

## THE BIRD FAUNA FROM LOTRIOARA RIVER BASIN (LOTRU MOUNTAINS, ROMANIA)

ANA MARIA BENEDEK, IOAN SÎRBU

**Abstract.** The results of a one year study of bird communities from the Lotrioara River Basin (Lotru Mountains, Romania), using the transect method along the main valley, are presented. The study aimed to reveal the characteristics of the community's dynamics, both from spatial and temporal point of view. During the research period 70 species belonging to 9 orders were identified in the investigated area. The number of species decreases with the altitude, but it is also related to the heterogeneity of habitats. During the year the species' number varies from a minimum in winter to a maximum in spring. Insectivores are the prevailing feeding guild in the bird communities from Lotrioara basin, but during the cold season the dominance is taken over by omnivorous and granivorous species.

**Résumé.** On présente les résultats d'une étude des communautés des oiseaux du bassin de la rivière Lotrioara (Lotru Montagnes, Roumanie), en utilisant la méthode des transects au long de la vallée principale. L'étude visait à révéler les caractéristiques de la dynamique de l'ornithofaune, du point de vue spatial et temporel. Au cours de la période de recherche 70 espèces appartenant à 9 ordres ont été identifiées dans la zone étudiée. Le nombre d'espèces diminue avec l'altitude, mais il dépend aussi de l'hétérogénéité des habitats. Au cours de l'année, le nombre des espèces varie d'un minimum en hiver à un maximum en printemps. La structure trophique des communautés d'oiseaux dans le bassin Lotrioara est dominée par les insectivores, mais pendant la saison froide, la domination est prise par les omnivores et granivores.

**Key words:** elevational gradient, species richness, feeding guilds, bird phenology.

### INTRODUCTION

Birds are a well studied group in Romania, with many papers concerning the ornithofauna of different areas. Although most of them deal with wetlands and lowlands, some researches were carried out also in the Carpathians. The first data concerning birds from mountain areas in Romania date back to the 19<sup>th</sup> century. Stetter made the first avifaunal list of Transylvania, published in 1845. Several other naturalists working in the Carpathians made notes also on birds, among them A. Berger, J. Csato, W. Hausmann, O. Hermann, M. von Kimakovicz. Their data, along with his own observations, were synthesized by Bielz (1888) in the volume concerning the vertebrates of Transylvania. He cites among others, species that are currently extinct from Romania, like the three species of vultures: *Aegypius monachus*, *Gyps fulvus* and *Gypaetus barbatus*.

During the 20<sup>th</sup> century several ornithologists published papers concerning the bird fauna from different mountain areas. In the last two decades some studies were carried out in some of the South Carpathian massifs, namely Piatra Craiului (Petrescu, 1995), Făgăraș (Petrescu, 2005) and the neighbouring Cindrel Mountains (Murariu et al., 2009 a), where 92 species were found over a period of more than 135 years of observations. Other articles deal with a series of ecological aspects of bird communities. An ornithological zonation along vertical (elevation) and horizontal gradients, based on data from literature and personal observations, is presented by several authors: Papadopol (1992), Radu (1973), Papadopol and Petrescu (1992) and

others. Recently, Mestecăneanu (2008) published a paper on the monthly dynamics of bird communities from a dam lake in Iezer-Păpușa massif.

In this paper we present the results of the first study on the bird fauna done in Lotru Mountains. Up to the present there are only scarce data available on birds from this area, most of them dating back to the 19<sup>th</sup> century when Kimakowicz made several observations at Prejba, mentioning *Tetrao urogallus*, *Apus melba*, *Regulus regulus*, *Eremophila alpestris* and *Loxia curvirostra* (Bielz, 1888). The only recently published data concern a female capercaillie (*T. urogallus*) and her 10 chicks (Roberts, 2000).

The present study highlights the variation of the ornithofauna, both in space (along the elevational gradient) and time (seasonally). It also reveals the changes occurred in its trophic structure.

### STUDY AREA AND METHODS

Lotrioara River Basin is part of Lotru Mountains (Southern Carpathians), being placed in the middle of Romania (Fig. 1). Lotrioara is a right side tributary of the Olt River. Its river basin has 117 km<sup>2</sup> and the largest part is covered by natural or planted forests, from deciduous in the lower part, to coniferous in the upper areas. The valleys are mostly narrow, with steep slopes. However, in the lower sector Lotrioara valley is open and wide, and a traditional village was established here, resulting in a large forest clearing, now occupied by orchards and hayfields. Originally stretching on 1.5 km, during the last years the village has expanded by new buildings down- and upstream. In the river basin, small areas are occupied by secondary mountain meadows, resulted from deforestation. Subalpine shrubs are found only on the highest peaks, on the southern slope. On Sterpu Peak (2143 m), above the subalpine shrubs, an alpine meadow can also be distinguished.

The investigations were carried out monthly during one year, using the transect method. Five transects, coded from I to V, were established along the main



Fig. 1 - Position of the research area and the five transects.

valley and in the upper sector on the left side slope, from upstream the confluence with Olt River (420 m), up to Prejba Chalet (1660 m) (Fig. 1). Transect I is a sector in the beech forest near the confluence, including Lotrioara village, II and III are transects in the mixed forest along Lotrioara Valley and one of its tributaries - Pârâul Cailor, IV crosses a slope covered by a young spruce plantation, and V is a transect in an ecotone area, at the limit between an old spruce forest and secondary meadows near Prejba Chalet. Besides these transects other observations were made along the way to Sterpu Peak. The data were included in tab. 1 in a separate column, noted as transect VI, and were included only in some of the analysis (the seasonal dynamics and the trophic structure).

A cluster analysis based on the Jaccard index was performed in order to assess the similarity of bird fauna structure in the four seasons and at different elevations.

The bird species were ascribed to the feeding guilds according to their prevailing food (Bezzel, 1996), while their phenological status was established based on the observations during the present research. The dependence of the trophic structure of bird fauna on season and the altitude were tested by Pearson chi-square test of independence.

## RESULTS

During the one year study, 70 species of birds belonging to 9 orders, were identified in Lotrioara River Basin. Among them, the best represented are the orders Passeriformes (49 species), Falconiformes (9 species) and Piciformes (5 species), the systematics being according to Bruun et al. (1999).

The list of the observed species is given in table 1, with the mention of the seasonal and altitudinal occurrence, as well as their inclusion in the annexes II (strictly protected fauna species) and III (protected fauna species) of the Convention on the Conservation of European Wildlife and Natural Habitats (known as the Bern Convention) (<http://conventions.coe.int/Treaty/en/Treaties/Html/104.html>) (column BC in tab. 1), Annex I (species subject of special conservation measures concerning their habitat) of the Directive 2009/147/EC (known as the Birds Directive) (<http://ec.europa.eu/environment/nature/legislation/birdsdirective>) (column BD) and their conservation status (VU-vulnerable, EN-endangered, CR-critically endangered) according to the Red Book of Romanian Vertebrates (Munteanu, 2005) (column RB). The codes used for seasons are: W - winter (observations from December to February), SP - spring (March to May), SM - summer (June to August), A - autumn (September to November).

The species richness remains relatively constant during the warm period of the year, with a slight decrease from spring, when the maximum number of species (41) was recorded, till autumn, but is lower during winter, when the species' number (23) drops to a little more than half.

The number of bird species decreases constantly (a difference of 5 species between consecutive sectors) on altitude. The only exception is represented by the sector V (spruce forest and montane meadow), where a higher number of species than in the previous one was observed. A high number of species (42) was recorded apart from these transects, on the way to Sterpu Peak. This is the sole part of the river basin where subalpine *Pinus mugo* shrubs and rocky meadows can be found, as well as an alpine meadow covering a small area around the peak. The alpine and subalpine meadows are the typical habitats for *Anthus spinoletta* and *Prunella*

Table 1

The bird species observed in Lotrioara River Basin and their seasonal and altitudinal distribution (the codes are explained in the text).

No.	Species	Season				Sector						BC	BD	RB
		W	SP	SM	A	I	II	III	IV	V	VI			
1.	<i>Aquila pomarina</i>			+							+	II	I	VU
2.	<i>Hieraetus pennatus</i>			+	+			+			+	II	I	CR
3.	<i>Circaetus gallicus</i>			+							+	II	I	VU
4.	<i>Buteo buteo</i>	+	+	+	+	+	+	+			+	II		
5.	<i>Pernis apivorus</i>			+		+	+	+			+	II	I	VU
6.	<i>Accipiter gentilis</i>		+	+	+	+	+	+			+	II		
7.	<i>Accipiter nisus</i>	+		+	+	+	+				+	II		
8.	<i>Falco subbuteo</i>			+	+					+	+	II		
9.	<i>Falco tinnunculus</i>			+							+	II		
10.	<i>Tetrao urogallus</i>	+		+	+			+		+	+	III	I	
11.	<i>Bonasa bonasia</i>	+		+	+			+		+	+	III	I	
12.	<i>Columba palumbus</i>		+	+						+	+			
13.	<i>Cuculus canorus</i>		+	+		+	+		+			III		
14.	<i>Strix uralensis</i>		+	+				+			+	II	I	
15.	<i>Upupa epops</i>			+				+				II		VU
16.	<i>Picus canus</i>				+			+				II	I	
17.	<i>Dendrocopos major</i>	+	+	+	+	+	+				+	II		
18.	<i>Dendrocopos minor</i>				+		+					II		
19.	<i>Dryocopus martius</i>				+					+		II	I	
20.	<i>Jynx torquilla</i>			+						+		II		EN
21.	<i>Alauda arvensis</i>		+							+		III		
22.	<i>Hirundo rustica</i>		+	+		+						II		
23.	<i>Delichon urbica</i>			+	+	+					+	II		
24.	<i>Anthus spinoletta</i>			+	+						+	II		
25.	<i>Anthus trivialis</i>			+	+				+	+		II		
26.	<i>Motacilla cinerea</i>		+	+	+	+	+	+			+	II		
27.	<i>Motacilla alba</i>		+	+	+	+	+	+		+	+	II		
28.	<i>Lanius collurio</i>		+	+		+	+		+		+	II		
29.	<i>Sturnus vulgaris</i>				+									
30.	<i>Garrulus glandarius</i>	+	+	+	+	+	+	+	+	+	+			
31.	<i>Nucifraga caryocatactes</i>	+	+	+	+	+	+	+	+	+	+	II		
32.	<i>Corvus corax</i>	+	+	+	+	+	+	+	+	+	+	III		EN
33.	<i>Cinclus cinclus</i>	+	+	+	+	+	+	+			+	II		
34.	<i>Troglodytes troglodytes</i>	+	+	+	+	+	+	+	+	+	+	II		
35.	<i>Prunella collaris</i>			+							+	II		
36.	<i>Prunella modularis</i>		+	+		+	+	+	+		+	II		
37.	<i>Sylvia atricapilla</i>		+	+	+	+	+	+	+	+	+	II		
38.	<i>Sylvia curruca</i>		+	+		+				+	+	II		
39.	<i>Phylloscopus trochilus</i>		+	+			+	+	+			II		
40.	<i>Phylloscopus collybita</i>		+	+	+	+	+	+	+		+	II		
41.	<i>Phylloscopus sibilatrix</i>			+							+	II		
42.	<i>Regulus regulus</i>	+	+	+	+	+	+	+	+	+	+	II		
43.	<i>Regulus ignicapillus</i>		+		+	+	+	+				II		
44.	<i>Ficedula parva</i>			+					+			II	I	
45.	<i>Muscicapa striata</i>			+							+	II		
46.	<i>Phoenicurus phoenicurus</i>		+	+		+					+	II		
47.	<i>Phoenicurus ochruros</i>		+	+	+	+				+	+	II		
48.	<i>Erithacus rubecula</i>		+	+	+	+	+	+	+	+	+	II		
49.	<i>Turdus torquatus</i>			+						+		II		
50.	<i>Turdus merula</i>		+	+	+	+	+	+	+	+	+	III		
51.	<i>Turdus philomelos</i>		+	+	+	+	+	+				III		
52.	<i>Turdus viscivorus</i>		+	+	+			+		+		III		
53.	<i>Turdus pilaris</i>		+			+						III		
54.	<i>Parus montanus</i>	+	+	+	+	+	+	+	+	+	+	II		
55.	<i>Parus cristatus</i>	+	+	+	+		+	+		+	+	II		
56.	<i>Parus caeruleus</i>	+	+	+	+	+	+	+	+	+	+	II		
57.	<i>Parus ater</i>	+	+	+	+	+	+	+	+	+	+	II		
58.	<i>Parus major</i>	+	+	+	+	+	+	+	+	+	+	II		
59.	<i>Aegithalos caudatus</i>	+	+	+	+	+	+	+	+	+	+	II		
60.	<i>Sitta europaea</i>	+	+	+	+	+	+	+				II		
61.	<i>Certhia familiaris</i>	+	+	+	+	+	+	+		+	+	II		
62.	<i>Fringilla coelebs</i>	+	+	+	+	+	+	+	+	+	+	III		
63.	<i>Pyrrhula pyrrhula</i>	+	+	+	+	+	+	+	+	+	+	III		
64.	<i>Coccothraustes coccothraustes</i>			+		+						II		
65.	<i>Carduelis spinus</i>	+			+	+	+	+		+		II		
66.	<i>Carduelis carduelis</i>		+		+	+	+	+		+		II		
67.	<i>Carduelis cannabina</i>				+	+						II		
68.	<i>Loxia curvirostra</i>	+		+	+					+	+	II		
69.	<i>Emberiza cia</i>		+			+						II		
70.	<i>Emberiza citrinella</i>		+	+							+	II		
<b>Total</b>		23	41	40	38	42	37	32	28	29	42	67	10	7

*collaris*, which were observed only here. Other 6 species were also found only along this transect: *Phylloscopus sibilatrix*, *Muscicapa striata*, *Pernis apivorus*, *Aquila pomarina*, *Falco tinnunculus* and *Delichon urbica*. The last two species were observed near Sterpu Peak as well.

Both the species number and the specific structure of bird communities remain relatively constant during the warm period of the year. Thus, the cluster analysis of the four seasons based on Jaccard similarity index (Fig. 2) shows a high homogeneity of the warm seasons, while during winter, the most distinctive bird fauna is found. The same analysis, performed along the altitudinal gradient, also reveals a gradual change in the ornithofauna, different transects joining by the increase in elevation (Fig. 3). However, the highest similarity (0.73 in terms of Jaccard index) was calculated not for the first two transects, but for transects II and III, both situated in the mixed forest vegetation level, joined at a greater distance (0.57) by transect I, which crosses the village. The most distinctive fauna (0.35) was found in transect V, situated at the highest elevation, but also along an ecotone.

Based on the birds' observed presence in the research area, we established three phenological categories: sedentary species - encountered during the entire study period, warm season species - observed during spring, summer and autumn but not found in winter, and wintering species. As several less abundant species were only seldom observed (some in a single transect), we do not have the evidence of breeding for all the species recorded during the warm period of the year. The

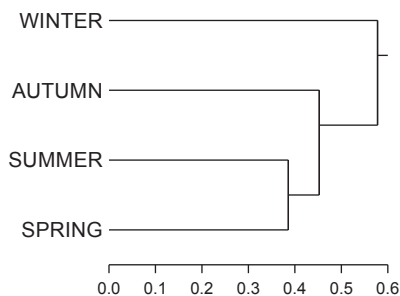


Fig. 2 - Similarity (1-Jaccard index values) between the four seasons based on the bird fauna.

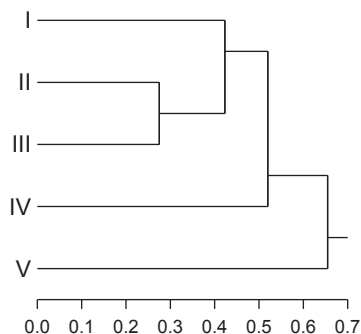


Fig. 3 - Cluster analysis of the five transects, based on the similarity (1-Jaccard index values) between their bird fauna.

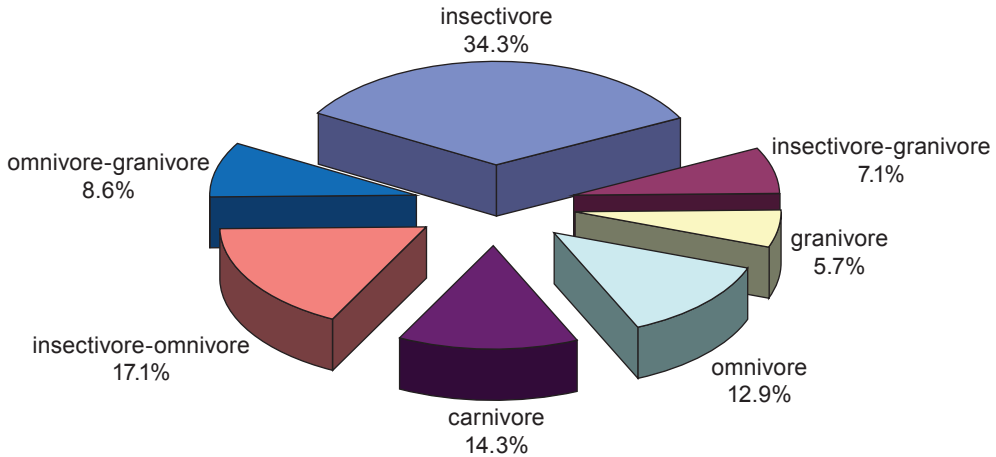


Fig. 4 - Trophic structure of bird community (% of species) from the Lotrioara River Basin during the study period.

warm season birds are the most numerous species, representing 67.1%, while the sedentary birds make up only 31.4% of the species.

Among the feeding guilds the insectivores are prevailing, representing 34.3% (Fig. 4) and, as the antropic impact on the valley is low, the carnivorous species are also well represented in the area (14.3%). However, many bird species, especially insectivores, change their diet during the year, according to the availability of different food sources. Some species feed during the breeding season exclusively (or mainly) on insects, but switch during winter to an exclusively vegetal (e.g. Emberizidae) or omnivorous diet (e.g. Turdidae), dominated by fruits (berries) and seeds. These species are included in two separate groups with a variable trophic regime, insectivores-granivores (7.1%) and the insectivores-omnivores (17.1%). The omnivores (12.9%) (belonging to Corvidae and Paridae families) have a mixed trophic regime all year round, although a shift in the prevailing food resource exploited by these birds also occurs with the change of seasons (Bezzel, 1996).

The Pearson chi-square test for independence revealed significant differences ( $\chi^2 = 18.56$ , d.f.= 3,  $p < 0.01$ ) between the ratios of feeding guilds in the breeding season (from late spring to late summer) and in the rest of the year (from beginning of autumn to early spring), showing a seasonal dynamics of the bird fauna trophic structure.

An important change is recorded by granivores, which increase in ratio from 5.8% during the breeding season to 30.4% in winter (Fig. 5). Omnivores also become more numerous, prevailing during the cold season (43.4%). In contrast, insectivores decrease from 59.4% in the breeding season to 17.7% in winter. Carnivores present a low amplitude of variation along the year.

Concerning the altitudinal distribution of the feeding guilds, the most evident characteristic is the variation of granivores, which reach the highest ratio (10.3%) in the uppermost sector (V), where numerous species which turn in winter to vegetarian diet (Fringillidae) also occur. However, the Pearson chi-square test for independence indicates no significant dependence of the trophic structure on the elevation.

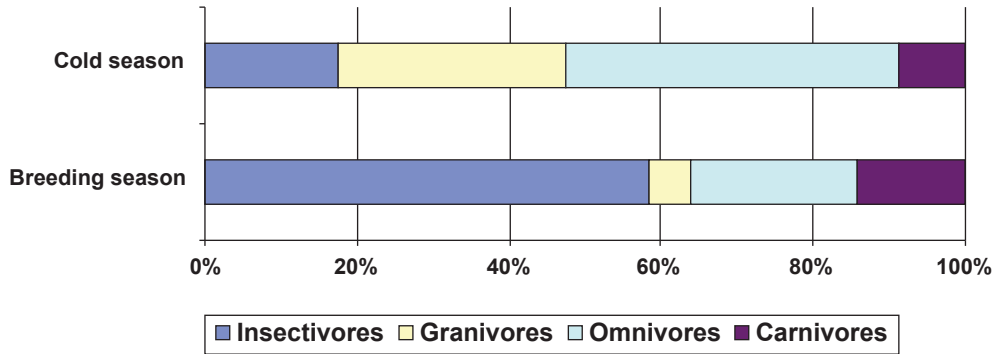


Fig. 5 - Seasonal dynamics of feeding guilds (% of species) in the ornithofauna from Lotrioara River Basin.

### DISCUSSIONS

The 70 identified bird species make Lotrioara River Basin comparable to other researched mountain areas. Based on observations during the breeding season Petrescu notes 64 bird species from Făgăraș Mountains (2005) and 76 from Piatra Craiului (1995), Murariu et al. (2009 b) 74 species (among them 10 mentioned only in the literature) from Zarand Mountains. During the 22 months study in the Râușor dam lake area (Jezer-Păpușa Mountains) Mestecăneanu (2008) recorded 69 bird species. However, these results cannot be compared directly, due to the differences in the research methodology and habitat structure from the study areas.

Lotrioara River Basin is a mountain area typical for the Southern Carpathians, characterised by a relatively low human impact, especially in its upper part. The high proportion of species included in the annexes of Bern Convention (95.7%, 80% being strictly protected - annex II), Bird Directive (14.2%) and in the Red Book of Romanian Vertebrates (10%, four species being considered vulnerable, two endangered and one critically endangered) confirms the conservative interest of this area, included in the ROSPA0043 Frumoasa, being one of the Important Bird Areas in Romania - AIA RO051 (Papp & Fântână, 2008).

Considering the elevational distribution some of the bird species from Lotrioara River Basin can be accounted as eurybiotic, being found in a large variety of habitats, at different altitudes (*Nucifraga caryocatactes*, *Corvus corax*, *Erithacus rubecula*, *Turdus merula*, *Fringilla coelebs*, *Phylloscopus collybita*, *Parus montanus*, etc.). Other species were observed only in the lower sector, or exclusively in the village (*Phoenicurus phoenicurus*, *Hirundo rustica*, *Turdus pilaris*, *Sturnus vulgaris*). The number of birds restricted to higher elevations is small, some of them being linked to the subalpine vegetation level (*Anthus spinoletta*, *Prunella collaris*), others to the spruce forest (*Turdus torquatus*, *Loxia curvirostra*). Thus, the species richness decreases constantly with the increase in altitude. The only exception is represented by the last sector, transect V, which shelters a higher number of species than the previous one, because it crosses a variety of habitats and the ecotone effect is strong. Here we observed birds typical both for mature spruce forests, feeding on the abundant seeds (*Loxia curvirostra*) or insects from the tree trunks (*Dendrocopos martius*, *Jynx torquilla*), and for open habitats (*Alauda arvensis*, *Anthus trivialis*).

The monotonic decrease of species' number with increasing altitude was mentioned by several other authors, in different mountains, both in tropical (Terborgh,

1977; MacKinnon & Phillips, 1993) and temperate (Sackl & Samwald, 1997; Sergio & Perdini, 2007) regions. In many cases the continuous decrease observed along the elevational gradient is the effect of area. If the necessary correction is made, the relationship between species richness and elevation gives in several cases a humpshaped curve (Rahbek, 1995).

Compared to the Romanian bird fauna, the ornithofauna from Lotrioara Basin has a very different phenologic structure. Considering the whole Romanian territory, most of the encountered bird species are sedentary, while in mountains, including the research area, most birds only nest here. The breeding species include the migratory birds (*Phylloscopus collybita*, *Sylvia atricapilla*, *Hirundo rustica*, *Cuculus canorus*) but also non-migratory species that during winter are found at lower elevations (*Turdus merula*, *T. viscivorus*, *Coccothraustes coccothraustes*, *Carduelis carduelis*). The relatively small proportion of sedentary species is due to the insufficient resources offered by the area in the cold season. Most of the resident species (*Garrulus glandarius*, *Nucifraga caryocatactes*, *Corvus corax*, *Parus montanus*, *P. ater*) are found during the whole year up to Prejba Chalet, while a smaller number (*P. major*, *Fringilla coelebs*, *Troglodytes troglodytes*) are present during winter only in the lower parts of the valley. The species which descend to lower altitudes during the cold season, whether they leave the basin or not, in spring return gradually up to the maximum elevation. Thus, *Turdus merula* was found in March in sectors I and II, in April in sectors I, II, III and in June up to Prejba Chalet. Contrary, the migratory species advance generally much faster on altitude. Thus, *Phylloscopus collybita* was first observed in April, being noted in the same day up to the maximum altitude where it was recorded, and *Motacilla alba* was observed in March next to Prejba Chalet.

The species not observed in winter are not necessarily completely absent from the research area in this season, but their densities are decreased, most of the individuals having left the valley for some more suitable areas.

Among the feeding guilds, the prevailing insectivores include birds feeding on insects mainly in the canopy (*Phylloscopus* spp., *Regulus* spp., *Aegithalos caudatus*), on the tree stems (*Dendrocopos minor*, *Dryocopus martius*), in the air (*Delichon urbica*, *Hirundo rustica*), on the ground (*Motacilla alba*, *Anthus spinoletta*), and also two species living exclusively along the river courses (*Cinclus cinclus* and *Motacilla cinerea*), which feed on aquatic invertebrates. The latter are included by some authors (Stănescu, 1971) in a separate feeding guild, the potamotrophs. Most species belonging to this group are breeding species, as insects are a resource available mainly in the warm season, being the most important food for the growing chicks. Thus, the strong decrease of the insectivores' ratio during winter is due to the migration of some species (*Phylloscopus* spp., *Delichon urbica*, *Hirundo rustica*, *Lanius collurio*) and to the fact that other species (*Turdus* spp., *Fringilla coelebs*) switch to vegetal food. The shift in the birds' diet occurs at the end of the breeding season, at the end of summer and beginning of autumn, when fruits and seeds become an accessible food resource, and becomes stronger in winter, when insects and other invertebrates are scarce and difficult to reach.

In turn the ratio of granivores increases significantly during the cold season. Their food includes seeds and fruits of trees, both deciduous (*Carduelis spinus*, *Pyrrhula pyrrhula*) and coniferous (*Loxia curvirostra*), but also herbaceous plants (*Carduelis cannabina*, *C. carduelis*). The slight increase of granivores' ratio at higher elevations was observed also in other studies (Klosius, 2008). However, like in our case, the differences were not significant.

### Conclusions

During this study in Lotrioara River Basin 70 bird species belonging to 9 orders were recorded. The spatial dynamics of the community is characterised by the decrease of species' number with the increase in altitude. However, this relation is not always linear, being influenced also by the habitat heterogeneity. Transects are clustered depending on altitude and habitat type. The bird community from Lotrioara River Basin is dominated by the breeding species, a few species being adapted to the harsh environmental conditions in the mountain valleys during winter. Insectivores prevail in the community, but significant seasonal variations are recorded, during winter omnivores and granivores becoming dominant.

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## AVIFAUNA DIN BAZINUL RÂULUI LOTRIOARA (MUNȚII LOTRULUI, ROMÂNIA)

### REZUMAT

Sunt prezentate rezultatele unui studiu asupra comunităților de păsări din bazinul râului Lotrioara (Munții Lotrului, România), desfășurat pe parcursul unui an, utilizând metoda transectelor de-a lungul văii principale. Cercetările au urmărit caracteristicile dinamicii ornitofaunei, atât din punct de vedere spațial cât și temporal. Pe perioada studiului au fost identificate, în zona cercetată, 70 de specii aparținând la 9 ordine. Numărul de specii scade cu creșterea altitudinii, însă această descreștere nu este liniară, ci depinde și de heterogenitatea habitatelor. Pe parcursul anului, numărul speciilor variază de la un minim iarna la un maxim în timpul verii. Structura trofică a comunităților de păsări din bazinul râului Lotrioara este dominată de insectivore, dar în perioada rece a anului dominanța este preluată de omnivore și granivore.

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"Lucian Blaga" University of Sibiu  
Faculty of Sciences, Department of  
Environmental Sciences and Physics  
5-7, Dr. I. Raţiu St., 550012 - Sibiu, Romania  
e-mails: benedek\_ana@yahoo.com  
meosirbu@yahoo.com