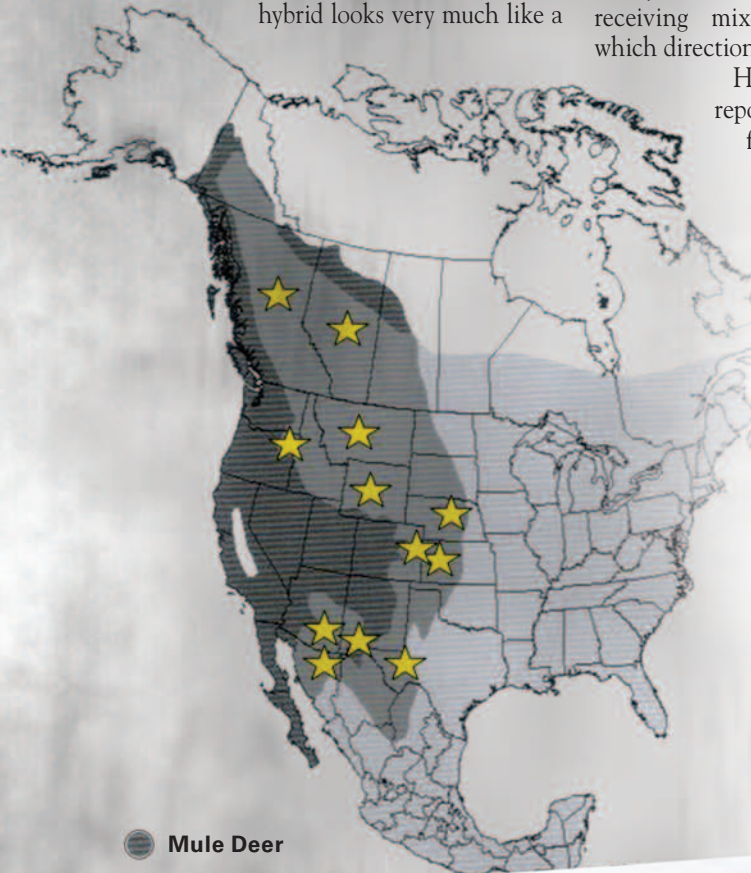
Some areas develop concentrations of hybrids, like the southern end of the Galiuro Mountains in Arizona, where Jesse Lim harvested this hybrid in January 2006.




other mammals. However female hybrids are fertile and can breed back to one of the parent species. Hybrid fawns were found to have very low survival even when pampered in a captive facility. Efforts in Arizona to produce hybrids in captivity in the 1930s and 1960s showed that only about half of the hybrid fawns survived their first six months.

Biologists have documented the presence of hybrids in the wild on many occasions. In fact, most states and provinces where both species occur have at least one record of whitetail/ mule deer hybridization. However, the relative scarcity of confirmed hybrids among the hundreds of thousands of deer that have been seen and harvested throughout the area of overlapping range illustrates how rare they are.

Unraveling the DNA

Recent advances in DNA analysis technology allow us to look at features more definitive than ears and antlers. Although we know a lot about the physical features of hybrids, what can you do when the whole animal or the diagnostic parts were not saved? Another complicating factor is that not all hybrids are half mule deer and half whitetail. A first generation (50:50) female hybrid may breed with a mule deer buck and the offspring will be three-quarters mule deer. This offspring may then breed with a mule deer, resulting in deer that are seven-eighths mule deer and not easily distinguishable from a one hundred-percent mule deer. This scenario could also occur when hybrids back-cross to whitetails.



-  Mule Deer
-  White-tailed and Mule Deer Overlap
-  White-tailed Deer

ABOVE: Whitetail and mule deer hybrids have been documented in the wild throughout North America where their ranges overlap. Illustration by Jim Heffelfinger.



First generation hybrid (50:50) produced in captivity by the Arizona Game and Fish. Known hybrids from captivity helped us identify physical characteristics such as the tail and metatarsal glands seen here.

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In cases like this we have to stop using our low-tech ruler to measure relatively big things and turn instead to high-tech scientific methods to measure very tiny things like DNA molecules. The DNA molecule holds a tremendous amount of information and recent advances in computers, software, and genetic analysis techniques have allowed scientists to begin unraveling the data that is twisted up in that double helix molecule.

Early genetic tests to detect hybrids focused on proteins that differed between the two species. The production of proteins in the body is regulated by genes; thus by analyzing differences between some proteins, researchers can identify what species a sample of tissue came from. Protein analysis by a process called "electrophoresis" produces a series of horizontal bands on a gel surface. This protein produces a band in a different location for whitetails and mule deer. When a test shows bands of both whitetail and mule deer, it indicates a hybrid animal.

West Texans have reported an increasing trend in the number of hybrids they see on their ranches. In the early 1980s, whitetails and mule deer in a five-county area were tested for diagnostic proteins. The researchers found that on average, 5.6 percent of the deer they tested had evidence of hybridization. Similar work in Montana showed that less than two percent of deer may have been subjected to some level of hybridization in the past. Hybridization has been documented to occur in both directions; that is, mule deer bucks mating white-tailed does and white-tailed bucks mating mule deer does.

The original genetic tests relied mostly on fresh or frozen tissue, but that is not always available. Advances in genetic testing soon made the old protein tests seem very primitive by comparison. We were convinced that by applying new genetic analyses to this old question, we would be able to develop a solid genetic test that could use a small piece of dried skin, muscle, bone, or antler to identify a suspicious-looking animal as a hybrid.

The Boone and Crockett Club is one of the oldest conservation organizations in North America, and it remains at the forefront of scientific developments. Through its Conservation Research Grants Program, the Club invited researchers to submit proposals to develop a test that could determine if a deer was a hybrid. Out of several proposals submitted, one by Dr. Irv Kornfield at the University of Maine was selected because of

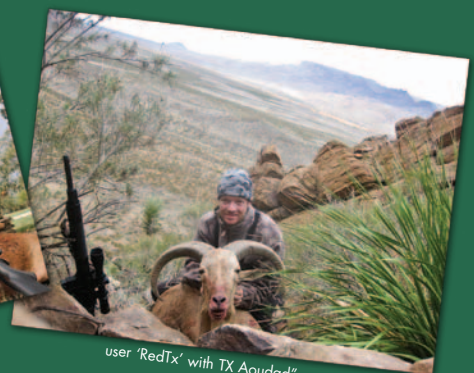
the wide variety of different genetic markers he was working with and the potential to find clear genetic differences between mule deer and whitetails (and hence be able to identify any hybrids). Certainly genetic differences had been found between the two deer species, but no one had assembled a test that could be used for this specific purpose.

Dr. Kornfield's work highlighted several separate genetic markers that showed differences between pure mule deer and pure whitetails. Some markers showed complete

separation between the species; in other words, when looking at that part of the DNA molecule, all whitetails looked one way and all mule deer looked different. In other cases, a particular genetic marker showed species differences in most, but not all cases. For example, one marker may be present in 91 percent of the whitetails and only 9 percent of the mule deer. Even though these partial markers are not 100 percent, we can combine several together and have a collection of markers that provide a powerful test of

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whether a deer is white-tailed deer, mule deer, or something in between.

In fact, Dr. Kornfield initially used 17 different markers to identify both species and their hybrids. After evaluating the initial results, he narrowed it down to 12 useful and informative ones and used that collection of markers on 40 to 50 deer of each species collected in the wild in far corners of their geographic range. He then tested individuals he knew were first generation (F1) hybrids (50:50) and others that were the result of a mating between an F1 hybrid and one of the parental species. In the end, he found that by using the most informative five markers, he could identify an F1 hybrid 95 percent of the time. By using seven markers, that confidence increased to 99 percent.

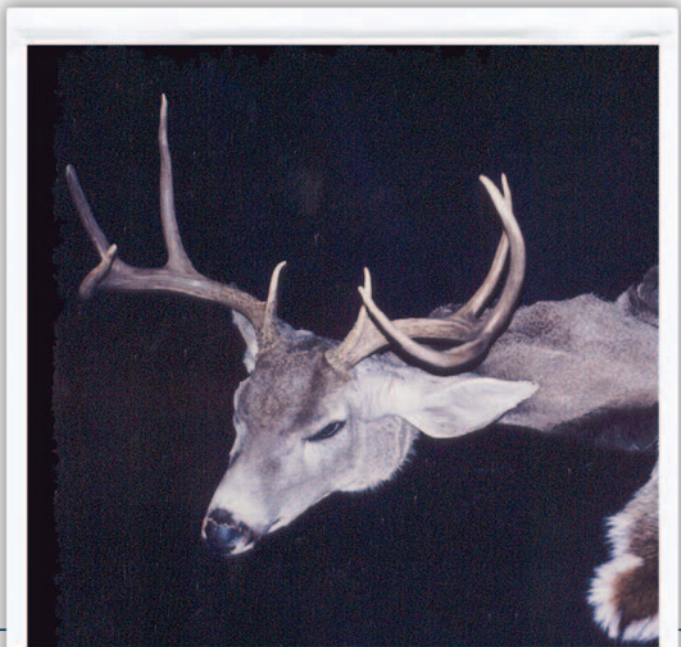
While Dr. Kornfield was developing these markers, the Boone and Crockett Club funded another deer genetic project to be able to identify whether or not a deer was a Coues' whitetail. Wildlife Genetics International was leading the Coues' research and during the course of that work, they added a few mule deer and known F1 hybrids to their analysis out of curiosity. The results were stunning, with mule deer, whitetails, and hybrids separating out nicely in discrete clusters using a program called "Genetix." They did not have different combinations of hybridization in various fractions (1/2, 3/4, 7/8, etc.) because this was not the goal of their research, but the separation is clear enough that it appears second generation (F2) back-crosses may be identifiable as points between the pure parents and the hybrids in the middle. Indeed, other suspected hybrids from the wild (parentage unknown) fell between the middle cluster of F1 hybrids and the clusters of both parents on either end.

Keeping Records Clean

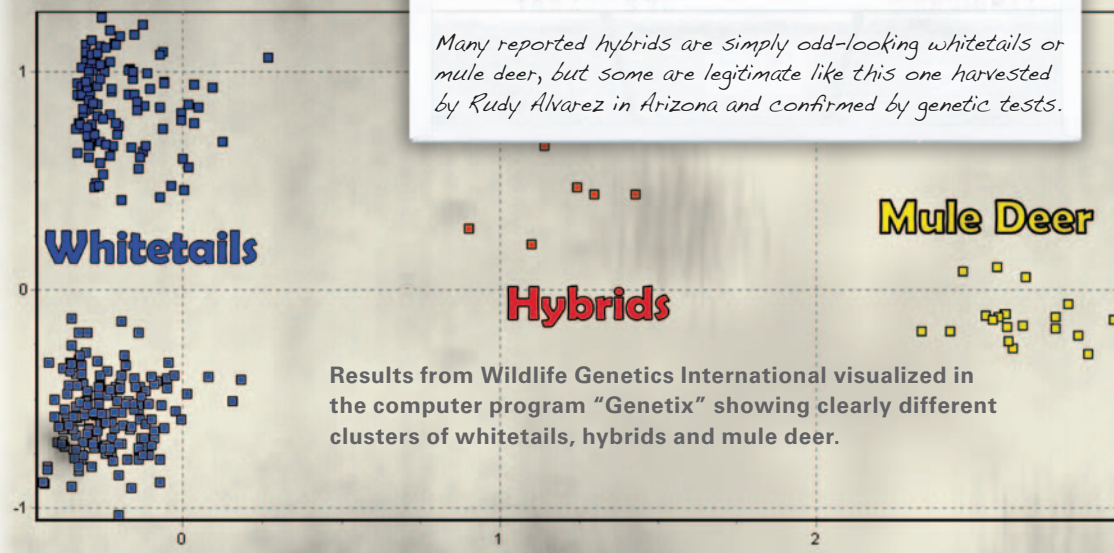
It is very important to the Boone and Crockett Club that trophy records be kept free of errors. Genetic contamination results in records contamination. With the smaller Coues' whitetail as a separate records category, it is very important that none of those high-ranking bucks contain a large dose of mule deer! A mature F1 hybrid could fairly easily approach the world record Coues' whitetail in size. Even in parts of the country where white-tailed deer and mule deer are similar in size, it is important that the

categories are kept clean and true. It is well known that mixing two species often results in "hybrid vigor" where the hybrid offspring is larger than either parent for at least the first generation.

Several random and scattered genetic markers have come to light in the last decade that show differences between mule deer and white-tailed deer. The differences that Wildlife Genetics International found using a collection of microsatellite markers is currently the fastest, easiest, and least expensive



Many reported hybrids are simply odd-looking whitetails or mule deer, but some are legitimate like this one harvested by Rudy Alvarez in Arizona and confirmed by genetic tests.



method to test an individual deer that the Club suspects is a hybrid. In the future, a suspected hybrid will simply be compared to a random sample of 60 whitetails and 60 mule deer with the GeneClass program. The results will provide a numerical assessment of whether the mystery deer belongs to the white-tailed deer or mule deer group. A suspected hybrid may be shown to clearly belong to one of the parent species or it may be something in between.

Boone and Crockett now has a protocol for how suspected hybrids will be processed and dealt with in a fair and transparent way. Basically, if the Club has reason to suspect a deer has been exposed to recent hybridization, the person submitting the trophy will be required to have the deer tested with this approved protocol to show that it is not a hybrid as defined by the Club.

After years of trying to keep records clean and accurate by relying on physical

characteristics, we can now take a closer look—literally—at individual deer and base records-keeping decisions on good, solid science. This research would not have been possible if it wasn't for the hours of work by agency biologists and hunters too numerous to mention who provided samples, and the generous funding contributions from not only the Boone and Crockett Club, but also the Pope and Young Club, Camp Fire Conservation Fund, Inc., National Fish and Wildlife Foundation, Dallas Safari Club, Arizona Game and Fish Department, Seattle Chapter of Safari Club International, Purdue University, California Deer Association, and Safari Club International.

The early architects of the Boone and Crockett records program would be proud of this outstanding cooperation and the Club's continued commitment to maintaining accurate records of North America's finest big game specimens. ■