

# AGE-DEPENDENT CHANGES OF ANTLER SIZE IN RED DEER IN TWO CONTRASTING HABITATS IN HUNGARY

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## ABSTRACT

The purpose of the study was to analyse age-dependent changes of antler size in red deer (*Cervus elaphus*) in two contrasting habitats. The study involves the area of Gemenc-Hajós ("excellent habitat") and the Börzsöny Mountains ("poor habitat"). We statistically analysed the trophy evaluation data, population estimates and harvest data of local game management units.

We also compared the two study areas on the basis of the most important antler characteristics of different age groups (antler mass, antler length, number of antler tines). Mean antler masses in the area of Gemenc-Hajós exceeded that of in Börzsöny Mountains during the entire study period. The difference is insignificant in the case of young stags; however, considering the middle-aged, even more the old age groups, the age-dependent deviations of the averages between the two different habitats show an increasing trend.

The differences in the mean antler lengths show a similar trend, however, the growth is not as considerable as in the antler masses. In turn, considering young stags the differences are negligible. Finally, taking into account the mean number of tines, we can report similar differences as in the case of antler lengths.

The results indicate that antler sizes of young stags shot in the area of Gemenc-Hajós on average are very similar to that of the stags shot in the Börzsöny Mountains, which can be attributed to the contrasting habitats and the diverse harvest per age group. From the middle-age the differences of averages are increasing as the better habitat allows red deer stags to develop larger antlers.

**Keywords:** red deer, age distribution, habitat differences, antler size and characteristics, Hungary

## INTRODUCTION

So far, few studies have focused on the comparison of antler size of red deer living in contrasting habitats in Hungary (TÓTH ET AL., 2010). Therefore, it is important to compare statistically the antler characteristics of red deer populations to reveal the factors that can cause the differences between populations living in contrasting habitat conditions and the ways they are manifested.

Antler is a super-product, which determines the competition and mating success of stags (CLUTTON-BROCK, 1982; CLUTTON-BROCK ET AL., 1982). It shows the social rank in stags honestly advertising male reproductive quality (MALO ET AL., 2005) and females prefer males with the largest, more branched antlers, and all things considered, prefer males in excellent condition (CLUTTON-BROCK, 1982; CLUTTON-BROCK ET AL., 1982; KRUK ET AL., 2002; MYSTERUD ET AL., 2002; MYSTERUD ET AL., 2005).

Changes of antler size are closely related to age (KRUK ET AL., 2002). The species-specific antler mass, antler length, and antler development itself are hereditary characteristics; their manifestation is regulated by the neuroendocrine system, and performed by metabolic processes. However, these processes are influenced by environmental factors affecting hereditary characteristics (CSÁNYI, 2007; KRUK ET AL., 2002; MYSTERUD ET AL., 2005; SZEMETHY ÉS BIRÓ, 2005; TÓTH ÉS MTSAL, 2010).

According to LEHOCZKI (2011), the most important environmental factors influencing antler development in roe deer are body weight, nutritional status, population density, land use, land cover, climatic conditions, parasite load, and also soil characteristics. These environmental factors also influence antler development in red deer (KRUUK et al., 2002).

## MATERIALS AND METHODS

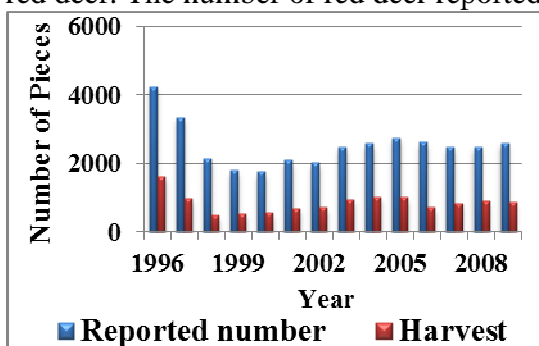
### Description of study areas

#### *The area of Gemenc-Hajós*

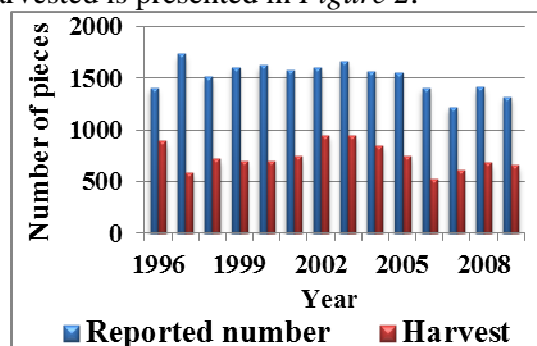
The size of the area is 69989 hectares, which is partially located in South Bács-Kiskun and South Baranya game management districts (III/1 Plan of South Baranya Game Management District, 2004; III/2 Plan of South Bács-Kiskun Game Management District, 2004). The sample area possesses good-quality soil, intensive agriculture; furthermore, Gemenc has a great variety of floodplain forests, which allows outstanding conditions for red deer. The quality of red deer population in the area regarding trophy production is excellent. The number of red deer reported and harvested is presented in *Figure 1*.

#### *The area of Börzsöny Mountains*

This is the part of Börzsöny-Nógrád-Gödöllő game management district, which is situated in the North Central Mountains game management area (II/1. Plan of Börzsöny-Nógrád-Gödöllő Game Management District, 2004). The study area covers 66225 hectares including the whole Börzsöny Mountains. This area possesses poor quality soils, lower yields, less biomass produced; on the whole, we can count on lower quality population of red deer. The number of red deer reported and harvested is presented in *Figure 2*.



**Figure 1. Reported population number and harvest of red deer in the area of Gemenc-Hajós**



**Figure 2. Reported population number and harvest of red deer in the area of Börzsöny Mountains**

### Data and statistical methods

Our study is based on the trophy evaluation data, population reports (estimates) and game harvest data of local game management units, which were provided by National Game Management Database, located in Gödöllő, Hungary. For the study we used trophy evaluation data from 1990-2009 (N= 3948 for Börzsöny Mountains and N= 4307 for Gemenc-Hajós). Stags were grouped as young between 1-5 years, middle-aged between 6-10 years and old over 11 years.

We used antler parameters measured in trophy evaluation as the mean antler mass (kg), right and left antler lengths (cm) and number of right and left antler tines. Antler measurements were made according to the CIC system of trophy evaluation (CIC, 2010).

We calculated the means and standard deviations and made the diagrams with Microsoft Excel 2010. We used t-test to analyse differences between the study areas (Graphpad Instat 3).

## RESULTS

### Changes of antler masses in the two habitats by age groups

In most cases, means of antler masses of stags in Gemenc-Hajós are greater than in Börzsöny Mountains (*Figure 3, Figure 4, and Figure 5*). According to t-test, means of antler masses of stags between the two habitats differ significantly in case of young ( $p < 0,001$ ;  $t = 4,175$ ;  $df = 38$ ), middle-aged ( $p < 0,001$ ;  $t = 12,831$ ;  $df = 38$ ) and old ( $p < 0,001$ ;  $t = 11,133$ ;  $df = 38$ ) age groups. Visually explored, between the young age groups, there are hardly any differences (*Figure 3*), while trophy evaluation data of the middle-aged (*Figure 4*) and old (*Figure 5*) age groups show an increasing difference between the two study areas (habitats).

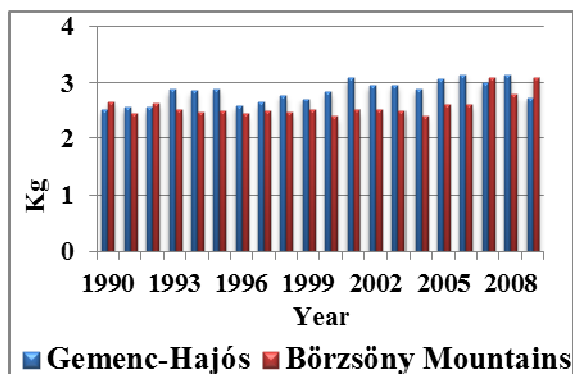


Figure 3. Means of antler masses in young stags in the study areas

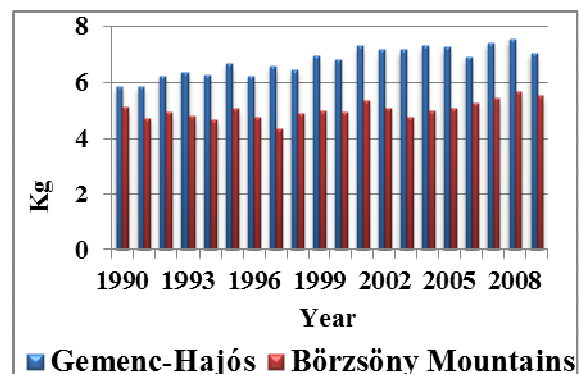


Figure 4. Means of antler masses in middle-aged stags in the study areas

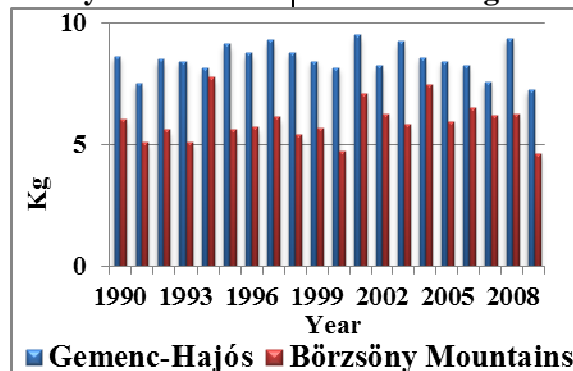
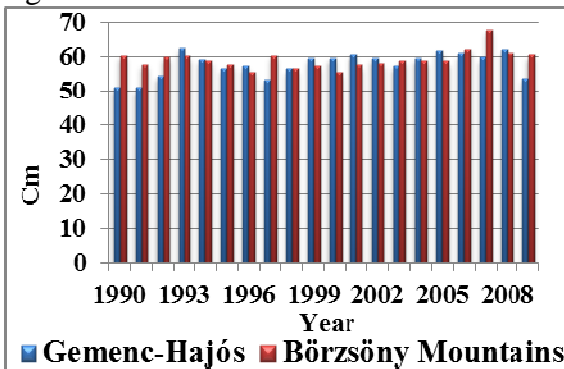


Figure 5. Means of antler masses in old stags in the study areas

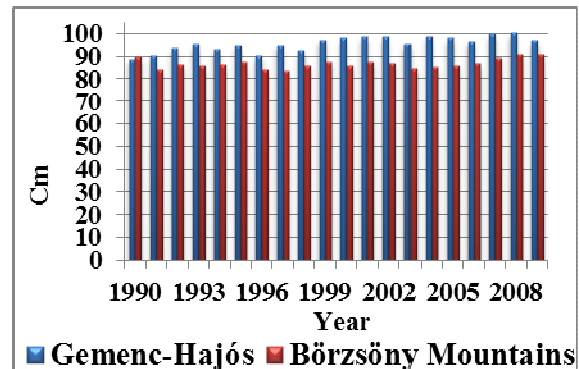
### Changes of antler lengths in the two habitats by age groups

Regarding the means of antler lengths in the two habitats, there is no considerable difference between young age groups as we have seen in case of antler masses (*Figure 5*). However, considering middle-aged (*Figure 6*) and old (*Figure 7*) age-groups, the means of antler lengths are much greater in the Gemenc-Hajós study area. According to the t-test, the means of antler lengths of young stags between the two habitats do not differ significantly ( $p = 0,1738$ ;  $t = 0,2164$ ;  $df = 38$ ), while in case of middle-aged ( $p < 0,001$ ;  $t =$

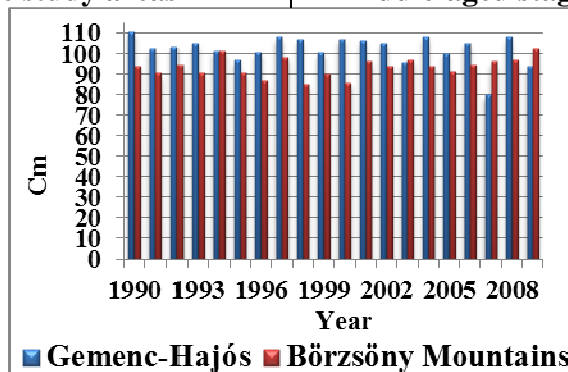
9,931;  $df= 38$ ) and old ( $p<0,001$ ;  $t= 4,626$ ;  $df= 38$ ) age groups the differences are significant.



**Figure 6. Means of antler lengths in young stags in the study areas**



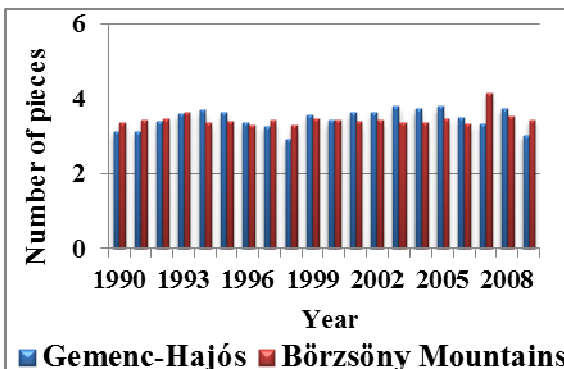
**Figure 7. Means of antler lengths in middle-aged stags in the study areas**



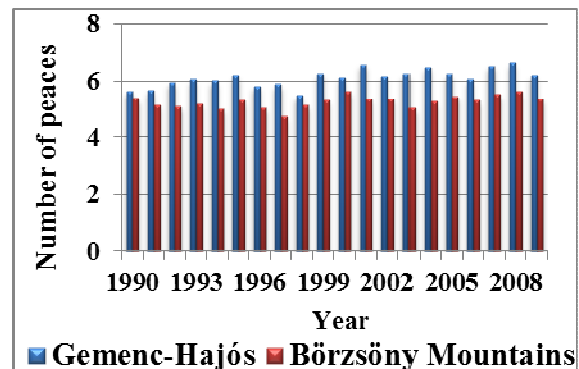
**Figure 8. Means of antler lengths in old stags in the study areas**

### Changes in the number of tines in the two habitats by age groups

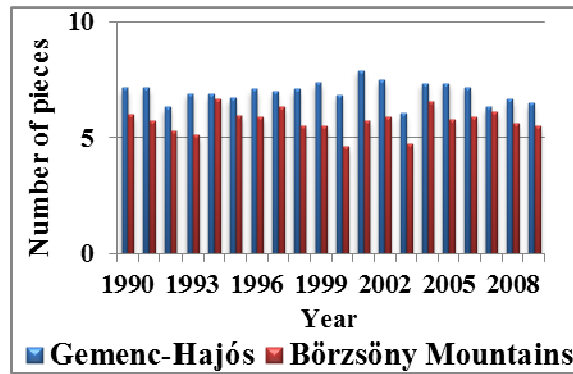
Regarding the means of antler tines the tendency is the same as we have seen in the case of antler lengths (*Figure 9, Figure 10, and Figure 11*). According to the t-test, the average number of tines of young stags do not differ significantly ( $p=0,8298$ ;  $t= 0,2164$ ;  $df= 38$ ) between the two habitats, while in the case of middle-aged ( $p<0,001$ ;  $t= 9,848$ ;  $df= 38$ ) and old ( $p<0,001$ ;  $t= 8,025$ ;  $df= 38$ ) age groups the difference is statistically significant.



**Figure 9. Means of antler tines in young stags in the study areas**



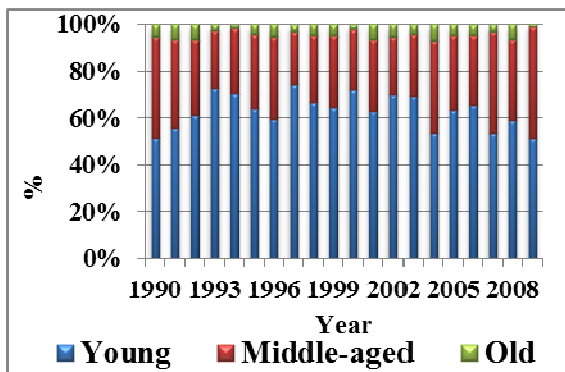
**Figure 10. Means of antler tines in middle-aged stags in the study areas**



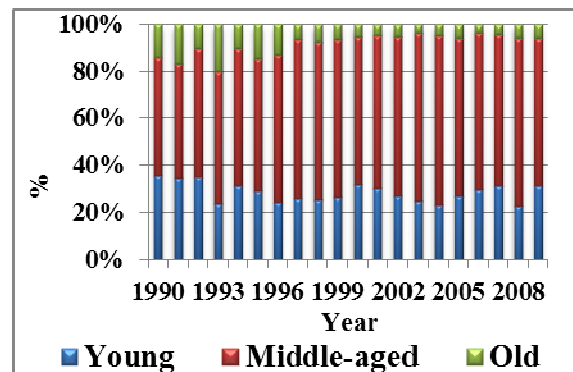
**Figure. 11 Means of antler tines in old stags in the study areas**

**Age distribution and comparison of age groups in the two different habitats**

We made the comparison of age groups by trophy evaluation data. It is obvious that the proportions of young stags among evaluated trophies are considerably greater in the area of Börzsöny Mountains, than in the area of Gemenc-Hajós. This means the share of the young age group was at least twice larger in the Börzsöny area in the past 20 years (*Figure 12 and Figure 13*).



**Figure 12. Age distribution of stags in the area of Börzsöny Mountains**



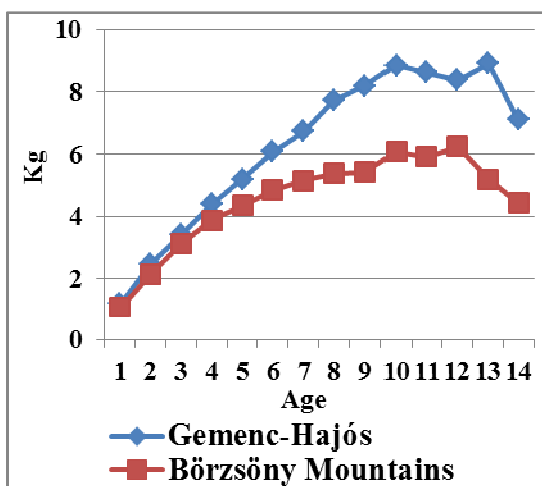
**Figure 13. Age distribution of stags in the area of Gemenc-Hajós**

**CONCLUSIONS**

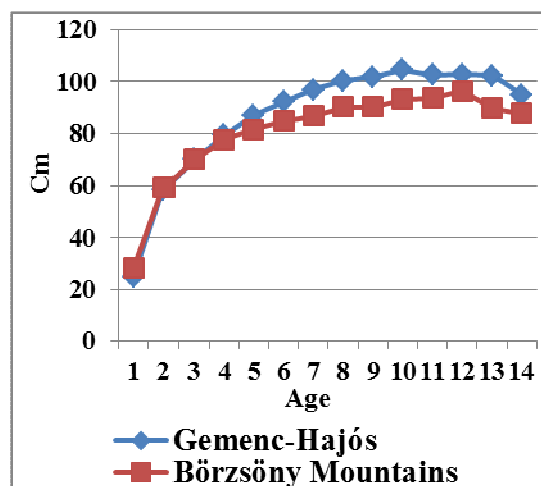
We found significant differences between antler masses of all age groups analysed in the two contrasting habitats. The differences in the young age group were not significant; meanwhile those of the middle aged and the old stags were statistically significant. TÓTH ET AL. (2010) reported different findings in young red deer stags living in 5 different habitats; they found significant differences in antler masses, antler lengths and the number of antler tines.

As far as we can see, the small statistical difference between the antler masses of young age groups is the result of the selective shooting of young males. In both areas young stags under a minimum (and not defined) antler weight are removed by hunters. The slower antler development in the poor areas accounts for the fact that more small antlered males are removed in Börzsöny. At the same time, in the excellent area of Gemenc-Hajós the antler development of the young is better and most of them "escape" early shooting since

they have “promising” antlers. As a result, in Börzsöny Mountains the proportion of young stags shot was twice as large as in Gemenc-Hajós (*Figure 12 and Figure 13*). In answer to better conditions more middle-aged stags can be shot in this area. Furthermore, it is traceable that after the young age the antlers of stags in the area of Gemenc-Hajós are increasing faster, though culmination is reached at very similar ages (9-10 years) in both regions (*Figure 14 and Figure 15*). The steeper increase in the excellent habitat can be attributed to better habitat conditions in the first place.



**Figure 14** Age-dependent changes of antler masses in stags in the study areas



**Figure 15** Age-dependent changes of antler lengths in stags in the study areas

## ACKNOWLEDGEMENTS

Research was supported/subsidized by the TÁMOP 4.2.2/B-10/1-2010-011 „Development of a complex educational assistance/support system for talented students and prospective researchers at the Szent István University” project.

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