Fig. 1. Methods of measuring of the mandible (A), radius (B), ulna (C), and humerus (D). For details see "Material and methods".

Acta zoologica cracoviensia, **47**(1-2): 49-59, Kraków, 30 June, 2004

Small mammals of the Wołosate area (Bieszczady National Park, SE Poland)*

Małgorzata TABORSKA

Received: 27 Jan., 2004

Accepted for publication: 8 June, 2004

TABORSKA M. 2004. Small mammals of the Wołosate area (Bieszczady National Park, SE Poland). *Acta zoologica cracoviensia*, **47**(1-2): 49-59.

Abstract. Small mammals were trapped in 12 habitats in 2002 and 2003. In all, 56 individuals of 9 species were caught in 2002, and 751 individuals of 11 species – in 2003. Insectivora communities did not differ statistically significantly in the two consecutive years (trappability index = number of individuals caught/trap-nights number Wo_{2002} = 1.26%; Wo_{2003} = 0.72%; $p<0.01$), whereas the Rodentia community differed significantly (Wo_{2002} = 3.15; Wo_{2003}'03 = 30.88 $p<0.03$). In both years, the most numerous among the animals trapped were *A. flavicollis* and *C. glareolus* among rodents and *S. araneus* among insectivores, dominating in almost all habitats. The least diverse group was that of beech forest and alder wood ecotone (Simpson's dominance index c=0.72 and 0.80 in 2002, and 0.50 and 0.53 in 2003).

Key words: Micromammalia, "land of valleys", Western Bieszczady Mountains.

Department of Animal Ecology, Institute of Environmental Sciences, Jagiellonian University, Gronostajowa 7, 31-070 Kraków, Poland.
E-mail: tabor@eko.uj.edu.pl

I. INTRODUCTION

The area of Wołosate is characterised by a mosaic of habitats, typical to the Bieszczady "land of valleys" (WINNICKI & ZEMANEK 1998). The much fragmented habitats structure corresponds to agricultural-forest habitats found in other parts of Poland but with much limited human pressure, and natural character of the communities in adjacent forests. The occurrence of Micromammalia in such landscape depends much on the nature of habitats but also on the presence of tree clumps among fields which provide corridors for movement of animals (KOZAKIEWICZ 1990; PIŁACIŃSKA 1998; RAJSKA-JURGIEL 1990).

The studies of the micromammalian fauna of the Western Bieszczady Mts have a fairly long record (TATARINOV 1956; BENDJUK 1965; GRODZIŃSKI 1957; GRODZIŃSKI et al. 1966, (BUCHALCZYK & MARKOWSKI 1979; NIESIOŁOWSKI & BARTOSZ 1969 after GÓRECKI et al. 2000). In 1993, mammals were collected in the area of Wołosate along Wołosate-Tarnica transect (SUROWIEC & GÓRECKI 1997). The transect included poloninas, Carpathian beech wood, Carpathian alder wood, beech/alder and beech/meadow ecotones, as well as a meadow in the „land of valleys". During this

*This study was carried out under project No. 318/ PO43/2002/22 financed by the Committee for Scientific Research in 2002-2003.

study, attention was focused particularly on the micromammalian communities in the mosaic-patterned of the Wołosatka stream valley, utilisation of habitats by particular species, species diversity and shifts in domination patterns.

A c k n o w l e d g e m e n t s. I am grateful to management and employee of Bieszczady National Park for many constructive comments and for the assistance.

II. STUDY AREA AND METHODS

The habitat mosaic of the Wołosatka stream valley is formed by former meadows and pastures grown over by common birch *Betula verrucosa* EHRH and grey alder *Alnus incana* (LINNAEUS). Alder wood *Alnetum incanae* LUDI, 1921, occurs along banks of brooks and streams, the woods covering the valley are dominated by beech forest *Dentario glandulosae-Fagetum* MATUSZKIEWICZ, 1964, whereas the slopes of Tarnica mountain are covered by poloninas- subalpine meadows. Certain measures of active protection are implemented in the valley (e.g. periodic cutting of portions of the meadows, cutting down tree and shrub undergrowth as well as extensive pasturing of horses (WINNICKI & ZEMANEK 1998).

In both 2002 and 2003, mammals were trapped from June to October, along a transect cutting across the valley: from the slope of Kiczera Niżna (Kiczera Manzina), through Wołosate settlement, and reaching a slope of Tarnica Mt. (Fig.1). Live-traps with standard bait were used.

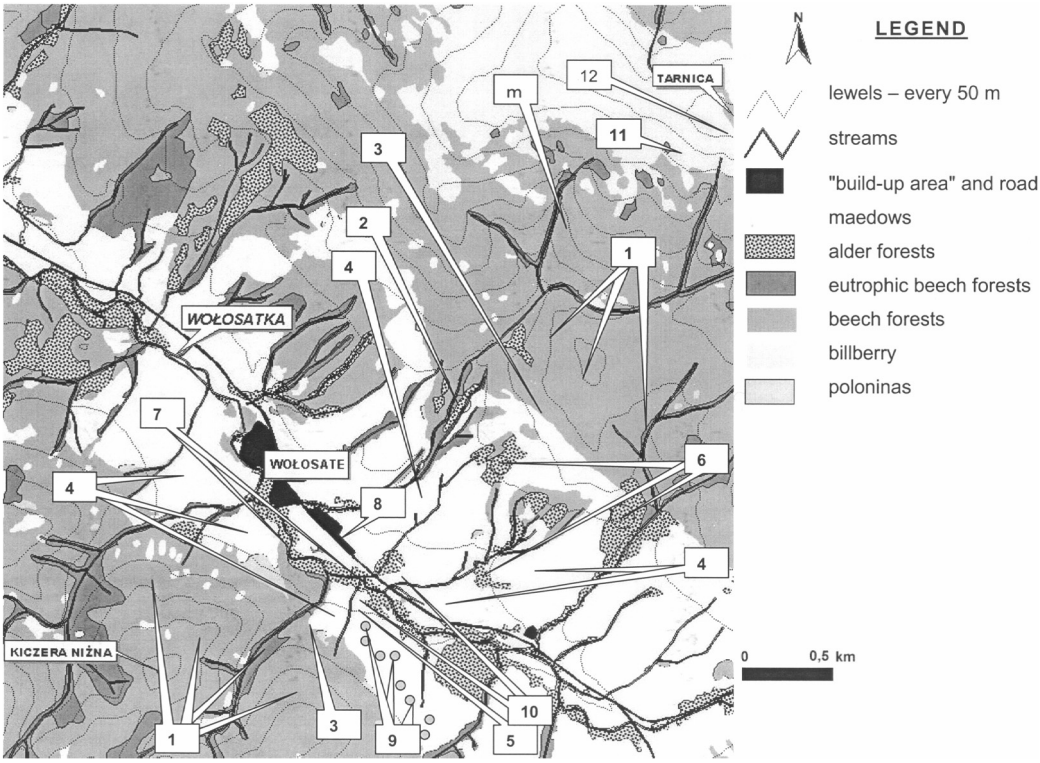

Fig. 1. The neighbourhoods of Wołosate (=22°41'03"E; =49°03'45"N, H=670 m a.s.l.) Habitats (trap plots): 1– beach forests; 2 – beach/alder ecotone; 3 – forest/meadows ecotone; 4 – grasslands; 5 – raspberry; 6 – grey alder community; 7 – alder forests, 8 – "build-up area"; 9 – clumps of birch; 10 – tall herb associations; 11 – poloninas; 12 – willow-alder scrubs; m – larch community.

The trapping was conducted in 12 principal habitats:

1) Beech forest *Dentario glandulosae-Fagetum* MATUSZKIEWICZ, 1964; 2) Beech- alder ecotone; 3) Forest-meadows ecotone with major proportion of hazel *Corylus avellana* LINNAEUS, beech *Fagus silvatica* LINNAEUS, common spruce *Picea abies* (LINNAEUS) and fruit trees; 4) meadows of the *Molinio-Arrenatheretea* R.Tx., 1937 class (meadows: *Cirsiuetum riuvularis* RALSKI, 1931, *Campanulo serratae- Agrostietum capillaris* ass. nova KORZENIAK, 1999, and *Deschampsia caespitosa* community) with patches of billberry *Vaccinium myrtillus* LINNAEUS; 5) raspberry community *Rubus idaeus* LINNAEUS; 6) grey alder community *Alnus incana* (LINNAEUS) MNCH, 1998, on previous farmlands; 7) alder forest *Alnetum incanae* LUDI, 1921; 8)"build-up area"- an area subject to human pressure (buildings, refuse container, old cemetery); 9) clumps of common birch *B. verrucosa*; 10) patches of *Filipendulo-Geraneitum* KOCH,1926, tall herb community and of long-leaved mint community *Mentha longifolia* LINNAEUS. In 2003, the trapping was extended to cover the slope of Tarnica Mt; 11) poloninas – tall-grass *Tanaceto-Calamagrostietum arrundinaceae* with patches of billberry *Vaccinietum myrtilli* SZAFER, 1923; 12) willow-alder scrub *Salici silesiaceae-Alnetum viridis*. In 2002, traps were once used in a larch forest association *Larix decidua* MILL on the slope of Tarnica.

In order to compare data obtained in different habitats and years, the number of animals caught were expressed in the form of trappability index **Wo** (number of individuals/trap-nights number)×100% (AULAK 1970). The domination structure was determined (percentages of the total number of animals caught, Simpson's Dominance Index $\mathbf{c} = \sum p_i^2$ where: p_i – number of individuals of i-th species/total number of individuals caught in a given habitat), habitats preferences (**Ww** – Habitats Preference Index = Wo of a species in a given habitat/sum of Wo of the species in all habitats)×100% (AULAK 1970)) as well as indices of species diversity for particular habitats (Simpson index **D** and Shannon-Wiener index **H** (WEINER 1999). Both D and H were calculated because Simpson index gives more weight to common species whereas Shannon-Wiener index to the species represented in small numbers of trappings.

III. RESULTS

In 2002, a total of 56 individuals of 9 species were caught (6 species of rodents and 3 species of insectivores) while in 2003 – 751 individuals of 11 species (7 species of rodents, 3 species of insectivores and 1 carnivore species) (Table I). Compared with the year 2003, the number of rodents in 2002 was dramatically low, $Wo_{2002} = 3.15\%$, $Wo_{2003} = 30.88\%$), thence the results of trapping in 2002 was made subject to a detailed analysis. In these two years, insectivores did not show statistically significant differences in numbers (Table II). The trappability index for them was 1.26% in 2002 and 0.72% in 2003. The analysis of habitat preferences (Fig. 2) pertains to rodent community in 2003. The species diversity (coefficients H and D) and Simpson's domination indices (λ) were calculated jointly for Micromammalia (Table II).

Yellow-necked mouse *Apodemus flavicollis* MELCHIOR, 1834, and bank vole *Clethrionomys glareolus* (SCHREBER, 1780) were the most numerous in trappings in both years (Table I) and occurred in almost all habitats (Fig. 2). In most of the habitats they were either dominating or co-dominating species (Fig. 3). In 2003, there was an invasion by striped field mouse *Apodemus agrarius* PALLAS, 1771, a species not found in 2002 (Table I). This species was most numerous in the habitats of the central part of the valley (Fig. 1) in alder woods (Ww=50%, where it was a dominant species in 2003, raspberry community, tall-herb community and near settlements (combined Ww = 72%, Fig. 2 and 3). The proportions of these two species of voles: field vole *Microtus agrestis* (LINNAEUS, 1761) and common vole *Microtus arvalis* (PALLAS, 1779), in overall trapping were low, as was the proportion of European pine vole *Pitymys subterraneus* (SÉLYS-LONGCHAMPS 1836) (Table I). In autumn of 2002 one individual of wood mouse *Apodemus sylvaticus* (LINNAEUS, 1758) was caught in beech-alder ecotone, and in September 2003, fat dormouse *Glis glis* LINNAEUS,

Table I

Number of small mammals caught in the habitats of Wołosatka valley in 2002 and 2003. pn- trap-nights number

Habitat	Year	pn	*A.flavicolis*	*A. agrarius*	*A. silvaticus*	*C. glareolus*	*M. agrestis*	*M. arvalis*	*P. subterraneus*	*G. glis*	Rodentia	*S. araneus*	*S. minutus*	*S. alpinus*	Insectivora	*Mustela nivalis*
beech forest	2002	304	3	0	0	15	0	0	0	0	18	1	0	0	1	0
	2003	650	99	0	0	127	0	0	0	1	226	1	0	0	1	0
beech/alder ecotone	2002	60	8	0	1	0	0	0	0	0	9	1	0	1	2	0
	2003	80	8	0	0	13	0	0	0	0	21	0	0	0	0	0
forest/meadow ecotone	2002	200	0	0	0	2	2	0	0	0	4	6	1	0	7	0
	2003	220	34	7	0	47	5	0	0	0	93	2	3	0	5	0
meadow	2002	240	0	0	0	0	0	1	0	0	1	0	0	0	0	0
	2003	396	11	4	0	9	4	4	0	0	32	0	0	1	1	1
raspberry	2002	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
	2003	72	12	12	0	4	4	1	2	0	35	1	0	0	1	0
grey alder	2002	40	0	0	0	0	1	0	0	0	1	1	0	0	1	0
	2003	224	17	10	0	16	1	5	1	0	50	1	1	0	2	0
alder forest	2002	144	0	0	0	1	0	0	3	0	4	4	0	1	5	0
	2003	140	31	47	0	29	1	3	9	0	120	1	0	1	2	5
build-up area	2002	16	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	2003	176	1	24	0	18	0	1	0	0	44	1	0	0	1	0
birch woodlots	2002	224	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	2003	60	2	0	0	0	2	0	0	0	4	1	0	0	1	0
tall herb	2002	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
	2003	176	27	24	0	3	8	0	2	0	64	1	0	0	1	0
poloninas	2002	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
	2003	80	6	0	0	6	3	2	1	0	18	2	0	0	2	0
willow-alder	2002	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
	2003	80	4	0	0	5	2	0	0	0	11	0	0	0	0	0
larch forest	2002	40	0	0	0	3	0	0	0	0	3	0	0	0	0	0
	2003	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·
all	2002	1268	11	0	1	21	3	1	3	0	40	13	2	1	16	0
	2003	2354	261	128	0	227	30	16	15	1	678	11	4	2	17	6

1766, was caught in beech forest (Table I). Among Insectivora, the most frequently occurring was common shrew *Sorex araneus* LINNAEUS, 1758, (Table I), present in most of the habitats (Fig. 2). The proportions of other species of shrews: lesser shrew *S. minutus* LINNAEUS, 1766, and alpine shrew *S. alpinus* SCHINZ, 1837, were low and the values of their trappability index in both years were comparable (Table I).

Table II

Comparison of the Rodentia (WoR) and Insectivora (WoI) trappability index, Shannon-Wiener diversity coefficient (H), Simpson diversity coefficient (D) and Simpson domination index (c) in 2002 and 2003

Habitat	Year	WoR	Wo Ri	H	D	c
beech forest	2002	5.92	6.25	0.63	0.35	0.72
	2003	34.77	34.92	0.71	0.5	0.5
beech/alder ecotone	2002	15.00	18.33	0.89	0.45	0.8
	2003	26.25	26.25	0.66	0.47	0.53
forest/meadow ecotone	2002	2.00	5.50	1.17	0.63	0.5
	2003	42.27	44.55	1.25	0.64	0.36
meadows	2002	0.42	0.42	·	·	·
	2003	8.08	8.33	1.59	0.77	0.23
raspberry	2002	·	·	·	·	·
	2003	48.61	50.00	1.58	0.75	0.25
grey alder	2002	2.50	5.00	0.69	0.5	1
	2003	22.32	23.21	1.57	0.75	0.24
alder forest	2002	2.78	6.25	1.21	0.68	0.63
	2003	85.71	87.14	1.46	0.72	0.28
build-up area	2002	0.00	0.00	0	0	0
	2003	30.11	30.68	1.19	0.66	0.34
birch	2002	0.00	0.00	0	0	0
	2003	6.67	8.33	1.05	0.64	0.36
tall herb	2002	·	·	·	·	·
	2003	36.36	36.93	1.3	0.67	0.33
poloninas	2002	·	·	·	·	·
	2003	22.50	25.00	1.62	0.78	0.23
willow-alder	2002	·	·	·	·	·
	2003	13.75	13.75	1.04	0.63	0.37
larch forest	2002	7.50	7.50	0	0	1
	2003	·	·	·	·	·

Micromammalian communities

Beech forest (1) $Wo_{2002} = 6.25\%$, $Wo_{2003} = 34.92\%$

Species: *A. flavicollis*, *C. glareolus*, *G. glis*, *S. araneus*

It is inhabited by little diversified strongly dominated community. In 2002, trappability index was high compared with other habitats (Table II). In both years of study *C. glareolus* was a dominant and *A. flavicollis* – a co-dominant species (Fig. 3).

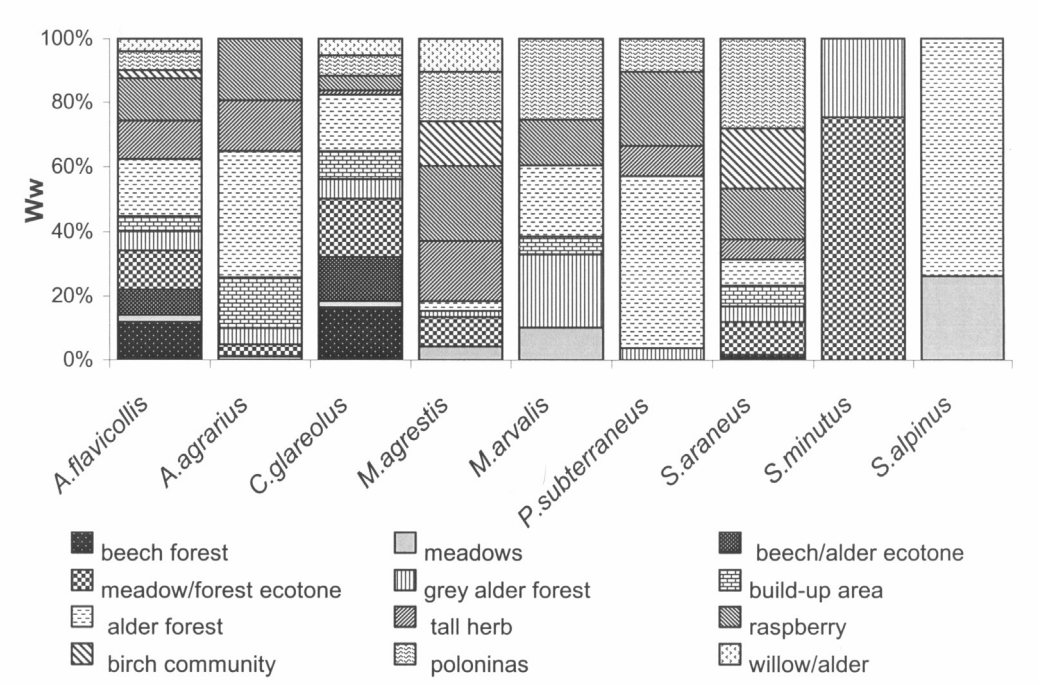

Fig. 2. Habitat preferences of Micromammalia in Bieszczady National Park in 2003.

Beech-alder ecotone (2) Wo_{2002} = 18.33%, Wo_{2003} = 26.25%

Species: *A. flavicollis*, *A. sylvaticus*, *C. glareolus*, *S. araneus*, *S. alpinus*

A community dominated by *A. flavicollis* (particularly in 2002) and *C. glareolus* (dominant species in 2003) (Fig. 3). The values of species diversity indices higher in 2003 than in 2002 resulted from the presence of *Sorex* species among the mammals caught *Sorex* (Table I). In 2002, this habitat had the highest trappability index of all habitats. Wo in 2002 was lower than that of beech forest (Table II).

Forest/meadows ecotone (3)Wo_{2002}= 5.50%, Wo_{2003}=44.55 %

Species: *A. flavicollis*, *A. agrarius*, *C. glareolus*, *M. agrestis*, *S. araneus*, *S. minutus*

High value of trappability index in 2003 was associated with high population numbers of *A. flavicollis* and *C. glareolus* (they were mostly sexually active individuals). *C. glareolu*s was a dominant species in both years (Fig. 3). The higher species diversity of the micromammalian community in 2003 reflected the presence of *A. flavicollis* and *A. agrarius*, absent in 2002. There were 7 individuals of the *Insectivora* order caught in 2002 (Wo=3.5%) and 5 in 2003 (Wo=2.27%) (Table I).

Meadows (4) Wo_{2002} = 0.42 %, Wo_{2003}=8.33%

Species: *A. flavicollis*, *A. agrarius*, *C. glareolus*, *M. agrestis*, *M. arvalis*, *S. alpinus*

The habitats were characterised by low numbers of *Micromammalia* in both years (Table II). In 2002, the only individual caught was a single *M. arvalis* male. The high values of species diversity indices in 2003 resulted from similarity in number of rodent species (Table I). These habitats are open, nevertheless *A. flavicollis* and *C. glareolus* were dominant species (Fig. 3), mostly adults.

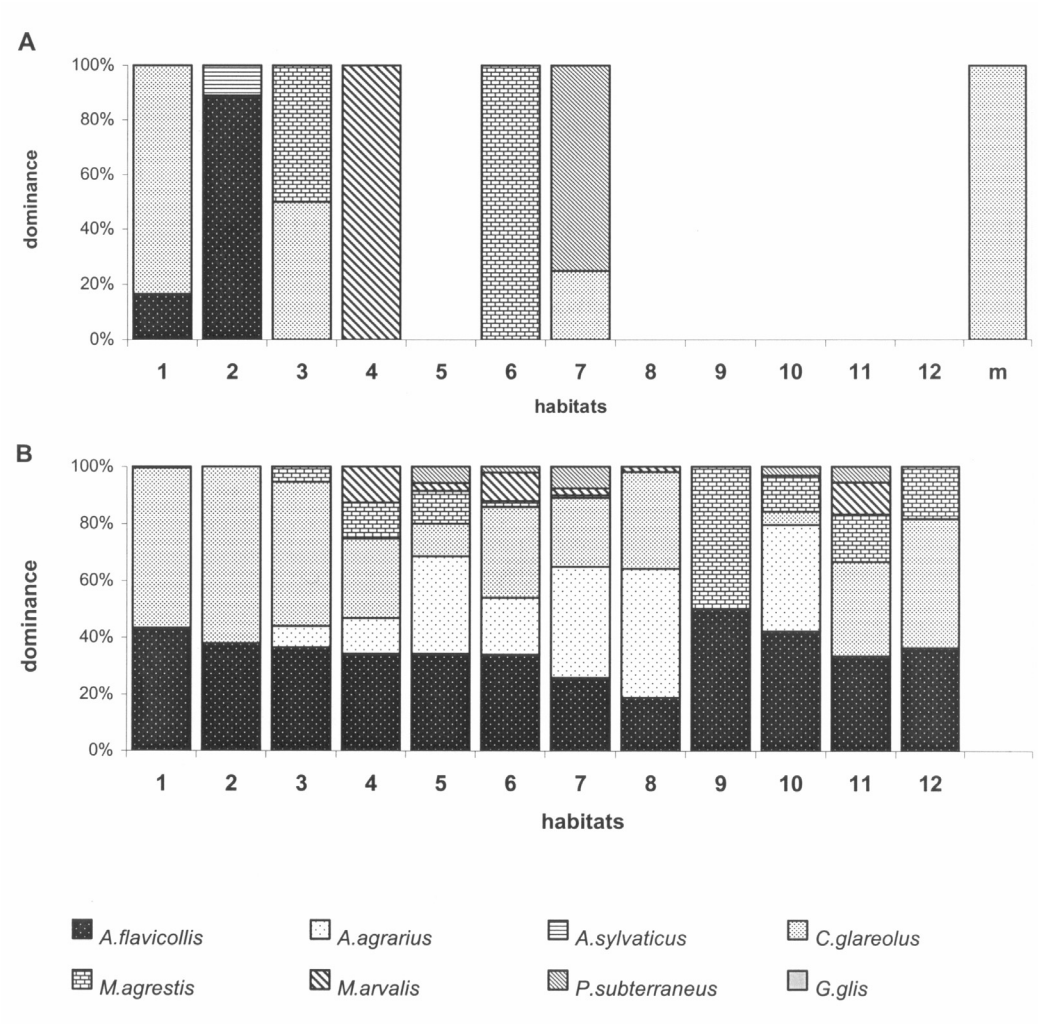

Fig. 3. Percentage of various species (dominance) in Rodentia community in 2002 (A) and 2003 (B). Habitats as on fig.1.

Raspberry community (5) Wo_{2003} = 50%.

Species: *A. flavicollis*, *A. agrarius*, *C. glareolus*, *M. agrestis*, *M. arvalis*, *P. subterraneus*, *S. araneus*

The trapping was carried out only in 2003. High trappability index was associated with the presence of *A. flavicollis* and *A. agrarius* (Table I), co-dominating species in this habitat. Their proportions in adjacent alder wood and tall herb communities were also high (Fig. 2).

Grey alder community (6) Wo_{2002} = 5 %, Wo_{2003} = 23.21%

Species: *A. flavicollis*, *A. agrarius*, *C. glareolus*, *M. agrestis*, *M. arvalis*, *P. subterraneus*, *S. araneus*, *S. minutus*

In 2002 one rodent was caught (*M. agrestis*). In 2003, the habitat was inhabited by diverse rodent community (Tables I and II) dominated by *A. flavicollis* and *C. glareolus* (Fig. 3).

Alder forest (7) Wo_{2002} = 5 %, Wo_{2003} = 23.21%

Species: *A. flavicollis*, *A. agrarius*, *C. glareolus*, *M. agrestis*, *M. arvalis*, *P. subterraneus*, *S. araneus*, *S. alpinus*

This habitat had the largest number of Micromammalia in the 2003 trapping (Table II). Even though individuals from 8 species were caught, the species diversity indices were lower than those in meadows, raspberry and grey alder communities (Table II). It resulted from great differences in the numbers for particular species (Table I). The low level of dominance was brought about by high proportions of as many as three species: *A. agrarius* (dominant species in the community) and *A. flavicollis* and *C. glareolus* – (co-dominants) (Fig. 3). In spring, *A. agrarius* was the dominating species (67.27%), in summer – *A. flavicollis* (43.24%), while in autumn – *C. glareolus* (46.42%). In 2002, *S. araneus* was the dominant (Table I).

"Build-up area" (8) Wo_{2002} = 0 %, Wo_{2003} = 30.68%

Species: *A. flavicollis*, *A. agrarius*, *C. glareolus*, *M. arvalis*, *S. araneus*

Small mammals were trapped here only in 2003 (mainly in the cemetery and around refuse container. Even though the traces of the presence of *C. glareolus* were evident in house garden, these voles were trapped only sporadically. The diversity of rodent community was average, and high proportions of three species (*A. agrarius*. *C. glareolus*, *A. flavicollis*) resulted in fairly low Simpson's dominance index (Table II). A.agrarius was a dominant species in this habitat while *C. glareolus* was a co-dominant (Fig. 3).

Birch scrub community (9) Wo_{2002} = 0 %, Wo_{2003} = 8.33%

Species: *A. flavicollis*, *M. agrestis*, *S. araneus*

The habitat rather sparsely inhabited by small mammals, which was reflected in the lowest values of the trappability index in both years (Table II). The only individuals trapped were those caught in July 2003 in the edge of the scrub.

Tall herb community (10) Wo_{2003} = 36.93%

Species: *A. flavicollis*, *A. agrarius*, *C. glareolus*, *M. agrestis*, *P. subterraneus*, *S. araneus*

Habitat with diversified community of small mammals with the trapability index higher than that of beech forest (Table II). The low values Simpson's dominance index (Table II) resulted from high numbers of *A. flavicollis* and *A. agrarius*, dominating in the community (Fig. 3).

Poloninas- subalpine meadows (11) Wo_{2003}=25%

Species: *A. flavicollis*, *C. glareolus*, *M. agrestis*, *M. arvalis*, *P. subterraneus*, *S. araneus*

A habitat with low Simpson's dominance index for Micromammalia community (Table II). High proportion of forest species: *A. flavicollis* and *C. glareolus* (Fig. 3) is associated with the presence of shrubs (willows *Salix* sp.) and shrublets (*Vaccinium myrtillus*, *Vaccinium vitis-idea*). The value of trappability index more than doubles that for meadows in the valley (Fig. 2).

Willow/alder scrubs (12) Wo_{2003}=13.75%

Species: *A. flavicollis*, *C. glareolus*, *M. agre*stis

The value of trappability index is half of that in the meadow community in poloninas (Table II). The rodent community is dominated by *C.glareolus* and *A.flavicollis* (Fig. 3).

Larch forest Wo_{2002}=7.5%

species: *C. glareolu*s

Three individuals of *C. glareolus* were caught (Table I).

The least diversified community of small mammal species inhabited in 2003 the beech-alder ecotone (H=0.66, D=0.47) and the beech forest (H=0.71; D=0.50). These habitats had high values of Simpson's dominance index in 2002 (c = 0.80% and 0.72%, respectively) and the highest value thereof among all habitats in 2003 (c = 0.53% and 0.50%). The highest values of the indices of species diversity were found in meadows (H = 1.59; D = 0.77), raspberry community (H = 1.58; D = 0.75) and alder wood (H = 1.46; D = 0.72, Table II).

IV. DISCUSSION

The results of trapping were compared with data from 10 years ago (GÓRECKI et al. 2000). The proportion of Insectivora found in the 1993 study (Wo = 0.79%) (GÓRECKI et al. 2000) was similar to these found in 2002 and 2003. The numbers of rodents caught in 1993 (Wo = 14.09%) (GÓRECKI et al. 2000) exceeded that of 2002 but was lower by half than the number in 2003 (Table I). The studies of 1993 (SUROWIEC & GÓRECKI 1997). were carried out in a much lower scale that this study. Similar fluctuations in numbers of rodents caught were observed in the 1950s (GRODZIŃSKI 1957). The most numerous micromammalian communities were those of alder wood in 2003 (Table II) and in 1993 (GÓRECKI et al. 2000).

Most of the habitats were dominated by rodent species typical for forest areas i.e. *C. glareolus* and *A. flavicollis*, found in 2003 in all habitats of the valley. The meadows should not represent a barrier for individuals of these species because of their range of penetration: 850 to 1200 m for *C. glareolus* (KOZAKIEWICZ 1990) and 500 m for *A. flavicollis* (RAJSKA-JURGIEL 1990) and also because of the dense grass cover and abundant litter layer. These species have earlier been also recorded in meadows (BUCHALCZYK & MARKOWSKI 1979; GÓRECKI et al. 2000) and in 1951 and 1952 there were invasions of *C. glareolus* into cultivated fields and deserted villages (GRODZIŃSKI 1957). Also known are reports from Czarnohora of end-of-summer seasonal migrations of *A. flavicollis* and *C. glareolus* into the poloninas (BENEDJUK 1965).

The numbers of *A. agrarius* caught were evidently different in the two years of study, and the trappability index in 2003 (Wo = 5.44%) was almost 19 times higher than that a decade ago (Wo = 0.29%) (GÓRECKI et al. 2000). In 1994, this species accounted for 0.5% of all Micromammalia caught in Bieszczady Mts, in 1969 – for 5%, while in 1970 this species was not caught at all (BUCHALCZYK & MARKOWSKI 1979). In the poloninas in 1966 it accounted for 0.4% of the trapped animals, in trapping specimens (GRODZIŃSKI et al.1966), in 1993 – for 10% (GÓRECKI et al. 2000), while in 2003 it was not present, at the same time occurring in high number in the Wołosatka stream valley (Table I). Such dynamics is typical of this species (PUCEK 1984). A high proportion of this species in buildings was found earlier, when house mouse *Mus musculus* LINNAEUS, 1758, was absent (BUCHALCZYK & MARKOWSKI 1979).

In contrast to situation in 2003, in 1993, *P. subterraneus* was found only in open habitats: poloninas and meadows (GÓRECKI et al. 2000). It preferred dry habitats (BUCHALCZYK & MARKOWSKI 1979). In Beskid Niski Mts, the species was caught in fertile moist forests (HAITLINGER & SZYSZKA 1977). SKURATOWICZ (1947) regarded fertile waterlogged sites within forests, and vegetable gardens as typical habitats for this species. *P. subterraneus* seems to prefer extremely different habitats, rich in plants producing tubers, bulbs and rhizomes which are essential components of its food (FERIANCOVÁ-MASAROVÁ & HANAK 1965).

In 2002, *A. sylvaticus* was caught, which was absent there in 1960s, 1970s, and in 1993 (it was only found in owl's pellets collected in other parts of Bieszczady Mts (GÓRECKI et al. 2000, BUCHALCZYK & MARKOWSKI 1979)). The Wołosatka stream valley lacks the xerothermic shrubland which is a suitable habitat for this species thus its presence could be the effect of dry summer and the vacated space left by extraordinarily low numbers of other rodent species.

The presence of *G. glis* among the mammals trapped has been reported in beech forests and buildings in Ustrzyki Górne locality in some earlier studies (BUCHALCZYK & MARKOWSKI, 1979).

The abundance of habitats suitable for this species means that it is probably occurring in numbers. Traditional traps are rather ineffective in catching this species (HAITLINGER & SZYSZKA, 1977), and attempts to catch these mammals in live-traps set on trees in 2003 failed (author's own observations).

S. alpinus, caught in alder wood, beech-alder ecotone and in meadow (Table I), has been earlier recorded in beech forest (GÓRECKI et al. 2000), in alder wood and beech forest (BUCHALCZYK & MARKOWSKI 1979) and in poloninas (GRODZIŃSKI et al. 1966). Because of the known range of habitats preferred by this species: mountain stream valleys, brad-leaved perennianl plant communities and communities with proportions of mosses (FERIANCOVÁ-MASAROVÁ & HANAK 1965), it might be suspected to occur throughout the study area.

The domination relationships in beech forest found in 2003 were typical to Bieszczady (GÓRECKI et al. 2000; MARKOWSKI & BUCHALCZYK 1979; POLUSHYNA 1965). In alder wood they were rather like those in the Ukrainian Carpathians where *C. glareolus* and *P. subterraneus* dominate (POLUSHYNA 1965) whereas in 1993 it was a domination of *C. glareolus* (GÓRECKI et al. 2000). The domination relationships in the poloninas community were different than those found earlier, which resulted mainly from low proportions of species of *Microtus* genus as well as from absence of *A. agrarius* and *P. subterraneus* in 2003.

Mosaic habitats are characterised by increased proportion of margin zones with structure of tree and shrub layers different from that inside the forest. The width of such margin zone is estimated to be some 30 m in alder-ash forest, 20 m in alder wood and as much as 100 m beech-sycamore forest. In the case of 50 hectare compact wood islands, the margin accounts for 50% of the habitat area (ŻARSKA 1996). Compared with the size of the Wo³osatka stream valley and taking into account the mosaic structure of its habitats, the edging effect accompanying the ecotonal zones (KOZAKIEWICZ 1990) might affect the entire Valley. The winter mortality of Micromammalia in such habitats is the highest, sometimes reaching even 90% of the population (RAJSKA-JURGIEL 1990). In this situation, the vicinity of vast natural forest abundant in diverse community of predators will entail their enhanced penetration. High population numbers of common viper *Vipera berus* (LINNAEUS, 1758) in early summer of 2002 (author's own observations) which is a principal nest predator (GLIWICZ 1977) could have been a limiting factor of the numbers of rodents. The low proportions of *M. arvalis* and *M. agrestis* could result not only from the population dynamics characteristic to these species but also from a major reduction caused by predators and from competition with *A. agrarius* and *A. flavicollis*, similar to that noted in agricultural/forest landscapes (PIŁACIŃSKA 1998).

V. CONCLUSIONS

The Micromammalia communities in various habitats differed in terms of composition as well as in the population dynamics of various species. The forest species: *A. flavicollis* and *C. glareolus* penetrated into most of the habitats in the Valley. Typical proportions of the micromammalian comunity of the latter habitat were low proportions of *M. arvalis* and *M. agrestis* and absence of *M. musculus*. The meadows of poloninas had more numerous micromammalian communities that those in the "land of valleys".

The structure of the landscape of Wołosatka stream valley and the diversity of its habitats causes the specific living conditions for small mammals there to be more typical of ecotone structures than of open habitats.

REFERENCES

AULAK W. 1970. Small mammals community of the Białowieża National Park, *Acta Theriologica*, **15**:465-514.

BUCHALCZYK T., MARKOWSKI J. 1979. Mammals of the Western Bieszczady Mts. *Ochrona Przyrody*, **42**: 119-145. (In Polish with English summary).

FERIANCOVÁ-MASAROVÁ Z., HANAK V., 1965. [Vertebrates of Slovakia. IV-Mammals]. Vydavatelstvo Slovenskej Akadémie Vied, Bratislava, 331pp. (In Czech).

GLIWICZ J. 1977. Characteristics of survivorship of the bank vole (*Clethrionmys glareolus* SCHREBER 1970). *Wiadomości Ekologiczne*, **23**: 269-281. (In Polish with English summary).

GÓRECKI A., ĆWIKOWSKI C., GRYC A., JABŁOŃSKA I. 2000. Small mammals in the Bieszczady Mountains. *Monografie Bieszczadzkie*, **9**: 71-90. (In Polish with English summary).

GRODZIŃSKI W., GÓRECKI A., JANAS K., MIGULA P. 1966. Effect of rodents on the primary productivity of alpine meadows in Bieszczady Mountains. *Acta Theriologica,* **11**(20): 419-431.

GRODZIŃSKI W. 1957. Materials for the Study of the Vertebrate Fauna of the Western Bieszczads. *Zeszyty Naukowe UJ Kraków, ser. Zoologia,* **10**(1): 117-221. (In Polish with English summary).

HAITLINGER R., SZYSZKA K. 1977. Small mammals of the Gorce, Beskid Wyspowy, Radziejowa Range and some neighbouring areas. *Przegląd Zoologiczny*, **31**(2): 155-170. (In Polish with English summary).

KOZAKIEWICZ M. 1990. [Influence of the habitat heterogenity on the populations and the small mammals community: the role of ecotonal zone and habitats isolations] [In:] R. ANDRZEJEWSKI (ed.) – Functionning of small mammal populations and the habitat heterogeneity. *Zeszyty SGGW-AR*, **31**: 37-51. (In Polish).

PIŁACIŃSKA B. 1998. [Environmental islands asplaces of occurrences of rodents] [In:] J. BANASZAK (ed.) – Ecology of forest islands]: 309-313. (In Polish).

POLUSHYNA N. A. 1965. [Notes about charakteristik of mammals of Soviet Carpathians] [In:] Flora and fauna of Ukrainian Carpathian. MViSSO USSR Uzhgorod Derzh. Univ., Biol. Fak., Uzhgorod, 100-103. (In Russian).

PUCEK Z. (ed.) 1984. Keys to vertebrates of Poland. Mammals. PWN Warszawa, 384 pp.

RAJSKA-JURGIEL E. 1990. [Structure of landscape and functioning of forest rodents]. [In:] R. ANDRZEJEWSKI (ed.) – Functionning of small mammal populations and the habitat heterogeneity]. *Zeszyty SGGW-AR*, **31**: 9-26. (In Polish).

SKURATOWICZ W. 1947. [Keys to local mammals]. Księgarnia Akademicka Poznań, 67 pp. (In Polish).

SUROWIEC I., GÓRECKI A. 1997. Monitoring of the small mammals communities in the Bieszczady National Park. *Roczniki Bieszczadzkie*, **6**: 277-278. (In Polish with English summary).

WEINER J. 1999. [Life and evolution of biosphere. Textbook of general ecology]. PWN. Warszawa: 415-417. (In Polish).

WINNICKI T., ZEMANEK B. 1998. [Nature of Bieszczady National Park]. Wydawn. BdPN, Ustrzyki Dolne, 122 pp. (In Polish).

ŻARSKA B. 1996. Spatial range of vegetation changes in marginal zones of forests and forests shaping. *Problemy Ekologii Krajobrazu*, **2**: 72-76. (In Polish with English summary).