



*Who Gets
to Be a*

*Deer
Daddy?*

What does it take to win time with a hot doe?
Is it age? Big antlers? Body size?
A combination, or maybe none of these?
This Two-Part Series follows a search for the answer.

By Dr. Steve Demarais, Dr. Bronson Strickland, Dr. Phil Jones, Dr. Randy DeYoung and Ken Gee

Breeding success among whitetail bucks has long been associated with certain physical factors, most importantly their age, antler size, body weight, nutritional status, and physical condition. These are the factors that, together, combine to determine dominance among bucks. In the early decades of deer management, biologists assumed relatively few mature, dominant bucks sired most fawns, thus preventing younger, subordinate bucks from

breeding. This may still sound similar to what you have read in some articles, right? But what if these long-held assumptions are not entirely true?

Here at the Mississippi State University Deer Lab we have conducted a series of studies designed to reveal the degree of truth behind these long-held assumptions about breeding. It is almost impossible to intensively study behavior in a free-ranging population of white-tailed

deer, not to mention the fact we can't determine which bucks sire which fawns, if any, through visual observation alone. So, we initiated our study in a controlled environment, using a captive population of white-tailed deer, before conducting studies in the wild. In this article, the first in a two-part series, we'll share several studies conducted in captivity. In the next issue of *Quality Whitetails*, we'll discuss studies done in the wild.



JOE LACEFIELD

of the relationship between social dominance and buck breeding success in deer were still rather lacking. So, we set out to solve this problem by conducting the first study to examine the relationship between social dominance and genetic paternity in white-tailed deer.

Our overall goal for captive studies was to investigate the role of social dominance in buck breeding success. We wanted to determine if subordinate bucks were able to secure breeding opportunities and the circumstances under which it might happen.

We conducted the study at the Rusty Dawkins Memorial Deer Unit at Mississippi State University. We allowed different groupings of bucks and does to breed each year in various pens. Breeding capability evaluations indicated that all of our bucks were, in fact, physiologically capable of siring offspring.

First, we determined buck dominance ranks from behavioral observations during the breeding period. We determined these social hierarchies from both direct aggressive-submissive encounters between bucks, as well as from indirect behaviors, such as avoidance or isolation. We made these inferences using behavioral cues including pursuit and courtship of does, rub-urination, and scraping behavior. We paid close attention to each deer's posture, including

position of the ears, and remained alert for any cues such as direct stares and so forth.

We assigned paternity of the resulting fawns using the most advanced genetic methods, similar to those used with human paternity. We first obtained DNA profiles for all potential parents and compared them to the DNA of all fawns. We used genetic paternity to determine the breeding success of bucks in relation to dominance rank.

Social Dominance and Breeding Success

As it turns out, what these studies show us is that the relationship between social dominance and buck breeding success may be more complex than we used to think it was. Surprisingly, dominance does not always equate to breeding success, because bucks of all ages and dominance ranks may successfully use alternative breeding tactics. And, guess what? These alternative tactics do not necessarily rely on dominance.

But all speculation aside, let's let the numbers do the talking. Although dominant bucks did sire most offspring in our trials, subordinates still sired offspring in five of six trials. Also, multiple paternity – the siring of twin offspring by two different bucks – occurred in 24 percent of compound litters (litters with more than

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Captive Studies

In our studies using captive white-tailed deer, we investigated the long-held assumption that relatively few dominant bucks sire most fawns and thus prevent subordinates from breeding. Although this assumption heavily influences population predictions and management strategies, it was mostly based on mere visual observations of buck-doe pairs seen together, not of actual breeding. Actual scientific studies



In the captive phase of the MSU Deer Lab research, body size was evaluated as a factor in buck breeding success. To isolate the factor, antlers were removed and all bucks were equally well-fed, eliminating the influence of nutrition, health and antler size. Researchers then evaluated "dominance" based on physical cues. With lowered head, ears pinned back, and hair bristling, this buck is signalling aggression.

one fawn). A subordinate buck was able to sire a fawn in these litters.

Furthermore, we found that buck dominance ranks were not necessarily predictable or stable during the rut. Buck dominance rank only remained constant throughout the observation period in four of six pens. In the other two pens, buck dominance shifted during the study.

Indeed, dominance status of the buck affected the number of offspring sired, with the dominant bucks siring the majority – 64 to 100 percent – of fawns in the four pens where dominance rank remained

constant. In the two pens where dominance shifts occurred, the precise time of dominance shift could not be pinpointed. Rather, there appeared to be a period of transition lasting at least two to three weeks during which the formerly subordinate buck became the dominant buck. In general, though, the parentage assignment results reflected these shifts in dominance.

Age, Body Weight, Antlers: What Really Matters?

As far as age as a reliable determinant of breeding success goes, there was

a clear association between dominance and age only among 1½- and 2½-year-old bucks, where the older bucks were in fact dominant in all three pens. In one pen containing bucks aged 3½ and 5½ years, the 3½-year-old buck, though younger, was dominant throughout the study. In two other trials, a 3½-year-old old buck eventually achieved dominance over the 5½-year-old. Older age didn't always equal more breeding success, or so it seems.

Recent studies seem to show that our association of a more mature age with breeding success actually has more to do with the fact that age is quite closely tied up with physical characteristics such as body weight and antler size. Differences among deer in behavior, such as varying degrees of experience or aggression, may also influence breeding success, but we are not sure exactly how much.

The problem is that it can be very difficult to clearly separate one factor from another when determining dominance. Buck body weight, in these studies, was closely associated with age. Interestingly though, the only 1½-year-old deer to sire more than one fawn through the course of the study was the heaviest in his age class. Perhaps then, among younger deer, body weight may be the single most important factor influencing breeding opportunities, but not among older bucks.

Antlers are yet another physical factor that have long been assumed to play an important role in establishing social dominance among other bucks and likewise securing breeding success, as they may also serve as a signal of buck quality to does. And yet, although studies have shown how antlers may be such a signal, there is currently no evidence that does select bucks with larger antlers. Due to the tending-bond mating strategy of deer, doe choice may be more passive by “choosing” the buck that has already proven himself as a viable mate through buck-to-buck competition, in which he potentially has an advantage due to larger antlers.

Many authors have argued for various ecological or evolutionary justifications for these nutritionally expensive “bony appendages.” In nature, if an animal expends energy to grow something this significant, then there should be a darn good reason for them to be there. The most obvious justification is tied to improving breeding success. But, nevertheless, suffice it to say that the role of antlers

in establishing social dominance appears to be just as hazy as other physical factors. (In next issue's article, we will explain that work by Dr. Randy DeYoung at Texas A&M University-Kingsville showed the typical successful breeder actually had only average sized antlers.)

So what really matters when it comes to breeding success? Age? Body weight? Antlers? All or none of the above? By experimentally isolating the physical factors that we often associate with social dominance, we can measure the effects of these physical characteristics on breeding success. More importantly, however, we can also reveal the degree of importance that unmeasured variables, such as behavioral traits, have on breeding success.

We decided to focus specifically on the effects of body weight. In order to eliminate the influence of other physical factors, we maintained all deer on the same diet, examined deer for health status, and removed antlers before introducing bucks into breeding pens. This allowed us to minimize the potential influences of nutrition, health, and antler characteristics as much as possible, and to instead focus specifically on body weight as a physical

The assumption that breeding success is reliant on physical factors like antler size and body weight isn't completely true. Influenced by physical factors? Absolutely. Solely dependent on physical factors? Not so!

determinant of breeding success.

At the beginning of our trials, we predicted that bucks with greater body weight than their competitors would achieve greater breeding success. But, since these larger bucks are more actively involved in breeding, it is possible that they may suffer reduced breeding success as the rut progresses, due to declining condition or weight loss. So, we also predicted that, although larger bucks would have greater success in the first half of the breeding season, their success would decline in the second half.

Body Weight and Breeding Success

Our predictions turned out to be only partially true. Contrary to our assumption of possible decline in success over time, the average breeding success of the largest buck from each breeding trial was actually almost identical between the first and second halves of the breeding season. Although there were four cases where breeding success of the larger buck was somewhat reduced in the last half of the breeding season, this was countered by two bucks that were relatively unsuccessful in the early season but substantially improved their breeding success in the late season.

Keep in mind that the penned bucks in these trials were limited primarily to the strategy of direct physical confrontation. In the wild, more breeding opportunities may exist and allow younger, smaller bucks to mate. For example, during the peak of the rut there may be more estrous does than the older, dominant bucks are capable of breeding, thus providing mating opportunities for younger bucks. Furthermore, skewed adult sex ratios with relatively few bucks could lead to greater breeding success of younger, smaller bucks.

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About This Article

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Our prediction of a direct relationship between body weight and breeding success did turn out to be true, although with a caveat or two. Our results do confirm that greater body weight indicates a greater level of breeding success, while low relative body weight places significant limitations on breeding success.

However, it is important to note that, although body weight seems to indicate a greater possibility of success, we also found that body weight alone does not consistently guarantee greater breeding success. Just because dominant bucks with higher body weight were able to breed more frequently didn't mean that subordinate bucks weren't often able to successfully breed as well.

For instance, in our more recent round of trials from 2006 to 2009, different fathers sired twin fawns in 18 out of 124 compound litters. In the three pens that had more than two bucks in them, smaller bucks actually jointly sired two out of 12 compound litters. That's almost 25



HARDY JACKSON

Personality goes a long way. Younger bucks with smaller bodies and smaller antlers still get their share of breeding action, suggesting that attitude and other factors are in play when bucks compete for does.

percent of twin fawns that bucks of smaller body weight were able to successfully sire.

So, what is it that allows these subordinate deer of lesser body weight to breed as well? The fact that body weight alone cannot reliably guarantee breeding suc-

cess is probably due to some unmeasured, uncontrolled variables that also factor in to the degree of success. These potential variables probably include behavioral or personality traits (like attitude and persistence) that differ from deer to deer. Similar to the aforementioned issue with skewed sex ratios in the wild, simultaneous estrous among does in the deer pens may have allowed subordinate bucks breeding opportunities. That is, if more than two doe were in estrous at the same time, the heavier buck may not have been able to restrict access to both does, thus giving a smaller buck opportunity to breed. The assumption, then, that breeding success is reliant on physical factors isn't completely true. Influenced by physical factors? Absolutely. Solely dependent on physical factors? Not so! Behavioral factors have at least some influence, though exactly how much is not known.

Continued.

Conclusions from Pinned Deer Research

The assumption of a dominance-based breeding hierarchy, where a few dominant bucks sire most offspring, was a central tenet of deer ecology and management, affecting both population predictions and management strategies. But it is time for our methods of prediction and strategy decisions to change.

It turns out that dominance may not exactly work as we once thought. Although we were measuring for the effect of physical factors, it turned out that unknown behavioral variables, possibly related to

aggressiveness or breeding drive, also played an important role in our first study. These unknown variables limited the ability of some bucks to compete successfully in spite of greater relative body weight.

So, while greater body weight does often allow for greater breeding success, it doesn't always guarantee monopolization of does. Bucks helped by physical factors such as greater body weight may be hindered by behavioral factors. Likewise, bucks hindered by lesser body weight may make up for this with certain behavioral factors. In other words, it seems that physi-

cal factors such as body weight aren't necessarily always reliable indicators of potential breeding success among bucks.

Even if factors such as body weight were a fair prediction of dominance, though, it seems that dominance itself isn't as predictable as we have long assumed. Several alternative explanations remain possible. First, dominance may appear less important to buck breeding success because many does come into estrous at the same time, which may provide mating opportunities for younger bucks while older, dominant bucks are occupied. Second, the physical attributes assumed to convey dominance, such as body weight, may not be correctly assessed in the field by researchers, resulting in misleading conclusions. Third, it seems that dominance may not be stable throughout the entire breeding season due to factors such as exhaustion and injury, allowing a greater number of bucks access to breeding opportunities.

We should no longer necessarily presume that social dominance always relies on such factors as age, body weight, or even antler size. And then, even once dominance is determined, we shouldn't presume that dominance is stable or constant. And we should certainly not presume that dominance always equates with guaranteed or sole success in breeding. Although social dominance plays a role in increased success, dominant deer aren't the only ones breeding, by any means. It turns out that socially subordinate deer are getting plenty of action too! In the end, what it may come down to is attitude.

In Part 2 of this series, we will look at factors that might affect breeding success of bucks in *wild* populations.



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