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SMALL MAMMALS (ORD. INSECTIVORA AND ORD. RODENTIA) COMMUNITY'S SEASONAL DYNAMICS IN CEFA NATURE PARK (CRIȘANA, ROMANIA)

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Abstract. Up to present, 16 species of small mammals are known from Cefa Nature Park. *Spermophilus citellus*, cited from the area in 1956, is probably extinct. The results of 9 trapping sessions carried out between 2005 and 2008 revealed the clear prevalence of *Apodemus agrarius*, a hygrophilous species which finds suitable conditions in the habitats from the vicinity of Cefa Fish Farm, without showing any preference. The dynamics of *A. agrarius* population and of the whole small mammals community is characterized by low densities at the beginning of summer (suggesting a late breeding season), followed by a sudden increase, recording maximum abundances in autumn. In winter mortality rates appear to be low, as densities remain high also in the cold season.

Résumé. Jusqu'à présent 16 espèces de petits mammifères sont connues du Parc Naturel Cefa. *Spermophilus citellus*, cité de la région en 1956, y est probablement disparu. Les résultats des 9 campagnes de terrain, déroulées entre 2005 et 2008, ont relevé la dominance nette d'*Apodemus agrarius*, une espèce hygrophile qui trouve des conditions favorables dans les habitats de la région, sans montrer une préférence pour l'un d'eux. La dynamique de la population d'*A. agrarius* ainsi que celle de l'entière communauté est caractérisée par une densité réduite au début de l'été (montrant une période tardive de reproduction), suivie par un fort accroissement, avec des densités maximales en automne. Les rates de mortalité hyémales semblent être réduites, car les abondances restent hautes aussi pendant la saison froide.

Key words: insectivores, rodents, live trapping, community structure and dynamics, habitat selection.

INTRODUCTION

In the literature, there is only one species of small mammals mentioned from Cefa area, namely *Spermophilus citellus* (Linnaeus, 1758), cited by R. Călinescu, in 1956. As the species was not seen again in the last 10 years and we did not find any evidence of its presence in the field, we consider *S. citellus* as an extinct species in the area.

In September 2005, the authors initiated a study on small mammals' communities from the future natural park Cefa-Rădvani Forest, aiming mainly at the monitoring of its seasonal dynamics. The study was carried out in the frame of the Phare 2003 „Romanian-Hungarian Corridor for Biodiversity Conservation” program, coordinated by the Apuseni Mountains Nature Park Administration, Oradea Forestry Directorate. After the end of the program (in 2006), the research was continued by volunteering. Some preliminary data from this research were previously published (Benedek & Sîrbu, 2005).

MATERIALS AND METHOD

Study area. Cefa Nature Park is situated in Crișul Repede River Basin. Its territory is crossed from North to South by Criș Channel, which gathers the water excess through the smaller canals that drain the area. The park is characterized by high habitats diversity and their patchy distribution, as well as by their high degree

of ecological integrity. Thus, in a small area various habitats are found: marshy areas, fish ponds, canals of different sizes, ditches, pools (permanent and temporary) with or without vegetation, salt marshes, pastures, wet hayfields, cultivated lands and forest. The habitat heterogeneity of the area allows the survival of a wide variety of species belonging to different systematic and ecological groups, and is reflected also in the small mammals' community structure.

The traps were set in the vicinity of Cefa Forest Range. Six habitats were investigated: Rădvani Forest, dominated by *Quercus robur*, *Q. cerris*, *Fraxinus excelsior*, with a compact shrub layer composed mainly of *Crataegus monogyna* and *Prunus spinosa* and a rich high herbaceous layer; the forest edge; the bank of channel bordering the fish farm; the meadow between the forest and the canal; the shrubs from this area; and the dam between one fish pond and the canal (this habitat only in the last two campaigns).

During the spring campaigns in February 2006 and 2007, due to the sudden early snow melting, the investigated area was excessively wet, large surfaces (especially in the meadow and less in the forest) were covered by water, up to 20 cm deep. In June 2006 a line of traps was set in the pasture beyond the fish farm, towards the border. The pasture is a mosaic of microhabitats, consisting of patches of typical salt vegetation, with *Artemisia maritima* and *Limonium gmelini*, alternating with micro depressions with *Juncus* species and higher zones with mesoxerophyllous plant communities. The vegetation is short, being grazed by sheep herds. In spite of the high number of traps that were used, no animal was captured here.

Up to present 9 seasonal campaigns were carried out in Cefa Nature Park, in September 2005, February, June and September 2006, February and June 2007, February, June and October 2008. Small mammals were captured using baited live-traps (Polish and Fitch traps), during four nights in each trip, checked twice every night and once during the day. Captured animals were identified, measured, marked by fur clipping and released. In order to standardize the data, we used the capture index previously described (Benedek, 2006).

RESULTS AND DISCUSSION

During the field campaigns a total number of 240 individuals were captured, belonging to eight species, three insectivores and five rodents. For other eight species there is evidence of their presence in the area. The systematic list of these species according to Murariu (2000) and Popescu & Murariu (2001) is presented below:

Ordo Insectivora Bowdich, 1821

Fam. Erinaceidae Bonaparte, 1838

1. *Erinaceus concolor* Martin, 1838 – A specimen was observed one night in September 2006, on the pasture next to the border.

Fam. Soricidae Gray, 1821

2. *Sorex araneus* Linnaeus, 1758 – the most common shrew species in other areas, was found in low numbers only in some periods, especially at the forest edge.

3. *Crocidura leucodon* (Hermann, 1780) – was found in several campaigns, in different habitats, having the highest abundance among insectivores in the park.

4. *Crocidura suaveolens* (Pallas, 1811) – was encountered only in the first trapping session, being captured two specimens, suggesting its low abundance in the area.

Fam. Talpidae Gray, 1825

5. *Talpa europaea* Linnaeus, 1758 – is a very wide spread and abundant insectivore in the park, its presence being indicated by the fresh mole hills, very numerous both in open areas and at the forest skirt, especially on canal banks.

Ordo Rodentia Gray, 1821

Fam. Arvicolidae (Microtidae) Gray, 1821

6. *Arvicola terrestris* (Linnaeus, 1758) – was spotted on the lake shore near the forest range, feeding on fish food.

7. *Microtus arvalis* (Pallas, 1778) – was captured in low numbers only during the first and the last two campaigns, when it was found on the dam, but its abundance in the area is higher than it appears from the captures, as it is revealed by the *Asio otus* (Linnaeus, 1758) pellets' analysis. However, compared to other areas, its presence in the pellets is less numerous, suggesting that Cefa region does not have optimal conditions for this species, due to the high humidity, which favours the outnumbering *Apodemus agrarius*.

8. *Ondatra zibethicus* (Linnaeus, 1766) – finds suitable conditions in the fishponds from the park, being frequently seen on the lake surface.

Fam. Muridae Gray, 1821

9. *Micromys minutus* (Pallas 1771) – inhabits the reed beds bordering the fishponds and the canals. Although it was not captured in the traps, *M. minutus* appears to be rather abundant in the area, a high number of specimens being identified in the pellets of *Asio otus* collected from the vicinity of the forest range. Some nests belonging to this species were found on the dam where the traps were placed.

10. *Apodemus agrarius* (Pallas, 1771) – is the dominant species in the area, favoured by the high humidity determined by the lakes and canals. It was found in most habitats, during all the campaigns, except for June 2008. Its density presents high variations, especially seasonal but also multiannual.

11. *Apodemus flavicollis* (Melchior, 1834) – although typical for forested areas, it is a constant presence in the investigated area, being encountered in every campaign, in the forest but also in neighbouring habitats.

12. *Apodemus sylvaticus* (Linnaeus, 1758) – appears to have a variable density, being encountered only in some years (2006 – February and 2008). It avoids the forest.

13. *Mus musculus* Linnaeus, 1758 – was captured in the forest range's stable but also on the canal bank in its very vicinity.

14. *Mus spicilegus* Petényi, 1882 – is a certain presence in the area, confirmed by the characteristic piles of soil and vegetation built by this species. According to Mr. Lăzurean, the local forester, these piles are found in the cultivated terrains outside the village.

15. *Rattus norvegicus* (Berkenhout, 1769) – was observed on the lake shore next to the forest range, feeding on fish food. The lake shores represent an ideal habitat for the brown rat, with abundant food, both natural and artificial, sheltering a numerous population. This fact was confirmed by the fish farm workers.

Fam. Myoxidae (Gliridae) Gray, 1821

16. *Muscardinus avellanarius* (Linnaeus, 1758) – according to Mr. Lăzurean the species inhabits Rădvani Forest, but its abundance is low. No specimen was captured during the study.

The quantitative data for the nine field campaigns are presented in table 1.

Table 1

Small mammals captured at Cefa in the nine field campaigns.

Campaign Species	Sept. 2005	Feb. 2006	June 2006	Sept. 2006	Feb. 2007	June 2007	Feb. 2008	June 2008	Oct. 2008	Total
<i>A. flavicollis</i>	1	5	3	16	2	1	1	1	9	39
<i>S. araneus</i>	1	0	0	3	0	0	1	2	0	7
<i>A. agrarius</i>	17	14	8	40	32	7	1	0	33	152
<i>A. sylvaticus</i>	0	3	0	0	0	0	3	3	9	18
<i>C. suaveolens</i>	2	0	0	0	0	0	0	0	0	2
<i>M. arvalis</i>	1	0	0	0	0	0	0	4	2	7
<i>C. leucodon</i>	4	5	0	2	0	0	0	0	0	11
<i>M. musculus</i>	1	0	0	2	0	0	0	0	1	4
Total	27	27	11	63	34	8	6	10	54	240

Considering the small mammals community based on the captures in the Cefa Fish Farm – Rădvani Forest area during the entire study, *A. agrarius* is clearly dominant, representing 63.33% of the captured specimens. This hygrophylous species finds suitable conditions in the vicinity of Cefa Fish Farm, which confers to the neighbouring habitats a high humidity during all the year. Rădvani Forest has a slighter influence on the small mammals' community structure compared to the lakes and canals. Thus, *A. flavicollis*, the species typical for the forest, represents 16.25% from the captured animals. However, compared to *A. sylvaticus*, its sibling species characteristic for open habitats (7.5%), the share of *A. flavicollis* in the community is rather high, indicating the important role played by Rădvani Forest in this part of Miersig Plain.

Insectivores have a low share in the small mammals' community from Cefa. Among them a higher abundance was recorded for *C. leucodon*, representing 4.58% of the captured specimens. It was encountered in several habitats, without showing any preference. It is interesting that, in different campaigns, it was found in different habitats. Thus, in September 2005 the species was encountered only at the forest edge, in February 2006 in the forest and its skirt, and in September 2006 only on the canal bank.

The distribution of *A. agrarius* individuals in the investigated habitats during the 9 field campaigns (Fig. 2) shows no preference of this species for any habitat. This may be due to the short distances between the investigated spots, which allow easy habitat interchanging. Besides, in this area all habitats have a high humidity during most part of the year. The only habitat that *A. agrarius* avoids is Rădvani

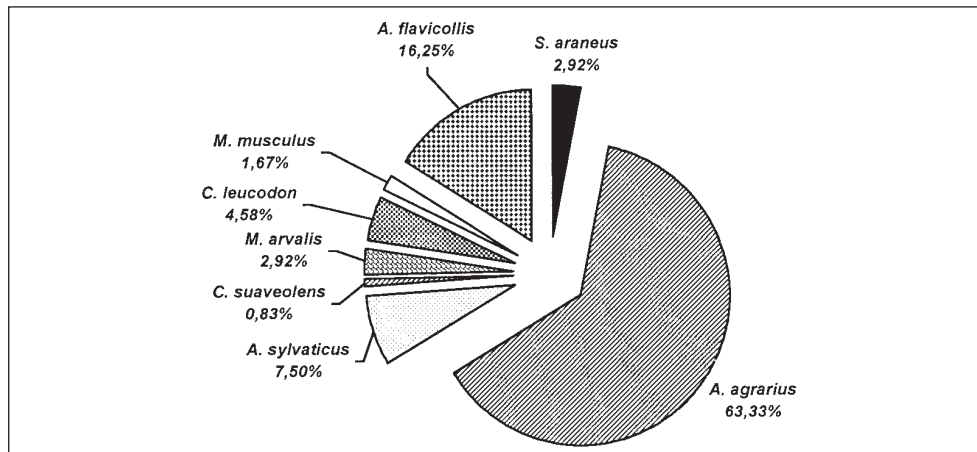


Fig. 1 – Relative abundance of species captured at Cefa during the nine field campaigns.

Forest, where it was found only in February 2006 (together with *C. leucodon*), probably due to the withdrawal of specimens from the flooded open areas.

The lack of habitat preferences in the area is characteristic not only for *A. agrarius*, but for the whole community, thus in the dynamics analysis we will consider the results from all the investigated habitats together.

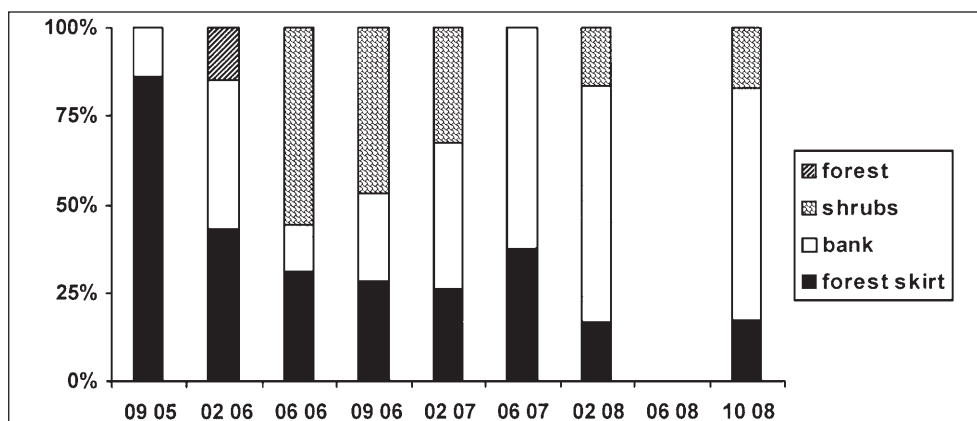


Fig. 2 – Distribution of *A. agrarius* individuals in the investigated habitats during the nine field campaigns.

The number of captured specimens is not correlated with the species' number (Fig. 3). The maximum number of species (7) was captured during the first campaign, in September 2005, when only a relatively few individuals (27) were encountered. The maximum number of specimens (63) was recorded also in September, the next year, when only five species were found. Thus, without being correlated, the minimum number of species (illustrating low population densities within the community) and individuals is recorded at the beginning of summer. Afterwards it suddenly increases and reaches maximum values in autumn. Considering the dynamics of species' number during the research we observe a decrease in the first period, followed by a recovery in 2008.

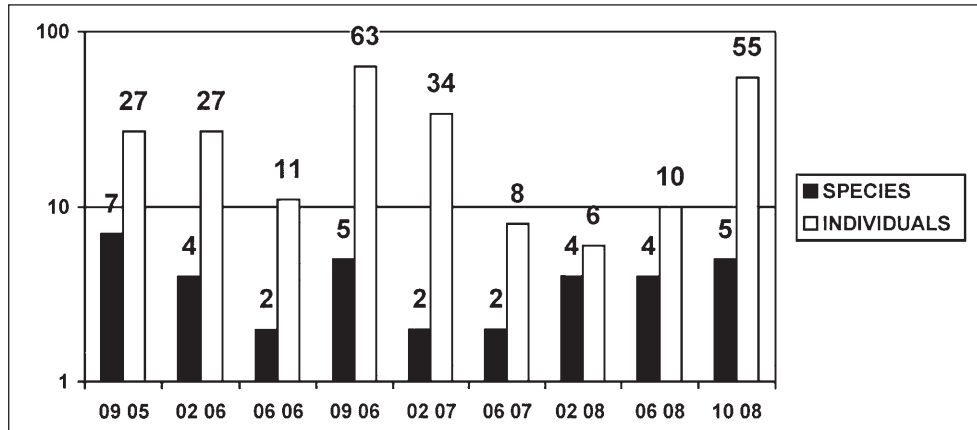


Fig. 3 – Seasonal dynamics of species and specimens' number at Cefa (logarithmic scale).

Seasonal dynamics of small mammals' community from the researched area was analyzed based on the capture index calculated for all habitats (Fig. 4).

Comparing the capture results from February 2006 with those from the previous autumn, the most significant difference is represented by the drop in the species' number. Thus, in September 2005 in the three investigated habitats, seven species (three insectivores – all the captured species - and four rodents) were encountered, while in February 2006 their number decreased to four, the less abundant ones (*S. araneus*, *C. suaveolens*, *M. arvalis*) were not found again, but a new species (*A. sylvaticus*) was captured during this campaign. The dominance is maintained by *A. agrarius*, representing more than half of the captured individuals. The community's abundance recorded a slight increase, the same number of

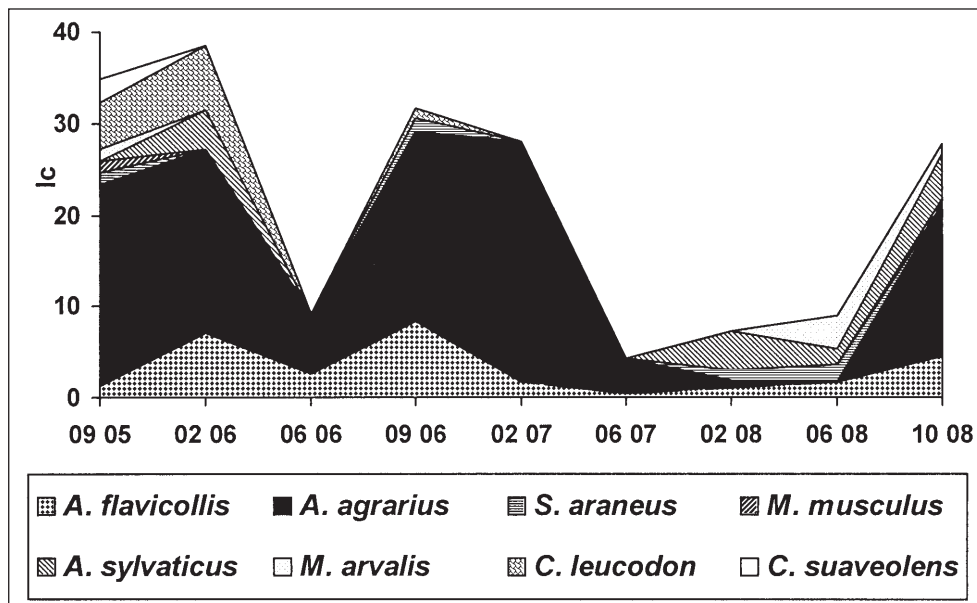


Fig. 4 – Seasonal dynamics of small mammals' communities between 2005 and 2008.

specimens being captured using a lower trapping effort. This increase is due partly to new individuals entered in the population, as in September animals were still breeding, most females being pregnant (in February all rodent populations were dominated by subadults born in autumn) and partly to low winter mortality rate. Considering the species separately there is a difference. Thus, *A. agrarius* recorded a slight decrease in abundance (from $I_c = 21.93$ in September 2005 to $I_c = 20$ in February 2006), while the abundance of *A. flavicollis* increased from $I_c = 2.15$ in September to $I_c = 7.14$ in February. As most of *A. agrarius* females were breeding in September, the decrease of capture index value can be explained by a higher winter mortality rate and by migrations between habitats. Such migrations take place in most species, depending on food and shelter resources (Theiss, 1962; Hamar & Șutova, 1965; Simionescu, 1970; Banaru, 1998). The higher abundance of *A. flavicollis* is due both to a higher winter survival rate and to a new investigated habitat favourable for this species, namely Rădvani Forest, which was not researched in September.

A significant change in the small mammals' community occurred in June 2006 when both the specific diversity and the community's abundance recorded an important decrease. Only the two common *Apodemus* species (*A. agrarius* and *A. flavicollis*) were captured. The low population densities in June suggest a late breeding season in both species.

This annual dynamics pattern is repeated also next year, from September 2006 to June 2007, with slightly lower capture index values and fewer species. Another difference is that unlike February 2006, in February 2007 the abundance was lower than during the previous autumn, due to the significant decrease in *A. flavicollis* population abundance, from $I_c = 8.31$ to $I_c = 1.65$. Although data from autumn 2007 are not available, presumably the numerical recovery of small mammals' community did not occur, so in February 2008 the abundance remained low, its increase being recorded only in October 2008.

A. agrarius, the dominant species, presents a relatively stable multiannual dynamics (except February and June 2008), but a high amplitude seasonal dynamics, with minimum densities at the beginning of summer and maximum in the autumn, remaining high also in the cold season.

Conclusions.

During the nine field campaigns a total number of 240 individuals were captured, belonging to nine species, three insectivores and six rodents. For other eight species (two insectivores and six rodents) there is evidence of their presence in the area. *Spermophilus citellus*, cited from the area in 1956, is in present probably extinct. The small mammals' community is clearly dominated by *Apodemus agrarius*, followed by *Apodemus flavicollis*, the only species with a constant presence in the area. *A. agrarius* is a hygrophilous species which finds suitable conditions in the habitats from the vicinity of Cefa Fish Farm, without showing any preference. The only characteristic habitat is Rădvani Forest, inhabited by *A. flavicollis*, the typical forest species. The other species identified in this habitat (*A. agrarius* and *Crocidura leucodon*) are not permanent inhabitants. They were captured only in February 2006, when their presence in the forest was caused by the flooding of open areas.

Although species and specimens numbers seem not to be correlated, their highest values are recorded in autumn and the lowest at the beginning of summer. During the study we recorded a decrease of species' (but also individuals') number in the first period, followed by a recovery in 2008. *A. agrarius*, the dominant species that imprints the pattern of the whole small mammals community presents a

relatively stable multiannual dynamics (except February and June 2008), but a high amplitude seasonal dynamics, with minimum densities at the beginning of summer (suggesting a late breeding season) and maximum in the autumn, remaining high also in the cold season.

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DINAMICA SEZONIERĂ A COMUNITĂȚII DE MAMIFERE MICI (ORD. INSECTIVORA ȘI ORD. RODENTIA) ÎN PARCUL NATURAL CEFA (CRIȘANA, ROMÂNIA)

REZUMAT

Până în prezent sunt cunoscute din Parcul Natural Cefa 16 specii de mamifere mici. *Spermophilus citellus*, citat din zonă în 1956, este probabil extins. Rezultatele celor nouă campanii de teren întreprinse între 2005 și 2008 au relevat dominanța netă a lui *Apodemus agrarius*, specie higrofilă care găsește condiții favorabile în habitatele din apropierea Pescăriei Cefa, fără a manifesta însă vreo preferință. Dinamica populației de *A. agrarius*, precum și a întregii comunități de mamifere mici este caracterizată prin densități scăzute la începutul verii (indicând o perioadă de reproducere târzie), urmată de o creștere bruscă, înregistrând abundențe maxime toamna. Rata de mortalitate pare a fi scăzută pe perioada iernii, întrucât densitățile se mențin ridicate și în sezonul rece.

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