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Collecting and interpreting deer harvest data *for better deer management*

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WHY SHOULD YOU COLLECT HARVEST DATA?

Collecting deer harvest data is essential to understand the effects of management on a local deer population over time. Whether you want to grow larger bucks, increase fawn recruitment, increase weight per age class, or simply improve the overall health of the deer on the property you hunt, it is difficult to see if your management efforts have been successful without collecting data. Landowners and hunters often seek guidance from wildlife biologists to help manage deer on the property they own or hunt, but even biologists cannot prescribe proper management without the necessary information to guide their recommendations.

The relationship between deer density and the amount of food to support them is a primary consideration in deer management. When deer numbers approach the carrying capacity of the available habitat, deer condition declines because the amount and quality of food available to each deer becomes limited. Biologists use the relationship between deer condition and deer numbers to determine what management actions need to be taken. Harvest data provide critical information related to the health and nutritional status of the deer on your property, and information from harvest data represents the foundation for management decisions. Analyzing harvest data substantiates decisions on how many does should be killed, if the fawning rate is going up or down, and if weight and antler size by age class are responding to your efforts. Additionally, age structure of the local population, prevalence of parasites, and disease occurrence all are indicators of herd health and can be monitored with harvest data. If harvest data are analyzed along with habitat data, you can relate herd health with the nutritional carrying capacity of the property, and you will have a clear indication of what level of additional habitat management is needed to influence weight, antler size, and recruitment (addition of fawns into the fall population).

Collecting harvest data can be a daunting task, but it shouldn't be. Collecting the necessary data is easy once you realize what to do and how to do it, and it only takes about 10 – 15 minutes per animal. However, it is easy to neglect data collection while celebrating with a large buck in the skinning shed or trying to clean a doe late in the evening! Nonetheless, with the little time and effort invested, you will be able to see if and how your management efforts have affected the deer herd, and if additional changes are necessary.

Fig 1a (top); Most hunters are more than willing to take a few minutes to get a photo of the deer they killed, but often do not understand the importance of taking a few minutes to collect data on the deer they killed. Fig 1b (bottom); It only takes a few extra minutes to pull a jawbone and weigh a deer to get weight per age class data.

Date of Harvest	Weapon	Sex	Age (tooth wear)	Age (Cementum Annuli)	Antler Score	Live Weight	Fetus count	Conception date	Lactating?	KFI	Shoulder height (in)
10/22/2019	Bow	M	2.5	2.5	87	132	N/A	N/A	N/A	0.72	35
10/23/2019	Bow	F	5.5	4.5	N/A	103	N/A	N/A	Yes	0.63	32
10/25/2019	Bow	F	4.5	4.5	N/A	109	N/A	N/A	Yes	0.51	31
10/25/2019	Bow	F	1.5	N/A	N/A	87	N/A	N/A	No	0.42	27
10/25/2019	Bow	F	0.5	N/A	N/A	52	N/A	N/A	No	0.12	17
10/25/2019	Bow	F	2.5	2.5	N/A	102	N/A	N/A	Yes	0.45	24
10/25/2019	Bow	M	4.5	4.5	137	167	N/A	N/A	N/A	0.85	38
11/4/2019	Muzzleloader	M	5.5	4.5	153	182	N/A	N/A	N/A	1.13	36
11/5/2019	Muzzleloader	M	3.5	3.5	122	156	N/A	N/A	N/A	0.64	37
11/7/2019	Muzzleloader	F	1.5	N/A	N/A	91	N/A	N/A	Yes	0.39	29
11/7/2019	Muzzleloader	F	5.5	7.5	N/A	108	N/A	N/A	No	0.54	35
11/7/2019	Muzzleloader	F	4.5	5.5	N/A	114	N/A	N/A	Yes	0.43	33
11/9/2019	Rifle	F	1.5	N/A	N/A	101	N/A	N/A	Yes	0.62	30
11/10/2019	Rifle	M	0.5	N/A	N/A	57	N/A	N/A	N/A	0.17	19
12/11/2019	Rifle	F	2.5	2.5	N/A	98	1	10/15/2019	No	0.74	29
12/14/2019	Rifle	M	3.5	3.5	114	141	N/A	N/A	N/A	0.31	37

Fig 2; Entering harvest data into a spreadsheet allows you to easily organize data and compare trends over time.

WHAT AND HOW MUCH DATA SHOULD YOU COLLECT?

Several types of data can be collected from harvested deer, and each gives insight into slightly different components of herd health and a well-managed deer herd. For example, body weight, antler score, and kidney fat provide information on the nutritional status of a deer, whereas lactation status and fetal counts can be used to estimate herd productivity. We categorize data collection into two groups: basic and advanced. All managers should strive to collect the basic data, but those wanting more detailed information and the ability to fine-tune their management program can collect additional data.

We strongly recommend you collect data from ALL of the deer killed on the property you own, hunt, or manage if you are serious about understanding the effects of management. Collecting data from each animal killed is especially necessary for small properties or where relatively few deer are killed annually. Any data you collect is useful, but to get the full picture of how the deer population is influenced by management, a large sample size is needed to make the most accurate decisions. If necessary, you can increase your sample size by working with your neighbors, encouraging them to collect data, and then sharing the results once the data are analyzed and interpreted.

BASIC MEASUREMENTS

Basic data deer managers should collect include sex, age, body weight, antler score, and lactation status. These data are simple to collect and provide information that will be used to determine management decisions, such as the number of does that should be killed or if additional habitat management is needed. Body weight and antler score can provide insight into deer nutritional condition, and lactation status provides information on herd productivity.

Age

Age of each deer is critical to collect, as it is used to scale all other data. Average weight, antler size, and lactation rate all increase up to a certain point with age. Therefore, it is inaccurate and misleading to compare any of these metrics between relatively young and older animals. This point cannot be emphasized enough—**the harvest data you collect are meaningless unless paired with an age estimate.** There are two primary ways to estimate age of harvested deer: tooth wear and replacement (TWR) and cementum annuli (CA). Neither technique is perfect, but both provide necessary information to make accurate management decisions.

"THE HARVEST DATA YOU COLLECT ARE MEANINGLESS UNLESS PAIRED WITH AN AGE ESTIMATE."

Tooth wear and replacement (TWR)

TWR requires extracting the lower jawbone to examine tooth eruption and wear patterns. You cannot accurately estimate tooth wear by simply looking into the mouth with a flashlight. TWR is very accurate in separating three groups: fawns, yearlings, and deer 2.5 years old and older. [Note: we typically refer to deer age in half-years because jawbones usually are obtained during hunting seasons in fall/winter, approximately 6 months later than the time of year when deer are born.] Accuracy of TWR declines in older age classes, but the technique is sufficiently accurate to make sound management decisions. Jawbones can be removed with a jawbone extractor tool and pruning shears, which can be purchased from Forestry Suppliers, the National Deer Association, or other suppliers. An extractor with an angled tip allows for easier removal of the jawbone. Following removal, the jawbone can be aged on site or it can be labeled for aging later. If stored for aging later, jawbones should be cleaned of flesh, dried with open airflow (often in a hanging wire-mesh basket), and labeled with a data tag. Additionally, we recommend you remove both jawbones, as slightly different wear patterns may be present on each jaw. If the wear differs on the jawbones, it is recommended to estimate age based on the jaw with more wear. TWR is more accurate than CA for deer 2.5 years old and younger. Benefits of TWR include it is free, and you get immediate age estimates. Instructional videos on how to remove and age jawbones are available at www.youtube.com/watch?v=aInmVYwRbBw, www.youtube.com/watch?v=Pvg81GH2RTA.

Fig 3a, b, and c; Jawbones can be removed for aging without damaging the cape with a jawbone extractor and pruning shears. Fig 3c shows jawbones pulled and tagged at the end of deer season, ready for age estimation by a biologist prior to recording on the deer harvest data sheet.

Fig 4; For deer that will not be shoulder-mounted, you can view the jawbone for aging by simply cutting the cheek to expose the jaw. The jaw will have to be opened such that wear can be viewed on all teeth, included the back cusp of the third molar (M-3).

Cementum annuli (CA)

CA age estimates are produced by examining a thin section of the root of incisors. Annuli, or rings, are deposited on the roots of the teeth during winter, and these can be counted to estimate age. Age estimation by CA is considered more accurate than TWR for deer 4.5 years old and older, but still there is variability in age estimates produced by CA. Additionally, CA estimates may be less accurate in areas that do not experience winters that limit food availability and create periods of stress. CA aging is performed by several laboratories in the U.S., including Matson's Lab (www.matsonslab.com) and Wildlife Analytical Laboratories (www.deerage.com). Cost varies, but generally averages around $20 per animal. Information regarding shipment of incisors is available from the laboratory, as each has slightly different recommendations on preparing incisors for aging. Benefits of CA include it is less subjective than TWR and more accurate for mature animals.

Deciding which aging technique to use depends on your management objectives, location, and resources. For most managers and landowners, TWR provides sufficiently accurate data to scale other harvest data, such as body weight, antler size, and lactation status. For landowners seeking more accurate age estimates for fully mature deer, it may be worth sending them to a lab for CA aging. It is important to remember that both techniques are simply providing an estimate of age, and neither technique is 100% accurate every time.

Body weight

Body weight is one of the most important measurements to collect from harvested deer, as it provides a measure of the nutritional condition of each deer. Strategies that either reduce deer density or improve forage availability should have positive impacts on deer condition in most areas, which should result in increased body weight by age class (see Fig 5 and Fig 25). Weight generally is collected from a hanging scale. Both analog (spring) and digital scales work, but digital scales are more precise and easier to read. Regardless of scale type, **it is critical to calibrate your scale each year to make sure weights are accurate**. If you use an analog scale, we recommend one that weighs in 1- or 2-pound increments, not 5-pound increments.

Deer can be weighed either whole (live weight) or field-dressed, and it is best for consistency and comparisons over time to weigh all deer the same way from a property. Conversion charts exist to determine live weight from field-dressed weight (and vice-versa), but don't rely on the accuracy of such conversion charts as the average weights of deer within a certain age class vary greatly in different parts of the country, and the weight of the internal contents of deer, even within a given age class in a given area, often varies considerably (easily 5 – 10 pounds). **You should record the harvest date along with the body weight for all deer**. Recording date of harvest is especially important for bucks because they typically lose a considerable amount of weight (10 to 20%) through the hunting season as a result of rutting behavior (increased movement and energy expenditure with reduced food intake).

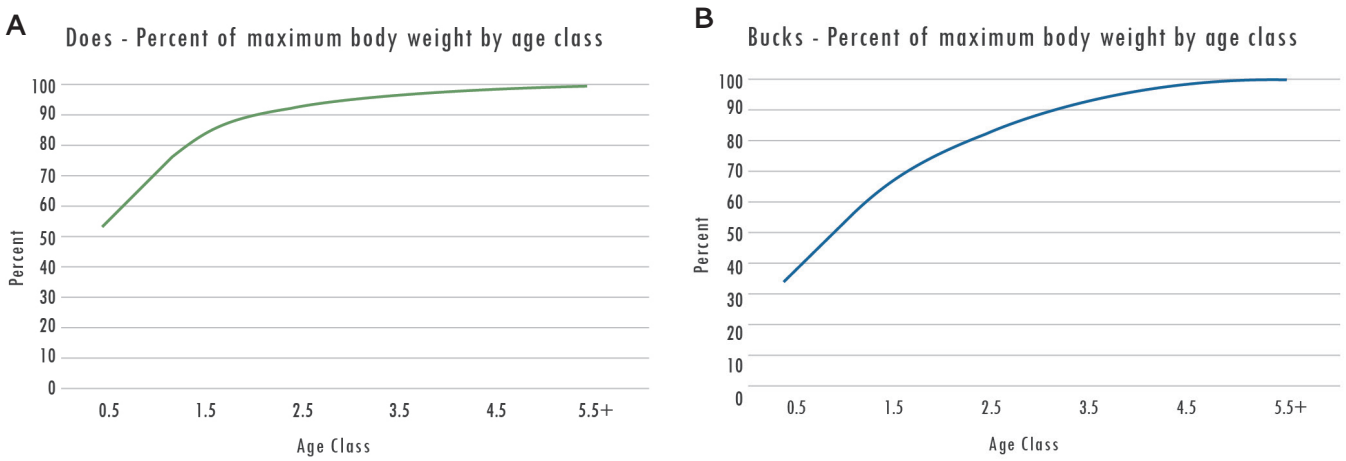


Fig 5a and b; Body weights of bucks and does increase with age, so it is critical to collect age data to scale other measurements. Because body weight is maximized at approximately 3.5 years for does and 5.5 years for bucks, biologists often group does as 3.5 years old and older and group bucks as 5.5 years old and older for analysis.

Fig 6; Collecting weights of all harvested deer is essential to track nutritional status over time.

Antler score

Producing larger bucks is an objective for many management programs, and antler size by age class is one measure of the nutritional status of bucks. Antler size by age class is relatively sensitive to changes in habitat quality, even more so than weight by age class. Thus, information on antler size by age class of each buck killed should be recorded to determine influence of your management over time. The Boone and Crockett scoring method is the most popular way to measure antlers, and it includes measurements of inside spread, length of main beams, length of antler tines, and four circumference (or mass) measurements on each main beam. Boone and Crockett measurements are easy to collect, and this method provides a comprehensive assessment of antler size. Scoring charts for typical and nontypical white-tailed deer can be found at www.boone-crockett.org/download-bc-score-charts. We recommend calculating gross Boone and Crockett score, which is the total score of the animal before deductions are taken. Gross score is not valid for entering in Boone and Crockett records, but it provides the best measure of total antler growth and is best to use when making comparisons over time.

We know there are some managers who do not want to take the time to measure the Boone and Crockett score. However, if you have any desire or intent to evaluate antler changes by age class over

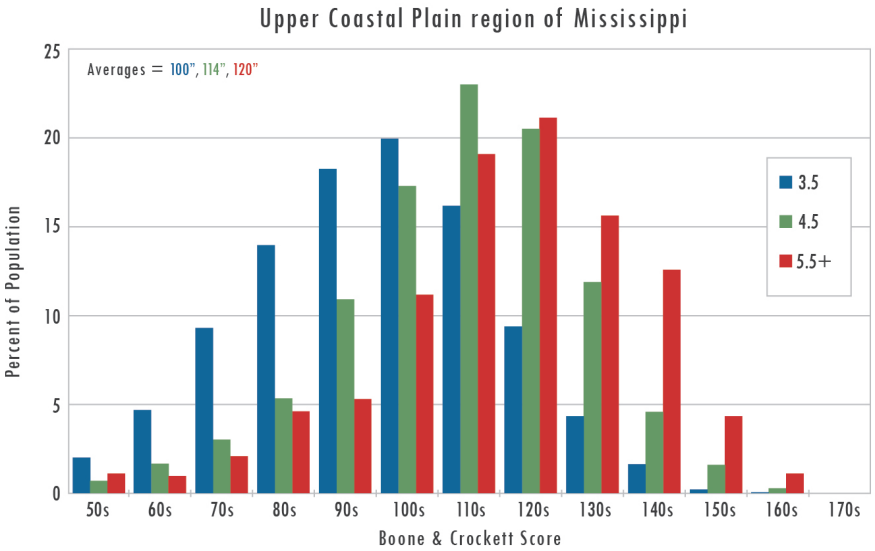


Fig 7; Each age class of bucks has an average antler size. Most of the bucks in any age class have antlers that are close to the average, but there are a relative few that are smaller than average in that age class and a few that are larger than the average in that age class. This graph shows the distribution of bucks around the average in the 3.5, 4.5, and 5.5+ age classes in the upper coastal plain of Mississippi. For example, in this region of Mississippi, the average mature buck scores about 120 inches, but there are a few bucks that score in the 150s and 160s. This is a critical concept that deer managers must understand.

Fig 8; The gross Boone and Crockett score provides more detailed information on antler characteristics than basic measurements, and the B&C score can be measured within 10 minutes for most bucks.

time, some measurement must be made. Collecting the circumference at the base of the antlers, main beam lengths, spread, and number of antler points provides baseline data that can be used as an index to compare antler size by age class over time. These measurements can be used to estimate the Boone and Crockett score. However, these measurements are less sensitive to changes in antler score over time compared to Boone and Crockett score, as they do not account for changes in tine length. With about 5 additional minutes, the tine lengths could be recorded to complete the Boone and Crockett score, which can be important, especially for bucks of a targeted age, such as all bucks ≥3 years old. The Mississippi State Deer Lab provides a conversion calculator www.msudeer.msstate.edu/estimate-boone-and-crockett-score.php to estimate Boone and Crockett score from basic antler measurements.

Lactation status

Herd productivity information is important when making doe harvest decisions, and documenting lactation provides a simple metric to gauge fawn production and survival. Does that are lactating during the hunting season have produced at least

Fig 9; Milk may be present when the teats are squeezed. If you cannot squeeze milk from the teats, cut into the udder and check for milk or a relatively dark fluid. If present, you should record 'yes' for lactation.

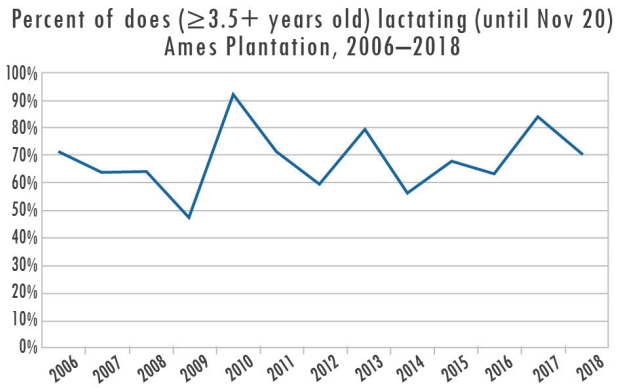


Fig 10; It is not uncommon for lactation rates of harvested does to vary from year to year. It is important to look at 3 – 5-year trends to see how the population is responding to management efforts. Here, you can see the year-to-year variability at Ames Plantation in west Tennessee, but over the long term, lactation rates increased slightly.

one fawn that survived into the fall season, so lactation serves as an index for recruitment into the deer population. Fawn recruitment is an important measure of the productivity of a local deer population and provides valuable insight on appropriate and sustainable harvest levels. Following harvest, hunters should examine the udders for presence of milk or fluid. Although milk may be visible when the teats are squeezed, it is often necessary to cut the udder to determine whether milk is present.

It is important to realize evidence of lactation becomes less obvious with increased time since fawns were weaned. Fawns can be weaned at approximately 10 weeks of age, and many states have deer seasons that open 1 – 2 months after the majority of fawns have been weaned. Fortunately, does continue to show evidence of milk in their udders at this time. It is important to account for decreasing lactation rates by examining does harvested by a certain date determined by the average fawning date in your area. You can determine the peak birthing period on your property by measuring fetuses (see below), and biologists with your state wildlife agency can help you determine the date to cease lactation data collection. It should be obvious how recording the harvest date for does (as well as bucks) is important information. Lactation data should be considered an index to productivity, not an exact measurement. Lactating does may have produced multiple fawns that survived or only one. Additionally, nonlactating does may have given birth to one or more fawns, but the fawn(s) died early from predation, starvation, disease, or some other mortality factor.

In general, >70% of does ≥2.5 years old show lactation in a productive, healthy herd. It is important to keep in mind that a greater percentage than this actually bred the prior fall/winter and birthed a fawn(s) in spring/summer, but not all fetuses become fawns, and not all fawns survive to the fall, so you are collecting lactation data to provide an index to the percentage of does that successfully raised a fawn. The percentage of yearling (1.5 years old) does that show lactation is a measure of doe fawns that bred the prior fall/winter. This measurement is a great barometer of overall habitat quality and herd health. The national average is about 13%, but varies from 0 – 15% in the

South, 0 – 23% in the Northeast, and 2 – 43% in the Midwest. Although the percentage of doe fawns that breed is greatest in areas with high-quality habitat, it is rare for more than 50% of doe fawns to breed. Regardless, lactation data should be considered in conjunction with other data, including hunter observation data and camera surveys that estimate the number of fawns per doe on a property, along with an assessment of habitat condition and quality. When combined with other data, trends in lactation data over time can be an important indicator of doe productivity and fawn survival.

ADVANCED MEASUREMENTS

Managers who want to learn more about the productivity and status of deer on their property can collect additional measurements. Fetal counts can be used to evaluate herd productivity along with lactation data, and kidney fat can provide information on short-term nutritional condition. Additionally, body frame measurements can document long-term changes in herd condition across multiple generations of deer. Not all of these measurements are needed on every property, but collecting multiple types of data provides a more complete picture of herd condition.

Kidney Fat Index (KFI)

Fat reserves provide insight into the seasonal, short-term nutritional condition of deer. Measuring total body fat on each deer is impractical, so we use other measures that are highly correlated with total body fat. Weighing the amount of fat deposited around the kidneys can be used as a relative measure of fat reserves. KFI is calculated by comparing the weight of the kidneys to the weight of the fat attached to them. **(Time out: we know what you're thinking. Probably something like, "You've got to be kidding me! You want me to cut the kidneys out and weight them?!? I don't have time to do that!!" Yep. We sure do, and there is good reason for it. Please continue reading…)**

The thought of removing the kidneys is intimidating to many people because most people don't know exactly where the kidneys are located, don't know what they look like, and most people do not have a small digital scale to weigh them. Well, once you realize where they are and what they look

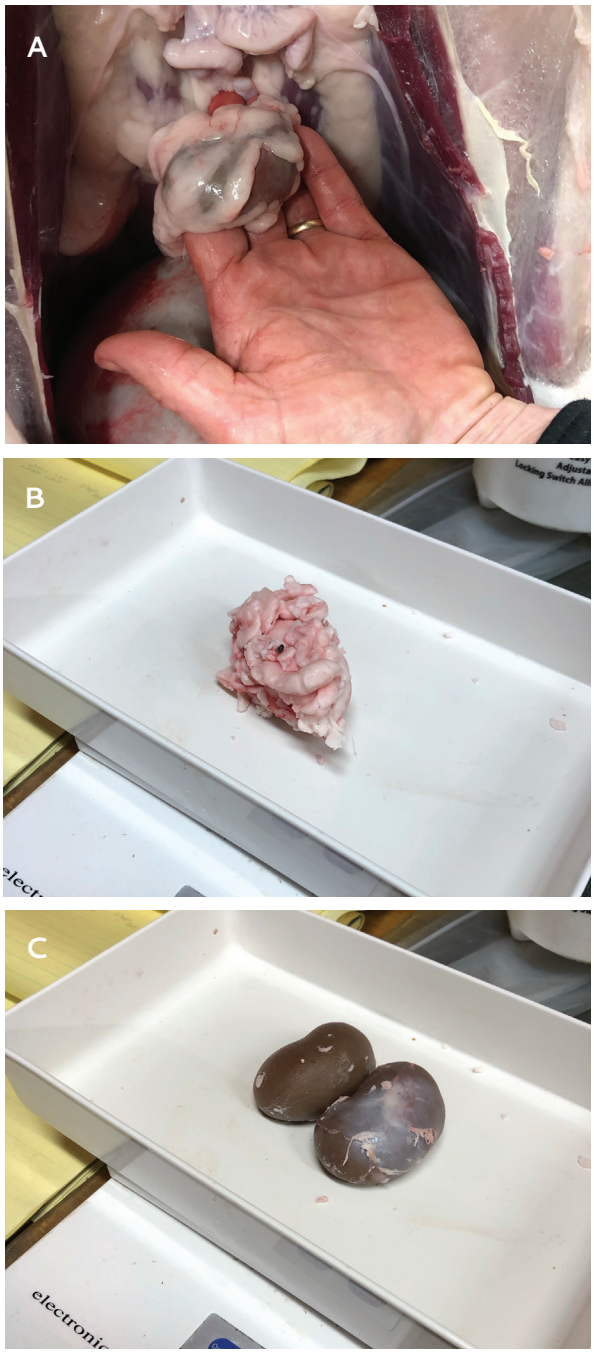


Fig 11a, b, and c; Removing and weighing the fat on both kidneys can provide an index of fat reserves and body condition. On this deer, the KFI is calculated by dividing the weight of the fat from both kidneys (50 g) by the weight of the kidneys (94 g), which equals a KFI score of 0.53. Remember to trim and discard the fat on either end of the kidney before removing the rest of the fat around the kidney for weighing.

like (see Figs. 11a, b, and c), you quickly understand how easy this is when removing the organs and intestines, and a small digital scale only costs about $20. We would not recommend calculating KFI if it were not a good measure of herd health, and it is one of the first measurements to indicate improvements in nutritional availability and body condition.

The kidneys are located near the tenderloins, and they may not be readily obvious if they are covered in fat, which is the case if deer are in good condition. Even if they are covered in fat, they are easy to find by simply grabbing the fat near the anterior (front) portion of the tenderloins and feeling for the firm, oblong-shaped organs about the size of a goose egg (usually about 3" in length). Remove the kidneys and the fat attached to them, then trim and discard the fat on each end of the kidney (leaving the fat around the kidney). Now peel away the fat surrounding each kidney and weigh both kidneys, then weigh the associated fat separately on a small digital scale. The KFI is calculated by dividing the weight of the fat on both kidneys by the weight of both kidneys. This number may be less than or greater than 1, and higher KFI values obviously indicate greater fat reserves.

Date of harvest should be considered when examining KFI from year to year, as deer harvested later in the season may have decreased fat reserves compared to deer killed earlier in the hunting season. Sex also should be considered, especially with regard to the amount of fat that may be lost for bucks during the rut. As long as these factors are considered, KFI provides useful insights into the current nutritional condition of animals and is a relatively easy metric to collect while cleaning a deer.

Fetal age

Fetuses are located in the uterus, which is found near the bladder. The uterus has two lobes, and each lobe may contain a fetus (rarely more than one) if the doe was bred. If a fetus is present, the date of conception and the projected birthing date can be determined using a fetal scale developed by Joe Hamilton (Certified Wildlife Biologist and founder of the Quality Deer Management Association). Fetal scales can be purchased from the National Deer Association, Forestry Suppliers, or other suppliers. It is important to consider harvest dates when collecting fetal data, as does harvested less than a month after breeding are unlikely to have fetuses that are easily visible. Fetal data may not be applicable in some states where the rut occurs close to the end of hunting season, or on properties where the majority of

Fig 12; Fetuses are located in the lobes of the uterus and are evident about a month after breeding.

Fig 13; Fetuses are easily aged using a fetus scale. The point of the knife shows the correct placement on the scale to record the age of the fetus.

doe harvest is conducted prior to or close to the rut. However, on properties where a sufficient number of does are harvested at least a month after breeding has occurred, collecting fetal data provides useful information. If you are not able to collect fetal data, you may be able to obtain it from your state wildlife agency, as many collect fetal data from does obtained from vehicle collisions during late winter and early spring.

Does killed approximately 40 days after they have bred have fetuses large enough to be aged, and fetuses can be sexed at 60 days. Much information can be gained from collecting and measuring the fetuses. Timing of peak breeding (peak of the rut) is of interest to most hunters, and aging fetuses from harvested does can provide that information. In addition to timing, the length of the breeding season also is of interest and certainly can have implications for hunting. In some areas, especially in the northern US, the breeding season is quite contracted with a majority of breeding occurring over a couple weeks. In other areas, especially

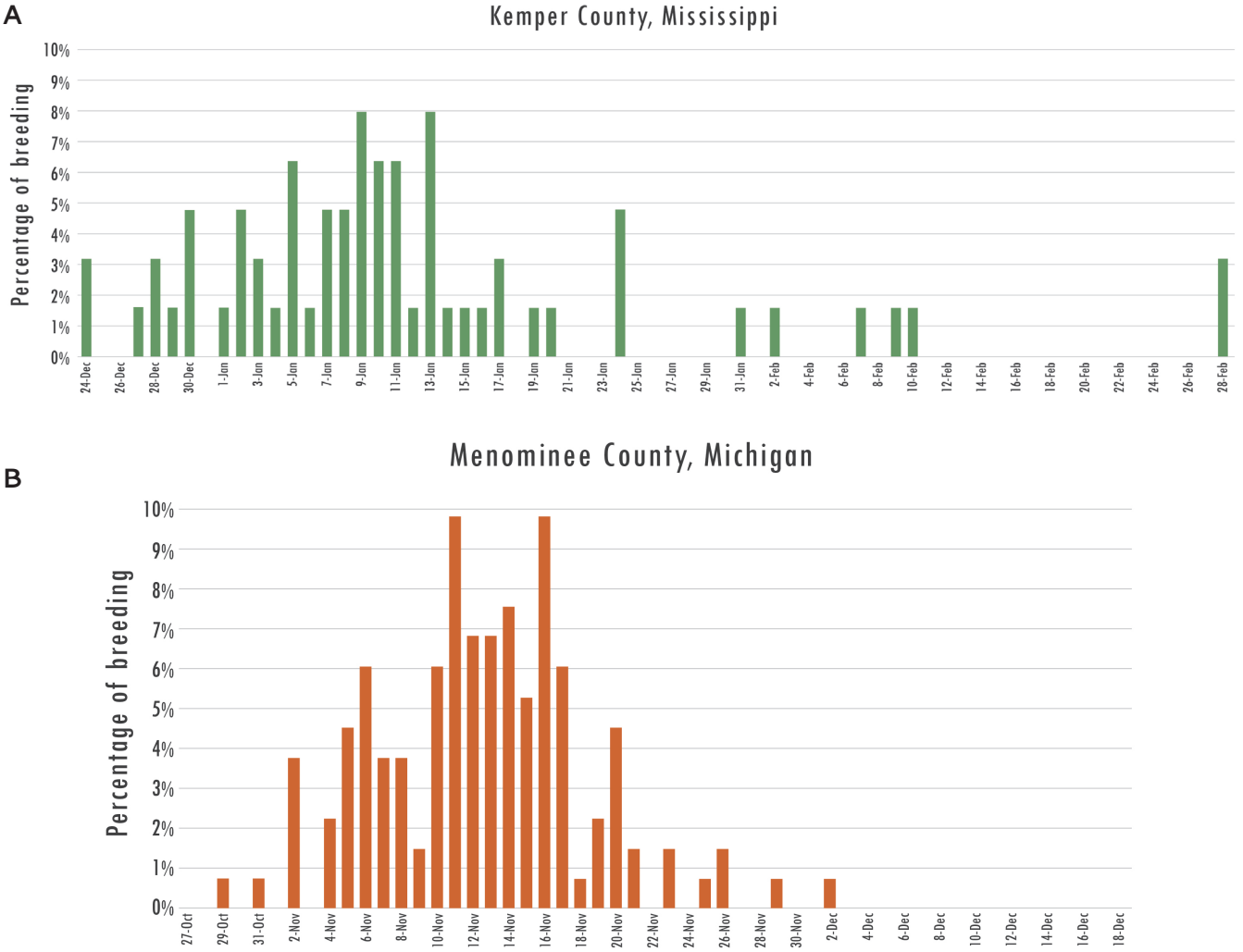


Fig 14a and b; Breeding dates can be determined by measuring fetuses with a fetal scale. In Kemper County, Mississippi (14a), breeding is spread out over at least a 48–day period. Approximately 60% of the does are bred from January 1 – 14, and 75% are bred in the month of January. In Menominee County, Michigan (14b), approximately 60% of the does are bred November 10 – 17, and almost all are bred in the month of November. Michigan data courtesy Jared Duquette, MI Dept of Natural Resources]

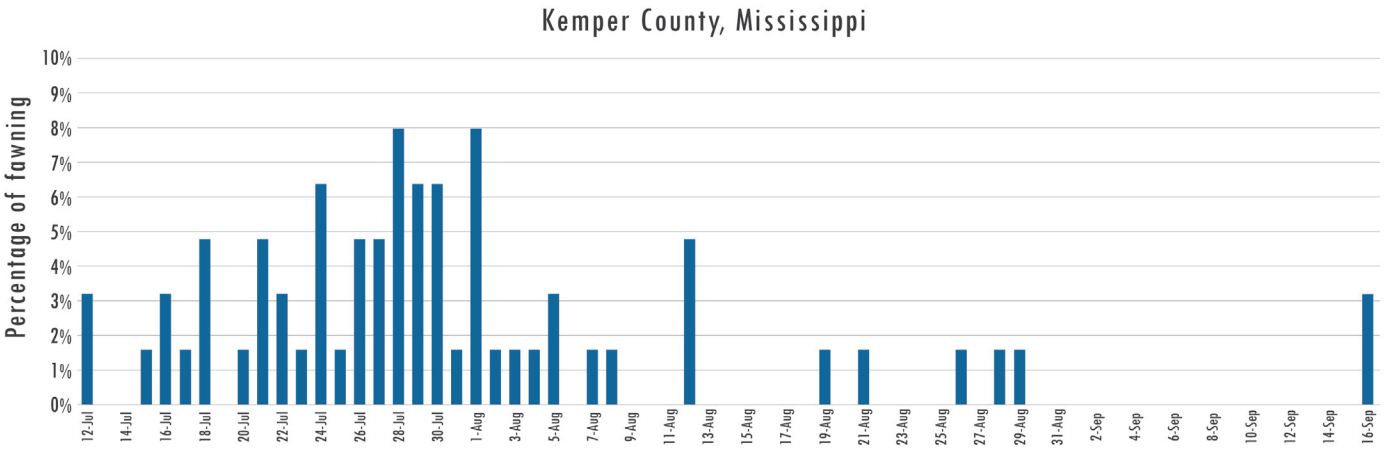


Fig 15; Fetal data also allows accurate projections of fawning dates. Such information is important as it can guide timing of management activities. For example, peak fawning occurs mid-July through early August in Kemper County, MS. Obviously, management of early successional areas typically selected as fawning cover should not be concentrated during this time period.

in the southern US, a similar percentage of does may be bred over a 4 – 6-week period. Biologists speculate on why this occurs. One possibility is that some does were not bred during their first estrus cycle, especially if the sex ratio is skewed heavily toward does. Another possibility is that some does come into estrus later than others, which may be influenced by available nutrition. Regardless, it is informational to have empirical evidence of when the rut occurs, how long it occurs, and if there are year to year changes on the property you hunt or manage.

Aging fetuses also provides information as to when fawns are born on your property. Knowing the range of fawning dates can influence habitat management activities as well as potential best times for predator control. Obviously, you wouldn't want to burn or mow old-fields that may be used for fawning cover during the fawning period, and you might concentrate your trapping effort for coyotes just prior to fawning if coyotes are limiting fawn survival in your area.

Checking for fetuses also provides information on herd productivity and nutritional condition. For example, the percentage of yearling does with a fetus is a good barometer of herd productivity and nutritional condition. In general, if >70% of the yearling does have a fetus, that indicates high productivity and available nutrition. In most areas, the majority of yearling does will breed. The big difference in reproductive output is the percentage of yearling does that gives birth to twins as opposed to single fawns. [Note: do not confuse the rate of yearling does with a fetus with the rate of lactating yearling does. Yearling does with a fetus represent the percentage of yearling does that recently bred as a yearling (1.5 years old). Lactating yearling does represent how many yearling does were bred when they were doe fawns the previous fall/winter.] Does ≥3 years old should have multiple fetuses unless they are in relatively poor nutritional condition or have other complications.

Body frame measurements

Body weight is the most common measurement of nutritional condition that managers collect, but there are two ways that body weight may increase following improved forage availability. First, deer on an improved diet may gain muscle and increase fat stores. This effect may happen relatively quickly following management actions. However, improved nutrition also may lead to increased skeletal measurements over a few generations of deer. These generational changes are thought to be caused by nutritional cues passed from the pregnant doe to the fetus while it is developing. Thus, management strategies that cause significant improvements to deer nutrition over time can lead to larger-framed deer over several generations.

Fig 16a and b; Shoulder height is measured from the tip of the hoof to the top of the shoulder, which can be seen here under the tip of the recorder's fingers, and can provide information on long-term changes in deer size if collected over time with an adequate sample size. The shoulder height of this deer is 32 inches.

Managers interested in documenting generational effects of improved nutrition should collect body-frame measurements on harvested deer. The most common measurements are shoulder height, total body length, and hind foot length, but shoulder height is the easiest body measurement to collect with the least amount of error. Shoulder height is collected by measuring the straightened front leg of a harvested deer from the tip of the hoof to the top of the shoulder. All of these measurements can be collected with a flexible tape measure. Collecting body frame measurements is not necessary on many properties, but these measurements can provide data on the long-term positive effects of management, especially on properties that have chronically suffered from poor food availability over many years and deer exhibit relatively small body sizes. With improved management that corrects nutritional deficiencies, collecting deer body-frame measurements will show the results of improved nutrition following several years that span at least a few deer generations.

OTHER DATA THAT MAY BE RECORDED

There are many additional data that may be collected and prove useful later when evaluating the progression of your management. Some are simple observations, whereas others might place deer in certain categories, and they may range from hunter satisfaction to occurrence of disease.

Observation data

Hunter observation data are extremely useful to indicate various trends, such as deer density, rut activity, fawn recruitment, and deer occurrence at a particular stand location or area of the property. Combining doe/fawn observation data with lactation data provides more confidence when determining if fawn recruitment is limited or changing. Observation data also help clarify our "selective memory." For example, how common is it to hear about how many deer there were or how big the bucks were back in the good ole days, but now we do not see as many, or the bucks are not as big?!? Observation data combined with harvest data immediately confirm or disprove selective memory! The Mississippi State University Deer Lab has produced an application that allows

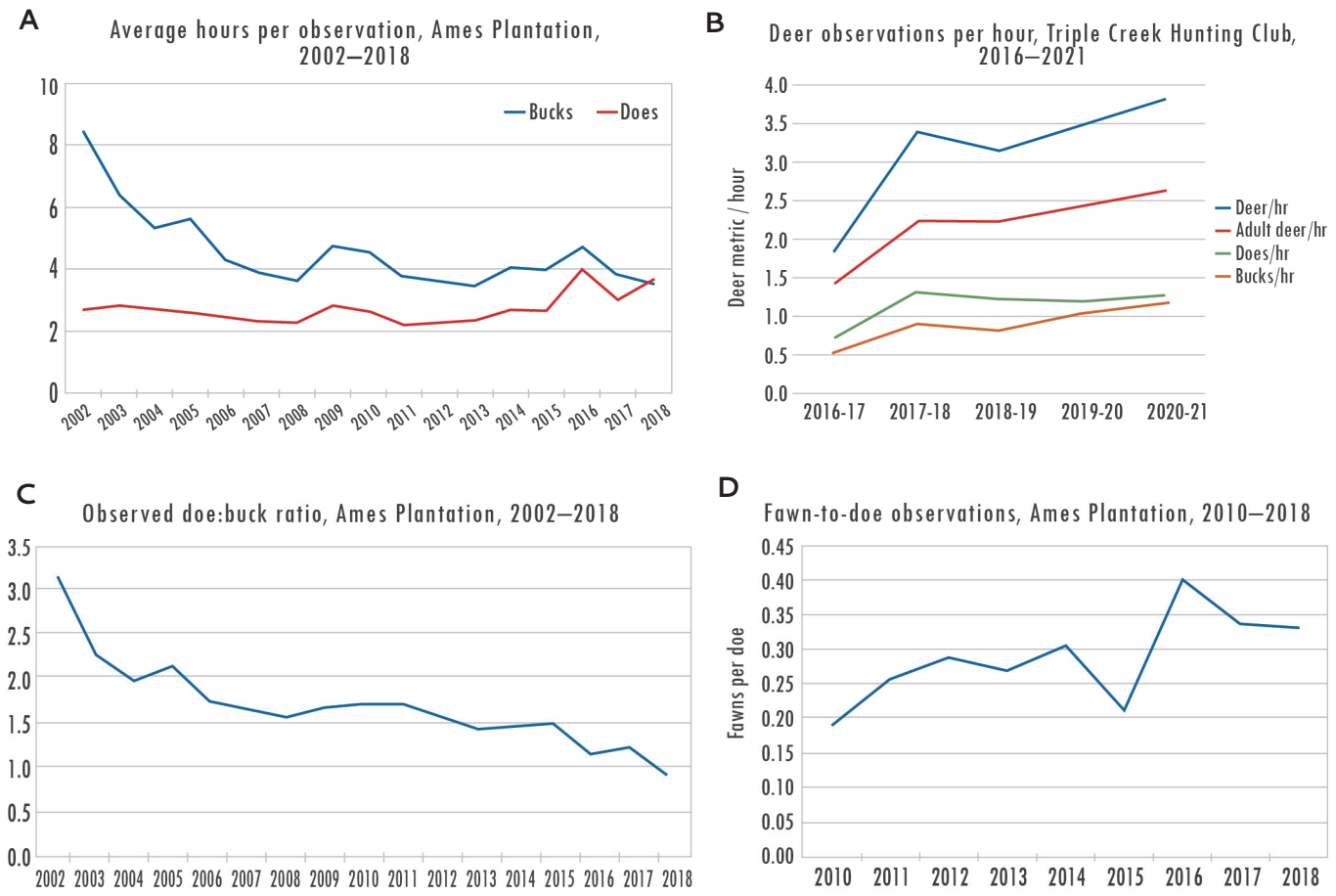


Fig 17a, b, c, and d; Observation data are extremely useful, whether to monitor how frequency of sightings might be increasing or decreasing (17a and b), how the sex ratio might be changing (17c), or if fawn recruitment is increasing (17d). Keep in mind, observation data are estimates to provide an index on changes over time, not exact measurements.

recording observation data on a smartphone. It is available for Apple users at apps.apple.com/us/app/msues-deer-hunt/id919207002, and Android users can locate the app at play.google.com/store/apps/details?id=com.msstate.ext.msuesdeerhunt&hl=en.

Deer harvest location

Recording the location where each deer was killed can be very enlightening over time, especially if you create a map marking all the locations. Such maps not only can illustrate where most deer have been killed over the years, but also show "holes," indicating areas of the property where few or no deer have been killed. Such information can cause you to wonder why deer were not killed there and correct the situation, whether it be related to habitat or simply that it is an overlooked area of the property, though lots of deer activity may occur there.

Buck harvest category

Most property managers or hunting clubs implement some type of restriction on which bucks are eligible to shoot. Most have some type of age requirement, whereby buck age is estimated

Fig 18; Buck age can be estimated during observation or from trail camera photos. Age estimates may be used to determine which bucks are eligible for harvest. Although this buck did not have a high-scoring rack, he was 5.5 years old, and the likelihood of him growing a larger rack in later years was low. Including such information on the deer harvest data sheet helps explain why certain deer were shot and why antler size of harvested bucks may not change. That is, the antler characteristics of bucks killed within any age class do not necessarily reflect the actual average characteristics of that buck age class—they may be skewed (up or down) by hunter selection.

by relative body size and conformation, whereas others still implement some type of antler restriction, such as minimum number of antler points, antler spread, or length of main beam. Regardless of restriction, within each age class, there is an average body weight and an average antler size, usually measured or estimated using the Boone and Crockett scoring system. Of course, within each age class, there are bucks that exceed the average weight or antler size for that age class, and there are bucks with below-average weights or antler size for that age class. A common strategy, especially where deer are overabundant and density needs to be reduced, is to protect young- and middle-aged bucks with above-average-size antlers, but allow those with below-average-size antlers to be taken. Combined with shooting an appropriate number of does, this strategy helps reduce overall density while allowing bucks with the greatest potential for relatively large antlers to realize maturity, which increases hunting excitement for many hunters. That being said, **it is critical to make clear that such selective harvest strategies do not influence or improve the antler genetics of the local deer population**. Nonetheless, it is informative for each hunter to record on the observation data sheet the estimated age of observed bucks. Also, it is very informative to indicate on the harvest data sheet if the hunter considered the buck below average for its age, if it was killed by a youth or first-time hunter, or if the hunter considered the buck average or above average for its estimated age. Looking back over the years, this information will help explain how or why harvested buck age structure and antler size did or did not change, and this information is especially important for those properties with relative low sample sizes.

Disease occurrence

Recording incidence of symptoms and evidence of various diseases and parasites on data harvest data sheets can be important in tracking overall herd health over time. Hoof sloughing is a symptom associated with Epizootic Hemorrhagic Disease or associated Blue Tongue viruses. You may find body weights are lower one year and wonder why. Checking deer for hoof sloughing will help indicate occurrence of hemorrhagic disease, and even though a certain percentage of deer with the disease will live, the virus can lead to reduced weights as a result of the compromised physiological condition.

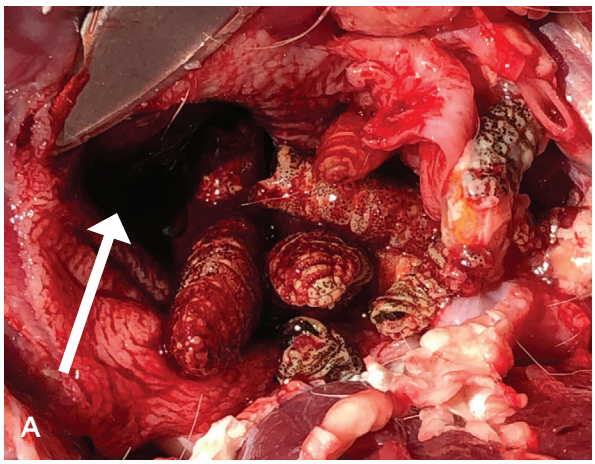
Parasites, including ticks and louse flies, are common on deer, but extreme infestations of ticks can lead to reduced body condition. Recording incidence of extreme loads of ticks or incidence of warts (cutaneous fibroma) can be informative. Louse flies (often called "deer keds") are insects, not ticks (they have 6 legs instead of 8) and not lice (though you may find lice on deer also). [Note: We know it's confusing, but to clarify, multiple louse are called lice, but a louse fly is not a louse, and thus louse flies are not lice!] The "keds" often seen between the hind legs of deer actually are adult flies, but they do not have wings, and though they

Fig 19; Recording incidence of disease can help managers understand unexpected variation in deer density and productivity. Here, the sloughing hooves of these deer are evidence they suffered from epizootic hemorrhagic disease (EHD). Not all deer that contract EHD die, but it is common for those that survive to experience weight loss and reduced productivity, including fawning rate and antler growth during that year.

Figs 20a and b; There are several external parasites common to white-tailed deer. Some of the most common include ticks, louse flies (or "keds"), and lice. Shown here (20a) from left to right is a larval lone star tick, a nymphal lone star tick ("seed tick"), a louse, a louse fly (ked), and an adult lone star tick. Fig 20b shows a larval lone star tick, a lymphal lone star tick, an adult male lone star tick, and three adult female lone star ticks in increasing degrees of engorgement. Photos courtesy Southeastern Cooperative Wildlife Disease Study, University of Georgia.

may be numerous, they are not known to have any impact on deer health.

Another parasite commonly found in harvested deer while processing is nasal bots. Nasal bots are fly larvae of the genus *Cephenemyia* that live in the nasal and sinus passages of deer until they fully develop and exit the deer, upon which time they burrow in the ground and later pupate and emerge as adult flies. Nasal bots are commonly found in deer, and you may find it interesting to know how



Figs 21a and b; Nasal bots are fly larvae found in the nasal and sinus passages of deer. They kind of look like grubs (beetle larvae) that you might find in your yard, and their "skin" is relatively tough. You might see them wiggling out of the nose of a deer a few hours after the deer is dead, or you may find them in the back of the throat or in the nasal passage if you cut the deer's head off, such as when you are searching for lymph glands to sample for chronic wasting disease. Fig 21a shows nasal bots in the pharyngeal passage (see arrow) of a deer. Fig 21b shows them outside on a tailgate (hint: they make very good bluegill bait!).

frequently they occur on your property. Nasal bots can be irritating to deer, but do not cause any real problem, and deer with nasal bots are perfectly fine for human consumption (the deer meat, not the bots).

Camera data

Almost everyone who hunts these days also uses cameras to either provide some survey of the deer on the property or at least to get a glimpse of the bucks using the property. Analysis of camera data can be complex and complicated, and there are many techniques used to provide data on a wide range of metrics. Nonetheless, it is relatively simple to set cameras up in a suitable fashion to get meaningful data without a complicated analysis. If nothing else, if you place your cameras in a consistent fashion, you can easily get an index of deer abundance, sex ratio, fawn recruitment, and buck age structure from year to year. Standardized placement of cameras (such as 1 camera per 100 acres) can provide more accurate results than selective placement, which often is skewed to areas of the property with the greatest abundance of deer. However, even if you only place cameras in food plots, for example, if you are consistent in your placement, you have the basis for an index from year to year. Information on how to conduct a camera survey to estimate deer density, age structure, sex ratio, and fawn recruitment can be found at extension.msstate.edu/sites/default/files/publications//p2788.pdf.

It is impossible to assess the accuracy of any camera survey without marked animals. However, bucks do have marks (antlers!), and though some may be difficult to distinguish (spikes, for example), you can estimate the number of bucks using your property with a fair degree of accuracy. You also can use cameras to estimate antler size per age class, which can be very helpful as you are able to evaluate many more bucks via pictures than the number killed per hunting season. Lots of techniques and strategies may be employed with cameras, but regardless of how you use them, the information gained from your cameras can be used with the harvest data to get a more complete picture of how deer are responding to your habitat and population management efforts.

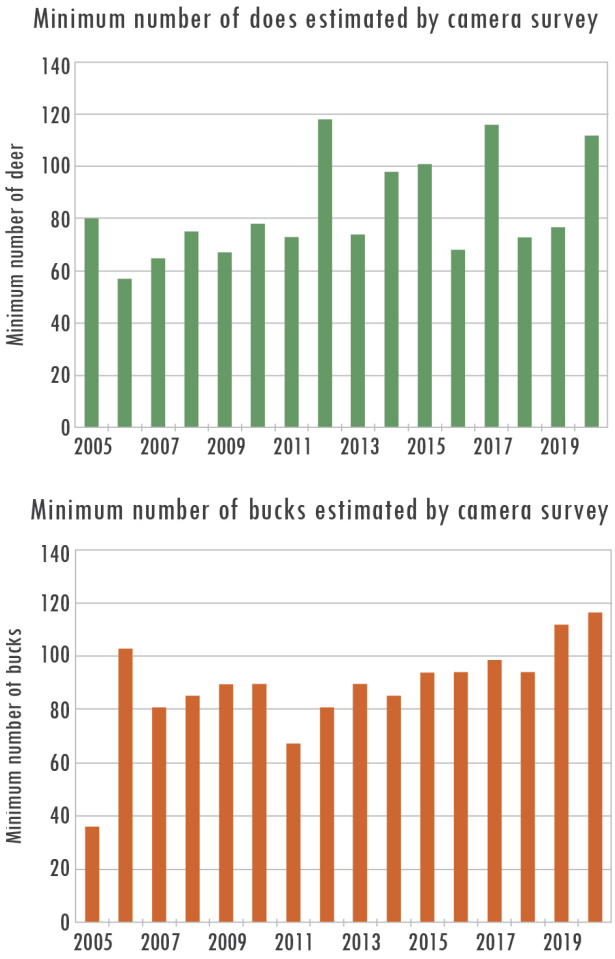


Fig 22a and b. Deer density can be estimated using a camera survey. Fig 22a shows density estimates from a property in Pennsylvania using one camera per 100 acres over a 2–week period in late August/early September, 2005 – 20. The population estimate is calculated by determining the minimum number of individual bucks photographed during the survey and using the ratio of individual bucks:total buck photos to estimate the number of does and fawns. Fig 22b shows the buck population estimate on the same property.

ANALYZING AND INTERPRETING HARVEST DATA

Interpreting harvest data is critically important to understand if your management efforts are having any impact. Harvest data provide a measure for management success, but data must be examined carefully to detect and interpret trends. Each state wildlife agency has wildlife biologists who can help interpret your data. Some states have Private

Lands Biologists or Deer Management Assistance Program biologists who specifically help hunters and landowners reach deer management goals. Although it takes a little time to enter data, viewing harvest data is most easily accomplished in a spreadsheet program such as Excel or Google Sheets. Entering data into an Excel file or other software system allows you to sort data based on year, sex, and age class, calculate averages, and make graphs. See Appendix 1 for printable examples of blank data sheets.

After entering your data into a computer, sort the data by sex and age. Buck and doe data should be examined separately, as should data from different age classes. For does, we recommend grouping them into the following age classes: fawn, 1.5, 2.5, and 3.5+ years. For bucks, we recommend grouping into: fawn, 1.5, 2.5, 3.5, 4.5, and 5.5+ years. Depending on the objectives of your management program, you may have very few bucks in the younger age classes, and if you are just starting a management program, you may have very few bucks at all. The problem associated with low sample sizes is why we emphasize recording harvest data for all does. Typically, you can determine if the herd is responding to your management program by examining the doe harvest data. If an adequate number of does are killed each year, you can estimate the age structure of the does on your property, which can provide insight into recruitment (population growth or decline) over time. Some measurements, such as body weight and kidney fat index, may respond to management relatively quickly (1 – 3 years). Date of kill must be considered carefully, as bucks often lose a substantial amount of weight during the rut, and evidence of lactation in does declines about 8 weeks or so after a doe completely weans her fawns.

It is important to remember that there will be a lag time between your management (such as increased food availability) and changes in harvest data, as it takes time for deer to respond to improved nutrition. Although body weight may increase within a few years of management, it will take several years for the full effects of your management to be realized. This time lag is especially true for antler measurements, as the bucks you are harvesting today had mothers that may have been under different nutritional conditions when they were pregnant, and most of the bucks you kill may have been born miles from where you killed them. Although you can see immediate positive impacts in your hunting opportunities following your habitat management efforts, it commonly takes 3 – 5 years to begin to see the results of management in harvest data (increased body weight and antler size by age class), and it is critical to not rush to conclusions early in the process. Collecting harvest data should be considered an essential part of management. Tracking how your management efforts have positively influenced deer health and physical characteristics over time is a worthwhile task and rewarding process.

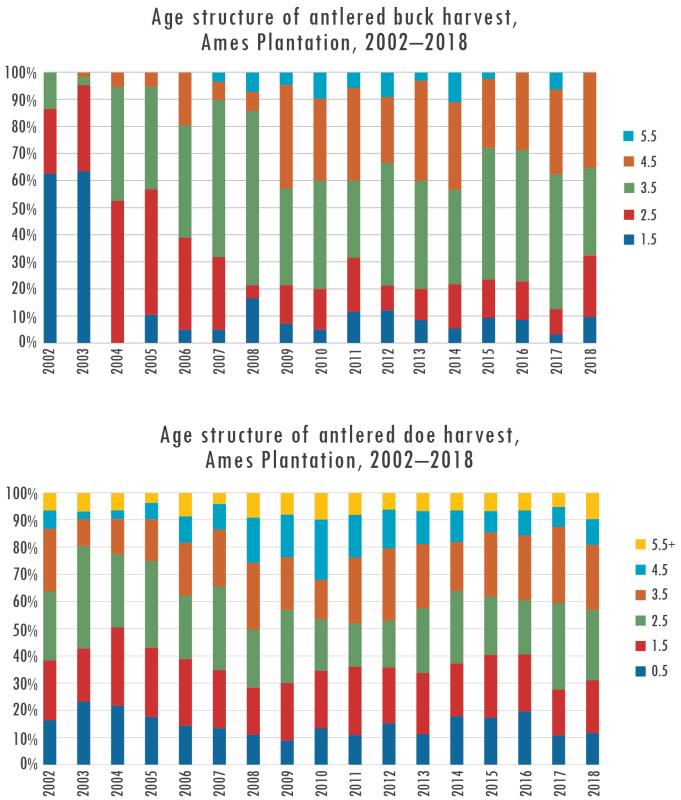


Fig 23a and b; Recording the age of deer killed allows you to see changes over time. Here, you can see how the age structure of bucks (23a) killed at Ames Plantation in west Tennessee increased following implementation of a Quality Deer Management program in 2004. The age structure of does (23b) killed remained similar over 17 years with approximately 1 doe killed per 85 acres annually over a 16,000–acre area.

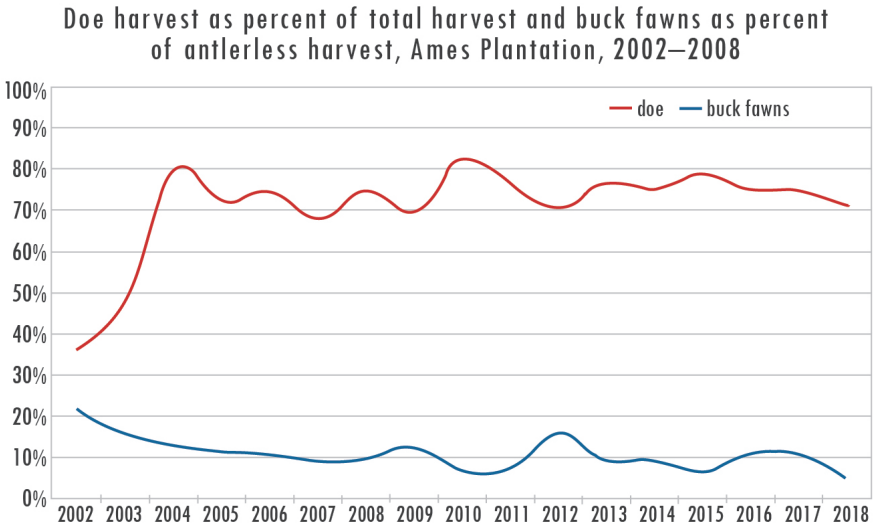


Fig 24; At the most basic level, recording the sex and age of all deer killed provides an accurate assessment of what is being removed from an area. Here, you can see does represented approximately 75% of the deer killed annually at Ames Plantation in west Tennessee, and an effort was made to keep the percentage of buck fawns in the antlerless harvest below 10%.

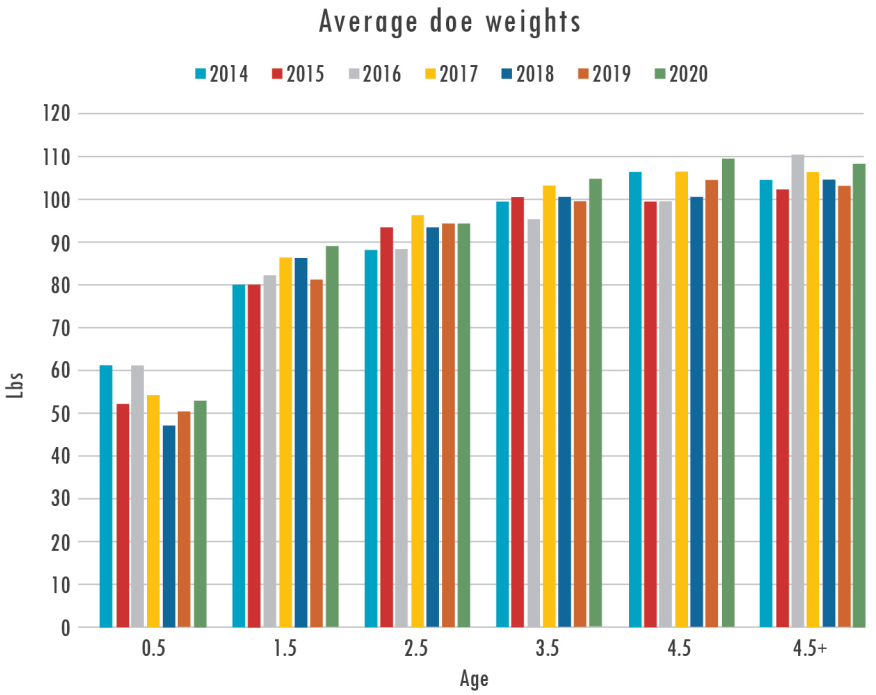


Fig 25; These data are from a 9,000-ac property in southeastern South Carolina. The vegetation is predominantly loblolly pine savanna with sandy-loam soils. The property is primarily managed for quail. However, in an effort to improve habitat for deer, property managers increased acreage in food plots from less than 100 in 2014 to 360 acres in 2017. Also, in 2017, they increased acreage disked to >600 acres to decrease grass cover and improve brooding cover for quail and increased forbs for deer forage. They also began killing more does in 2018, from a doe per 90 acres in 2015 – 17, to a doe per 55 acres in 2018 – 20. As a result, the average yearling doe weight increased nearly 10 pounds, and average weights of 2-, 3-, and 4-year-old does increased about 5 pounds.

APPENDIX 1; BASIC HARVEST DATA COLLECTION

HARVEST DATE	SEX	AGE	LIVE WEIGHT	LACTATING?	ANTLER SCORE	COMMENTS

APPENDIX 2; ADVANCED HARVEST DATA COLLECTION

HARVEST DATE	SEX	AGE	LIVE WEIGHT	LACTATING?	FETUS COUNT	CONCEPTION DATE	KFI	SHOULDER HEIGHT	ANTLER SCORE	COMMENTS

APPENDIX 3; OBSERVATION DATA COLLECTION

DATE	STAND SITE	HOURS HUNTED (TO THE NEAREST HALF HOUR)	NUMBER OF DOES	NUMBER OF FAWNS	NUMBER OF UNIDENTIFIED ANTLERLESS DEER	NUMBER OF YEARLING BUCKS	NUMBER OF 2.5–3.5 YEAR OLD BUCKS	NUMBER OF 4.5+ YEAR OLD BUCKS
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PB 1892 (08/21) Programs in agriculture and natural resources, 4-H youth development, family and consumer sciences, and resource development. University of Tennessee Institute of Agriculture, US Department of Agriculture, and county governments cooperating. UT Extension provides equal opportunities in programs and employment.