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**DATA REGARDING THE SMALL MAMMAL COMMUNITIES
(MAMMALIA: INSECTIVORA, RODENTIA) FROM RÂU ŞES
RIVER BASIN (ȚARCU AND GODEANU MOUNTAINS,
ROMANIA)**

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Abstract. The investigations carried out in the Râu Şes River basin in 2003 revealed a period of decline of the rodent populations. There were recorded very low total values of capture index, the absence of *Apodemus flavicollis*, and a low density of *Clethrionomys glareolus* population. In case of this species however, a high percentage of reproductive females was observed, suggesting its numerical recovery. A relative high abundance was recorded in case of *Sorex araneus* and *Muscardinus avellanarius*. Another interesting aspect was the capture of a rare insectivore, namely *Sorex alpinus*. The absence or the very low density of small mammals in some habitats was due also to their disturbance by forest exploitation, more sensitive appearing to be *C. glareolus*. In 2004 some important changes were recorded: the increase of total abundance, the presence of small mammals in every investigated habitat and the presence of *A. flavicollis*, which became the dominant species in all stations.

Résumé. Les recherches entreprises en 2003 dans le bassin hydrographique de Râu Şes ont relevé une période de déclin des populations des rongeurs. Nous avons enregistré durant ce période des valeurs très basses de l'index de capture, l'absence totale de l'espèce *Apodemus flavicollis* et une densité réduite de *Clethrionomys glareolus*. Pour la dernière espèce a été observé un pourcentage élevé des femelles reproductives. Une densité élevée a été enregistrée par *Sorex araneus* et *Muscardinius avellanarius*. Très intéressante a été aussi la présence d'une espèce rare, *Sorex alpinus*. L'absence ou la très basse densité des petits mammifères en quelques habitats ont été provoqués aussi par les exploitations forestières. Plus sensible aux perturbations a été *C. glareolus*. En 2004 nous avons observé quelques modifications importantes de la communauté de petits mammifères. L'abondance totale a augmenté, tous les habitats étudiés ont été peuplés et surtout, *A. flavicollis* est devenu l'espèce dominante en chaque station.

Key words: insectivores, rodents, live trapping, population dynamics, impact of timber exploitation.

During the summer of 2003, a study co-ordinated by ICAS (Institute of Forestry Research and) Simeria, regarding the diversity of some plant and animal groups from Râu Şes forest area was carried out. The study aimed to compare the biodiversity of different types of forests (virgin, quasi-virgin, natural, plantation), based on data regarding several taxonomic groups (herbaceous plants and trees, amphibians, reptiles, birds and mammals). Unfortunately, the reality in the field was completely different from what it was expected. For instance, some of the forest parcels that were supposed to be virgin were already exploited or in course of exploitation. That is why the aims of the mentioned study were only in part fulfilled, but other interesting data, regarding the communities structure and its variations in time (as in 2004 some of the habitats were investigated again) and space were obtained.

MATERIAL AND METHODS

Râu Şes is formed of the confluence of three rivulets (Zana, Morii and Morarului) that spring from Godeanu Mts, separating them from Țarcu. It collects several rivulets from both slopes and flows into Gura Apelor dam lake. Its river basin is covered almost entirely by forests up to the subalpine limit.

In 2003 ten investigation stations (Fig. 1) were established in several types of forest from different altitudes, from the lakeshore to the upper limit forest. In some stations two habitats were surveyed. A short description of the habitats is given below, the stations being presented in the increasing order of altitude.

Station I. Above the lakeshore, at the confluence of Lăpușnicu Mare and Lăpușnicu Mic rivers. *a.* Young spruce plantation (about 20 years) on the lakeshore, with high herbaceous layer, dominated by *Deschampsia caespitosa*. *b.* Uneven aged mixed forest with patches of rich shrub layer and poor herbaceous layer.

Station II. Uneven aged mixed forest in Godeanu Mts dominated by *Fagus sylvatica*, very poor herbaceous layer and no shrub layer. In the neighbourhood there have been recent exploitations, a great amount of timber being extracted.

Station III. Downstream the confluence of Râu Șes with Corciova rivulet. *a.* Uneven aged mixed forest below the road, dominated by beech, rare trees but with rich canopy, poor herbaceous layer, with *Oxalis acetosella* and *Asperula odorata*, steep slope, thick leafmold. *b.* Uneven aged mixed forest above the road, recently exploited, with *Rubus idaeus* shrubs and poor herbaceous layer formed of *Oxalis* and *Asperula*.

Station IV. Uneven aged mixed forest, probably virgin until a short period before the survey, but exploited at the moment of investigations, being extracted only conifers. Very rich herbaceous layer, up to 0.5-1 m, formed of *Adenostyles alliariae*, *Senecio nemorensis*, *Athyrium filix-femina*, with many *Lilium martagon* specimens. Steep slope, thin soil stratum, carried away by timber extraction.

Station V. Uneven aged mixed forest, relatively rare, which was supposed to be virgin but has been already exploited one year ago. The herbaceous layer unevenly distributed, entirely absent on the timber extraction paths, formed mostly of *Calamagrostis arundinacea* and *Hieracium* sp.

Station VI. Confluence of Metania rivulet with Râu Șes. *a.* Uneven aged mixed forest in Țarcu Mts., once exploited, with many young trees and dead trunks, steep slopes. *b.* Undisturbed uneven aged mixed forest in Godeanu Mts, steep slope, rocks and dead trunks and large *Athyrium filix-femina* shrubs.

Station VII. Undisturbed middle-aged spruce forest (probably plantation), *Sorbus aucuparia* trees and *Vaccinium myrtillus* shrubs, with many dead trunks and no high shrub layer.

Station VIII. *a.* Undisturbed even aged spruce forest in Țarcu Mts, steep slope, many dead trunks and almost compact moss layer. *Athyrium* and *Calamagrostis* in the herbaceous layer and isolated specimens of *Sorbus aucuparia* and *Acer pseudoplatanus* in the tree layer. The shrub layer formed exclusively of young trees. *b.* Spruce forest in Godeanu Mts with rich shrub layer formed of *Spirea ulmifolia*, *Rubus idaeus* and *Lonicera nigra*.

Station IX. Corciova rivulet. *a.* Undisturbed spruce upper limit forest. Rare *Picea abies* old trees, many dead trunks and seedlings. The herbaceous layer rich and high, formed of *Dactylis caespitosa*, and *Juniperus communis* shrubs towards the subalpine meadow and uneven in rest, formed of patches with *Athyrium* and *Calamagrostis*, and areas with no herbaceous plants or few *Oxalis acetosella*. *b.* Spruce forest patch along a temporary rivulet, on a steep slope.

Station X. Undisturbed spruce upper limit forest on Metania Brook bank, with rare old trees, many young trees and shrubs of *Juniperus communis* and *Vaccinium myrtillus* towards the subalpine meadow limit. Downwards poor herbaceous layer and steep slope.

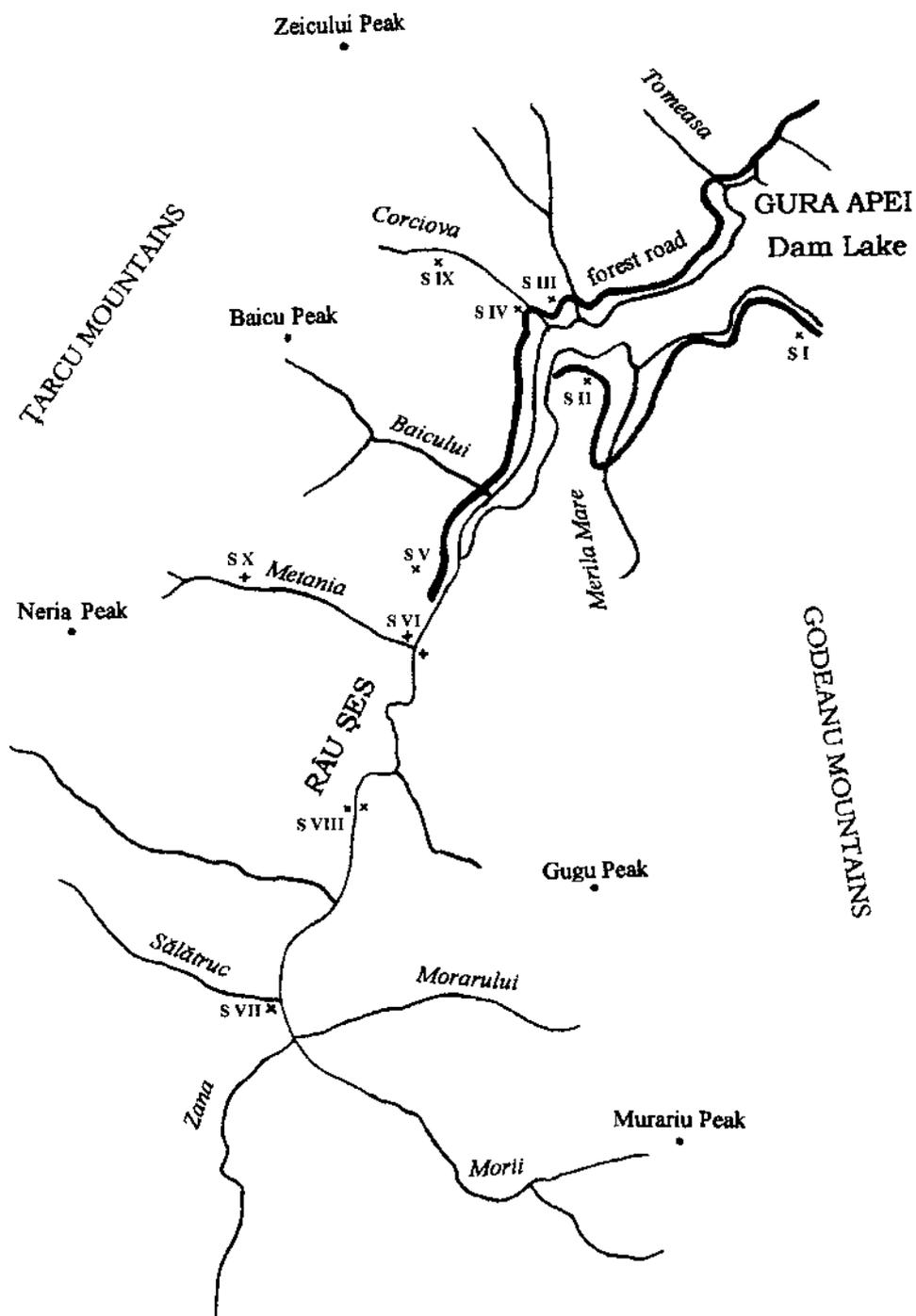


Fig. 1 – The survey stations in Râu Şes River basin.

In 2004, some of these stations, namely III b, IV, IX a and IX b, were researched again in order to gain information regarding the small mammals' community dynamics.

The field investigations were carried out between 26th of June - 2nd of July and 5 - 25th of August 2003 and 3 - 6th of September 2004. Small mammals were captured using baited box live-traps (80 in June 2003, 50 in August 2003 and 40 in September 2004), placed at 10 m intervals, checked twice every night. Captured animals were identified, measured, marked and released.

In order to standardise the data, we calculated a capture index, according to the formula: $Ic_i = (n_i / c * n - c_n) * 100$

where: Ic_i - capture index for species i ; n_i - number of captured individuals belonging to species i ; c - number of traps; n - number of nights; c_n - mean number per night of not functional traps.

RESULTS AND DISCUSSION

During the field investigations in Râu Şes River basin, 70 small mammals were captured. Five species were identified, two insectivores and three rodents. Other two species were observed in the studied area. Among these, six were identified during the research in 2003, while in 2004 only three were found, probably because of the much shorter investigation period.

Order Insectivora Family Soricidae

1. *Sorex araneus* Linnaeus, 1758 - frequently captured in 2003 and 2004, in all types of forests, sometimes in a relatively high number.

2. *Sorex alpinus* Schintz, 1837 - is a rare species, inhabiting humid and shadowed compact forests up to 1500 m altitude (Murariu, 2000). Although only seldom mentioned from Romania, the species is more widely distributed than it was quoted, but in most years it has very low densities, being captured only accidentally. In some periods, the abundance of this species increases and it becomes a constant presence among the captured species, although never reaching high values. Two specimens were captured at the confluence of Metania with Râu Şes, on both slopes.

Family Talpidae

3. *Talpa europaea* Linnaeus, 1758 - one specimen was observed in station V, in the mixed forest, and another was found dead in a young spruce plantation clearing from Godeanu, above the Gura Apei Lake. Besides, many molehills were noticed both in the forest and above its limits, in the subalpine pasture.

Order Rodentia Family Arvicolidae (Microtidae)

4. *Clethrionomys glareolus* Schreber, 1780 - dominant species in 2003, was found at different altitudes.

5. *Chionomys nivalis* (Martins, 1842) - one individual was observed above the forest upper limit, next to the Baciú Brook.

Family Muridae

6. *Apodemus flavicollis* (Melchior, 1834) – dominant species in 2004 in every investigated station (14 specimens captured); it was not found the previous year in any of the researched habitats.

Family Gliridae

7. *Muscardinus avellanarius* (Linnaeus, 1758) - 5 individuals (two young) were captured in 2003, both in mixed and spruce forests, with or without shrub layer, but only in Țarcu Mts, always together with *C. glareolus*. Not found again in 2004.

The quantitative data for the habitats investigated in 2003, expressed by the capture index, are presented in table 1. In the missing habitats no small mammals were found.

Table 1

The values of the capture index in the investigated habitats from Râu Şes River basin, in the year 2003 (the habitat codes are explained in the text).

| Vegetation level Station Species | Mixed forest | | | | | | | Spruce forest | | | Upper limit spruce forest | | F |
|--|--------------|------|------|-------|------|------|------|---------------|--------|--------|------------------------------|------|------|
| | I a | I b | II | III a | V | VI a | VI b | VII | VIII a | VIII b | IX a | X | |
| <i>S. araneus</i> | 2.77 | 1.85 | 1.04 | 2.08 | - | 3.57 | 2.70 | - | 3.33 | 10.52 | 2.85 | - | 0.60 |
| <i>S. alpinus</i> | - | - | - | - | - | 1.19 | 2.70 | - | - | - | - | - | 0.13 |
| <i>C. glareolus</i> | - | 1.85 | - | 4.16 | 1.34 | 3.57 | 8.10 | 2.66 | 8.33 | - | 2.85 | 1.07 | 0.60 |
| <i>M. avellanarius</i> | - | - | - | - | 0.89 | 1.19 | - | 1.33 | - | - | - | 1.07 | 0.26 |
| Total | 2.77 | 3.70 | 1.04 | 6.24 | 2.23 | 9.52 | 13.5 | 4 | 11.66 | 10.52 | 5.70 | 2.14 | |

The total capture index values recorded in 2003 in Râu Şes River basin are very low compared with the results of other studies (Benedek et al., 2002; Benedek & Sike, 2003 - 2004), suggesting a decline of the rodent populations during that year. No significant numerical decrease of the community can be observed at higher altitudes, as it is mentioned in the literature (Simionescu, 1968). This might be due to the fact that at lower altitudes the investigated habitats were more or less disturbed, whereas at higher altitudes the research stations were placed in relatively undisturbed areas. Thus, in three habitats (station IV, habitats III b and IX b) no small mammal was captured and the lowest capture index value (1.04) was recorded in station II.

Although only 22 individuals were captured with an effort of 1,100 trap-nights (capture index value = 2), *C. glareolus* was the dominant species of the small mammal community in 2003, reaching 52% of the total number of captured animals (Fig. 2), present in 9 of the 15 investigated habitats (F = 0.6).

During the research period relative abundance of young animals in the *C. glareolus* population was high (41%), although adults were dominant (Fig. 3). Among the 13 adult specimens that were captured, 10 were females, 9 being pregnant or lactating. This high percent of reproductive animals is probably due to the low density of the population and suggests its trend of numerical recovery.

The other species present a relatively high abundance, compared with data from literature (Simionescu, 1968; Benedek et al., 2002; Benedek & Sike, 2003-2004) or from the authors' field investigations in the previous years. Although with

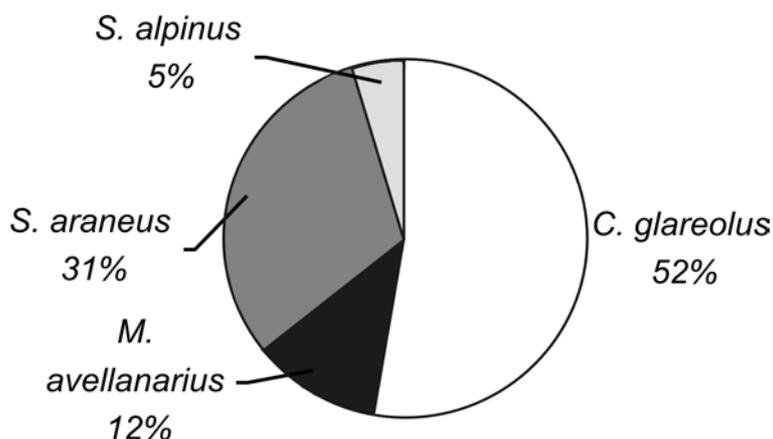


Fig. 2 – Structure of the small mammal community from Râu Șes river basin in 2003.

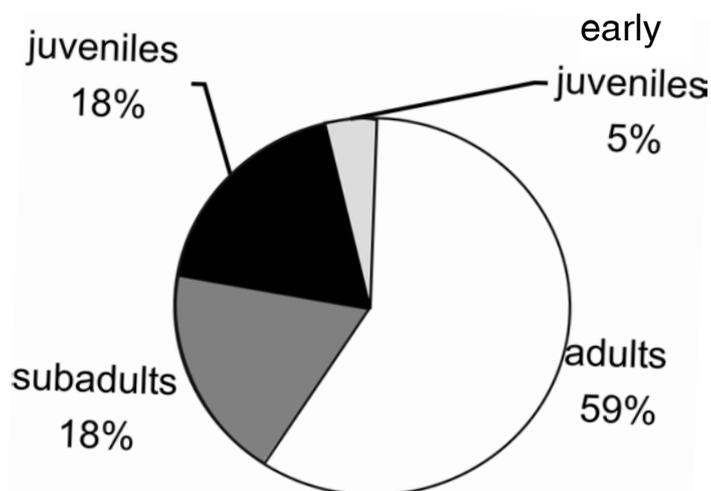


Fig. 3 – Age structure of *C. glareolus* population during the research period in 2003.

a smaller number of captured individuals (relative abundance = 31%), *S. araneus* recorded the same frequency (0.6) as *C. glareolus*, being in some habitats the single captured species, with a very high capture index (10.52 in habitat VII b) for this species. *M. avellanarius* was captured in four stations ($F = 0.26$), even in less characteristic habitats, like the spruce forest with no shrub layer.

Of special interest was the absence in 2003 of *A. flavicollis*, a typical forest species, usually dominant in the mountain habitats (*idem*). Based on the forest workers' statements we can assert that during the year 2002 this species recorded a very high density, the same situation being observed by the authors also in the neighbouring Retezatul Mic massif. However, the population decline in 2003 was not restricted to Râu Șes River basin, having a wider extent, the species disappearing from mountain areas higher than 1,000 m, locally even lower (in Retezat Mountains

the species was captured on Buta and Pietrele valleys in the lowest station, placed at 900 and 1000 m altitude, while at Gura Zlata, 750 m, no *A. flavicollis* specimen was found).

In 2004, the small mammal community structure recorded an important change. *A. flavicollis*, completely absent in 2003, became the dominant species, representing half of the captured animals (Fig. 4). Regarding the variations in the species' densities illustrated by the capture index (Fig. 5), *S. araneus* and *C. glareolus* also recorded an increase, in spite of their diminished relative abundance. It appears that *A. flavicollis* presents the broadest ranges in the population dynamics. The variations from year to year in population density in case of *C. glareolus* are much lower, while for *S. araneus* only slight differences were observed in this period. It is possible that in the next years, at further increases of terrestrial rodents' densities, the abundance of the last species to decrease, reaching the values recorded in other areas before 2003 (idem).

In habitats disturbed during 2003 by timber exploitation (III b and IV), where no small mammal was captured, in 2004, besides *A. flavicollis*, *C. glareolus* and *S. araneus* were present, while in areas where no habitat changes occurred (IX b), only *A. flavicollis* was captured in 2004. This means that the low abundance recorded in 2003 was due both to the absence of *A. flavicollis* and the numerical decrease in other rodent populations (especially *C. glareolus*) and to the habitat disturbance. Timber exploitation causes a drastic reduction of the small mammal populations

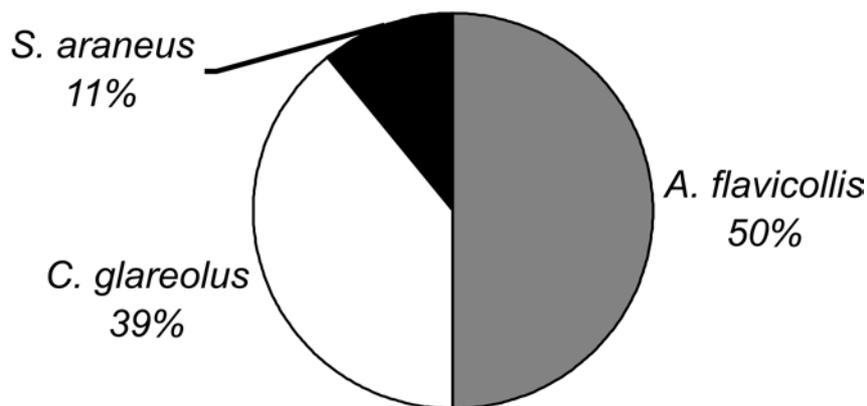


Fig. 4 – The structure of the small mammal community from Râu Șes River basin in 2004.

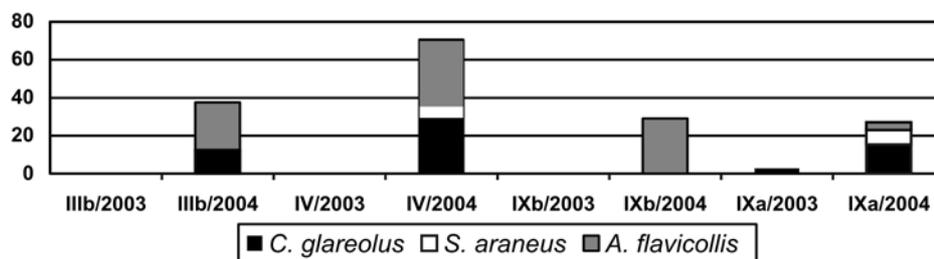


Fig. 5 – Variation of the capture index in four habitats in the years 2003 and 2004.

from the disturbed area, to the point when no animal is captured during a two or three nights trapping session (habitats III b and IV). The neighbouring habitats appear also to be affected, as in case of the mixed forest from Godeanu Mts (station II), where only one *S. araneus* individual was captured during two nights. The absence of *C. glareolus* from disturbed habitats suggests that this species is very sensitive to human pressure, this fact being observed also during other studies (Benedek & Sike, 2003-2004).

However, if the habitat changes are not significant, timber exploitation has a relatively short time impact on the small mammals, as the next year the community structure resembles that of the undisturbed areas.

Conclusions

During the investigations carried out in 2003 and 2004 in the forested area of Râu Şes River basin, 7 species of small mammals were identified, three insectivores (*Sorex araneus*, *S. alpinus* and *Talpa europaea*) and four rodents (*Clethrionomys glareolus*, *Chionomys nivalis*, *Apodemus flavicollis* and *Muscardinus avellanarius*). In 2003, the small mammal community recorded a very low abundance and in several habitats no specimen was captured, some of them being disturbed by the timber exploitation. The community was dominated by *C. glareolus*. *S. araneus* also reached a high relative abundance, being found in several habitats, sometimes as the single species. In 2004, the capture index values for all communities increased, in every investigated habitat being higher than 20. Although the densities of *C. glareolus* and *S. araneus* recorded higher values than the previous year, the community dominance was taken over by *A. flavicollis*, which was absent in 2003. Thus, it seems that the highest numerical variations from year to year are recorded for *A. flavicollis*. The low values of the community densities can be caused either by the decrease of rodent populations or by the habitat disturbance. In 2003, timber exploitation caused the absence or the very low density of small mammals in several investigated habitats.

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DATE PRIVIND COMUNITĂȚILE TERESTRE DE MAMIFERE MICI (MAMMALIA: INSECTIVORA, RODENTIA) DIN BAZINUL RÂULUI ŞES (MUNȚII ȚARCU ȘI GODEANU, ROMÂNIA)

REZUMAT

Investigațiile din bazinul Râului Şes întreprinse în anul 2003 au surprins comunitățile de rozătoare într-o perioadă de declin, înregistrându-se valori totale foarte scăzute ale indicelui de captură, absența totală a speciei *Apodemus flavicollis* și densitatea scăzută a populației de *Clethrionomys glareolus*. În cazul acestei specii s-a observat însă o pondere foarte ridicată a femelelor reproductive, care sugerează o tendință de refacere numerică a populației. S-a remarcat și o abundență relativă ridicată a speciilor *Sorex araneus* și *Muscardinus avellanarius*, precum și prezența unei specii rare, *Sorex alpinus*. Absența sau densitatea foarte scăzută a mamiferelor mici în unele habitate s-a datorat însă și perturbării acestora de către exploatarea forestieră, mai sensibilă dovedindu-se specia *C. glareolus*. În 2004 comunitatea de mamifere mici a înregistrat o modificare importantă, atât în sensul creșterii abundenței totale și a populării tuturor habitatelor investigate, cât și a apariției speciei *A. flavicollis*, devenită dominantă în toate stațiile.

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