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THE AGE STRUCTURE OF THE PINE MARTEN (*MARTES MARTES* L.) POPULATION IN THE LITHUANIAN MIXED-DECIDUOUS FOREST

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To determine pine martens (*Martes martes* L.*)* age structure a research was carried out in 2010–2012 at ASU Game management laboratory. The investigation included 32 pine martens which were hunted in mixed-deciduous forest according to LR Hunting Regulations. The age of martens was determined employing two methods: *crista sagitallis externa coalescence* and mandibular teeth attrition level. After the research the martens were divided into three age groups: yearlings, two-year-old and older than two-year-old specimens. The results showed that the yearlings comprise from 53% to 62% of the pine marten population structures in the Lithuanian mixed-deciduous forests. Yearling individuals' number, analysing by two methods, differs by 9.4 %. Adult pine marten individuals' number, analysing by two methods, differs by 6.3 %. Statistical comparison of two age determination methods using the categorical data, relation of medium strength has been found between *M. martes* population groups formed by both age methods. Better results could be achieved by completing teeth cutting and cement layers counting.

Key word: Pine marten (*Martes martes L.*), age structure, *crista sagitallis externa* coalescence, mandibular teeth attrition level.

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INTRODUCTION

The sex and age composition of wildlife population is one of the most important population control goals in hunting research. These two biosocial population status indicators are very closely related to each other. The more complex the age structure of the wild animal species, the more elaborate its population status maintenance (homeostasis) and the relations of age dynamics are. The sex ratio is of especially high significance for the species residing in each separate territory in general and for each individual generation of the species separately.

Pine martens belong to the carnivora order (lat. *Carnivora*) and the mustelidae family (lat. *Mustelidae)*. Two species of martens live in Lithuania, i.e. the pine marten (*Martes Martes* L.) and the stone marten (*Martes foina* Erxleben 177). These two species are prevalent in almost all continents (Abramov et al. 2006).

The sex and age composition of the martens may be distinct in different locations of their habitat and may have certain peculiarities. These specific features are most often ordained by ecological conditions, hunting intensity, etc. Supposedly, the population of the pine martens is comprised of many generations of different birth years. The pine marten population may encompass females of at six generations of different ages and many more male generations (Grakov 1981).

Several authors have researched the population of the pine martens living in Lithuania (Balčiauskas, 1996, Baranauskas et al. 2005). Maldžiūnaitė (1959, 1963) was the one to study the pine marten population in Lithuania the most. At that time the studies of the age of the pine marten females showed that juvenile females were predominant in the population.

Fifty years ago, detailed researches were carried out in the northern region of Europe and the same tendency was determined throughout ten seasons: females were predominant in the pine marten population (54.5%) while adult specimens comprised as many as 40.8% only. Such sex and age tendencies were explained by the fact that the juvenile females were hunted more actively than the juvenile males. The results of these accounts were confirmed by hunting data when during the first two months of the hunting season (November and December) an average of 72±3.9% of the juvenile females and 68±4.4% of the juvenile males were hunted and 60% of adult males and females calculating from the total number of the respective sex and age of the animals (Grakov 1981).

It is rather difficult to carry out an accurate analysis on the age structure of the pine marten population according to the hunted game data. The hunted game data are affected by the following two incredibly significant and objective factors: ecological living conditions of the species and the behavioural specifics preordained by different age groups and sex. These factors were described by S. Švarc back in 1969. It is said that when the hunting gets pretty intense in the hunting grounds, the sex and age composition of the pine marten micropopulation come close to the factual one at the end of the hunting season (Grakov 1981).

Determining the age composition of the marten population is also rather difficult due to the peculiarities of the employed methods. Several methods to determine the marten age exist (Habermehl 1985, Heldin 1997); however, most of them only allow grouping individual specimens into juveniles and adult ones reliably. When researching the population quality of all the Mustelidae family, including the martens, the situation is quite contrary to the one with deer as it is immensely difficult to determine the age of the live mature specimens of the said family. Determining the age of individual adult specimens of the Mustelidae family is only possible when the animals are hunted down or otherwise dead. April 1 of the current year is the date agreed to be considered as the day of transferring to the next age group, thus, knowing the exact date of hunting down the specimen alleviated determining its age.

Most often the martens are divided into three age groups: yearlings, two-year-old specimens and older than two-year-old specimens (Stubbe et al. 1973). According to other authors (Habermehl 1985), the marten specimens can be divided into five age groups (yearlings, two-year-old, three-year-old, four-year-old and older than five-year-old specimens); however, this methods is not very accurate.

The age of martens can also be determined based on the colours of their fur. However, the fur and undercoat of a five-month-old marten is already in its final formation stage and, thus, it is not possible to determine the marten age from the appearance of its coat. The body length and

Table 1. Pine marten (*Martes martes* L.) age according to the crista sagitallis externa coalescence (KKKS)

Age	Male		Female		Totally martens:	
	n	%	n	%	n	%
Yearling	8	25	12	37,5	20	62,5
Two-year-old	6	18,75	6	18,75	12	37,5
Older than two-year old	-	-	-	-	-	-
Totally in the order of age groups:	14	43,75	18	56,25	32	100,0

weight also partially defines the marten age. According to the research data (Röttcher 1965), the marten body length increases considerably till they reach the age of six months; however, as the first year of martens comes to an end and they grow mature, determining the age of live specimens using this feature is no longer possible. Later on, the age of martens can only be determined from the following features of the hunted down specimen: coalescence of cranial bones, lower canine tooth wear degree, the baculum (*baculum, os penis*) shape, growth layers in dental cementum (Klevezal 1988). As the marten grows older, determining its age becomes even more difficult. Therefore, it is recommended to perform and employ several age determination methods (Monakhov 2004, Abramov et al. 2006) in order to determine the population age of the Mustelidae family.

The aim of the work – to determine the age structure of the pine marten (*Martes martes* L.) population in the Lithuanian mixed-deciduous forests.

MATERIAL AND METHODS

The researches were carried out during 2010-2012 in the Game Management Laboratory of Aleksandras Stulginskis University. The martens were hunted in the territories of Kaunas, Šiauliai, Jonava, Šilutė, Vilkaviškis, and Marijampolė Municipalities according to the Hunting Rules of the Republic of Lithuania. 32 specimens of pine martens were studied.

The age structure of the pine marten population was determined by two methods: according to the coalescence of the sagittal crest (*crista sagitallis externa*) (hereinafter referred to as the KKKS) and the mandibular teeth attrition (hereinafter referred to as the AŽDN) (Stube et al., 1973). After the research the martens were divided into three age groups: yearlings, two-year-old and older than two-year-old specimens.

The calculations were done employing the Data Analysis software of Excel.

RESULTS AND DISCUSSION

Having performed the age analysis of the hunted down martens, the obtained data were provided in Tables 1 and 2. The data of Table 1 shows that more females (n=18) of pine martens were hunted for the research than the males (n=14).

Having determined the age according to the coalescence of the sagittal crest (KKKS), the results showed that the number of the yearling pine martens was larger (62.5 %). There were no martens older than two years old found. Usually, the number of yearlings allows determining the micropopulation status and its increase. According the data found in literature the increase in the pine marten population may vary from 38% to 133% in a certain year (Grakov, 1963). Such fluctuations are possibly related to the hunting intensity, climate conditions and the resources of food available to the martens during the current year. The discussion of the research data leads to a conclusion that the status of the pine marten population in Lithuanian mixed-deciduous forest is good. When analysing the animals based on their sex, it was determined that there were more yearling females by 12.5 % than the yearling

Table 2. Pine marten (*Martes martes* L.) age according to the mandibular teeth attrition level (AŽDN)

Age	Male		Female		Totally martens:	
	n	%	n	%	n	%
Yearling	10	31,25	7	21,87	17	53,12
Two-year-old	4	12,5	10	31,25	14	43,75
Older than two-year old			1	3,125	1	3,13
Totally in the order of age groups:	14	43,75	18	56,25	32	100,0

males, in a total of 37.5%. These data confirm the information gathered by Maldžiūnaitė who in 1963 studied the age of the pine martens living in Lithuania. At that time, the results showed that juvenile female pine martens were predominant in the population. According to the data of Maldžiūnaitė, the number of juvenile and adult female pine martens in Lithuania was 38.4% and 34.6% respectively. According to another foreign researcher (Heldin 1997), the number of females in pine marten populations is larger than the males by 2-10%.

When analysing the age structure of pine martens based on the mandibular teeth attrition level (Table 2), the yearlings were also predominant. However, their number was less by 9.4% compared to the data gathered when employing the coalescence of the sagittal crest method.

The number of adult pine martens, i.e., two-year-old specimens, was similar in the cases of applying both methods and the difference was only 6.3%. Also, no pine martens older than two years old were found when using the method of the coalescence of *crista sagitallis externa*, and the number of specimens of this age group among according to the mandibular teeth attrition level was only 3.1 % (Table 2). This allows stating that analyses of both methods empower the marten specimens to divide into yearlings and adults.

The following two age categories were used when comparing the two age determination methods (coalescence of the sagittal crest (KKKS) and mandibular teeth attrition (AŽDN)) statistically: young (J), i.e. yearlings, and adult (A) i.e. two-year-old and older than two-year old. Table 3 presents the pine marten distribution according to age and age determination method.

The ϕ coefficient (the analogue to the correlation coefficient for category data) is called mean square contingency coefficient of populations formed by both age determination methods. This coefficient is calculated as follows:

$$\phi = \sqrt{\chi^2 / n} = \frac{|a \cdot d - b \cdot c|}{\sqrt{(a+b)(c+d)(b+d)(a+c)}} = \frac{11 \cdot 12 - 0 \cdot 9}{\sqrt{11 \cdot 21 \cdot 12 \cdot 20}} = 0{,}561 \quad (1).$$

The calculated coefficient value ϕ showed a medium strong relation between the populations formed by both methods, thus, it is possible to state that both age determination methods are similar.

The Guttman's Coefficient of Predictability λ assesses the proportional reduction in error of the predictability of one feature category, when the category of another feature is known. The Guttman's Coefficient of Predictability $\hat{\lambda}$ is calculated as follows:

$$\hat{\lambda}_{KKKS} = \frac{\max(a,b) + \max(c,d) - \max(a+c, b+d)}{n - \max(a+c, b+d)} = \frac{11+12-20}{32-20} = \frac{3}{12} = 0{,}25 \quad (2);$$

$$\hat{\lambda}_{AZDN} = \frac{\max(a,c) + \max(b,d) - \max(a+b, c+d)}{n - \max(a+b, c+d)} = \frac{11+12-21}{32-21} = \frac{2}{11} = 0{,}18 \quad (3).$$

These coefficients provide the following information: when determining the animal age by using the KKKS method, the probability of error is decreased by 25 % if the known age is determined by employing the AŽDN method; when determining the animal age by using the AŽDN methods, the probability of error is decreased by 18 % if the known age is determined by employing the KKKS method. Also, the information about age determined using one of the methods only decreases the probability of error more ($\hat{\lambda}_{KKKS} = 0{,}64$, $\hat{\lambda}_{AZDN} = 0{,}44$) when

Table 3. Probability distribution of pine marten age and its determination method

Pine marten *(Martes martes L.)*		*According to the crista sagitallis externa coalescence* (KKKS)		
		J	A	Totally:
According to the mandibular teeth attrition level (AŽDN)	J	11(a)	0(b)	11
	A	9(c)	12(d)	21
	Totally:	20	12	32

determining the age using another method.

The results of the analysis of the pine marten *(Martes martes L.)* population age in the mixed-deciduous forests of Lithuania by employing two different age determination methods showed that the number of young specimen of pine martens was larger than that of adults. The number of the yearling pine marten females was larger than the yearling males by 12.5%. Several researches believe that the number of hunted down young females is higher than that of adults because they get entrapped more often due to the low amount of behavioural experience they have and due to the fact that they are not resistant to other methods of hunting (Grakov 1981). The same reason applies to the fact that young martens take more time to find food and their paths for food seeking are longer, resulting in easier hunts than compared to the experienced mature females. The young males are affected by a similar behavioural model. Due to these tendencies, when analysing the age structure of the marten population, it is recommended to avoid relying on the hunted game during the first few months of the hunting season (from November to December), when the number of hunted down young marten specimens is higher than that of the adult martens because this may distort the data of the population age structure. Other researchers (Zalewski et all., 2004) claim that the mobility, i.e. probability of successful hunt, of the pine martens is essentially influenced by the prevailing temperature and the behaviour of the female martens feeding their young. It is of utmost importance to assess these behavioural peculiarities of young and adult martens when the conclusions about the age structure of the marten population are drawn in cases of small samples and especially when the precise time of their hunting down is not known. Following the summing up of the research results it was determined that the yearlings comprise from 53 % to 62 % of the pine marten population structures in the Lithuanian mixed deciduous forests. Only 3.1 % of older than two years old specimens were determined. The age determination results of marten species could be more accurate if an additional analysis of the growth layers in the dental cementum was carried out (Klevezal 1988). Other researchers (Maldžiūnaitė 1962, Grakov 1981) who analysed the age structure of the pine marten population also note that due to the specific nature of the biological material and method (in) accuracy, the research data do not always reflect the current status precisely and, thus, should only be assessed as references.

CONCLUSIONS

1. The results of the analysis of the age of pine martens (*Martes martes* L.) by employing two different age determination methods showed that the yearling comprise from 53% to 62% of the pine marten population structures in the Lithuanian mixed-deciduous forests.

2. Yearling pine marten individuals' number, analysing by two methods, differs by 9.4 %. Adult individuals' number, analysing by two methods, differs by 6.3 %.

3. Only 3.1 % of older than two years old pine marten specimens were determined.

4. The results of the statistical comparison of the two different age determination methods by using

categorical data showed that there were relations of medium strength between the (*Martes martes* L.) population age groups formed by both age determination methods.

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