ESTIMATING DENSITY OF EDIBLE DORMOUSE *GLIS GLIS* (L) IN FOREST HABITATS: WHICH METHOD SHOULD WE CHOOSE WHEN THE MONITORING IS DONE IN A PRIMEVAL FOREST?

*Ioan DUMA¹, Nicoleta IANOVICI¹, Ion IORDACHE²*

¹West University of Timişoara, Faculty of Chemistry-Biology-Geography, Department of Biology
²University “Alexandru Ioan Cuza”, Faculty of Biology

**ABSTRACT**

The present study is trying to reveal the density of edible dormouse in beech forests of different ages and at different altitudes on the Semenic-Cheile Carasului National Park. The density was estimated based on two methods: with the already well known dormouse nestboxes and by census method. The results are analyzed and compared in order to provide the best solutions for dormouse monitoring in National Parks of Romania which have a chronic lack of personnel and resources.

**KEY WORDS:** Edible dormouse, density, population estimation, methods, Semenic-Cheile Carasului National Park, Romania

**INTRODUCTION**

*Glis glis* (L.) is the largest European species from the Gliridae family. It can be found from the oak forests of the plain regions up to 2000 meters in the subalpine zone (Popescu & Murariu 2001). It prefers usually forest habitats, especially those with *Fagus sp.* and *Quercus sp.* In fact the species is so well adapted living in these forests that in years with no mast entire populations of *G. glis* fail to reproduce (Bieber 1998, Schlund 2002, Pilastro *et al.*, 2003). Exactly how the food abundance is related with the reproduction in this species is still a subject to debate. Some studies suggest that the animals can predict the food availability after abundance of flowers and seed buds in the spring (Bieber, 1998), others that previous year masting is the trigger of reproductive failure or success (Schlund, 2002). Also a third explanation is inferred by Fietz (Fietz *et al.*, 2004) who is suggesting that in one year not all individuals are reproducing due to energetical constrains.

Anyhow this dependency on oak and beech forests is making the species vulnerable to climate changes and to alterations in the quality of those habitats.

The main factors that are affecting negatively the populations of *Glis glis* are:

- habitat fragmentation, some studies showing that large corridor gaps represent a real barrier for arboreal species (Bright, 1998)
- forest exploitation. Usually the old forests which provide many suitable nests and enough food to sustain larger populations of *G. glis* are those that are searched for by logging companies.

These are enough reasons to put the species under constant monitoring at least in the protected areas to see how the population is evolving over the years. The literature on the density of the *G. glis* in Romania is missing completely
(although there are some studies that are ongoing at the moment in Transylvania), so unfortunately we can not compare our results with others. On the other hand, similar studies have been made in other countries from Europe. For example in Lower Saxony (Germany) were found 4.9 individuals/Ha, (Gaisler et al., 1977), 11 individuals /Ha in Roztoczanski National Park in Poland (Jurczynsyzn, 1994), and eaven 57 individuals/Ha (in September) in central Germany (Bieber, 1998).

In order to help the biologists of National Parks to monitor the populations of *Glis glis* we used and compared two methods: nest box checking and tracking in order to see if the census method is good enough in the particular conditions of old forests.

**Study area**

The investigations were conducted between 2006 and 2007 on the territory of Semenic-Cheile Carașului National Park, found in the South-Western Romania. The park is located in the Semenic Mountains and covers an area of 36.219 ha. On its territory is found the largest primeval beech forest from Europe covering 5000 ha.

The maximum altitude found in the Semenic Mountains is of 1447 meters on the Gozna peak. The climate of these mountains is characterized by an annual medium temperature of 4°C at the highest peaks and 8°C at lower altitudes, annual medium rainfall varies also according to the altitude but has values between 1000 to 1200mm. (Atlasul Climatologic al României, 1966).

**MATERIAL AND METHODS**

We have conducted our researches in three study sites: A, B and C on the Semenic mountain (Image. 1). The plot A was located along one valley at an altitude of 750 meters and had 100 years old beech forest with lush understorey (45°11'34"N, 22°00'48"E). Plot B was located on a slope facing east at an altitude of about 800 meters. The habitat found here was a beech forest less than 15 years old (45°11'01"N 22°00'05"E). The plot C was located at an altitude of 1350 meters in the largest preimval *Fagus sylvatica* forest from Romania. The trees (some of them) here were more than 400 years old (45°09'34"N 22°03'23"E).

In these plots we have used two methods of evaluating the density of *Glis glis*. One was with wooden nest boxes (20/20/35) placed on trees at a height of about 2-3 meters above the ground with the hole facing the three trunk. The distance between woeden boxes was of about 50 meters. On each plot a number of 25 nest boxes were placed covering an area of 6.25 ha. This lax tipe of grid was chosen in order to not encrise the carrying capacity of the habitat and to avoid obtaining eroneous data, as shown by Juškaitis in *Muscardinus avellanarius* (Juškaitis, 2006).

The boxes were checked twice a month from June till September.

We also used census method. This last method is usually used for monitoring birds but also was aplied by Jurczynszyn Miroslaw in 1994 for the
edible dormouse. His method was based only on the calls emitted by the *Glis glis*. We however tried to locate the individuals not only after sounds they emit but also using Yukon Night Vision device, and powerful IR flashlights. The position of each individual was located with the help of a GPS unit.

![Figure 1. The map of Semenic Mountain area with the location of the three sites](image)

The night investigations usually began at around 9-10 PM, depending on the month, and were carried out till about 1 AM. Only the dormice that were seen or heard in front or in lateral parts of the observer were counted. The individuals heard or seen behind were ignored to ensure that the same specimen is not counted twice.

It is well known already that the reproduction and also the autumnal density of *Glis glis* is depending on the quantity of food. So in order to see how the density was affected by the fruiting of the beech we measured the pollen produced by trees in the years of the study. The volumetric measurement point was located in the Timișoara city at an elevation of 20 m above ground level. The distance between the city and the study area is just 93 km in straight line (measurement made with the help of Google Earth program).

The pollen count was measured by the volumetric method with the use of a VPPS 2000 Lanzoni trap (Hirst type), and expressed as the number of pollen grains in 1 m³ per 24 h (Mandrioli et al, 1998; Comtois et al, 1999). Pollen grains were identified on the surface of 4 horizontal bands. Pollen grains identification was carried out using a ML-4M microscope, magnifying 400X. The numbers of pollen grains found in the cover-glass area were converted to pollen counts.

The *Fagaceae* family is represented in România by beech and oaks. These species are anemophilous trees producing stenopalynus pollen grains (not
DUMA IOAN et al.: Estimating density of edible dormouse *Glis glis* (L.) in forest habitats: which method should we choose when the monitoring is done in a primeval forest

distinguishable under light microscopy) in high quantities that are well dispersed through the air (Gómez-Casero et al., 2004, Tormo et al., 1996). In recent years, the rise in winter and spring temperatures as a consequence of global climate change is causing earlier leafing and flowering in many species, in both Europe and the USA (Bradley et al., 1999; Emberlin et al., 1997; Menzel & Fabian, 1999). The effect of recent climate warming on vegetation phenology and aerobiology is an important issue which is being taken into account in climate-change studies (Giannini & Magnani, 1994; Schwartz, 1999). Because *Fagales* pollen emission is a springtime phenomenon, pollen season dynamics are sensitive to changes in phenology (García-Mozo *et al.*, 2006).

**RESULTS**

In 2006 and 2007 in the dormouse were found only in the nestboxes from the plots the plots A and C probably these being placed in more suitable habitat. The nestboxes placed in the Plot B were empty or occupied by birds during both years.

The total number of *Glis glis* found in the two year study in the nestboxes was relatively low: just 46 individuals. The differences between the two methods used to determine the density of edible dormouse was significant. If we would consider only the data obtained by checking the nest boxes the density would be of 0.25/ha in June and 1.25-1.75/ha in autumn (table 1).

The census method revealed a much higher density of 0.75 individuals/ha in June and up to 5.0 individuals/ha in autumn (table 1).

Comparing the results obtained in the two year period of our study we observed that the density of *Glis glis* was lower on all plots during 2006 than in 2007. This fact may be explained by the poor mast in the years of 2005 and 2006 in the Banat region (table 3, fig. 5 and 6). This led to a reproductive failure and so in 2006 only one female with pups was found in a nest box on plot A.

In 2007 the beech threes produced a large amount of fruits that was anticipated in spring by large amount of pollen produced (table 3, fig. 7). In the late spring and autumn of 2007 we have found a number of 11 pups in four nest boxes. Also youngsters were observed in August by the census method in plots A and C (fig. 2 and 4). In these conditions the density of *Glis glis* raised in 2007 in all plots including in the study area B where we have observed the only two individuals during the two years investigations.

The differences observed between the two methods are significant from the statistical point of view. The Mann-Whitney test shows that U values for the differences between the two methods of investigation used for dormouse monitorisation in 2006 on plot A are significant $U=11.5$, $p=0.03569$ (n=8). The same significant values apply also for the year 2007 $U=5.5$, $p=0.006323$ (n=8).
Table 1. The density of *Glis glis* in the plots A and C by census method and from nestbox investigations

<table>
<thead>
<tr>
<th>Year</th>
<th>Site &quot;A&quot;</th>
<th>Site &quot;C&quot;</th>
<th>Site &quot;A&quot;</th>
<th>Site &quot;C&quot;</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>June</td>
<td>August</td>
<td>June</td>
<td>August</td>
</tr>
<tr>
<td></td>
<td>Box</td>
<td>Census</td>
<td>Box</td>
<td>Census</td>
</tr>
<tr>
<td>2006</td>
<td>0,25</td>
<td>0,75</td>
<td>0,25</td>
<td>0,75</td>
</tr>
<tr>
<td>2007</td>
<td>0,25</td>
<td>2,5</td>
<td>1,75</td>
<td>5</td>
</tr>
</tbody>
</table>

Statistical significant differences were observed also on the plot C. The U value for 2006 is U=9, p=0.01813 (n=8), and for the 2007: U=14.5, p=0.0742 (n=8).

Also the differences from year to year in the density of the edible dormouse are significant U for plot A is U=7.5, p=0.01172 (n=8), and for plot C: U =3.5, p=0.008809 (n=7).

Regarding the structure of the population (table 2) we observed that the males prevailed on plot A during both years of study (70% in 2006 and 17.64% in 2007). On the plot C however prevailed females in 2006 (100%) while in 2007 they represented only 11.76%. In 2006 we did not found any juvenile in the nestboxes while in 2007 the pups represented 64.7% in plot A and 52.9% in plot C.

Table 2. The structure of *Glis glis* population on site A and C during the study period

| Year | Plot A | | | Plot C |
|------|--------|--------|--------|
| 2006 | Males  | 7      | 0      |
|      | Females| 3      | 2      |
|      | Juveniles| 0    | 11     |
| 2007 | Males  | 3      | 6      |
|      | Females| 2      | 2      |
|      | Juveniles| 0    | 9      |

Figure 2. Number of individuals from the Plot A in 2006
DUMA IOAN et al.: Estimating density of edible dormouse Glis glis (L.) in forest habitats: which method should we choose when the monitoring is done in a primeval forest

Figure 3. Number of individuals from the Plot A in 2007

Figure 4. Number of individuals from the Plot C in 2006

Figure 5. Number of individuals from the Plot C in 2007
Figure 6. Concentrations of pollen grains (PG/m$^3$) measured in 2005

Figure 7. Concentrations of pollen grains (PG/m$^3$) measured in 2006

Figure 8. Concentrations of pollen grains (PG/m$^3$) measured in 2007
Table 3. Flowering period and the amount of pollen produced by oak and beech during 2005-2007

<table>
<thead>
<tr>
<th></th>
<th>2005</th>
<th>2006</th>
<th>2007</th>
</tr>
</thead>
<tbody>
<tr>
<td>First identification</td>
<td>18 IV</td>
<td>12 IV</td>
<td>27 III</td>
</tr>
<tr>
<td>Latest identification</td>
<td>25 V</td>
<td>27 V</td>
<td>19 V</td>
</tr>
<tr>
<td>Flowering period</td>
<td>38 zile</td>
<td>46 days</td>
<td>54 days</td>
</tr>
<tr>
<td>Maximum concentration</td>
<td>56 PG/m³ in April</td>
<td>110 PG/m³ in May</td>
<td>488 PG/m³ in April</td>
</tr>
</tbody>
</table>

DISCUSSIONS

Our study shows that the use of nest boxes on small plots and with only two checking’s per month has no satisfactory results when it comes to estimate the density and population size of the edible dormouse in primeval forests.

This poor occupation rate of the nestboxes may be explained also by the many natural hollows in the old trees. On one ha of old beech forest we've numbered 108 natural hollows. So in this case the competition for suitable nest is not so high, at least at low density of *Glis glis*.

The census method on the other hand is showing a more realistic estimation of the population size and density. Also like Jurczynszyn showed it is more convenient and practical for the biologists or forestry personnel of the National Parks since it does not require installation and constant verification of nestboxes.

On the other hand it does not provide data regarding the structure of the population.

The density found by us in the forests of Semenic Cheile Carasului was relatively low compared with those reported from other countries. This may be however the result of two years of poor mast in beech. On the contrary 2007 was a good year in terms of food availability and reproduction in *Glis glis*.

This has showed up as a rise in the autumnal density of the species.

REFERENCES

DUMA IOAN et al.: Estimating density of edible dormouse Glis glis (L.) in forest habitats: which method should we choose when the monitoring is done in a primeval forest

- **Schwartz M.D.** (1999) Advancing to full bloom: planning phonological research for the 21st century. *Int J Biometeorol, 42*, 113-118
- ***Atlasul Climatologic al Republicii Socialiste Romania, Comitetul de Stat al Apelor, Institutul Meteorologic, București, 1966***