ANALYSIS OF SOME POPULATION PARAMETERS OF THE BROWN HARE (LEPUS EUROPAEUS PALLAS,1758.) IN TWO HUNTING AREAS ON THE HUNGARIAN GREAT PLAIN

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Abstract: *The European brown hare is one of the most current and valuable small game species not only in Europe (COWAN,2004) but in Hungary as well. Population density in whole of Europe shows strong decreasing tendency. In the course of our monitoring demographic parameters of the European brown hare were examined. In the hunting season of 2014/15 we collected 235 samples from 2 typical habitats where the brown hare can be found in relatively high density. We analysed the data with the statistical program SPSS 22.(P <0,05). The following data were calculated: ratio of yearlings, coefficient of reproduction, reproduction index, sex ratio, coefficient of population increase, population increase by method Pintur et al (2006) and rate of utilisations by method Kovács and Heltay (1993). The future aim of our examinations is to determine the most likely reasons for the decreasing population of the European brown hare. To prove this, we collected a lot of data (body weight, gender, weight of perirenal fat, counts of placental scars, size of ovary, litter size, weight of the dried eye lens, the function of the testicle, weather data, predators data). On the basis of the data of hunting bag in both areas calculations were performed by the Kovács-Heltay model.*

Key words*: Brown hare, population decline, collecting samples, Kovács-Heltay model*

INTRODUCTION

The brown hare (*Lepus europaeus*) is not only one of the most important small games in Hungary but an important indicator member of the domestic fauna. A declining trend of the population of the species can be observed across Europe. On the basis of estimates by the National Game Management Database, its number is 461 007 individuals [5] in Hungary and 117 732 animals were hunted during the last hunting season. The most important reasons for the decrease of the number of the brown hare are the following: habitat reduction, intensive agriculture, climate change, diseases, parasites, the increase of the number of predators, wildlife management anomalies, decreasing living space, traffic and the reproductive indicators of females [11], [7]. In Britain habitat changes are the main cause of the decline in the number of European hares [17]. Additionally the reproductive performance of the brown hare may vary from year to year [14]. The brown hare is a valuable small game species in Hungary, so the annual utility amount of it must be adjusted to the selected indicators every year [3].

The aim of our assessment was to estimate the population status of hares in two hunting area in Hungarian Great Plain where the species can be found in relatively high abundance. The origin of samples were Túrkeve, and Békéscsaba, where was not similar survey recently.

MATERIALS AND METHODS

We estimated the pupulation density in autumn 2014 and in spring 2015 at night with spotlight by method KOVÁCS (1986). The 235 samples necessary for the research were collected in the hunting season of 2014, from the beginning of October till the end of December. The body was measured and the gender was determined immediately after hunting. The parts of the body that were examined mainly were male and female genitalia, kidneys and renal fat. For the purpose of determining the reproductive indicators of females

placental scars were counted, size of ovary was measured based on the method developed by KOVÁCS and HELTAY [11].

Age was estimated on the basis of two methods: One of them was the existence of the Stroh-mark. This mark is a little cartilage bumb on the ulna which is tangible until the age of 8 months of the animal [18]. Other method based on eye lens weight [11]. After hunting eye lenses were taken from hares promptly. Lenses were fixed in 4% buffered formalin and after that lenses were dried in a thermostat at 103 ^{o}C in the laboritory. They were measured on a precise analytic scale (PRL-II) with precision of 1 mg. Animals were diveded into two groups: dried eye lenses <280 mg (juvenil) and> 280 mg adult by method KŐHALMY (1999). As a result of our examination the following data were calculated at each hunting area: hunting bag ratio of yearlings, coefficient of reproduction, reproduction index, sex ratio, coefficient of population increase and population increase. KOVÁCS and HELTAY [11] formula was used for calculating of rate of the utilization of the brown hares in 2014/2015 hunting season in both hunting areas.

RESEARCH RESULTS

The results of our examination showed that population density in both hunting areas matches with literature: 0,13-0,20 individual/ha [16]. (Table 1) In the year of 2005 GÁL[6] estimated the population density significantly less (0,034 individual/ha in autumn).

Table 1

Some population parameters typical of hunting area

Hunting area		**Estimated population density (individual/ha)**	
		In autumn	In spring
1.	Békéscsaba	0,17	0,16
2.	Túrkeve	0,16	0,13

In habitat Békéscsaba (mainly arable habitat with little aspen forest patches) the estimated population density is higher than in habitat Túrkeve where more pasture can be found. Home range in spring and winter were larger than in summer and in autumn likely to depend on the food and hiding place from predators. AVRIL [1] didn't find any effect of the birth site density on either the propensity to disperse or the distance moved in young hares.

In autumn the young and old proportion were 1,56 in hunting field Békéscsaba (N=87) and 1,43 in Túrkeve (N=148). This important data for preplaning process for quantity of the sustainable stock management of the brown hares for it used the **Kovács-Heltay model** which are following [11]

$h=S_1*S_2*(1+r)-1$

h=rate of the utilisation of the brown hares (by holding level of the stock)

S_1 = (summer survival of the spring population average data:0,7) (by Kovács and Heltay,1993).

S_2 =(winter survival of the autumn stock, average data: 0,8) [11].

r=young/old proportion in autumn

A hunting area utilisation by holding level of the stock is possible if h> 0.

In our examination the following results supplied:

In hunting area Békéscsaba: h=0,7*0,8*(1+1,56)-1=0,43

In hunting area Túrkeve: h=0,7*0,8*(1+1,43)-1=0,36

Comparing these values with data of MAJZINGER [13], diagnosable that juvenil-adult ratio much more better (1,56 and 1,43) than the threshold of this value for the stablilize population needed (r=0,79).

Some of the other population parameter were calculated by method PINTUR [16] as well in the table 2.

Table 2

Selected indicators by hunting area, Area code : a :Békéscsaba, b:Túrkeve

Indicators		Hunting area	
		Békéscsaba	**Túrkeve**
1.	%juv	60,91	58,78
2.	R	1,56	1,43
3.	r	2,04	2,56
4.	Si	0,66	0,47
5.	cPI	2,56	2,43
6.	PI%	79,07	69,82

The formulas for calculating each indicator are shown below by method PINTUR[16].

1. Ratio of yearlings in the hunting bag:%juv=Njuv/N
2. Coefficient of reproduction: R=Njuv/Nad
3. Reproduction index: r=Njuv/Nadf
4. Sex ratio: Si=F/N
5.Coefficient of population increase:cPI=0,7(Njuv/Nad+1)
6. Population increase: PI%=(%juv-30)/(100-juv%) X100

Key: N-total number of individuals; Nad –number of adults; Nadf - number of adult females; F-number of females, area a: Békéscsaba, area b: Túrkeve

These selected indicators help to understand the population dynamics of brown hare which affect the utilisation.Our five values were between minimum and maximum of the results of PINTUR [16]. The cPI values were higher than in the examinations of PINTUR [16].

Compared with the average body weight of the hares there were no significant differences between age groups and hunting areas (3. Tables). Experiments of Marboutin et Hansen [15] young animals over 3000 gramm could easier to endure harsh winter. The average body weight of data FARAGÓ (2002) were 3765g (by young ♂) and 3761 g (by young ♀ hares). This value by adult animals were between 4213g (♂) and 4330g (♀). The weight depends on sex, season, food supply, and biological status of the reproduction [8].

Table 3

Average weight (gramm)/individual) of hares according to sex and age in the Hungarian Great Plain SE: Standard error, P <0,05

age	sex	
	male	**male**
<1 year	3194	3099
	(N=72)	(N=68)
	SE	SE
	(54)	(44,5)
>1 year	3739	3564
	(N=35)	(N=60)
	SE	SE
	(141,8)	(58,7)

CONCLUSIONS

The results of our examination show that population density is acceptable in approximately both areas, in autumn and spring alike. Ratio of yearlings in the hunting bag were good 58,7% (a) and 60,9%(b) based on evaluations method of BEUKOVIĆ [2]. These figures have a positive effect on wildlife management and the selected indicators may help in pre-planning processes for wildlife associations. It is important to bear in mind that there can be huge differences from year to year and hunting area by hunting area. The sustainable stock management the calculated values (by the Kovács-Heltay model) were h=0,43 in hunting field Békéscsaba and h=0,36 in Túrkeve. In the present cases utilisation

of the brown hares was well-founded by Kovács-Heltay model.Compared with the average weight of the hares there were no significant differences between age groups and hunting areas.

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