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POPULATION DENSITY OF *MYOXUS GLIS* (L.) IN SOME FOREST BIOTOPS

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ABSTRACT – Audible calls emitted by edible dormice were used for estimation of the population density in some forest habitats of the Roztoczanski National Park (Poland). Attempts were made to devise a method of assessing population density and to check in which weather conditions the assessment would be most reliable. Based on the preliminary observations, it appears that dormice called more frequently during windless nights than on windy ones, and more in August than July. The density estimates obtained during favourable weather (no wind and no rain) were from 1.0 to 11.0 individuals per hectare. Generally the highest densities of *Myoxus glis* were found in beech woods and in localities situated on the edges of the forests.

Key words: *Myoxus glis,* Audible calls, Census method.

RIASSUNTO – *Densità delle popolazioni di* Myoxus glis *(L.) in alcuni biotopi forestali* – Richiami udibili emessi dai ghiri sono stati utilizzati per stimare la densita di popolazione in alcuni habitat boschivi del Parco Nazionale Roztoczanski (Polonia). Si è cercato di stabilire la densita e di verificare in quali condizioni atinosferiche tale stima potesse essere piu attendibile. In base a osservazioni preliminari, si e stabilito che il ghiro emette piu richiami durante notti prive di vento che in quelle ventose e durante il mese di Agosto che non in Luglio. Le densita ottenute durante condizioni atmosferiche favorevoli (assenza di vento e di pioggia) erano comprese fra 1.0 e 11.0 ind./ha. Generalmente le densita piu elevate di *Myoxus glis* sono state trovate in faggete ed in localita situate al margine dei boschi.

Parole chiave: *Myoxus glis*, Richiami, Metodo di censimento.

INTRODUCTION

Small rodents are usually censused by trapping. This is difficult when one works with mammals which are not normally active on the ground. *Myoxus glis* lives mostly in the canopies of trees and bushes (Gorner & Henkel, 1988; Morris & Hoodless, 1992), so setting traps on the ground is not suitable for this species (Sidorowicz, 1958), and fixing traps above the ground is sometimes impossible. Therefore dormice have been censused by other methods such as checking of nestboxes (Vietinghoff-Riesch, 1960; Gaisler et al., 1977; Müller- Stieß, 1988), and counting their calls (Müller-Stieß, 1988). The first method needs nestboxes to be distributed prior to checking in the study area.

I have attempted to estimate the density of *Myoxus glis* based on using audible calls emitted by these animals. This method, to some extent is similar to those used in studies of birds (Enemar, 1959; IBCC, 1969). Calls of adult *Myoxus* individuals are characteristic and easy to hear by man. The noisy feeding of edible dormice can also help in finding these mammals. The aim of the present study was:

- to develop a census method for *Myoxus glis* by using their audible calls;
- to check in what weather conditions and in which of two summer months (July and August) this method would be the most effective;
- to estimate the population density of edible dormice in some forest biotopes.

STUDY AREA AND METHODS

The study was carried out in the Roztoczanski National Park (RPN) located in the Roztocze Region of southeastern Poland, during nights in July and August of 1991 to 1993.

The hilly area of RPN is almost completely covered with various forests. The climate is continental (with oceanic influences) with 650 mm annual precipitation. Winters are long and fairly cold, but summers are long with many (48%) sunny days (Lipiec, 1985).

Some individual edible dormice were watched during their nocturnal activity to find out how often they call. Standing under a tree which was occupied by *Myoxus glis*, notes about time and number of calls were made. Only the animals which were watched for longer than half an hour were taken into account (Tablel). These observations were made both in July and August in different weather conditions (i.e. during windy and windless nights, during and after the rain), inside the forest and outside of it (but very close to its edge).

Assessments of dormouse abundance were made within rectangular plots (1-3 ha) marked out along forest tracks and forest borders. The size of each plot was dependent on the area of forest searched and difficulties encountered moving in it at night. Each of the plots was divided into smaller rectangles, for facilitation of the work, and precisely marked by using reflective materials. When moving in a zig-zag along the plot, calling edible dormice were counted in successive smaller rectangles. A second person, who moved simultaneously along the track (or border), signalling with torch light, was very helpfull and sometimes necessery to establish precise locations.

The study plots (D1-4) were located in four types of tree stands in which the presence of edible dormice had been ascertained earlier. The four study plots were located in beech woods with or without thin undergrowth: D1 - max. 150 yrs. old, without undergrowth; D2 - max. 140 yrs. old, without undergrowth; D3 - max. 180 yrs. old. with thin beech undergrowth and single pines; D4 - max. 155 yrs. old. with thin undergrowth. Two plots were located in beech wood with diversified undergrowth: B1 and B2 - with an understorey of *Sambucus nigra*, *Sambucus racemosa*, young *Fagus silvatica*, *Cerasus avium* and with sporadic fir trees *(Abies alba)*, up to 160 yrs. old. Two other plots were located in mixed forests: T - mainly consists of oak (max 160 yrs old), fir (max 150 yrs old), beech, hornbeam and pine, with a rich understorey; and P where pine (max. 80 yrs. old) is a dominant and beech (max 150 yrs old) occurs sporadically, without undergrowth.

Some of the plots were situated on the edges of the woods (D1, B1, T) and some were deeper in the forests (D3, D4, D2, B2, P).

Bird nestboxes of various types with an entrance opening 45 mm in diameter himged out in the beech wood, on the plots B1 (14 boxes) and B2 (10 boxes), in

winter 1990/1991, were checked 2 - 5 times a year.

RESULTS

FOUNDATIONS OF THE METHOD

Comparisons of frequencies of calls emitted by *Myoxus glis* in two summer months during two different weather conditions, inside and outside the forest were studied (Table 1). The edible dormice called more frequently in August than in July, more during windless nights than on windy ones and more when they were active inside the forest than outside. The results from windy nights were obtained during breeze but not strong wind. During strong wind as well as during rain and after it, both hearing and counting calls are very difficult or even impossible.

Tab. 1 – Number of vocalisations of particular individuals of *Myoxus glis* during 30 min. observation in July and August during windless and windy nights.

		NUMBER OF VOICES IN 30 MINUTES							
		INSIDE THE FOREST				OUT OF THE FOREST			
Month	Weather	total time of observation (min)	$\overline{X}$	SD	min-max	total time of observation (min)	$\overline{X}$	SD	min-max
July	no wind	492	30,6	18.3	8.9-57,O	493	5.5	1.0	4.3-6.1
	wind	276	6,7	7,1	0,3-14,4	665	3,9	4.6	0,6-11,5
August	no wind	220	71,7	19,5	50,1-88,0	395	30,0	0.0	
	wind	554	9,8	10,0	0,9-24,3	30	5.0	-	

POPULATION DENSITY OBTAINED BY COUNTING CALLS OF *MYOXUS GLIS*

Based on the results described above, only those censuses which were made in August and during favourable weather conditions (no wind, no rain) were taken into account in the present paper. Special attention was paid to solitary trees growing here and there along the edges of the forests. Results achieved up to now on the investigated plots showed the density of the *Myoxus glis* population was from 1.0 to 11.0 individuals per 1 ha. The data from different habitats are shown in Fig. 1.

The highest density of dormice was found in beech woods, up to 11 ind./ha in D1 and up to 10 ind./ha in B1. However, some plots also located in beech woods had a much lower density i.e. up to 4.0 ind./ha in D4 and B2, or even with only 1.5 ind./ha in D2. This latter result is similar to that obtained from P (1 - 3 ind/ha), where pine is the predominant tree species (Fig. 1). In the plots situated on the edges of the beech woods, (D1, B1) the density of edible dormice were higher than on the others (D3, D4, D2, B2). Comparison of two pairs of plots, DI with D4 and B1 with B2, which were situated very close one to another, is very interesting in this context. On plots D1 and B1 the densities were much higher.

OCCUPATION OF BIRD NESTBOXES ON THE PLOTS B1 AND B2

The maximum numbers of adult *Myoxus glis* found in nestboxes situated on

plots B1 and B2 in the years 1991-1993 are shown in Tab. 2. On plot B1 the numbers were always higher than on plot B2, where in 1992 and 1993 nestboxes were not occupied at all.

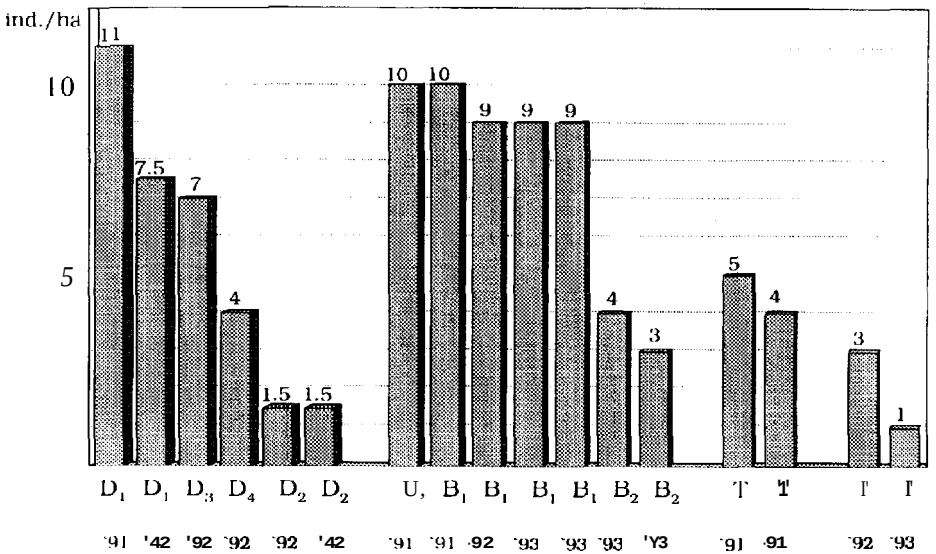

Fig. 1 – The densities of *Myoxus glis* (individuals/ha) obtained in particular counts by listening to audible calls emitted by this species. Explanations: D1 - D4, B1, B2, T, P are the reference symbols of study plots: '91, '92, '93 refers to the years when counts were made.

Tab. 2 – Comparison of the maximum number of adult *Myoxus glis* found during a single control of nestboxes with the maximum number of edible dormice found by listening to their voices on two plots (B1, B2), in the years 1991-1993.

		NUMBER OF INDV. FOUND IN NESTBOXES			NUMBER OF INDV. COUNTED BY VOICES		
Plot (1 ha)	Number of nestboxes	1991	1992	1993	1991	1992	1993
B1	14	**4**	***3***	3	10	10	9
B2	10	**1**	0	0			**4**

DISCUSSION

Observations suggest that the function of sounds emitted by edible dormice is connected with keeping away other individuals from the place of current foraging. Hönel (1991) and Müller-Stieß (1991) found that very attractive feeding places form special feeding areas at the centres of home ranges. In these feeding places, edible dormice spend the majority of their ativity time and they called there most intensively. Müller-Stieß (1991) stated also that such feeding centres were defended against other dormice during late summer and autumn. In the Roztocze Region beech nuts ripen in August. During that time some beech trees which fruit

abundantly, become attractive feeding places for *Myoxus glis*. It seems that such trees in August were defended more intensively against other edible dormice than the same trees were in July, when nuts were unripe. Hence, as expected, the animals emitted more calls in August.

The smaller number of calls emitted during windy nights (compared to windless ones), appeared to be a result of more cautious behaviour of *Myoxus glis* in these conditions. Several times I observed edible dormice when they were sitting on lower branches and started to move nervously with their ears when trees began to rustle in the wind. They kept doing this for some time as if trying to catch a sound connected with danger. Vietinghoff-Riesch (1960) observed similar behaviour by *Myoxus glis* when silence was disturbed, and rapid reassurance of the animals when all rustling ceased. Vietinghoff-Riesch pointed out that hearing plays the most important role in recognition of danger. It seems that when it is calm and not a leaf moves, animals spend less time trying to hear impending danger than they do when leaves rustle, and they have more time for other activity hence they emit more calls.

A smaller number of calls outside the forest than inside it can also be connected with more careful behaviour of edible dormice when they are out of the dense tree stands.

There is abundant published information about habitat preferences of *Myoxus glis*. Authors mention old deciduous woods (Vietinghoff-Riesch, 1960; Gaisler et al., 1977; Neumann, 1985), deciduous and mixed forests (Ognev, 1947; Gorner & Henkel, 1988; Schober, 1988; Bitz, 1990) and mixed forests (Müller-Stieß, 1991) as typical habitats for this species. The present study in general agrees with these results; the edible dormice live in almost all the deciduous and mixed forests of **RPN**.

It is difficult to compare the density of Myoxus glis in suitable habitats of RPN with other places in Europe, because the study methods differed in each case. Using checks of nestboxes European authors estimated the density of dormice as follows: Vietinghoff-Riesch (1960) in Lower Saxony (Germany) - 4.9 ind./ha, Gaisler et al. (1977) in Moravia (Czechoslovakia) - 1.0 ind./ha, Müller-Stieß (1988) in Saarland (Germany) - 20 - 22 ind./ha. It should be noted that these data seem to be obtained in the same way but there are nevertheless differences: Vietinghoff-Riesch based his data on number of individuals found in September; Gaisler et al. based results on the average number of individuals obtained during 4 years of study; Müller-Stieß` data are based on numbers of animals found in autumn but he computed the density using a quite different method (Smith after Müller-Stieß, 1988). Results obtained in the **RPN** by checks of nestboxes in August (Tab. 2) showed lower number of dormice than the results from Germany but higher than the Czech studies.

A method similar to mine, listening to audible calls, was used by Müller-Stieß (1988). Though some differences also occured between these two methods, such as taking into account only voices of animals in my study (taking other signs of dormouse presence only additionally) and writing down all calling, jumping and foraging dormice in the investigation made by Müller-Stieß. He found a population density of ***Myoxus*** *glis* up to 5 ind./ha in a very diversified area covered with

deciduous forest (beech, oak, robinia) and orchards. My results from plots situated in the mixed forest (T) and some beech woods (D4, B2) correspond with data of Müller-Stieß (1988).

In the present study numbers of *Myoxus glis* found in nestboxes were lower than numbers of animals heard (Tab. 2). On plot B1 the maximum numbers of animals found in nestboxes and ones heard at night were very similar from year to year. Numbers heard were still 2.5 -3.3 times higher than those found in nestboxes. In B2 estimation based on vocalisations was made only in 1993, when no nestboxes on this plot were occupied by edible dormice. It is obvious that not every animal living in the forest where nestboxes were available actually occupied one, especially in old tree stands where there are numerous natural holes (as in KPN). Thus, estimation of population density of edible dormice by using their audible calls has some advantages in comparison with checking nestboxes because:

- it does not require the distribution of nestboxes before the time of checking;
- it takes little time;
- dormice are not disturbed during the census.

It has also some disadvantages:

- it requires suitable weather conditions;
- data about sex and age structure cannot be obtained;
- some individuals can be counted twice and some not at all.

Further investigation should improve the method and will make it a very useful research tool for the study of *Myoxus glis*.

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