

BIOTOPIC DISTRIBUTION OF URBAN BIRD FAUNA IN THE REPRODUCTIVE PERIOD

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Abstract. *The ornithological observations accomplished on bird populations from different biotopes of Chisinau city allow us to present the actual characteristic of bird population distribution and density from the urban territories in breeding period. The biotopic distribution of bird fauna in Chisinau city is conditioned by the phytocenotic structure of green spaces within the city, as well as by the vegetal structure of its surroundings, which provide nest places and shelters for various bird species. In the breeding period 64 bird species were registered on the territory of Chisinau city. The most abundant and various is the bird fauna from the green zone of the city that includes several parks in different areas of the city, which represent the main link in the process of creation, development and conservation of urban bird fauna by comparing with residential districts, where the reproduction conditions are limited.*

Keywords: *distribution, diversity, density, ornithofauna, urban environment.*

Rezumat. Distribuția biotopică a ornitofaunei urbane în perioada de reproducere. *Observațiile ornitologice efectuate asupra populațiilor de păsări în zona de cercetare în diverse biotopuri din orașul Chișinău ne-au permis să prezentăm o caracteristică actualizată a distribuției și densității populațiilor de păsări din teritoriul urban în perioada de cuibărit. Distribuția biotopică a ornitofaunei din orașul Chișinău este condiționată de structura fitocenotică a spațiilor verzi din raza orașului, cât și de structura vegetală a culoarului din jurul lui, care oferă locuri de cuibărit și adăpost pentru diverse specii de păsări. În perioada de reproducere pe teritoriul orașului Chișinău au fost identificate 64 specii de păsări. Cea mai reprezentativă și mai variată este ornitofauna din zona verde a orașului care include câteva parcuri din diverse zone, acestea reprezentând veriga de bază în procesul de formare, dezvoltare și conservare a ornitofaunei urbane, comparativ cu spațiile verzi din sectoarele de locuit unde condițiile de reproducere a ornitofaunei sunt limitate.*

Cuvinte cheie: *distribuție, diversitate, densitate, ornitofaună, mediu urban.*

INTRODUCTION

The biologic diversity represents a specific peculiarity of our planet that insures the optimum functioning of the ecosystems, the existence and development of the biosphere as a whole. In the last decades as far as the man changes the natural landscapes, thus disturbing the normal development of the vital process of the animals, it was established that more and more bird species find refuge in the anthropogenic environment that still remains hospitable for many species.

At present in the Republic of Moldova practically did not remain any ecosystem which was not affected by man. The territory was modified in such a degree that the modern ecosystems represent a combination of natural and artificial elements. The proportion of urban ecosystems in Moldova is almost equal to the forest one and constitutes 9.4% of the republic territory. The urban ecosystems have a substantial importance and are a significant component of environment creation in the sectors occupied by buildings under construction; they create favourable life conditions for bird species with high adaptive potential.

MATERIAL AND METHODS

The studies concerning the biotopic distribution of urban bird fauna were accomplished in Chisinau city. The city territory was divided in several sectors, the routes were determined for the estimation of bird population number. The identification of the species was realized in the first hours of the morning when the bird activity is the highest (6 – 11 a.m.). The bird population number estimations were accomplished by the method of routes and squares after KLAUSNITSER (1990). The recording of bird singing was also accomplished.

The index of bird population density (ind/sq.km.) was calculated after the formulas proposed by NAUMOV (1965) and SHCHEGOLEV (1977). The density (M) was calculated according to the formula: $M = n/lx2dxA$, (SHCHEGOLEV, 1977), where: M is species abundance; n – number of individuals of certain species; 2d – identification strip (according to the singing activity of the birds); l – length of the route; A – species activity.

RESULTS AND DISCUSSIONS

The ornithological observations accomplished on bird populations in the study zone in various biotopes from Chisinau city allow showing the actual characteristics of bird populations' distribution and density within the urban territories. The bird number estimation was realized in breeding periods starting with year 2006. As study area, parks from different city sectors were selected.

The park “Valea Morilor” (“Mills’ Valley”) is situated in the north-western part of the city near the central district, on a terrain with accidental relief. The park occupies an area of about 120 ha, including 36 ha occupied by the lake. The alley around the lake consists of several tree species, as poplar, acacia, locust tree, pagoda tree, elm, birch. About half of the park territory includes a great variety of tree and bush species. Within the park area there are some fir sectors, where the 2nd and 3rd vegetation levels are missing. In the first vegetation level in different sectors of the park *Populus nigra*, *Betula pendula*, *Ulmus carpinifolia*, *Acer platanoides* etc. dominate. The 2nd level is represented by *Picea* sp., *Salix alba*, *Sophora japonica* etc. The 3rd level is represented by small bushes and scrub, which is rare because of its intense cutting in the last years that determined the decreasing of the number of bush birds. The park is bounded on one side by a district with residential buildings and from another side – by a commercial center. The park, in spite of its relief and vegetation peculiarities, has a rather rich bird fauna and serves as corridor for bird incursions in city.

The park “Valea Trandafirilor” (“Rose valley”) is situated in the south-eastern part of the city between Center and Botanica districts and occupies an area of 148 ha. It is formed by various tree communities, which alternate with open areas and three lakes with a total surface of 10.85 ha; they represent an attraction for water birds coming on the park territory. More than half of the park area is covered by plantations formed by trees, bushes and grassy vegetation arranged in parcels, each of them formed by different species. The urban park “Valea Trandafirilor” represents a complex of ecosystems favourable for many bird species that offer sufficient food supply, places for breeding and permanent shelter for resident and migratory bird species.

The Dendrological park is placed in the south-western part of the city near “Valea Morilor” park, and includes 4 phytocenotic complexes: decorative plants, cultivated plants, arboretum and spontaneous vegetation. The trees are grouped in parcels, and open spaces there are between them. The parcels are formed by *Populus pyramidalis*, *Acer tataricum*, *Populus alba*, *Malus sylvestris*, *Picea abies*, *Salix* sp., *Pinus* sp., *Betula* sp. The bush vegetation form separate assemblage and is represented by *Crataegus* sp., *Thuja* sp., *Salix* sp., *Syringa* sp., *Berberis* sp. The herbage is well developed and forms glades similar to meadows. The aquatic ecosystem is represented by a lake having an area of 2 ha, and by Durlleshti rivulet that passes along the park. The high variety of trees and bush species, and the limited access of people on the park territory allow the existence of various bird species from different ecological groups.

The public garden “Ștefan cel Mare” is the oldest park of the city. It was planted in 1818 and for long time it was the only park in the city. The vegetal compound of the park is particularly diverse and comprises about 50 tree and bush species, including some rare species, such as *Gleditsia* sp., *Libocedrus endl*, *Juniperus virginiana* etc. The park is placed in the centre of the city and occupies 7 ha. The trees form two levels, the first one is formed by *Betula* sp., *Acer tataricum*, *Robinia* sp., *Ulmus* sp., *Fraxinus* sp., *Populus* sp., the second one – by *Castanea* sp., *Salix* sp., *Platanus* sp., *Picea abies*, *Morus* sp., *Betula* sp., *Quercus* sp. There are also shrubs: *Buxus* sp., *Spirea* sp., *Cotinus coggygria*, *Syringa* sp. A fountain of 0.09 ha situated in centre of the park serves as aquatic source.

The vegetal structure, small area and unlimited access of people have a direct or indirect influence upon bird populations of this park. Therefore, the species numbers as well as birds’ density are much lower by comparing to other parks of the city. The above mentioned floristic diversity of the parks allows the existence of rather rich bird fauna by comparing the squares, alleys, residential districts, where the phytocenotic variety is much lower or missing completely because of intense constructions.

The parks, at their turn, have an important role in urban climat softening, regulate the temperature, retain and fix the substances that pollute the air, increase the humidity and serve as recreation places.

The results of our studies on distribution process of bird fauna from different biotopes of the city are presented in Table 1.

According to the accomplished studies 64 bird species were registered during the breeding period. The most abundant and diverse was the bird fauna from the green area of the city – parks, botanical gardens, squares, alleys etc. In the Dendrological park 58 bird species were recorded, in „Valea Morilor” park – 44, in „Valea Trandafirilor” park – 43, and in public garden „Ștefan cel Mare” was recorded the lowest number of bird species within the green sectors – only 10 species. This fact is due to several factors: its placement in the central zone of the city, influence of disturbing factors, reduced area, poor vegetation structure, the absence of aquatic biotope – all these factors lead to number limitation of bird species breeding in this park. Thus, the public garden „Ștefan cel Mare”, according to the species number is more similar to the residential district than to other studied parks. The sector of urban buildings was as expected – with much lower number of species by comparing to the green areas. The 5 floor building district offers nest conditions for 26 species, the 9 floor building district – for 19 species, the private sector – for 21 bird species. The compared studies of breeding bird populations from different biotopes shows that at the city limits there were registered many species that were not observed breeding in the central part of the city – *Corvus corax*, *Corvus monedula*, *Jynx torquilla*, *Emberiza calandra*, *Saxicola ruberta*, *Saxicola torquata* etc. The mentioned bird species are more frequently attracted by the forest plantations that joint with the urban environment.

Studying the floristic diversity of the investigated areas, which include several city parks in different city zones, we can see that the parks represent the main link in the process of creation, development and conservation of urban bird fauna, by comparing with the green areas from residential districts, where the breeding conditions of the birds are limited.

Depending on the preference toward nesting places, the birds recorded during breeding period can be divided in several ecological groups:

- arboreal species – bird species nesting in tree crowns;
- shrubby species – bird species nesting in bushes or shrubbery;
- terrestrial species – bird species nesting on soil surface, between herbs or near tree trunks;
- species nesting in holes – bird species with high plasticity, nesting on poles, in pipes and conducts, under house roof;
- species nesting in buildings – this bird group is connected to human settlements, and places their nests on buildings;
- hollow species – bird species nesting in tree hollows. Some species from this group are not able to make themselves hollows in tree trunks, so they use the existent hollows;
- water birds – species connected with aquatic biotopes and nesting in reed vegetation.

Table 1. Distribution of bird species within the studied biotopes.

Tabel 1. Distribuția speciilor de păsări în biotopurile studiate.

Species	P.V.M.	P.V.T.	Dendrol.	P.S.C.M.	9 floor district	5 floor district	Priv. sectors
<i>Ixobrychus minutus</i>	-	+	-	-	-	-	-
<i>Anas platyrhynchos</i>	+	+	+	-	-	-	-
<i>Accipiter nisus</i>	+	-	+	-	-	-	-
<i>Falco subbuteo</i>	+	-	+	-	-	-	-
<i>Gallinula chloropus</i>	+	+	+	-	-	-	-
<i>Fulica atra</i>	+	+	+	-	-	-	-
<i>Columba livia domestica</i>	+	+	+	+	+	+	+
<i>Columba palumbus</i>	-	+	+	-	-	-	+
<i>Streptopelia turtur</i>	-	+	-	-	-	-	-
<i>Streptopelia decaocto</i>	-	-	+	-	-	-	+
<i>Athene noctua</i>	-	-	+	-	-	-	+
<i>Strix aluco</i>	-	+	+	-	-	-	-
<i>Asio otus</i>	+	-	+	-	-	-	-
<i>Tyto alba</i>	-	-	-	-	-	-	+
<i>Apus apus</i>	-	-	-	-	+	+	+
<i>Alcedo atthis</i>	+	+	+	-	-	-	-
<i>Upupa epops</i>	+	-	+	-	-	-	-
<i>Dendrocopos syriacus</i>	+	+	+	-	+	+	-
<i>Dendrocopos major</i>	+	+	+	-	-	+	-
<i>Dendrocopos medius</i>	-	-	+	-	-	-	-
<i>Dendrocopos minor</i>	-	+	+	-	-	-	-
<i>Picus canus</i>	+	+	+	-	-	-	-
<i>Jynx torquilla</i>	+	+	+	-	-	-	-
<i>Hirundo rustica</i>	+	-	+	-	+	+	+
<i>Delichon urbica</i>	-	-	+	-	+	+	+
<i>Motacilla alba</i>	+	+	+	-	+	-	-
<i>Lanius collurio</i>	+	+	+	-	-	+	-
<i>Oriolus oriolus</i>	+	+	+	-	-	-	-
<i>Sturnus vulgaris</i>	+	+	+	+	+	+	+
<i>Garrulus glandarius</i>	+	+	+	-	+	+	+
<i>Pica pica</i>	+	+	+	+	+	+	+
<i>Corvus monedula</i>	+	-	+	-	-	-	-
<i>Corvus frugilegus</i>	+	+	+	+	+	+	+
<i>Corvus corone cornix</i>	+	+	+	-	-	-	-
<i>Troglodytes troglodytes</i>	+	-	+	-	-	+	-
<i>Acrocephalus arundinaceus</i>	-	+	+	-	-	-	-
<i>Sylvia atricapilla</i>	+	+	+	-	-	+	-
<i>Sylvia curuca</i>	+	+	+	-	+	-	-
<i>Sylvia borin</i>	-	-	+	-	-	-	-
<i>Sylvia hortensis</i>	-	+	-	-	-	-	-
<i>Phylloscopus collybita</i>	+	+	+	-	+	+	+
<i>Phylloscopus sibilatrix</i>	-	-	+	-	-	-	-
<i>Muscicapa striata</i>	+	+	+	-	-	-	-
<i>Ficedula albicollis</i>	+	+	+	-	-	+	-
<i>Ficedula hypoleuca</i>	-	-	+	-	-	-	-
<i>Phoenicurus phoenicurus</i>	+	+	+	-	+	+	-
<i>Phoenicurus ochruros</i>	+	+	-	-	-	+	-
<i>Luscinia luscinia</i>	+	+	+	-	-	+	-
<i>Erithacus rubecula</i>	+	+	+	-	+	-	-
<i>Turdus merula</i>	+	-	+	-	-	-	+
<i>Turdus philomelos</i>	+	+	+	-	-	-	-
<i>Parus major</i>	+	+	+	+	+	+	+
<i>Parus caeruleus</i>	+	+	+	+	+	+	+
<i>Parus palustris</i>	+	-	+	-	-	+	-
<i>Remiz pendulinus</i>	-	-	+	-	-	-	-
<i>Sitta europaea</i>	+	+	+	-	-	-	-

<i>Certhia familiaris</i>	+	+	+	+	-	+	-
<i>Passer domesticus</i>	+	+	+	+	+	+	+
<i>Passer montanus</i>	+	+	+	+	+	+	+
<i>Fringilla coelebs</i>	+	+	+	+	-	+	+
<i>Carduelis chloris</i>	-	+	+	-	+	+	+
<i>Carduelis carduelis</i>	+	+	+	-	-	-	+
<i>Carduelis canabina</i>	-	-	+	-	-	-	-
Species number	64	44	43	58	10	19	21

The data presented in Fig. 1 show that the majority of bird species belongs to arboreal group (29%) and to hollow group (24%), while the lowest number of species (7%) belongs to water birds group, which is determined by reduced water surface and reed vegetation, but also by disturbing factors (stray dogs, cats, people). The species number that nest in holes is not stable, because the birds prefer the tree hollows from natural biocoenoses. In the anthropogenic ones, because of the lack of natural hollows, the birds can breed in various types of cavities of anthropogenic origin. For example, the species with higher adaptation plasticity as *Parus major*, *P. palustris*, *Phoenicurus ochruros* can occupy various cavities such as pipes, conducts, poles; *Passer domesticus* nests in hollows, under the house roof overhang, in artificial nests etc.

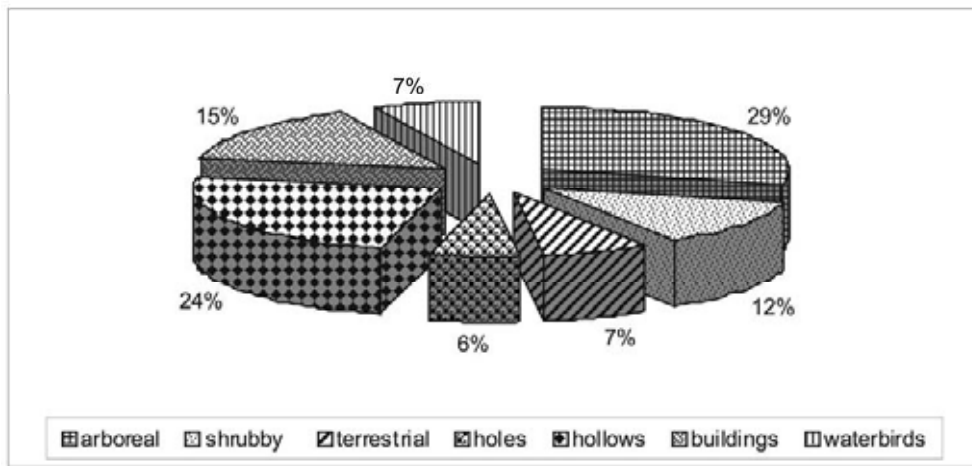


Figure 1. Proportion of bird ecological groups according to their nesting preferences.
 Figura 1. Ponderea grupurilor ecologice de păsări în dependență de preferințele de cuibărit.

At present can be observed the intense process of intrusion into the city of some species usually less common in urban areas, such as *Turdus merula*, *T. philomelos*, *Carduelis carduelis*, *Phoenicurus ochruros*, *Coccothraustes coccothraustes*. Inside the urban area, the number of individuals of these species grows every year in breeding period, thus contributing to the increasing of urban bird fauna diversity. These species will probably become more common in the future.

The information concerning bird density from various ecological groups in different studied ecosystems is presented in table no. 2. The analysis of table data revealed that the highest value of bird density belongs to the hole nesting species group (753.35 ind./km²) registered in “Valea Morilor” park. This fact can be explained by the existence of many hollow trees, lamps, poles and conducts that offer many nesting places for hole nesting species. The lowest value of this index (5.95 ind./km²) was recorded in arboreal ecological group in 9 floor building district, because here the bushes are practically missing (they were cut out to arrange parking places for cars).

Table 2. Density of bird population (ind./km²) and their distribution by ecological groups in nesting period.
 Tabel 2. Densitatea populațiilor de păsări și repartizarea lor pe grupuri ecologice în perioada nidicolă.

Study sectors	Ecological bird group according to nest places						
	Arboreal	Shrubby	Soil	Holes	Buildings	Hollow	Paludous
Park V.M.	214.27	25.5	74.82	753.39	180.28	212.57	108.84
Park V.T.	112.69	14.29	29.37	445.25	96.03	72.13	121.43
Dendrol. Park	65.29	36.72	12.24	158.77	22.45	216.32	4.08
Park Stefan c. M.	140.00	30.00	40.00	580.00	80.00	100.00	0
5 floor district	85.76	19.6	0	437.50	49.09	76.47	0
9 floor district	74.4	5.95	0	502.97	26.78	17.85	0
Private sector	122.25	11.90	0	327.37	35.7	127.37	0

After comparing the bird density recorded in park biotopes with the density from residential districts it can be observed that in parks the density of arboreal and hollow species is higher due to the structural diversity of tree crown and of tree age, while in residential areas the density of bird species is much lower because of low diversity of trees.

CONCLUSIONS

– The biotopic distribution of bird fauna in Chishinau city is conditioned by the phytocenotic structure of green areas within the city area, as well as by the vegetation structure of the corridor around it, which all provide breeding and shelter places for various bird species.

– On the territory of Chishinau city 64 bird species were recorded during the breeding season.

– The most abundant and diverse bird fauna lives in the green area of the city, the Dendrological park – 59 species, “Valea Morilor” park – 45, “Valea Trandafirilor” park – 44 species.

– The highest value of bird density belongs to the hole nesting species (753.35 ind./km²) recorded in “Valea Morilor” park and it can be explained by the existence of many hollows in trees, lamps, poles and pipes, that offer many nesting places for this kind of birds. The lowest value of this index (5.95 ind./km²) was recorded in arboreal ecological group in 9 floor building district, because here the bushes are practically missing.

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Received: May 26, 2009
Accepted: August 18, 2009