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Age Determination of Eurasian badger (*Meles meles*) from growth lines in tooth sections – preliminary results

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Schlüsselwörter: Altersbestimmung, Dachs, *Meles meles*, Zahnschnitte, altersbekannte Tiere

Summary

Data on estimates of age made from calcified thin sections of teeth of badgers of known age are tested and a comparison is made of two closely related age determination techniques. The results show that the method used is not quite correct. However, for the present, counting incremental lines in teeth is the best method. The age structure in a sample of traffic-killed badgers from Denmark shows that the animals may reach an age of over 20 years.

Zusammenfassung

Altersschätzungen anhand kalzifizierter Dünnschnitte von Zähnen werden bei altersbekannten Dachsen getestet, und die Daten dieser Altersbestimmung werden mit jenen aus einer ähnlichen Methoden der Altersbestimmung anhand von entkalkten Zahnschnitten verglichen. Die Ergebnisse zeigen, dass die verwendete Methode der Altersbestimmung nicht ganz fehlerfrei ist. Dennoch ist die gegenwärtig angewandte Altersschätzung anhand der jährlichen Zuwachslinien im Zahnzement die beste verfügbare Methode. Die Altersstruktur einer Stichprobe von Verkehrsopfern aus Dänemark zeigt, dass Dachse älter als 20 Jahre werden können.

1. Introduction

Population biologists often need a detailed age structure of the population they are studying. Much discussion has focused on the best methods of age determination in the Eurasian badger (*Meles meles*) (Lüps, Graf & Kappeler 1987; Hancox 1988; da Silva & MacDonald 1989; Harris, Cresswell & Cheeseman 1992). Only

few results from known age material have been published for this species (THOME & GEIGER 1997) and to our knowledge no authors have published results about the validity of using growth lines (incremental lines) in tooth sections in a larger scale. Here we present data on age determination of material from badgers with known age and include a re-interpretation of already published material. A detailed age structure of a recent Danish sample of traffic-killed badgers is presented as an example of an application of this method in population biology.

2. Materials and Methods

The material consist of tree parts: 1) ten badgers of known age marked as cubs in the Netherlands (material from GERHARD MÜSKENS, IBN-DLO): the age determination was based on one canine only and did not make use of any supplementary information; 2) thirty-three badgers collected in Denmark during the 1950ies, already age-estimated from decalcified tooth sections (GRUE & JENSEN 1979), were re-interpreted without using any supplementary information; and 3) 182 mainly road-killed badgers collected in Denmark during 1995–1999 with information on date of death, skull features, tooth wear, fusion of postcranial bones and data on reproduction were aged from tooth sections and other available information.

Age determinations were made by counting growth lines in the cement of a thin section (≅100 µm) of calcified canines (Fig. 1). The sections were made on a Buehler Isomet™ low speed saw and applied without any further treatment (DRISCOLL, JONES & NICHY 1985). The date of birth is set to the first of March for practical reasons. Two interpreters investigated the tooth sections independently and thereafter compared their results.

3. Results

The regression line in figure 2 (black line, $y = 1.403\ x$; $r = 0.975$) shows that estimates in this case tend to exceed the actual age of the animal (grey line).

As illustrated in figure 3 there is no perfect agreement between the estimates made by GRUE & JENSEN (1979) and those made in the present study on the same badgers. The calcified sections provided a slight underestimation of age compared with the decalcified sections.

In figure 4, it may be seen that some badgers may become very old: 2 females reached 21 years and according to the appearance of their uteri their reproductive activity had not ceased (LEYSSAC et al., in prep.).

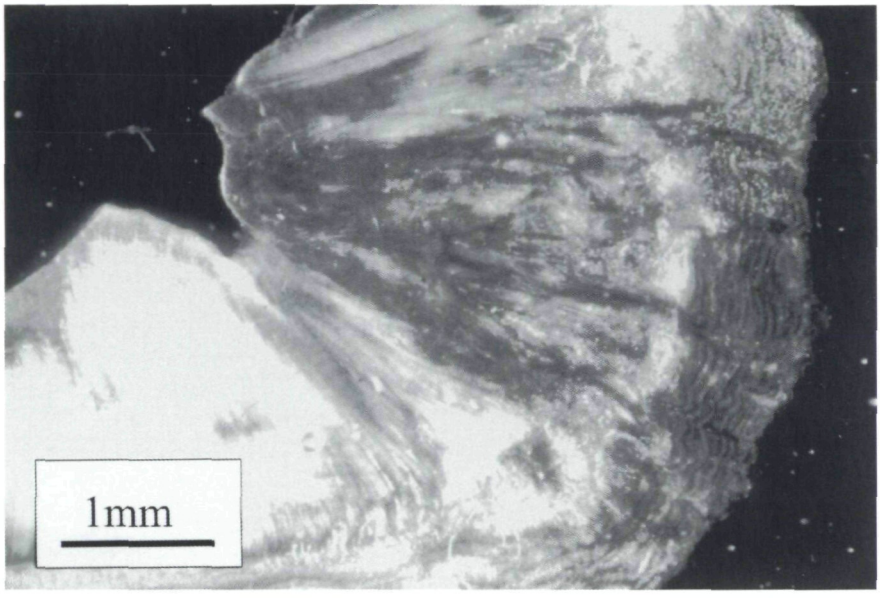

Fig. 1: A canine tooth section of a male badger age determined to be twelve years old. Incremental lines can be seen in the right part of the section

Fig. 2: The relationship between the estimated age and the true age (black line y = 1.403 x ; r = 0.975; N = 10). The grey line is the expected outcome

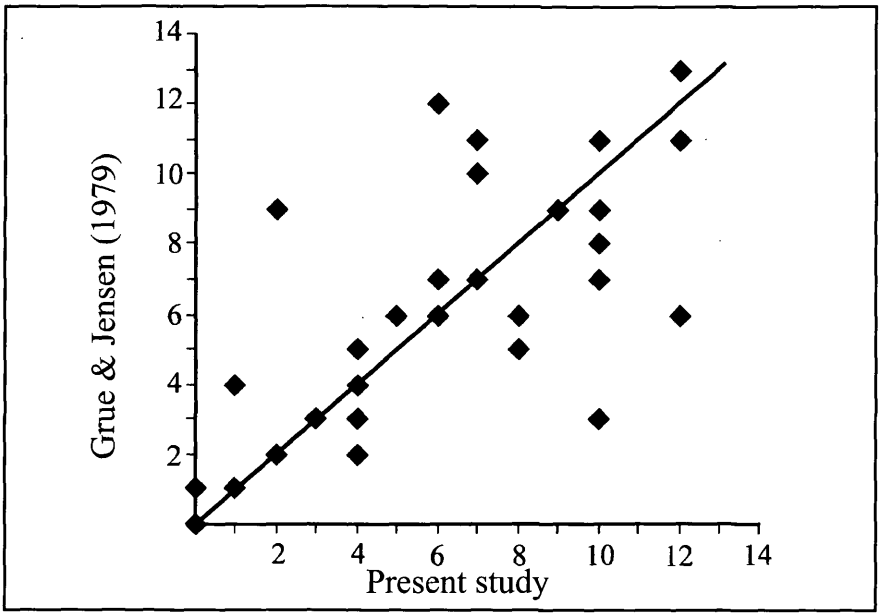

Fig. 3: Re-interpretation of 33 badgers prior age estimated by Grue & Jensen (1979). The full line is the expected outcome

Fig. 4: The age structure of 182 badgers collected in Denmark during 1995 – 1999. X-axis represents the percentage of individuals in each sex

4. Discussion

Figure 2 indicates that the age determinations made from tooth sections of badgers with known age are not correct in all cases. Knowledge of the date of death would probably have improved the accuracy of some of the estimates, but not with more than one year. In this work all animals tested were included, also animals in which additional data would have strengthened the estimates. There is a trend towards an even greater difference as animals get older, as would be expected by chance. For unknown reasons, the badgers of known age showed weaker growth lines than badgers from the recent Danish sample. This could be a result of differences in winter climate or the technique used in the preparation of the skulls.

Juveniles (age class 0-1) are probably underrepresented in the age structure in figure 4 due to the fact that they are not exposed to traffic until the second half of their first year. The fact that age class 3-4 shows a lower frequency than expected is more difficult to explain. We would have expected this age class to follow the trend of the neighbouring age classes. It can not be explained by low recruitment in one year since sampling covered 4-5 years.

There is a great need for more work on badgers of known age to test the accuracy of the different methods used in age determination. Age determination will never be perfectly correct, but at the moment the best method is counting growth lines in tooth sections. Whether calcified or uncalcified sections should be preferred can not be decided from the results of this study (figure 3). Age determination can probably be improved when the date of death and additional data, such as skull features and the status of the reproductive organs etc. are included.

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5. References

DA SILVA, J. & MACDONALD, D.W. (1989): Limitations to the use of tooth wear as a means of ageing eurasian badgers, *Meles meles*. Revue D'Ecologie La Terre Et La Vie, **44**: 275-278

DRISCOLL, K.M., JONES, G.S. & NICHY, F. (1985): An efficient method by which to determine age of carnivores, using dentine rings. Journal of Zoology, Series A, **205**: 309-313, London

GRUE, H. & JENSEN, B. (1979): Review of the formation of incremental lines in tooth cementum of terrestial mammals. Danish Review of Game Biology, **11**: 1-48

HANCOX, M. (1988): A review of age determination criteria in the Eurasian badger. Lynx **24**: 77-86

HARRIS, S., CRESSWELL, W.J. & CHEESEMAN, C.L. (1992): Age determination of badgers (*Meles meles*) from tooth wear: the need for a pragmatic approach. Journal of Zoology **228**: 679-684, London

LÜPS, P., GRAF, M. & KAPPELER, A. (1987): Möglichkeiten der Altersbestimmung beim Dachs *Meles meles* (L.). Naturhistorisches Museum Bern Jahrbuch **9**: 185-200, Bern

THOME, H. & GEIGER, G. (1997). [Comparison of two methods of age determination using teeth of known age from wild carnivores.]. Vergleich zweier Methoden der Altersbeurteilung an Zähnen altersbekannter wildlebender Fleischfresser. Anatomia Histologia Embryologia **26**: 81-84

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