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## UPPER VS. LOWER MOLARS FOR CEMENTUM ANNULI AGE DETERMINATION OF DEER

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**Abstract:** Ages were determined for 23 black-tailed deer (*Odocoileus hemionus columbianus*) and 14 white-tailed deer (*O. virginianus*) by examination of cementum annuli of both upper and lower 1st molars. Although estimated ages were virtually the same for both upper and lower molars, the clarity of annuli was significantly greater in upper molars for both species.

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Age determination of cervids by examination of cementum annuli of ground sections of lower molars under reflected light (Ransom 1966, Mitchell 1967, Bromley 1968) works well in populations where seasonal changes in food quality are sufficient to produce satisfactory annuli. The technique is fast, uncomplicated, and requires little equipment (McCullough 1979:28-29). Connolly et al. (1969) reported that age determinations by 2 experienced laboratories using histological techniques on incisors of black-tailed deer from Hopland Field Station in California were unreliable because the annuli were too indistinct to count accurately. Our subsequent work with histological preparations of the 1st lower molars of deer from this same population gave similarly unsatisfactory results. However, when the reflected light technique was tried, the cementum annuli proved to be distinct. Thus, this method may be more useful than generally is recognized.

Cementum annuli of the 1st lower molar in cervids usually are most distinct in the area between the 2 roots where a protuberance of the tooth extends downward into the cementum. One of the major difficulties is that annuli curve down around this protuberance, and "swirls" in the cementum make it difficult to distinguish

which annuli connect on either side of the protuberance. Preliminary work showed that the upper 1st molar lacked protuberances, and the cementum annuli were straighter and more distinct. Apparently the more massive size of upper molars and their stationary position in the skull results in more uniform cementum deposition.

The objective of this study was to evaluate the clarity of cementum annuli and estimates of age for upper and lower 1st molars from the same individuals on a sample of white-tailed and black-tailed deer.

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### METHODS

Corresponding upper and lower tooth rows were collected from 11 male and 3 female adult white-tailed deer of unknown age harvested on the University of Michigan's George Reserve in southeastern Michigan in the fall of 1983. Similar samples were collected from 23 adult male black-tailed deer taken by hunters in August

and September 1983 on the University of California's Hopland Field Station near Ukiah, California.

Upper and lower 1st molars were separated from the bone and ground on a 100-grit gem wheel, with sequential sections examined under a dissecting microscope at 20–30X until the section with the clearest cementum layers was obtained. Clarity of cementum annuli was scored on a scale of 1–5, with 1 being indistinct and difficult to count and 5 being highly distinct and easily counted. The examiner attempted to keep the estimates for the upper molar “blind” (independent) with respect to the result for the corresponding lower molar for each animal. This independence was achieved for the 23 pairs of black-tailed deer teeth examined. However, there were very few old-age deer in the 11 pairs of white-tailed deer molars, and the examiner at times inadvertently knew that a pair of older-aged teeth were from the same animal. This may have caused a spuriously high correlation between upper and lower molar age determination and also may have introduced a small bias to the clarity scores for the white-tailed deer samples. Clarity scores between upper and lower molars on the same individuals were evaluated by testing the null hypothesis of no differences at  $P = 0.05$ .

## RESULTS AND DISCUSSION

For all 14 samples of white-tailed deer, ages determined by cementum annuli were the same for upper and lower 1st molars. Ages ranged from 2 to 6 years. In 11 samples the upper molars were scored more distinct, in 1 sample the lower molar was more distinct, and in 2 samples both molars were scored identically. Frequency distribution plots of the small samples showed no strong deviation from normality; therefore, the clarity scores for upper and lower 1st molars were tested for differences by paired  $t$ -test. Because the null hypothesis of no difference was rejected ( $t = 2.69$ ,  $df = 13$ ,  $P \leq 0.01$ ), the alternate hypothesis of the upper molars showing greater clarity of cementum annuli was accepted.

For black-tailed deer, age estimates by annuli counts from upper and lower 1st molars agreed for all but 1 of 23 samples, with ages ranging from 2 to 5 years. The 1 estimate that did not agree was from a deer estimated to be 3 years old from the upper molar and 4 years old from the lower. The clarity scores for upper molars were greater than those of lower molars in 10 samples, lower in 2, and equal in 11. Because frequency distribution plots showed the scores to be approximately normally distributed, a paired  $t$ -test was applied. The null hypothesis of no difference in clarity scores of annuli between upper and lower molars was rejected ( $t = 2.71$ ,  $df = 22$ ,  $P = \leq 0.01$ ); therefore, the alternate hypothesis of upper molar cementum annuli having greater clarity was accepted.

It was concluded that the clarity of cementum annuli was significantly greater in upper than lower molars for both white-tailed and black-tailed deer. Although estimated ages were virtually the same in these samples, the upper molar is preferable because annuli can be identified more confidently with fewer sections ground, thus saving processing time. We expect that greater clarity will reduce confusion on old deer that present problems in counting cementum annuli.

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