



Original Contribution

**RELIABILITY OF DETERMINING STONE MARTEN'S (*MARTES FOINA*)
AGE BY TWO DIFFERENT SKULL FEATURES**

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ABSTRACT

Based on skulls from Central Bulgaria, the possibilities of aging stone martens were considered and compared. Two different skull morphological criteria methods were compared to more precise method – counting of annuli in dentin. Precise aging of stone martens was only possible by counting of annuli in dentin. It is not recommended using methods by development of sagittal crest and maxillary teeth attrition separately for aging stone martens. A combination of several methods is considered to be reliable.

Key words: aging, Stone marten, dentin, attrition

INTRODUCTION

Reliable age estimates of individuals are necessary for diverse ecological and evolutionary studies such as systematic comparisons, interpreting the changes in diverse physiological parameters etc.

For carnivores body size-measurements and tooth wear may allow an approximation of the age of live animals (1). Often a more detailed age classification of specimens is desired than merely a separation into juvenile and adult categories. Diverse methods were developed to estimate the real age of dead individuals as precise as possible (2). (3) considered cementum annuli in thin sections of the upper canines as reliable age indicators for mustelids (polecats), because of resulting from annual growth breaks. In Denmark, (4) also had determined polecat's age using cementum annuli counts.

For Stone marten (*Martes foina* Erxl, 1777), various schemes of age estimation were based on the development of diverse skull

characteristics (5). No comparisons of aging stone martens by skull characteristics and tooth annuli had been undertaken so far. In Lithuania a comparison between two aging methods (mandibular teeth attrition level and crista sagittalis externa coalescence) was made for pine marten (6).

In order to check the reliability of morphological criteria of skulls for aging stone martens, the estimates derived from: 1. develop of sagittal crest along with shape of the temporal ridges and 2. maxillary teeth attrition, were compared with respective to basic method: annuli counts in dentin.

MATERIAL AND METHODS

A total of 67 skulls of stone martens from Central Bulgaria were studied. Most of the samples were provided by hunters and gamekeepers between 1st of November and 1st of March (2013-2015). Other part of the samples was obtained from road killed animals in the same region.

From each specimen a lower canine was sectioned on the level of *radix dentis* and the surface was polished. The age-groups classification was made by the number of annuli in dentin according to (7) under reflected light with stereo microscope. The

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relative width of pulp cavity was used as support method. All annuli counts were made by one author (E.R.) well experienced in counting of incremental dental lines of diverse carnivores. After the examination specimens were divided into three age groups: yearlings (7-11 months), between one and two years (19-23 months) and older than two years (31+ months) (**Figure 1**), taking into account Stone Marten's bearing offspring in spring - early March to the middle of April (8). After that, another aging of the same specimens was made according to the

development of the sagittal crest (*crista sagittalis externa*) and shape of temporal ridges (*linea temporalis*) on the skull (5) and according to the maxillary teeth attrition (7), separately. This aging was made by another author (S.P.) to avoid an error in the determination to be made because of the memory of skull features (**Figure 2**). Finally, the comparison between these two methods and the counting of annuli in dentin was made. The percentages of discrepancies between the two methods and the first method was calculated.

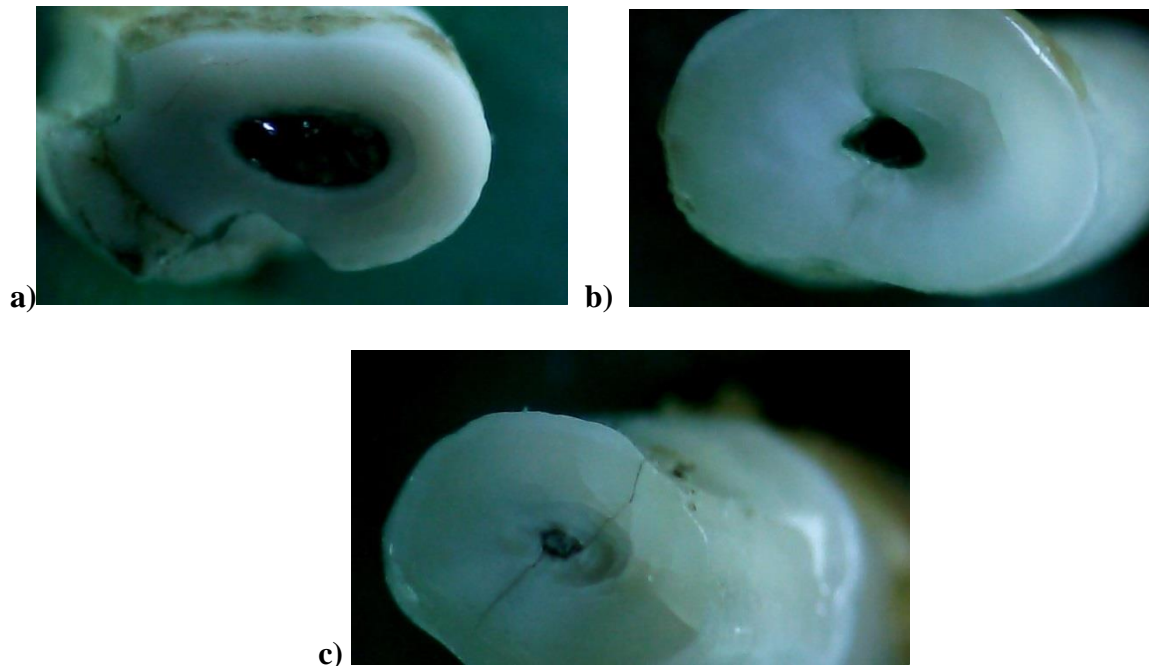


Figure 1. Aging groups in Stone marten according annuli counts in dentin – a) yearlings – one dentine layer and wide pulp cavity; b) between one and two years - two dentine layers and smaller pulp cavity; c) older than two years – five dentine layers and almost filled pulp cavity

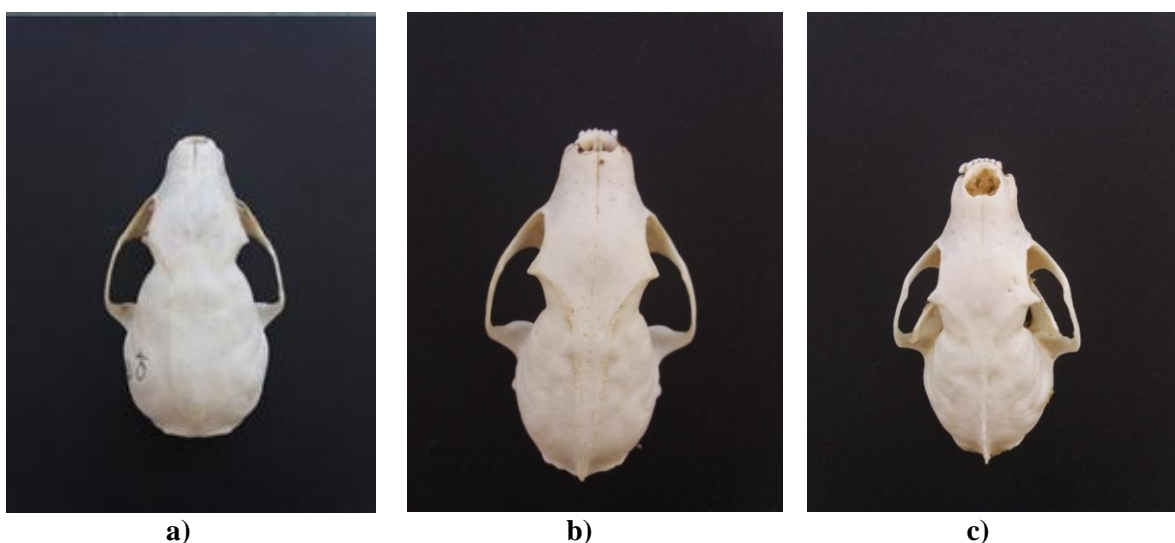


Figure 2. Dorsal view of aging groups in Stone marten according development of sagittal crest and shape of temporal ridges – a) yearlings – the sagittal crest is just visible at the posterior of the skull and parallel temporal ridges; b) between one and two years – the sagittal crest is clearly marked towards the posterior of the cranium and U- and V- shaped temporal ridges; c) older than two years – deep sagittal crest and Y- shape formed by the temporal ridges and sagittal crest

Finally, second age-groups classification was made. Specimens were divided into two age groups: juveniles (7-11 months) and adults (19+ months). The percentages of discrepancies between two methods and the

basic method were calculated for both groups separately.

RESULTS AND DISCUSSION

Table 1. Total percentage of discrepancies between two aging methods related to aging by number of annuli in dentin of 67 Stone marten's skull specimens

method	development of sagittal crest and shape of temporal ridges		maxillary teeth attrition	
	n	%	n	%
divided in three age groups	34	50.75	25	37.31
divided in two age groups	21	31.34	19	28.36

The comparison between aging by development of sagittal crest and shape of temporal ridges regarded to aging by number of annuli in dentin showed high percentage of discrepancy (**Table 1**). Contrary to (9) and (5) this method is not suitable for distinguishing stone martens in more than two age groups. Consequently, development of this skull feature is rather individual than age characteristic and the method is not reliable for precise aging. Using only this method in aging martens could be misleading.

Aging by maxillary teeth attrition was with lower percentage of discrepancy. According to (7) teeth attrition is rather appropriate method

in aging of large and middle-sized predatory mammals (wolf, red fox and badger) than of small sized mustelids. Our results showed that this method is more reliable in determining stone marten's age than aging by development of sagittal crest and shape of temporal ridges.

The comparison for reliability of both methods in separation of specimens in two age groups showed lower percentage of discrepancy (**Table 1**).

Because of higher reliability of tested methods in aging in two groups with wideranged second group, additional calculation of percentage of discrepancies within these two age groups was made (**Table 2**).

Table 2. Percentage of discrepancies between two aging methods related to aging by number of annuli in dentin in 27 juveniles and 40 adults Stone marten's skull specimens

method	development of sagittal crest and shape of temporal ridges		maxillary teeth attrition	
	n	%	n	%
juveniles	19	70.37	12	44.44
adults	2	5.0	7	17.5

These two methods are not applicable for determining juveniles, because of very high percentage of discrepancy. This also proves unreliability in separately using of these two methods. The variability of investigated skull features in stone martens was more due to individual differences. Probably these features have formed at an early age because of their presence in almost all adults.

Precise aging of stone martens was only possible by counting of annuli in dentin in lower canines. It is not recommended using methods by development of sagittal crest and maxillary teeth attrition separately for aging

stone martens. A combination of several methods would be more reliable.

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