The proof is in the tooth:
Aging deer

Matson's Laboratory in Milltown, Montana, was founded in 1969 by Gary Matson for the purpose of aging deer, a practice that continues today.

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Contributing Writer

"How old was that deer?"

This question has become increasingly popular in today's hunting culture with the emergence of the Quality Deer Management Association and other like-minded management practices focusing on harvesting mature deer in their prime.

Hunters have likely asked this question since man has hunted. We have a curious nature as hunters. Harvesting a buck with a broken tine always leads to a discussion of the possible battles the bruiser faced throughout the season. With the harvest of an injured animal – whether it be from an automobile accident, a fight with another buck, or an unlucky encounter with a non-lethal arrow – we inevitably begin to discuss the possibilities of the animal's life history.

We enjoy the connection with nature obtained on a silent day in the woods. When we do make the successful connection with our quarry, we are seemingly looking for an even greater, more personal connection and hence the questions arise and stories begin. Many of these questions cannot be answered definitively and are left to speculation based on the evidence we are given.

However, the age of the deer can be determined.

Teeth are composed of four tissues – enamel, which makes up the crown and protects the tooth, the pulp, which contains blood vessels supplying nourishment to the tooth and nerves transmitting signals to the brain, dentine, which acts as a support or framing for the enamel, and cementum, which covers the root and helps keep the tooth attached to the jaw. Often deer are aged based on the amount of wear seen on the crowns (enamel) of their teeth. While this can prove to be accurate for younger animals, the accuracy deteriorates in older individuals. Teeth wear estimates have been shown to have an accuracy of anywhere from 45 to 60 percent.

Cementum is deposited throughout an animal's life and holds the key to the other, more accurate method in age determination. Cementum age analysis for North American big game has been shown to have an accuracy of anywhere from 70 to 95 percent, with the vast majority of errors being off by one year.

In 1969, Gary Matson began pioneering the technique of aging teeth via cementum age analysis and founded Matson's Laboratory in Milltown, Montana. Over the years he developed the process we still use today. In 2014, Carolyn Nistler purchased the lab and began construction on a new facility in Manhattan, Montana.

Nistler announced, "Our new, state-of-the-art facility allows us to better accommodate our ever-growing client base, and provides room for future expansion of additional lab services."

The new facility, which opened in June 2015, is much larger and the additional services mentioned include soft tissue processing.

In the lab, the process starts with cleaning and organizing the teeth. Any remaining soft tissue is removed with nylon mesh after soaking the teeth in warm (60-80 degrees C) water and a biological detergent, Terg-A-Zyme. Since cementum can be damaged by harsh chemicals such as bleach and boiling, neither are used, and are strongly recommended against for those sending in teeth. The teeth are then decalcified through a chemical process. Once decalcified, the teeth are similar in texture to cartilage and can be trimmed. The crown containing the enamel is sliced off and the root tip is trimmed sagittal (parallel to the length of the tooth) to get close to the pulp cavity. After trimming,
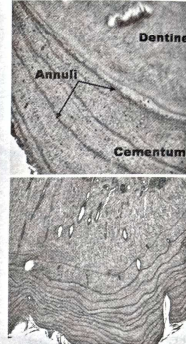
The cross sections of cementum are shown under a microscope. Cementum analysis relies on the teeth for the aging process.

the root tips are embedded in paraffin wax. The wax holds the teeth in place during sectioning. Sagittal sections 14 micrometers thick are taken with a microtome (a machine used to take thin slices of tissue) and mounted on slides, which are then stained to provide contrast and cover

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slipped to protect the fragile sections. Slides are then examined under a microscope for age determination.

Under the microscope, we are able to see the now hollow pulp cavity, the dentine, and the cementum. The cementum is the portion used in age determination and consists of "thick light" and "thin dark" bands. The thick light cementum is thought to be deposited during the summer when the animal has access to abundant food resources and isn't under environmental stress, whereas the thin dark bands are thought to be deposited in the late winter or early spring when food becomes scarce and environmental stress is high.

Cementum deposition is not entirely understood by biologists but the bands are laid down in regular, annual intervals. The thin dark bands, called annuli, are similar to rings on a tree. These annuli are counted and then an age is assigned.

Permanent teeth erupt (come through the gum line) differently in carnivores and ungulates (hoofed animals such as deer and elk). Matson's Lab has compiled extensive tooth eruption charts for each species aged. This information is evaluated by tooth type to correctly assign ages. Standard, or preferred, tooth types are those found throughout the years to yield the best age results. In ungulates the first incisor (I1) is standard, whereas in most carnivores a canine is preferred, with the exception of bears and mountain lions where the first premolar takes preference. Correctly identifying tooth type is critical to accurate age assignment.

Since these are wild animals, "assumed birthdays" are assigned to give consistent ages. For instance, with bears an assumed birthday of Feb. 1 is used, whereas with white-tailed deer June 1 is the assumed birthday. For simplicity and to remain consistent with historically reported ages, the ages are reported just as they are in humans (i.e., you're 29 until after your 30th birthday), so half ages are not assigned. A fawn born in the summer and shot in November will receive an age of 0.

In addition to the age assigned, a confidence coefficient of A, B, or C and an age range are assigned. Those teeth that yield clear cementum deposition patterns are likely to receive an A confidence coefficient with no age range, whereas those with difficult patterns are given either a B or C confidence coefficient and ranged appropriately. Typically northern populations exhibit clearer, more defined patterns of cementum deposition and yield the highest accuracy, while those in southern states such as Florida and Texas present less clear cementum patterns, which makes aging more difficult and in turn likely less accurate.

In addition to accuracy, which is a measure of the correctness of the age, precision, or a measure of the repeatability of the age, is also relevant. Since cementum age analysis is a science of interpretation, the importance for one individual to see the same evidence as another individual is crucial. Typically animals with high precision also yield high accuracy and vice versa.

By far the largest demand for cementum age analysis comes from state wildlife agencies. The Pennsylvania Game Commission and Wisconsin DNR send their bear teeth to Matson's annually along with more than a half dozen other states. Minnesota sends in a large order of furbearers and Vermont sends in large orders of teeth from white-tailed deer. Matson's has received teeth from Illinois and each of the other 49 states, all 10 Canadian provinces, and numerous countries abroad. State wildlife biologists use this age data to manage game populations and ensure sustainable hunting regulations are in place.

Pennsylvania Game Commission bear biologist Mark Ternent "uses the tooth age data for population trend monitoring, in particular for abundance estimates derived by age reconstruction, and for monitoring mean age of harvested bears."

Ternent added, "We also use the data to calculate and monitor age-specific survival and reproductive parameters."

Additionally, research scientist Nathan Roberts, with the Wisconsin DNR said, "Ages from teeth help us estimate the age-structure of populations. These data are used to estimate the trajectory and status of bears and furbearers. Ultimately, these data help inform the management and harvest plans of these species."

Quality age data via cementum age analysis has proven to be a useful tool in population management by helping to ensure the sustainable harvest of our wild game.

Nick Fortin, deer project leader for Vermont Fish and Wildlife, said, "Having accurate age information is critical for effectively managing white-tailed deer in Vermont. It helps us estimate population sizes and allows us to assess how certain management strategies (like antler point restrictions) affect the population."

Furthermore, private hunters curious to know the age of the deer they took off the back 40 may also submit teeth to the lab themselves. In both instances, hunters are providing a hand in wildlife conservation.

Matson's Laboratory has aged more than 2 million teeth from 198 species across the world. Hands down, no other lab in the world comes close to processing the volume and diversity of species. On average, the lab sees about 100,000 to 120,000 teeth annually.