

Differences between Bird Communities in the Forest Parks of two Megalopolises (Ukraine)

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Abstract: This work presents a comparative analysis of the avifauna of forest parks in two megalopolises in Ukraine by providing an Annex containing a list of all the species classified in categories as illustrated in Figure 2 including categories of protected species; this is believed to be very helpful in understanding the composition of the avifauna. The aim of the work is to study the composition and structure of bird communities in the forest park zones of Ukrainian cities, considering their avifauna as a reserve for the native bird species of the forest-steppe zone. The number of breeding species decreases eastwards for there are currently sixty-seven species in Kyiv and fifty-two species in Kharkiv. Most representatives of the species composition of birds in the forest parks of the cities are common for the faunas of the compared regions. The absence of some species in any of the researched forest parks can be attributed to the fact that the individuals of the population in this region select forest sites located outside the city for nesting. However, they use the forests in some regions for elements of ecological niche not pertaining to nesting. The similarity of the revealed communities is 0.70 according to the Jacquard index, and 0.82 using the Sorensen index. Birds nesting openly in the trees canopies prevail over birds nesting in hollows of various types (respectively: 46.3–26.9% in Kyiv and 46.2–25.0% in Kharkiv). The proportion of species that are eurytopic in the selection of nesting sites and that use several types either natural or anthropogenic, differs slightly (8.9–7.7%); their number

eastwards is higher. The synanthropization of the avifauna studied in the forest park of the region located eastwards is higher: the proportion of synanthropes is between 0.868 and 0.836, and the values of the index of community synanthropization are between 0.69–0.55.

Keywords: Bird communities, Ecological groups, Sinanthropization, Forest parks, Forest-steppe zone.

Introduction

Large-scale changes in regional faunas are now observed practically throughout the Palearctic region (Günalp and Seto, 2013; Lawlor and Meng, 2019). Excessive anthropogenic pressure results in the elimination of indigenous species that cannot adapt to the effects of disturbance factors (Ditchkoff *et al.*, 2006; Heyman, 2010). Birds are mobile animals that are flexible in acquiring new adaptations (Chaplygina, 2015), which allow them to settle in territories that have a strong pressure of anthropogenic factors (Blair and Johnson, 2008; Blinkova, *et al.*, 2020). This leads to the formation of a new community of birds nesting in urban areas (Kooiker, 2007; Batary *et al.*, 2014; Shupova, 2017). It consists mainly of species that undergo changes in a number of ecological and ethological characteristics (Palomino and Carrascal, 2005; Kurosawa, 2009; Blinkova, *et al.*, 2020). Therefore, it becomes really necessary to solve the problem of preserving the native fauna and biotic diversity in the transformed landscapes (Blinkova and

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Shupova, 2017; 2018).

In the residential areas, parks are the centers of wildlife habitats, with conditions close to natural. They provide the sites that many bird species need for nesting and foraging (Amrhein, 2013; Paker, *et al.*, 2013). However, not all bird species can live safely in city parks (Tomialojc, 2007). Landscape parks, which occupy a large area and include parts of natural biotopes serve as one of the main sources for city fauna recovery (Grimm *et al.*, 2008; Moller *et al.*, 2015). A study of the avifauna of such forest parks makes it possible to develop an algorithm for the coexistence of humans and the indigenous species of birds, including those classified as ‘vulnerable.’ For the present work, the researchers selected plots similar in environmental conditions in the urbanized areas of two large cities with a population of more than two million people within the same geographical zone.

The aim of the work is to study the species composition and the ecological structure of bird communities in the forest park zones of Ukrainian cities, considering their avifauna as a reserve for the native bird species of the forest-steppe zone.

Material and Methods

Study site

Bird species composition and the numbers of nesting pairs were investigated over the nesting periods from 2013 to 2017 within the area of model forest parks inside the two megacities of Kharkiv and Kyiv in Ukraine. For the analysis, the researchers used the average data for each of the cities during the above mentioned period. The geographic coordinates of the Kyiv and Kharkiv centers were as follows—Kyiv 50°27'03"N, 30°31'21"E; Kharkiv – 49°59'31" N and 36°13'52" E. Forest-steppe landscapes occupy 39.4% of the Kyiv area and are common to the south-west and south of the city. They are represented by mixed oak forests, where flood and dry meadows, meadow steppes are present in small fragments. The Kharkiv forest park

is represented by an integral upland maple-linden oak grove on the watershed of the Lopan and Kharkiv rivers. The forest has a natural origin, yet forest plantations occupy a significant part. The plant cover is made up of meadows, near-water plants, ruderals, and invasive vegetation. An important distinctive feature of the studied forest park zones is that they are transformed forest areas, which surrounded the cities in the recent past. However, currently, the cities penetrated into the territories of the forests. The residual fragments of the forests, entering the city line, are the recreation area for urban populations. The forest parks contain areas of natural forests with the predominance of *Quercus robur* L., *Acer platanoides* L., *Carpinus betulus* L., *Alnus glutinosa* Gaerth., and *Tilia cordata* L. and with century-old trees on such transformed forests. In some places, the forest plots require reforestation (Figure 1). The forest parks are densely surrounded by residential areas quite adjacent to them. The Kharkiv forest park extends over a huge forest area of 2385 hectares, and is located on the periphery of the city. In Kyiv, the forest park zone is fragmented into plots of various sizes (the largest of which is the Goloseevsky forest, with an area of 1052 ha), located on the outskirts of the city and in the center of a residential area. These forest areas have been conserved after they have been assigned the status of protected natural areas.

Bird surveys

The number and distribution of birds were determined by route counting (Bibby, *et al.*, 2000). The length of the counting lines was 0.8–1.0 km limited by the extent of homogeneous biotope fragment. The width on both sides of the direction of movement was 50 m, and the total length of fixed route was 5.7 km in Kyiv and 3.5 km in Kharkiv. On each route, observations were carried out annually with three repetitions during the nesting period when the birds are most attached to their habitats (end of April–June). The taxonomy and the nomenclature of birds were adopted according to the ‘International

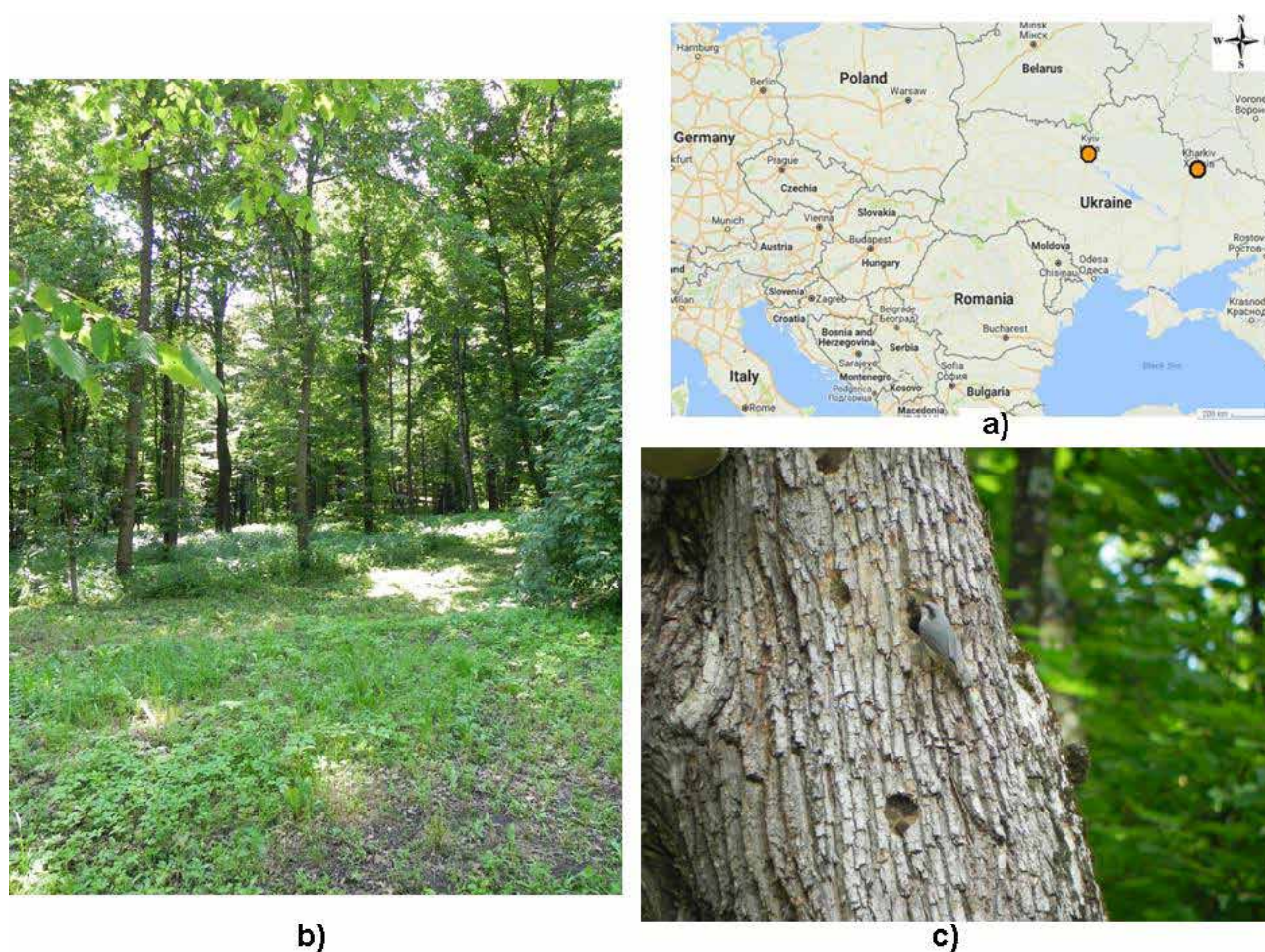


Figure 1. Research area: a) location of two megalopolises (red points); b) fragment of oak and hornbeam forests in a Kyiv forest park in summer; c) *Sitta europaea* on oak in a Kyiv forest park.

Code of the Zoological Nomenclature' (2012). The species of birds were determined and the search for their nests in tree canopies was performed visually using binoculars Nikon Aculon A211/10×50. The singing male bird was counted as a nesting pair for the passerine bird species (Bibby, *et al.*, 2000). The status of the species (breeding, feeding, and nomadism) was determined by the behaviour or the presence of a nest for the non-Passeriformes species.

The average data for the total study period (2013–2017) were calculated for each city. For the average number of pairs, the standard deviation was calculated.

The number of species to be protected according to the lists of various international conventions (Bern Convention, Bonn Convention, Washington Convention) was estimated. The synanthropization index of nesting bird communities for the forest park areas in the studied regions was

determined by Jedryczkowski (Klausnitzer, 1990): $W_s = L_s/L_o$, where L_s is the number of synanthropic species, and L_o is the total number of community species. In this index, the researchers took into account the species (populations) which occur in the Kyiv and Kharkiv cities and the populations of species which were nesting in the natural areas of the Kyiv and Kharkiv regions. Bird species forming synanthropic and natural populations were isolated simultaneously into the group of hemysynanthropes.

Bird species were also classified into ecological groups according to the patterns of microhabitat choice (Belik, 2006). The dendrophils are bird's species that live on the trees of plantation. The species of this category are divided into groups: birds nesting openly in the canopies of trees, ground nesters and nesters of tree hollows. The tree-hollow nesters are divided into primary birds that make hollows (Picidae), and

secondary ones, which settle in ready-made hollows (Sturnidae, some Muscicapidae, Paridae, and some Sittidae). The category of ground nesters includes birds associated with the forest open habitats (Scolopacidae, Caprimulgidae, Motacillidae). The category of cavity nesters includes birds associated with vertically dissected reliefs (cracks in rocks, trees, stumps): some Columbidae, Alcedinidae, Hirundinidae, some Corvidae, some Muscicapidae, some Passeridae. The category of building nesters includes birds associated with urban constructions (in particular, secondary synanthroposized tree hollow nesters or cavity nesters).

Results

In the forest parks of the megalopolises' forest-steppe zone, seventy-one species of birds were recorded, of which sixty-four species (90.1%) are mentioned in various lists

of international environmental conventions (Table 1). Forest parks in Kyiv are the nesting places for sixty-seven bird species; the relative number on average is $1.99 (\pm 0.49)$ pairs/km. In Kharkiv, the number is fifty-two species – $3.15 (\pm 0.54)$ pairs/km. The relative average of nesting pairs in the forest parks of the eastern region is almost twice higher than that in the western region. The similarity in the species composition between the nesting birds of the forest parks in the two cities is great (0.70 according to the Jacquard index, and 0.82 using the Sorensen index).

The basis of the communities are dendrophils. Birds nesting openly in the tree crowns prevail over birds nesting in hollows of various types (respectively: 46.3–26.9% in Kyiv and 46.2–25.0% in Kharkiv). The proportion of species that are eurytopic in the selection and use of nesting sites, whether natural or anthropogenic, differs slightly (8.9–7.7%). Six species nest in buildings

Table 1. The relative number of birds in the forest park areas in Kyiv and Kharkiv cities.

Species	Relative number (pair/km)		Conservation status
	Kyiv	Kharkiv	
1 <i>Anas platyrhynchos</i>	0.1	–	Bk3; Bo1,2
2 <i>Accipiter gentilis</i>	–	0.3	Bk2; Bo1,2; W2
3 <i>Accipiter nisus</i>	0.2	0.3	Bk2; Bo1,2; W2
4 <i>Buteo buteo</i>	0.1	–	Bk2; Bo1,2; W2
5 <i>Falco tinnunculus</i>	0.1	–	Bk2; Bo2; W2
6 <i>Tringa ochropus</i>	0.3	–	Bk2; Bo1,2
7 <i>Tringa totanus</i>	0.3	–	Bk3; Bo1,2
8 <i>Columba palumbus</i>	1.5	0.9	–
9 <i>Columba livia</i>	0.5	–	Bk3
10 <i>Streptopelia decaocto</i> *	0.1	1.1	Bk3
11 <i>Cuculus canorus</i>	0.4	0.9	Bk3
12 <i>Asio otus</i>	0.1	0.3	Bk2; W2
13 <i>Strix aluco</i>	0.1	–	Bk2; W2
14 <i>Caprimulgus europaeus</i>	0.7	–	Bk2
15 <i>Alcedo atthis</i>	–	0.3	Bk2
16 <i>Jynx torquilla</i>	0.3	1.7	Bk2
17 <i>Dendropicos spodocephalus</i>	0.2	0.5	Bk2
18 <i>Dryocopus martius</i>	0.9	–	Bk2

19	<i>Dendrocopos major</i>	1.9	2.8	Bk2
20	<i>Dendrocopos syriacus</i> *	0.1	0.6	Bk2
21	<i>Leiopicus medius</i>	1.7	0.6	Bk2
22	<i>Dryobates minor</i>	1.3	1.1	Bk2
23	<i>Hirundo rustica</i>	0.1	3.4	Bk2
24	<i>Delichon urbicum</i>	0.1	1.7	Bk2
25	<i>Anthus trivialis</i>	1.6	1.1	Bk2
26	<i>Motacilla alba</i>	0.3	1.7	Bk2
27	<i>Lanius collurio</i>	0.9	0.3	Bk2
28	<i>Lanius minor</i>	0.2	–	Bk2
29	<i>Lanius excubitor</i>	0.1	–	Bk2
30	<i>Oriolus oriolus</i>	2.7	1.7	Bk2
31	<i>Sturnus vulgaris</i>	3.8	2.9	–
32	<i>Garrulus glandarius</i>	0.6	1.7	–
33	<i>Pica pica</i>	0.3	4.6	–
34	<i>Corvus monedula</i>	–	0.5	–
35	<i>Corvus cornix</i>	1.7	1.7	–
36	<i>Corvus corax</i>	0.2	–	Bk3
37	<i>Troglodytes troglodytes</i>	2.1	–	Bk2
38	<i>Hippolais icterina</i>	0.5	0.5	Bk2
39	<i>Sylvia atricapilla</i>	1.4	2.8	Bk2
40	<i>Sylvia borin</i>	0.1	0.5	Bk2
41	<i>Sylvia curruca</i>	0.1	0.8	Bk2
42	<i>Phylloscopus collybita</i>	4.2	6.3	Bk2
43	<i>Phylloscopus sibilatrix</i>	1.6	2.9	Bk2
44	<i>Ficedula hypoleuca</i>	1.0	0.5	Bk2; Bo2
45	<i>Ficedula albicollis</i>	1.6	16.0	Bk2; Bo2
46	<i>Ficedula parva</i>	0.3	–	Bk2; Bo2
47	<i>Muscicapa striata</i>	2.0	2.0	Bk2; Bo2
48	<i>Phoenicurus phoenicurus</i>	0.1	–	Bk2; Bo2
49	<i>Phoenicurus ochruros</i> *	0.2	0.9	Bk2; Bo2
50	<i>Erithacus rubecula</i>	7.7	5.4	Bk2; Bo2
51	<i>Luscinia luscinia</i>	3.8	3.4	Bk2; Bo2
52	<i>Turdus pilaris</i>	2.6	2.9	Bk3; Bo2
53	<i>Turdus merula</i>	11.3	7.1	Bk3; Bo2
54	<i>Turdus philomelos</i>	2.9	10.3	Bk3; Bo2
55	<i>Aegithalos caudatus</i>	0.8	–	Bk2
56	<i>Poecile palustris</i>	1.2	0.6	Bk2
57	<i>Parus ater</i>	0.8	–	Bk2
58	<i>Cyanistes caeruleus</i>	1.5	1.1	Bk2
59	<i>Parus major</i>	24.1	18	Bk2
60	<i>Sitta europaea</i>	7.6	4.5	Bk2
61	<i>Certhia familiaris</i>	2.1	2.9	Bk2

62	<i>Passer domesticus</i>	–	3.4	–
63	<i>Passer montanus</i>	3.3	5.7	Bk3
64	<i>Fringilla coelebs</i>	19.1	14.9	Bk3
65	<i>Serinus serinus</i> *	0.2	–	Bk2
66	<i>Chloris chloris</i>	0.8	4.0	Bk2
67	<i>Carduelis carduelis</i>	0.9	5.7	Bk2
68	<i>Acanthis cannabina</i>	0.3	2.5	Bk2
69	<i>Coccothraustes coccothraustes</i>	3.3	3.4	Bk2
70	<i>Emberiza citrinella</i>	0.2	2.0	Bk2
71	<i>Emberiza hortulana</i>	0.1	–	Bk3

Note * - alien speceis; categories of: Bk2, Bk3- Bern; Bo1, Bo2- Bonn; W2- Washington Conventions.

(8.9–11.5%) (Figure 2). The common kingfisher (*Alcedo atthis*), was recorded within the area of the Kharkiv forest park. The nest of this bird was found on a bank in a gully inside the forest.

The study showed four species which are alien to the fauna of Ukraine: one in the forest park zone in Kyiv, and three in Kharkiv (see Table 1). They are: *Streptopelia decaocto*, *Dendrocopos syriacus*, *Phoenicurus ochruros*, and *Serinus serinus*. All of them are obligate synanthropes.

In addition to these species, three native obligate synanthropes were recorded in the forest-park zone of each city. In the Kyiv and Kharkiv forest parks, thirty-seven and thirty bird species were identified correspondingly as hemysynanthropic. The abundance of synanthropes in the bird communities in the Kharkiv forest park zone has a tendency to be higher than that in the Kyiv forest park (Figure 3). The index of synanthropization of the nesting bird communities in Kyiv was 0.55, and in Kharkiv – 0.69, which reveals

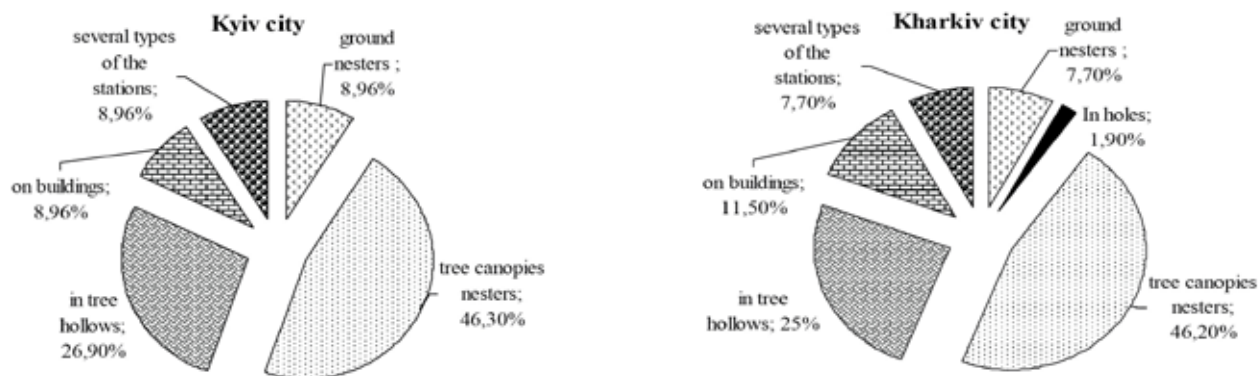


Figure 2. The distribution of the birds depending on the use of nesting habitats in the forest parks of the megalopolises (%).

a high degree of synanthropization of the nesting bird communities in the forest-park zone of the region located further to the east.

Discussion

Studies have shown that the relative average of bird population of the forest park zones in the eastern region is almost twice higher than

that in the western parts. Perhaps the data confirm the works of colleagues by the return of the local juveniles of birds due to dispersion (Norton *et al.*, 2000; Belisle and Clair, 2001; Brotons *et al.*, 2003; Caplat and Fonderflick, 2009) across a large area of forests in the city of Kharkiv. The similarity of the studied bird communities can be explained by the fact that the avifauna belongs to the forest

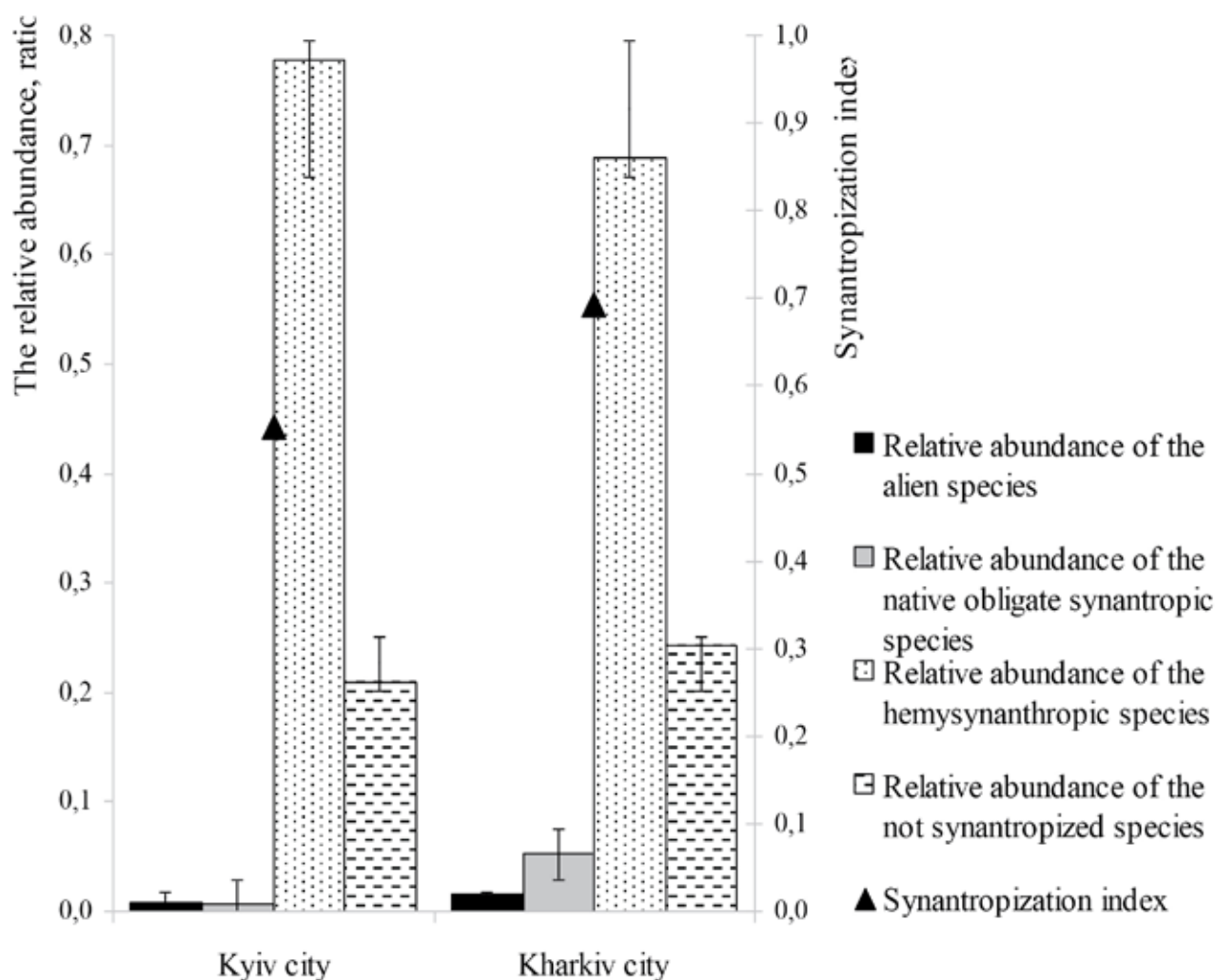


Figure 3. Synanthropization of the nesting bird communities in forest parks areas.

parks of one natural-geographical zone. The similarity of the avifauna in the western and eastern areas of the study area can also be attributed to the lack of oak regeneration in the oak-hornbeam forests of Kiev and its environs; instead, the Norway maple and field maple grow there (*Acer platanoides* and *Acer campestre*). The transformation of biotopes leads to changes in the populations of the fauna (McD. Sweeney *et al.*, 2010). Any changes in the plants are reflected in changes in the richness and subsequently in the avian structure (Martin and Joron 2003; Katsimanis *et al.*, 2006; Wenny *et al.*, 2011; Pawson *et al.*, 2013; Tryjanowski *et al.*, 2017).

For a detailed study of the ecological characteristics of bird communities, the researchers analyzed the distribution of birds by guilds, depending on their use of nesting microhabitats. The differences between the

avifaunas of the forest-park zones in the two megalopolises are manifested when comparing these parameters, although the tendency to similarity persists. The most striking difference is the kingfisher nesting in the forest ravines in Kharkiv. Since the end of the twentieth century, such nesting has become characteristic for some populations of the species due to the lack of typical nesting habitats in shore cliffs or in the case of the excessive disturbance of birds by people within the recreational areas (Shupova, 1999). In the forest parks of Kyiv, this species does not nest, despite the presence of ponds with fish and forest ravines, although it lives in the region. In some years, the kingfisher was noted using the ponds of the forest parks for feeding during the migration period, but due to the fact that the lakes are in the parks that are actively used by vacationers, the birds do not settle there. In spring and

autumn, when there are few vacationers and no swimming occurs, the kingfisher uses the ponds for feeding. The researchers believe that it is the activity of people resting in the forest parks of Kyiv that makes kingfishers not comfortable for nesting.

Although some similarities in the distribution of bird communities nesting on the ground or openly in the tree crowns and in hollows were noted, the species composition and the number of species in each region are different. The number of species nesting in the crowns of trees is greater in Kyiv forest parks (thirty-one species). In Kharkiv forest parks, only twenty-four species are canopy-nesting birds. Analyzing the lists of species, it was found that, some birds were absent in the forest zone of Kharkiv, but they exist in Kyiv. For species such as the serin (*Serinus serinus*) and the great grey shrike (*Lanius excubitor*), the territory of Kharkiv is located outside the nesting area. For the Kharkiv region, only one case of vocalization of a European finch is documented (Nadtochiy, 2002). It should be noted that the great grey shrike is a species typical for the forest zone (Tajkova, 2010; Tajkova and Red'kin, 2014). The southern border of its nesting area passes through the territory of Kyiv, and birds do not nest here regularly. Through the investigation of the avifauna of the Kiev region from 2008 to the present day in this work, it was observed that the nesting of the great grey shrike took place only once and that was in 2013. The northern goshawk (*Accipiter gentilis*) is a common species in the forest park of Kharkiv; it does not nest in the forest parks of Kyiv, but in forests outside the city.

In the studied regions, the species composition of cavity-nesting birds differs insignificantly, which is due mainly to the existence of secondary cavity-nesting birds that use readymade places. Thus, in the Kharkiv forest park zone, unlike that in Kyiv, there are no tawny owls (*Strix aluco*), red-breasted flycatcher (*Ficedula parva*), common redstart (*Phoenicurus phoenicurus*), and coal tits (*Parus ater*). The reason behind the insufficient number

of hollows is likely the small number of woodpeckers (Robles *et al.*, 2011; Felton *et al.*, 2016). With a lack of hollows, secondary cavity-nesting birds are less common (Carlson *et al.*, 1998; Robles *et al.*, 2012). In biotopes without artificial nests put up, woodpeckers annually support the “housing stock” and contribute to a rich diversity of birds and animals (Mikusiński *et al.*, 2001; Robles *et al.*, 2011), although during the fight for hollows, woodpeckers often drive out and kill secondary cavity-nesting birds (Michalczuk and Michalczuk, 2016). In the present study, the number of the species of primary cavity-nesting birds differs between the regions in relation to only one species due to the fact that the territory of the Kharkiv region is outside the black woodpecker's nesting area, in contrast to Kyiv. The number of secondary cavity-nesting bird species differs more significantly; there are fourteen of them in the Kyiv forest park zone and nine in the Kharkiv region. The number of bird species nesting on the ground in the forest parks of Kyiv is higher due to the redshank's (*Tringa totanus*) and the nightjar's nesting (*Caprimulgus europaeus*).

The conversion of natural habitats to human settlements left major impacts on the fauna (Tomialojc, 2007; Grimm *et al.*, 2008; Moller *et al.*, 2015). Urbanization becomes the ideal system for the invasion of animal communities by alien species (Crocini *et al.*, 2008; Evans, 2010; Díaz *et al.*, 2011; Moller *et al.*, 2015). The index of fauna synanthropization is an important indicator, as an increasing number of bird species are adapting to inhabit the human settlements. At the present stage of synanthropization, many hemysynanthropic species in different regions form synanthropic and natural populations. For example, synanthropic (sedentary) and natural (migratory) subpopulations of the blackbird (*Turdus merula*) live in Kyiv, while only a natural population live in Kharkiv. The Syrian woodpecker (*Dendrocopos syriacus*) in Kyiv nests only as a synanthrope in the courtyards of residential areas, city parks, and transformed biotopes of forest parks, and in the Kharkiv

region, it is also noted in natural biotopes. From the end of the nineteenth century, the Syrian woodpecker entered the European countries from Turkey through the Balkans (Munteanu and Samwald, 1997). These birds were first recorded in Ukraine in 1948. By the mid-sixties of the last century, the Syrian woodpecker settled up to 50° n. l., i.e., its breeding range reached Kyiv and Kharkiv almost simultaneously. Now it is an ordinary widespread species nesting in transformed biotopes. The tendency of the Syrian woodpecker to synanthropization allows for the prediction of its further relocation in the northern and eastern directions (Zavyalov *et al.*, 2008). The proportion of stenotopic native species demonstrates how favorable the state of biotopes is for preserving the natural avifauna of the region (Shupova, 2017).

Thus, in different regions within the same natural-geographical zone, the same species may be present at nesting with a different status. As a result of the synanthropization index calculation, it was found that in the east of the forest-steppe, the nesting bird communities are more synanthropized. This picture was formed as a result of the fact that the list of species living in the forest parks of Kyiv is wider and includes mostly non-synanthropic bird species. The presence of alien bird species is an important indicator of disturbances in the natural ecosystem (White *et al.*, 2009).

The dominant species in all forest parks are the great tit and chaffinch (*Fringilla coelebs*). In the forest parks, there are high numbers of the chiffchaff (*Phylloscopus collybita*), robin (*Erithacus rubecula*), song thrush (*Turdus philomelos*), blackbird (*Turdus merula*) and nuthatch (*Sitta europaea*). All of them are common species of forest ecosystems in the study area.

It was noted that forest parks providing nesting habitats for birds require secluded areas. The list includes: the goshawk (*Accipiter gentilis*), the sparrowhawk (*Accipiter nisus*), the common buzzard (*Buteo buteo*), the green sandpiper (*Tringa ochropus*), the redshank (*Tringa totanus*),

the nightjar (*Caprimulgus europaeus*), the black woodpecker (*Dryocopus martius*), the tree pipit (*Anthus trivialis*), the great grey shrike (*Lanius excubitor*), the lesser grey shrike (*Lanius minor*), and the red-breasted flycatcher (*Ficedula parva*). The territorial plot of the observed pairs is located within the city of Kyiv, although the distance to the nearest buildings is also about 400 m. The aforementioned birds do not nest in well-groomed parks in the central part of the cities and are peculiar for the natural biotopes of the region. The process of habitat fragmentation can also contribute to this (Gardner *et al.*, 2019). In small fragments of the natural environment, rare bird species have fewer opportunities for meeting a sexual partner, and, therefore, there are less chances for breeding (Norton *et al.*, 2000; Zannette, 2001; Belisle and Clair, 2002; Brotons *et al.*, 2003; Caplat and Fonderflick, 2009). Therefore, in the case of the continuing urbanization of the territories of megacities, it is likely to expect the disappearance of the populations of small-in-number bird species (Batary *et al.*, 2014).

Conclusions

In the forest-parks of the megalopolises' forest-steppe zone in Ukraine, the list of bird species nesting in the forest parks decreases eastwards. Most representatives of the species composition of bird communities in the forest parks of the cities are common for the faunas of the compared regions. The absence of some species in any of the forest parks is due to the fact that individuals of the population in this region select forest sites located outside the city for nesting. The share of eurytropic species in the east is higher; and the degree of synanthropy of the nesting bird communities of the forest park zone in the east region is higher.

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