Fragmenta Theriologica

Age Appraisal in Moose *

Porównanie dwóch metod oceny wieku łosi

Ryszard DZIĘCIOŁOWSKI

Dzięciołowski R., 1976: Age appraisal in moose. Acta theriol., 21, 23: 307—310 [With 1 Table & 1 Fig.]

A count of winter cement layers in incisors was compared with the tooth replacement and wear method as a means of ageing moose, *Alces alces* (L i n n a e u s, 1758). The appraisal of moose age by tooth replacement and wear was done independently by three experts and one three-person team. Regression analysis indicated that tooth wear may be used by experts to estimate moose age. Experts underestimated moose age with a like degree of concordance to a standard for all animals except the youngest when milk teeth were replaced by permanent teeth. The equation, $x=2y-4$, was developed to correct the age estimate to a conventional technique (y).

[Dept. Game Manage., Forest Res. Inst., Wery Kostrzewy 3, 00-973 Warszawa]

1. INTRODUCTION

The purpose of the present work was to compare two methods of appraising the age of moose: counting winter layers in incisor cement (S e r g e a n t & P i m l o t t, 1959; M i t c h e l l, 1963) *vs.* tooth replacement and wear (B u d e n z, 1965; M i t c h e l l & Y o u n g s o n, 1968). Similar comparisons were done previously for elk (S m i t h, 1970), red deer (H e l l, H e r z & G i n t e r, 1971), and for roe deer (S z a b i k, 1973).

2. METHODS

Incisors (I_3) were extracted from jaws of 57 moose killed during 1970 —1972 at Białystok province, mainly from the Augustów Forest.

An absolute appraisal of moose age was made by counting cement layers in teeth [1]. Then three experts (y_1, y_2, and y_3) and one three-person team [2] (y_4), independently estimated the age of each mandible

on the basis of tooth replacement and wear. Afterwards, linear regressions were calculated to compare age estimations among experts (assuming the hypothesis of equality of regression coefficients), and to evaluate the concordance between experts' estimates with the standard method (x).

Computations were done on digital computer Odra 1204 at the Polish Academy of Sciences, Warsaw.

3. RESULTS

In the case of a complete concordance between estimates, the regression equation should take the form of: $y = x$, i.e., $A = 0$ and $B = 1$. Calculations shown in table 1 contradict this hypothesis, since all coefficients B were significantly smaller than one and constants A were different from zero.

Correlation coefficients were significant (approximately 0.5), thus estimates by experts may be used to determine moose age with some approximation and the estimate of bias given in table 1.

Table 1

Comparison of results of regression analysis for moose age estimates by four experts ($N=57$) (Y=expert estimate, x=estimate according to standard method).

Expert	Equation $Y=A+Bx$	Estimate error $S\,\hat{y}$	Hypothesis test $B=1$	Correlation coefficient r
1	$Y_1 = 2.80 + 0.488x$	3.16	4.03*	0.459*
2	$Y_2 = 1.85 + 0.664x$	3.13	2.69*	0.680*
3	$Y_3 = 1.30 + 0.400x$	2.14	7.05*	0.530*
Commission	$Y_4 = 1.94 + 0.373x$	1.93	9.44*	0.544*
Total	$Y = 1.97 + 0.481x$	2.83	5.19*	0.489*

* Denotes significance at the level $\alpha = 0.05$

There were no significant differences in regression B coefficients among experts. This means that they all determined the age of moose with similar accuracy and with a similar degree of concordance with the standard. On the other hand estimates by experts differed significantly in regression constants. This means that mean levels of estimates by individual experts were different. Figure 1 shows that regression lines for individual experts had an approximately parallel course, but they were dislocated in relation to each other. Except for estimates of youngest animals, the regression lines were below the straight line regression ($y = x$) of the »best concordance«, and, thus, they underestimated age.

Equations were also calculated to estimate the »actual« age (x) on the basis of expert estimates. The relationship between x and the mean expert estimate (y) was determined two ways. Based on the regression

equation $x = \alpha + \beta y$ the value for x was $4.26 + 0.499y$ or rounded to $x = 1/2y + 4$. Based on the average (joint) regression equation for expert estimates (table 1, fifth line) the rounded result was $x = 2y - 4$.

The latter method is advocated by E l a n d t (1964) for making comparisons between an experimental method and standard method. Biological interpretation also supports it.

4. DISCUSSION

Among 228 independent estimates 38 were accurate, 53 were overestimated, and 137 were underestimated. Age estimates from both methods coincided for 14 to 21 percent of the cases. In studies with roe deer by S z a b i k (1973) the concordance of estimates with the two methods was 20 to 40 percent. S m i t h (1970) compared the same two methods on 35 incisors of elk (*Cervus canadensis*) and obtained 28 accurate estimates and 7 inaccurate. H e l l *et al.* (1971) obtained a better concordance of results between the two methods of age estimation of the red deer than we found for moose.

The error of team estimate was 1.93, lower than the errors of estimates for individual experts, 2.14 to 3.16 (Table 1). On the other hand,
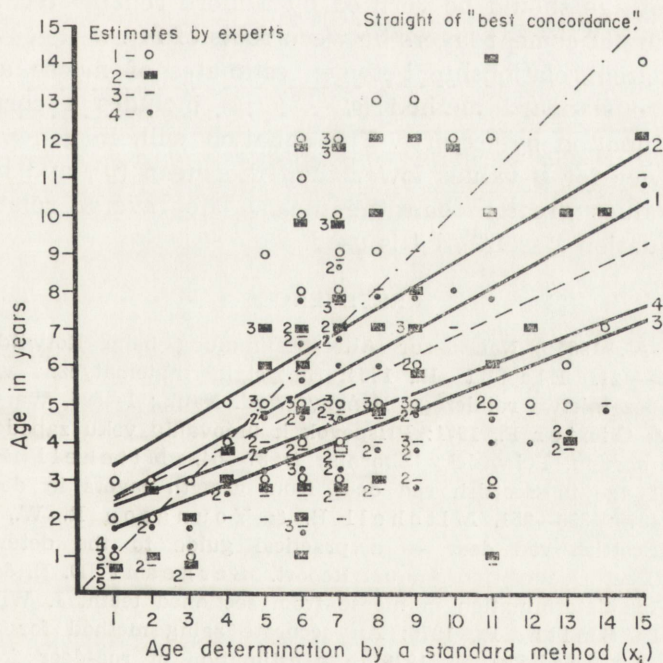

Fig. 1. Course of regression straight lines for moose age estimates by individual experts (numbers behind symbols +, X, − and O, denote number of identical estimates).

the correlation coefficient of 0.544 between the team's estimate and the standard estimate was lower than the 0.680 of one expert (Table 1). The relatively high correlation coefficients (r) indicate that the method of tooth replacement and wear may be used to estimate moose age, with a mean error of 2 to 3 years. In estimates of age for medium aged and older red deer the deviations were 1 and 2 years, respectively (M i t-c h e l l & Y o u n g s o n, 1968).

The accuracy of age estimation in moose by counting winter layers in cement was found by S e r g e a n t & P i m l o t t (1959) to be ±1 year in young animals and ±2 years in old animals. They advise caution because the first layer varies considerably in appearance and thickness (probably in relation to the time of teeth irruption), and the later growth layers in older animals are too narrow to be counted accurately. Their results agree with ours in showing that the age of younger animals was concordant with that determined independently by tooth replacement and wear, and the age of older animals was permanently overestimated by counting cement layers.

H e l l *et al.* (1971) concluded that estimating red deer age by tooth wear was of low accuracy and inadequate for research purposes. The method may be useful in trophy shows, but in cases of controversy the correctness of age should be verified by a more reliable technique such as the counting of cement layers between roots of M_1.

The calculated relationship between estimates of moose age by experts and the standard method ($x = 2y - 4$) includes a correction for errors of estimation by experts. The equation will, in general, produce estimates lower for y values lower than the mean ($\bar{y}$), and higher estimates for values greater than the mean. The reverse relation occurs when the equation $x = 1/2y + 4$ is used.

REFERENCE

B u d e n z A., 1965: Neues zur Altersbestimmung beim Rotwild. Wild und Hund, *12:* 420—421. E l a n d t R., 1964: Statystyka matematyczna w zastosowaniu do doświadczalnictwa rolniczego. Państw. Wyd. Nauk.; 1—595. Warszawa. H e l l P., H e r z J. & G i n t e r F., 1971: Prispevok k určovaniu veku zapadokarpatských jeleňov podle chrupu. Polovnicky Zbornik, *1:* 37—54. M i t c h e l l B., 1963: Determination of age in Scottish red deer from growth layers in dental cement. Nature, *198,* 4878: 350—351. M i t c h e l l B. & Y o u n g s o n R. W., 1968: Teeth and age in Scottish red deer — a practical guide to the determination of age. The Red Deer Commission Annual Report. S e r g e a n t D. E. & P i m l o t t D. H., 1959: Age determination in moose from sectioned teeth. J. Wildl. Manage., *23,* 3: 315—321. S m i t h R., 1970: An accurate aging method for elk. Wildlife Digest, *11:* 1—4. S z a b i k E., 1973. Age estimation of roe-deer from different hunting grounds of south-eastern Poland. Acta theriol., *18,* 12: 223—236.