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DIET COMPOSITION OF THE LONG-EARED OWL (*ASIO OTUS*) DURING THE AUTUMN-WINTER PERIOD IN THE NORTHERN PARK OF SOFIA

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Abstract. The diet composition of the Long-eared Owl during the autumn-winter period in 1993–1995 was studied. The area of study is the Northern Park in Sofia. The small mammals comprise 90.2 % of the diet. The major prey is the vole (*Microtus*) – 75.5 %. Mice (*Apodemus*, *Mus*, *Micromys*), shrews (*Crocidura*) and sparrows (*Passer*) are the alternative prey and comprise 18.3 % of the diet. The diversity of food is higher at the end of the autumn and the beginning of spring migration. It does not change during periods with snow blanket present.

Key words: Long-eared Owl (*Asio otus*), diet composition

The diet composition of the owls shows their environmental requirements, preferences, hunting habits, and competitive relationships among them. The Long-eared owl is a miophagous species, but its diet composition is dependent chiefly on the specifics and characteristics of the area (Schmidt, 1974, Glutz von Blotzheim, Bauer, 1980, Mikko, 1983, Tome, 1994). The diet composition has been studied by Симеонов (1964), Simeonov (1966) and Симеонов, Петров (1986). The last two publications have been especially focused on the autumn-winter diet within 11 habitats.

The contributions of this article consists of presenting data on the diet composition of the Long-eared Owl and the variations of the diet during the autumn-winter period in an area (Northern Park) that has not been studied – Sofia field.

MATERIAL AND METHODS

The material has been collected in the Northern Park in Sofia. The pellets were unevenly spread in a spruce wood of about 6000 sq. m. The surrounding region within 2 km was the hunting area of the Long-eared Owl according to СИМЕОНОВ (1964). There was a big diversity of habitats within this area, both natural and affected by human presence (woods, valleys, meadows, wetland, and others), and urban areas (housing estates, industrial zone, sport grounds, etc.). In 1993–1994 the pellets were collected twice during the season under study – in December and March, and the findings were analyzed all together. During the 1994–1995 season the pellets were collected on biweekly basis starting in November until March. When the snow blanket was thick we waited for the snow to melt in order to collect the material. The studied area was visited 10 times.

The mammals were identified by skull and hind girdle, and the birds by skull, girdles and limbs. The bones of the postcranial skeleton of the birds have not been completely used for identification in previous studies of diet composition of Long-eared Owl in Bulgaria.

The width of the food niche is calculated according to Tome (1994). The similarity of food among the different samples is determined following the Serensen formula (for species) and Bezzel et al. (1976) (for number of species). The cluster analysis was conducted in accordance to the average incorporating Песенко (1982). In these calculations the unidentified individuals in the genera *Apodemus*, *Passer*, *Carduelis*, *Sylvia*, *Fringilla*, *Emberiza* were assigned to species in the same proportion as their identified counterparts. The unidentified individuals of Passeriformes were excluded.

RESULTS

NUMBER OF WINTERING LONG-EARED OWLS

The flock of 5–6 birds is usually formed during the first decade of November. The highest number was recorded in December (30 individuals on 20.12.1993, 45 individuals on 03.12.1994). In January and until the mid-March the number of birds in a flock varies between 10-15. The flock breaks apart in the second half of March with the beginning of the breeding season (С и м е о н о в и др., 1990). The number of pellets and preys in the various samples correlates with the size of the wintering flock of Long-eared Owl (Table 1, 2).

DIET COMPOSITION

We determined a total of 72 taxa of mammals (15 species) and birds (44 species). Among them: Two taxa belong to domestic fauna – the rabbit (*Oryctolagus caniculus*) should have been prayed from the private farms, and the budgerigar

Table 1

Prey of the Long-eared Owl in the Northern Park of Sofia during autumn-winter periods of 1993-1995 (*- taxons, which have been discovered only during 1993-1994, **- taxons, which have been discovered only during 1994-1995)

№	Species	1993-1994		1994-1995		1993-1995	
		% of number	% of biomas	% of number	% of biomas	% of number	% of biomas
1	2	3	4	5	6	7	8
1	<i>Crocidura suaveolens</i>	3.24	0.53	0.35	0.05	1.52	0.24
2	<i>Crocidura leucodon</i>	0.47	0.15	0.05	0.02	0.21	0.07
3	<i>Micromys minutus</i>	1.33	0.37	0.55	0.15	0.86	0.24
4	<i>Apodemus flav./sylv.</i>	5.66	5.37	2.48	2.24	3.74	3.49
5	<i>Apodemus agrarius</i>	0.58	0.39	0.20	0.13	0.35	0.23
6	<i>Apodemus sp.</i>	6.52	5.34	2.30	1.80	4.00	3.21
7	<i>Rattus rattus</i>	0.29	1.89	0.10	0.62	0.18	1.13
8	<i>Rattus norvegicus</i>	0.04	0.50	0.05	0.66	0.04	0.60
9	<i>Mus musculus</i>	3.06	2.31	4.30	3.09	3.76	2.78
10	<i>Microtus arv./epir.</i>	66.03	71.53	83.37	85.89	75.48	80.18
	Mammals	87.32	89.35	93.79	94.66	90.18	92.45
11	<i>Passer domesticus</i>	2.38	2.54	1.18	1.19	1.67	1.73
12	<i>Passer montanus</i>	1.55	1.17	1.18	0.84	1.33	0.97
13	<i>Passer dom./mont.</i>	1.62	1.60	0.30	0.28	0.84	0.80
14	<i>Fringilla coelebs</i>	0.18	0.13	0.33	0.23	0.26	0.19
15	<i>Fr. montifringilla</i>	0.04	0.03	0.03	0.02	0.03	0.02
16	<i>Carduelis sp.</i>	0.36	0.21	0.25	0.14	0.29	0.16
17	<i>C. carduelis</i>	0.29	0.17	0.23	0.12	0.25	0.14
18	<i>C. chloris</i>	0.14	0.11	0.18	0.13	0.16	0.12
19	<i>C. spinus</i>	0.14	0.06	0.08	0.03	0.10	0.04
20	<i>Sylvia sp.</i>	0.14	0.07	0.10	0.05	0.12	0.05
21	<i>S. atricapilla</i>	0.21	0.12	0.05	0.03	0.12	0.07
22	<i>S. melanocephala</i>	0.11	0.04	0.05	0.02	0.07	0.03
23	<i>Lullula arborea</i>	0.04	0.03	0.05	0.04	0.04	0.04
24	<i>Alauda arvensis</i>	0.07	0.09	0.05	0.06	0.06	0.08
25	<i>Alaudidae</i>	0.07	0.08	0.18	0.19	0.13	0.15
26	<i>Streptopelia decaocto</i>	0.04	0.13	0.03	0.09	0.03	0.10
27	<i>Emberiza calandra</i>	0.04	0.06	0.03	0.04	0.03	0.04
28	<i>Emberiza cirrus</i>	0.11	0.09	0.05	0.04	0.07	0.06
29	<i>Parus major</i>	0.47	0.13	0.18	0.11	0.30	0.19
30	<i>Aegithalos caudatus</i>	0.11	0.03	0.03	0.01	0.06	0.02
31	<i>Saxicola torquata</i>	0.11	0.04	0.05	0.02	0.07	0.03
32	<i>Pyrrhula pyrrhula</i>	0.11	0.12	0.05	0.05	0.07	0.08
33	<i>Erithacus rubecula</i>	0.07	0.04	0.03	0.01	0.04	0.02
34	<i>C. coccothraustes</i>	0.04	0.06	0.08	0.13	0.06	0.10
35	<i>Phoenicurus ochrurus</i>	0.04	0.02	0.03	0.01	0.03	0.01
36	<i>Coturnix coturnix</i>	0.04	0.12	0.03	0.08	0.03	0.09
37	<i>Cettia cetti</i>	0.04	0.01	0.03	0.01	0.03	0.01
38	<i>Delichon urbica</i>	0.04	0.02	0.03	0.01	0.03	0.02
39	Passeriformes ordo	2.81	2.21	0.98	0.73	1.73	1.32
	Birds	12.68	10.65	6.34	5.34	9.80	7.55
	Total	2776		3997		6773	
	Niche width	2.20		1.43		1.64	

*Plecotus austriacus*** - 0,03; *Oryctolagus caniculus** - 0,04; *Sciurus vulgaris* - * - 0,04; *Arvicola terrestris* - * - 0,04; *Fringilla sp.* - ** - 0,08; *Sylvia communis* - * - 0,04; *Emberiza sp.* - ** - 0,08; *Em. citrinella* - * - 0,07; *Em. cia* - * - 0,25; *Turdus sp.* - * - 0,04; *T. philomelos* - ** - 0,05; *T. merula* - ** - 0,03; *Parus sp.* - ** - 0,03; *Phylloscopus sp.* - ** - 0,08; *Ph. trochilus* - * - 0,11; *Ph. sibilatrix* - * - 0,14; *Anthus sp.* - ** - 0,03; *Hippolais sp.* - ** - 0,03; *H. pallida* - * - 0,07; *Phoenicurus sp.* - * - 0,04; *Pica pica* - ** - 0,03; *Garrulus glandarius* - ** - 0,03; *Hirundo rustica* - * - 0,04; *H. daurica* - * - 0,07; *Troglodytes troglodytes* - * - 0,07; *Motacilla alba* - * - 0,04; *Oenanthe sp.* - * - 0,04; *O. oenanthe* - * - 0,07; *Prunella modularis* - * - 0,04; *Acanthis cannabina* - * - 0,07; *Lanius collurio* - * - 0,04; *Sturnus vulgaris* - * - 0,04; *Melospittacus undulatus* - * - 0,04.

Prey of the Long-eared Owl (*Asio otus*) in the Northern park of Sofia during Autumn-winter period of 1994/95 - % of the number
 (* - taxons which have been discovered in less than 50% of the samples)

No	Species	06.11.94	19.11.94	03.12.94	18.12.94	03.01.95	30.01.95	10.02.95	25.02.95	11.03.95	26.03.95
		%	%	%	%	%	%	%	%	%	%
1	2	3	4	5	6	7	8	9	10	11	12
1	<i>Cr. suaveolens</i>	6.90	0.53	0.11	0.15		1.42	0.53		0.29	
2	<i>Micromys minutus</i>		0.79	0.44	1.17	0.25	0.85		0.67	0.29	
3	<i>Apodemus sylv./flav.</i>	6.90	1.84	2.08	2.05	2.97	4.25	1.33	5.00	2.00	1.43
4	<i>Apodemus agrarius</i>		0.53	0.11	0.15				0.67	0.57	
5	<i>Apodemus sp.</i>	6.90	3.68	2.19	2.92	0.74	1.70	1.33	3.00	2.29	2.38
6	<i>Mus musculus</i>	3.45	4.74	4.60	4.53	2.48	3.68	5.59	4.67	5.14	2.38
7	<i>Microtus arv./epir.</i>	48.28	83.42	87.20	83.92	89.60	81.02	81.65	78.67	78.29	79.05
	Mammals	72.41	95.79	96.83	95.18	96.29	92.92	90.69	92.67	89.14	86.19
8	<i>Passer domesticus</i>	3.45	1.84	1.09	1.32	0.25	1.70	0.53	1.33	1.71	0.48
9	<i>Passer montanus</i>	3.45	0.53	0.77	0.58	1.24	1.42	1.86	1.00	0.57	5.24
10	<i>Passer dom./mon.</i>	3.45	1.05	0.22	0.15	0.50	0.28	0.27			
11	<i>Fringilla coelebs</i>		0.26	0.11	0.29			0.80	1.00	0.86	
12	<i>Carduelis carduelis</i>			0.11	0.29		0.28	0.53	0.33	0.29	0.48
13	<i>Carduelis sp.</i>			0.11		0.25	0.85	0.27	0.33	0.86	
14	<i>Alaudidae</i>				0.15		0.28			0.57	0.95
15	Passeriformes ordo		0.53	0.56	0.88	0.50	1.13	1.33	1.00	1.43	3.33
	Birds	27.59	4.21	3.17	4.82	3.71	7.08	9.31	7.33	10.86	13.81
	Total	29	380	914	684	404	353	376	300	350	210
	Niche width	3.67	1.43	1.31	1.41	1.24	1.51	1.49	1.59	1.62	1.58

Cr. leucodon- 6- 0,15; 7- 0,25; *Plecotus austriacus*- 9- 0,27; *Rattus rattus*- 4- 0,26; 5- 0,11; 11- 0,29; 12- 0,48; *R. norvegicus*- 6- 0,15; 12- 0,48; *Fringilla sp.*- 9- 0,27; 10- 0,33; 11- 0,29; *Fr. montifringilla*- 9- 0,27; *C. chloris*- 6- 0,29; 9- 0,53; 11- 0,57; 12- 0,48; *C. spinus*- 7- 0,25; 10- 0,33; 11- 0,29; *Sylvia atricapilla*- 1- 6,90; *Sylvia melanocephala*- 9- 0,27; 11- 0,29; *Alauda arvensis*- 5- 0,11; 8- 0,28; *Lullula arborea*- 11- 0,29; 12- 0,48; *Streptopelia decaocto*- 6- 0,15; *Emberiza sp.*- 9- 0,27; 11- 0,29; 12- 0,48; *Em. cirrus*- 9- 0,27; 10- 0,33; *Em. calandra*- 10- 0,33; *Turdus philomelos*- 6- 0,15; 9- 0,27; *T. merula*- 12- 0,48; *Parus sp.*- 6- 0,15; *P. major*- 6- 0,44; 7- 0,25; 9- 0,53; 11- 0,29; *Aegithalos caudatus*- 11- 0,29; *Phylloscopus sp.*- 7- 0,25; 8- 0,28; 11- 0,29; *Saxicola torquata*- 8- 0,57; *Anthus sp.*- 9- 0,27; *Pyrrhula pyrrhula*- 9- 0,27; 11- 0,29; *Hippolais sp.*- 1- 3,45; *Erithacus rubecula*- 10- 0,33; *Coccothraustes coccothraustes*- 10- 0,33; 11- 0,29; 12- 0,48; *Phoenicurus ochrurus*- 10- 0,33; *Coturnix coturnix*- 11- 0,29; *Pica pica*- 11- 0,29; *Garrulus glandarius*- 11- 0,29; *Cettia cetti*- 12- 0,48; *Delichon urbica*- 12- 0,48.

(*Melopsittacus undulatus*) is a escape pet. The prays are mainly mammals (90.18 %) and the voles (*Microtus*) compose 75.5 % of them. The mice (*Apodemus*, *Mus*) and shrews (*Crocidura*) do not prevail 5 % of the prays. The birds (9.8 %) are additional food component. Two synanthropic species of sparrows (*Passer*) are present in all samples and consist 43.3 % of all prayed birds. Proportions of pray species by biomass were similar to proportions by number, because of similar average weights of the most frequent prey species (Table 1, 2).

PREFERRED HUNTING AREAS

The majority of the prays has been caught in open areas – arable and uncultivated lands and small meadows in the park (81.1 % of all pray) (Table 3). These are the typical habitats for the “favorite” pray – the voles. The birds have been caught in bushes and woods, and nevertheless of their large species composition their number is low. The avian species that are prevailing (sparrows) are those that are typical inhabitants of residential and industrial areas.

Table 3

Preferred areas of pray of the Long-eared Owl according to the number of the casualties within the areas

Biotops	Mammals		Birds		Total	
	taxons	% of number	taxons	% of number	taxons	% of number
1 Shrubs and forest	1	0.02	34	37.06	35	2.70
2 Open areas	5	86.96	10	6.21	15	81.10
3 Wetlands	1	0.02	2	0.62	3	0.06
4 Resident and industrial areas	4	0.28	7	55.07	11	4.25
5 Diversified	3	12.73	4	1.04	7	11.88
Total	14	100	57	100	71	100

FOOD SIMILARITY

The similarity of species diet composition of the Long-eared owl in 1993/1994 is 67.3 %, and in 1994–1995 is 51.5 % for the ten samples. The differences come from the number of taxa of birds. It considerably varies – from 5 to 22 taxa. The samples of 6.11.94 and 26.3.95 show the least similarity with the rest. They include late autumn migrants and early spring migrants (Fig. 1).

The similarity in number of pray between the two studied periods is 69.9 %. It is higher than the species similarity, because the majority of the birds have been caught separately. A limited number of species (*Microtus*, *Apodemus*, *Mus*, *Micromys*, *Passer*) comprise the majority of pray – 89.1% in 1993–1994, and 96.0 % in 1994–1995. The ten samples of pellets in 1994–1995 form two groups with very high similarity among them. The first is of 6 pellet samples – 82.9 %, and the second of two samples – 83.4 %. It is the deviation in the number of pray, and not

in the diversity of species, that makes the difference between these two groups. The first sample (6.11.1994) stands away from the rest both in terms of the least number of prey (29 mammals and birds), and in terms of prevalence (*Microtus* – 48.3 %) (Fig. 2).

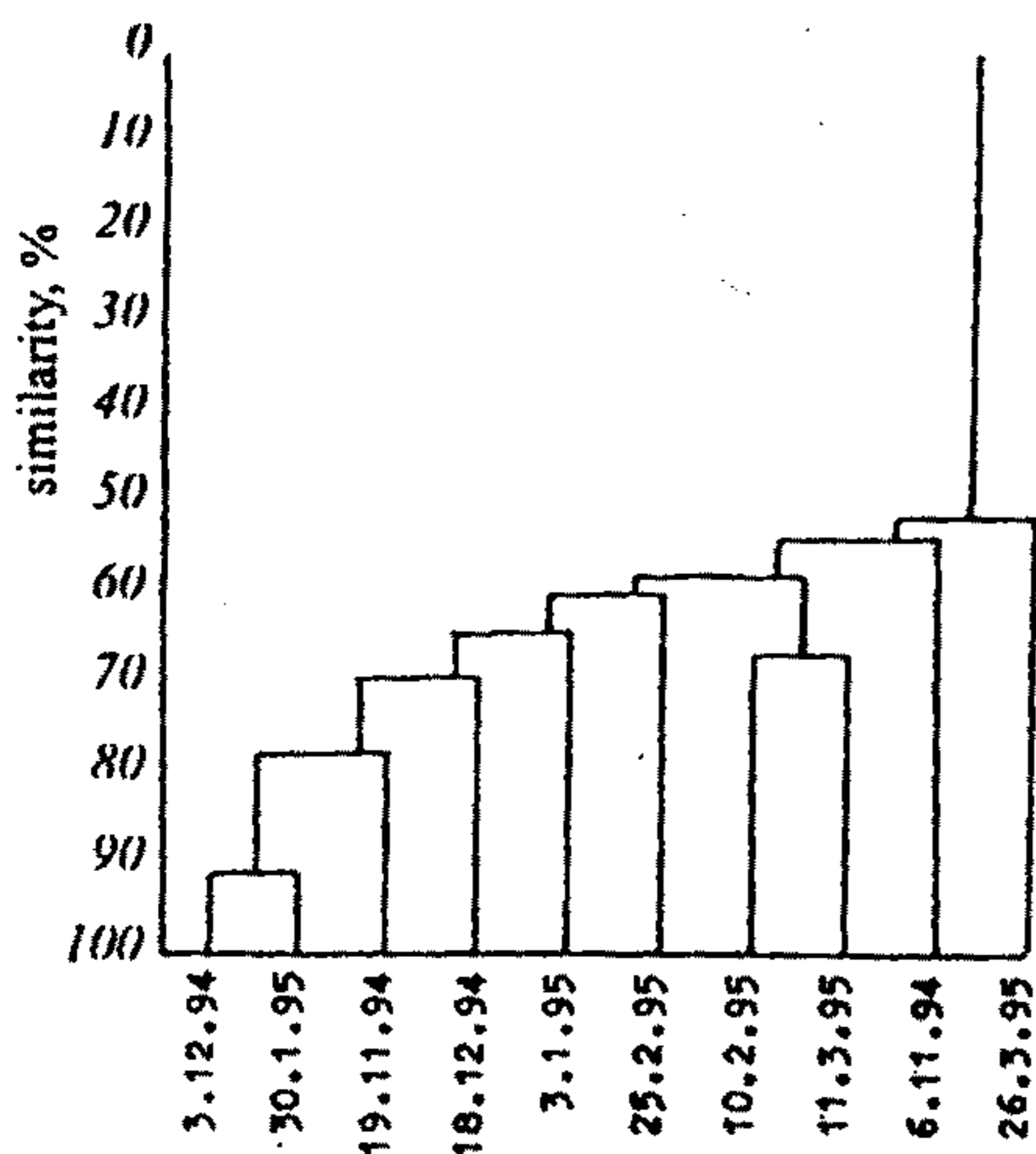


Fig 1. Similarity cluster according to the species composition of the diet of the Long-eared Owl, for the 10 samples in 1994-95.

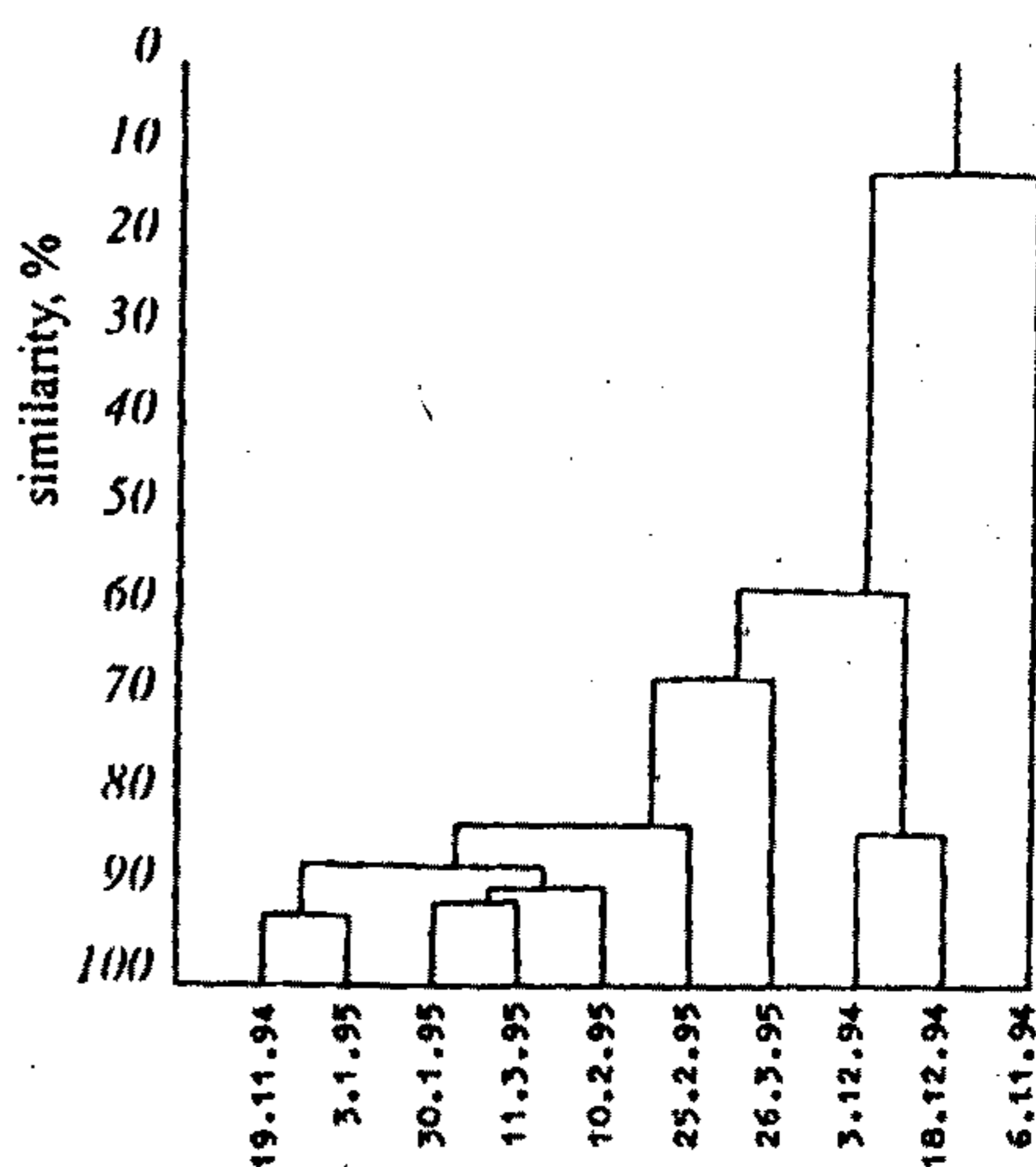


Fig 2. Similarity cluster according to the number of preys in the diet of the Long-eared Owl, for the 10 samples in 1994-95.

The high predominance of voles in the food determines the narrow breadth of the food niche in the autumn-winter periods in 1993/1995. The only exception is the first sample (6.11.1994), where birds comprise 27.6 % of prey. The breadth of the food niche does not change when there is a thick snow blanket, because the relative shares of different species of mammals and birds in the diet do not change (Table 1, 2).

DISCUSSION

In the studied period the variations in the total number of preys reflect the variations in the number of individuals in the wintering flock of Long-eared owl. The maximum number of 45 birds is the highest number ever reported in the Bulgaria (Симеонов и др., 1990).

The small mammals are the major preys of Long-eared owl, and this fact supports other studies in Europe (S c m i d t, 1974, G l u t z v o n B l o t z h e i m, B a u e r, 1980, M i k k o l a, 1983, C r a m p, 1985, С и м е о н о в и д р., 1990). They comprise 90.2 % of the diet by number, and 92.5 % of the biomass. Voles

(*Microtus*) are most common prey – 75.5 % of the number, and 80.2 % of the biomass. Mice (*Apodemus*, *Mus*), shrews (*Crocidura*) and sparrows (*Passer*) appeared to be the alternative prey and comprise 18.3 % of the number and 13.8 % of the biomass. Previous studies in Bulgaria report of prevalence of voles of less than 50 %, and one of the studies reports of mice (*Apodemus*) being the major prey (С и м е о н о в, 1966, С и м е о н о в, П е т р о в, 1986). The relative share of *Microtus* in Central Europe is 66 %. However, more recent research works show considerable increase in its dietary share: 78 % – in Germany and 83.7 % in France (М и к к о л а, 1983). The presence of the additional species depends on the population density of voles (Т о м е, 1994). Possibly this dependency determines the different frequency of occurrence of voles in the diet of Long-eared Owl, as well as the number of the birds in the wintering flock in the two autumn-winter periods.

The birds are presented in the diet by more species and higher occurrence than ever reported before in Bulgaria. The reason can be that for the first time in Bulgaria all skeleton elements were collected and used for species identification.

The information available so far shows increase of the share of birds and mice in the diet, and decrease of the share of voles during periods of heavy snow fall and thick snow blanket (С и м е о н о в, П е т р о в, 1986). The diversity of food, represented by the breadth of the food niche is not influenced by the presence of snow blanket. The breadth of the food niche is higher toward the end of the autumn migration and the beginning of spring migration. It is higher during the 1993/94 season, although the winter was snowier. The similarity between diet composition of all ten samples in 1994–1995 (Fig. 2) confirms that there is no relevance between the presence and thickness of snow blanket and qualitative and quantitative characteristics of the diet composition.

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