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## ANNUAL DYNAMICS OF BIRD COMMUNITIES IN URBAN PARKS IN LVIV, UKRAINE: PRELIMINARY ANALYSIS OF DIVERSITY AND COMPOSITION VARIABILITY

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Species and numeric composition of bird communities were analyzed in parks of Lviv based on results of monthly censuses on 20 linear transects on eight study plots. During the year, 79 bird species that belong to eight taxonomic orders were registered. Birds' diversity was assessed by species number and Simpson index and it varies throughout the year and denotes higher level during the breeding season. Similarly, birds' density is the highest in breeding season, but it also has a less expressed peak in winter period. This shows that biotopical preferences to be presented in urban greenery of particular birds are especially notable only while breeding, but in non-breeding season those birds stay resident in scale of the city though disperse in other habitat types. Between-months, stability of species composition (assessed by Jaccard index) and numeric composition (by Bray–Curtis index) was analyzed. Communities were the most stable during the breeding season as birds are related to their nesting sites. According to zoogeographic classification, European species dominate during all months. Siberian, Transpalearctic and Mediterranean species also play role in forming of the community structure. The main food resources type which compensates energy demands of birds during the breeding season is invertebrates; this shows the importance of birds in controlling the abundance of invertebrates in urban ecosystems. Seeds are also important food resource types, especially during the non-breeding period. Abundance variability of part of species is related with season. Three main groups of these species were defined: breeding migrants (mainly songbirds such as *Fringilla coelebs*, *Erithacus rubecula*, *Sylvia atricapilla*, *Phylloscopus collybita* etc., also *Columba palumbus*), wintering migrants (*Spinus spinus*, *Turdus viscivorus*, *Bombycilla garrulus*, *Pyrrhula pyrrhula*) and residents (typical synanthropic species whose numbers vary: *Turdus merula*, *Coccothraustes coccothraustes*, *Troglodytes*

*trogodytes*, *Cyanistes caeruleus* etc.). The last ones, probably, migrate in non-breeding seasons to other habitat types, that can explain their abundance variability.

**Keywords:** seasonal variation, urban ecosystems, synanthropic species, bird species composition, urban forest, bird community

## INTRODUCTION

The consequences of urbanization processes on wildlife are known widely: economic growth in human society could be one of the reasons of species endangerment [11], habitat loss and fragmentation are thought to be the main reasons of biodiversity declining and populations extinction [7, 13]. In those conditions species have two possible options – to avoid urban habitats or to accept new conditions [16]. Accepting new conditions, or synurbization *sensu* M. Luniak [4, 25], provides the species with some benefits such as a milder microclimate, food, places to hide etc. (as well as dangers such as heavy metal poisoning [36], stress [26] and behavioral changes [32]). Thus, this phenomenon is common for many animal species.

Bird's diversity and composition are also being affected by changes caused by urbanization [5, 10, 19, 27]. Furthermore, considering their abundance, mobility and species richness, birds are appropriate indicators of changes in ecosystems, animal communities or landscapes [14, 20, 21]. This reveals why birds are common objects in ecological studies, especially in urban habitats. From the view of avifauna, it is impossible to consider the city as a single whole, and in most research the city is considered as a complexity of different habitat types [2, 6, 9] that makes synurbization processes easier to study in birds.

In general, habitat diversity of city urban greenery, e.g. urban parks and forests, is one of the most stable and productive in ecological meaning habitat type, which is, in fact, an "island" of wildlife in the city. It depends on origin, and can be actually a residual of native ecosystems [30]. Some authors assume that large urban parks could be a buffer for penetration of wild species into the city [37], but this question hasn't been studied enough. Nonetheless, it is known that bird diversity is high compared to other habitat types in urban parks [8, 28, 38, 40], and changes in the most diverse communities are the most informative [35], which makes urban greenery the best habitat type to study.

While spatial distribution and dynamics of bird communities in urban parks is studied well, less attention is paid to its time dynamics [24]. Bird communities are variable because of variation in species biology features and their migration status [17]. Bird-habitat relationships are unstable during the year a breeding and non-breeding periods [29]. Also migrant species contribute to general seasonal variability and birds of some species wander during the non-breeding season which means changes in their habitat preferences during the year without visible effects on species abundance on a local scale. Annual habitat preference or migration cycles affect the composition of a bird community in places with ecological consequences; it is more important to understand it in the context of possible effects of urban heat island as a part of urbanization process on birds phenological features [41].

Summarizing, information about seasonal dynamics of bird communities supplements fields of avian biology and general ecology common with topics of urban planning [24], predicting changes of bird diversity and composition caused by anthropogenic

landscape transformation, which could indicate about possible future changes in other taxonomic groups and whole ecosystems, biogeographical changes and synurbization mechanisms. Also, annual dynamics, stability of community structure and dynamics of diversity level show the stability of ecosystems and primary productivity [23], according to the species-energy hypothesis [12]. This can show possible deficiency in urban greenery management – a problem that is being acutely felt in the Ukrainian cities.

The aim of this work was to reveal general tendencies of the dynamics of bird communities in urban parks, i.e. to provide a descriptive study of this phenomenon. Primarily, it was decided not to look at avian community in a discrete way, i.e. during breeding or non-breeding season, but to concern the composition dynamics as a continual process as in [32]. The objectives were (1) to reveal the species composition and community structure of birds in urban greenery during throughout the year, (2) to define the time of peaks of diversity, abundance of birds and stability of the whole community, (3) to study changes in ecological (viz. trophic) and biogeographical structure of bird communities, and (4) to reveal the abundance dynamics of most common forest bird species.

## MATERIALS AND METHODS

**Study area.** Bird surveys were conducted in Lviv city (Western Ukraine, 49°49'N 24°00'E). Lviv is a city located on the main European watershed between the East European Plain and the North European Plain. The total population is approx. 725 thousands inhabitants and the area of administrative boundaries equals 182 km<sup>2</sup>. The area of urban greenery, according to the city council, is 4419 ha (24 % of total city area).

Study plots (n = 8) were chosen in order to represent the whole parks and forests on the area of the city. Linear transects (in sum, n<sub>t</sub> = 20) each of 500 m length and 100 m width were paved, the number of those per plot depended on the total area of model plot.

Holoskiivsky cemetery is allocated in the northern suburbs, A = 80.3 ha, n<sub>t</sub> = 3. In fact, the cemetery is a part of the Briukhovitsky forest massif (A = 3200 ha) – typical Roztocze forest, which has undergone strong anthropogenic transformation. *Pinus sylvestris*, *Thuja occidentalis*, *Betula pendula* and *Acer platanoides* are the most common tree species on studied transects.

Yanivsky cemetery is located in the northwestern part of the city, and it is an old cemetery. A = 30 ha, n<sub>t</sub> = 2. *Acer platanoides*, *Robinia pseudoacacia*, *Betula pendula*, *Thuja occidentalis* and *Fraxinus excelsior* are the most common tree species.

Bilogorshcha forest is located in western suburbs near the mire and village-like part of the city. A = 195 ha, n<sub>t</sub> = 4. *Alnus glutinosa*, *Quercus robur*, *Pinus sylvestris*, *Betula pendula* and *Carpinus betulus* are the most common. There are one derelict pond and a stream on that area.

Lychakivsky park and Lychakivsky cemetery are located in the eastern part of city, both are old green areas. A = 10 ha and A = 34 ha, respectively; n<sub>t</sub> = 3. *Acer platanoides*, *Fraxinus excelsior*, *Thuja occidentalis* and *Pinus sylvestris* are the most common.

Pohulianka forest park is adjacent to the Lychakivsky park and stretches east. A = 108 ha, n<sub>t</sub> = 3. *Fagus sylvatica*, *Carpinus betulus*, *Acer sp.*, *Picea abies* and *Alnus glutinosa* are the most common.

Stryisky park is an old park in the central part of city. A = 52 ha, n<sub>t</sub> = 3. *Acer sp.*, *Tilia cordata*, *Fraxinus excelsior*, *Fagus sylvatica*, *Carpinus betulus* and some exotic species, such as *Salix babylonica*, *Ginkgo biloba* and *Mahonia aquifolium*, form the tree community. There is one big decorative pond “Pond with swans” on the area.

Osvytsky Gai park is located in the southern suburbs near the Zubra river. A = 82 ha,  $n_t = 2$ . *Acer platanoides*, *Alnus glutinosa*, *Quercus robur* and *Fraxinus excelsior* are the most common.

**Bird surveys.** Bird surveys were conducted on each linear transect every month during a period from December 2017 to November 2018. Linear transects method was chosen and data obtained using this method are the most representative concerning the whole community structure [18, 3]. Birds were located at the same distance (50 m on both sides from observer) in all months. Surveys were carried out during 20–30 min time period on each transect in morning hours of days without strong wind, rain, or snow. During the non-breeding season, each observed individual was registered as one, both resident and migrant birds were countered; during the breeding season, adult individuals, which probably was breeding, and juveniles were counted. This approach was used to emphasize the ecological value of each individual in the whole community, not only breeding birds. Bird species were identified by sounds or appearance; in cases of misidentification (poor information such as non-typical song or calls, quick visual observation), observations were ignored.

Private property rights were not violated during the progress of this study, entrances to all model plots are free (with exception of the Lychakiv cemetery where all tickets needed were bought).

**Data analysis.** Data analysis was performed using the R environment (3.5.1) [34] in RStudio (1.1.447). Packages xtable, psych, ggplot2 and dplyr were used; also own unpublished functions were used in this work for calculating Jaccard, Bray-Curtis and Simpson indices.

We used the data from each separate census ( $n = 12$  months  $\times$  20 linear transects = 240 censuses) for analysis. Abundance of birds was not recalculated to define the density of each species because transects of similar area (500 $\times$ 100 m) were used.

Community diversity was calculated using Simpson diversity index [22]; it was chosen since it assess diversity in [0; 1]-scale.

Stability between months on a defined transect was assessed using Jaccard similarity index for species presence-absence matrix and Bray-Curtis similarity index for community composition *sensu lato* similarity [33, 42].

Trophic preferences and zoogeographical fauna type of species became known via data of the Zoogeographical Databank of the Institute of Systematics and Ecology of Animals of SB RAS based on the works of Stegmann [39]. This databank describes the zoogeographical fauna type (in sum, 18 types; species of 6 types was presented in our data) and trophic preferences (the combination of six group: insectivorous, seed- and fruit-eaters, vegetative parts of plants eaters, raptors, insectivorous in the first part of summer and seedeater in the second, insectivorous and seedeater in the first part of summer and pure seedeater in the second; preferences described for each season: autumn, winter, spring and summer) of each species. What concerns trophic preferences, it is obviously that the sum of parts of different trophic groups in the community can be more than one, because some species can mix different diets. For example, according to the Databank, *Dendrocopos major* is both insectivorous and seedeater in winter. To assess the abundance of individuals of species belonging to certain ecological group or fauna type mean value was calculated ignoring cases of absence of these group representatives.

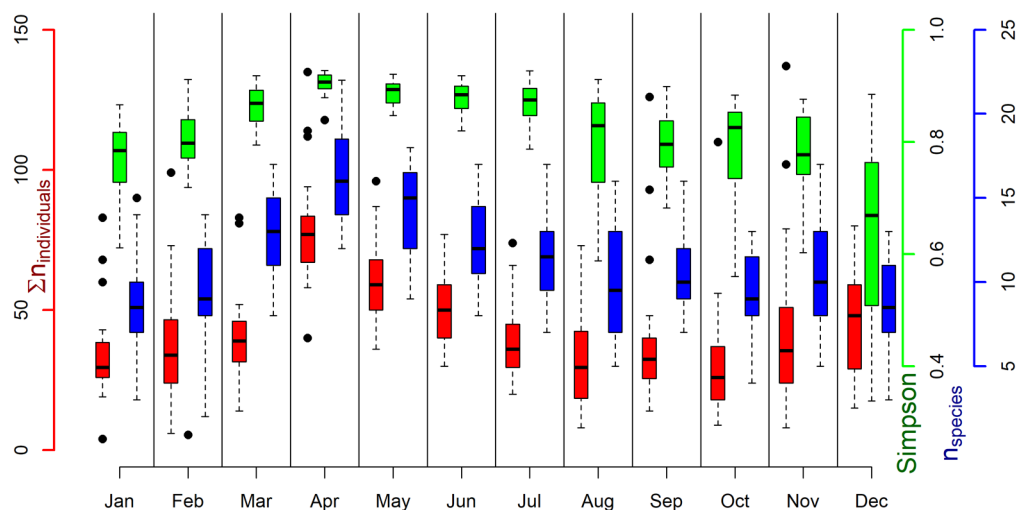
## RESULTS AND DISCUSSION

79 bird species were registered during one year in urban greenery in Lviv. Those taxa are listed in the Supplement according to HBW and BirdLife International taxonomy [15]. For example, the number of species that breed in parks and forests in Lviv (but only within the ecological merges) was assessed as 61 in 1994–1995 and the number of wintering species was 38; in sum, 67 species was registered in this study period by the team of ornithologists (described in PhD thesis of A. Bokotey, 1998). There are some differences in the species list caused by strong declining of some species in the city (for example, *Passer domesticus* and *Streptopelia turtur* were observed in the 1990s), rare observations of the species (*Picus viridis* is rare and is being under protection of the National Red List), some species was not observed during this study due to probabilistic reasons (*Athene noctua* and *Asio otus* – because special night censuses were not conducted; *Anthus trivialis*, *Emberiza schoeniclus*). Some species that were not mentioned by Bokotey were observed in this study, mainly because it concerned the periods of migrations (but other reasons, such as changes in populations or differences of study plots, can be also considered): *Accipiter gentilis*, *Buteo buteo*, *Columba palumbus*, *Scolopax rusticola*, *Strix uralensis*, *Dendrocopos leucotos*, *Delichon urbicum*, *Hirundo rustica*, *Alauda arvensis*, *Motacilla alba*, *Lanius collurio*, *Phylloscopus trochilus*, *Ficedula hypoleuca*, *Turdus iliacus*, *Lophophanes cristatus*, *Certhia brachydactyla*, *Fringilla montifringilla*, *Acanthis flammea* and *Loxia curvirostra*.

Species richness summarized on all transects is the lowest during the non-breeding period: it changes from 38 species registered a month in July to 30 species in August and stays on this level till the end of winter (28 in September, 30 in October, 27 in November, 31 in December, 30 in January, 27 in February). The breeding season is the period of high species richness among birds in urban greenery: 39 species were registered in March, 44 – in April, 43 – in May, 45 – in June and 38 – in July (see not summarized data on Fig. 1).

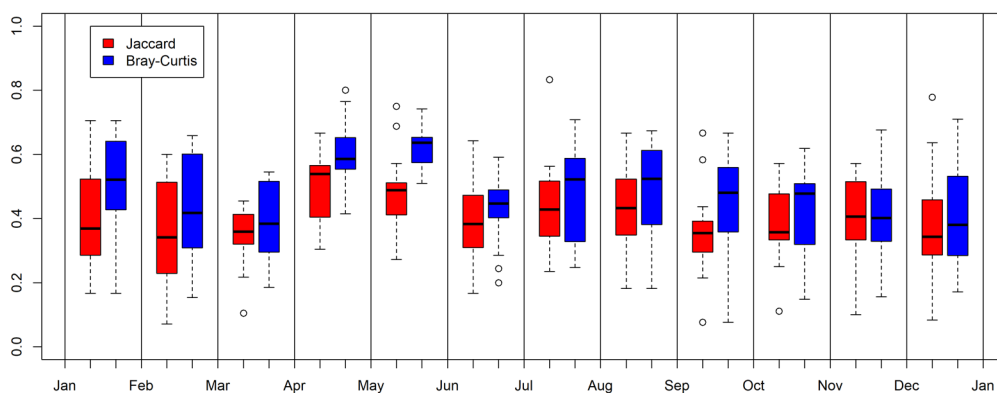
Averaged by month, all three parameters that can assess diversity level – sum of individuals of all species (which does not actually mean the diversity level), species richness and Simpson diversity index – indicate that the peak of diversity level matches with the beginning of breeding season in that latitude – end of March ( $\Sigma n_{ind.} = 40.95 \pm 17.14$  SD ind./5 ha, Simpson 1-D =  $0.87 \pm 0.04$ ,  $n_{sp} = 12.95 \pm 2.76$ ) and whole April ( $\Sigma n_{ind.} = 79.1 \pm 21.58$ , Simpson 1-D =  $0.90 \pm 0.02$ ,  $n_{sp} = 16.40 \pm 2.78$ ). It can be concluded that urban greenery is the more preferred biotope type by some bird species for breeding than for residence during the non-breeding season. I presume that this phenomenon is connected with some general biotope characteristics, i.e. abundance of safe places for nesting, than with food resource preferences, insofar as if the second option was true, the species richness would be saved during the whole vegetation season. Besides that, the peak of the sum of individuals can be explained by fledglings, but it is uncertain considering the data gathering methods.

Between-months, species composition stability (Fig. 2) calculated with the Jaccard index doesn't change significantly (ANOVA results for pairs Nov/Dec, Dec/Jan, Jan/Feb, Feb/Mar are  $F(3, 76) = 0.415$ ,  $p = 0.743$ ) during the winter (Table 1). Significant changes of Jaccard indices were observed, again, in the beginning of the breeding season (Welch Two sample t-test for  $J_{Mar/Apr}$  and  $J_{Apr/May}$   $t = -5.211$ ,  $p\text{-value} = 7.7 \cdot 10^{-6}$ ) and in the period between June and July (for  $J_{May/Jun}$  and  $J_{Jun/Jul}$   $t = 2.598$ ,  $p\text{-value} = 0.013$ ).



**Fig. 1.** Annual dynamics of all-species birds abundance, species richness and diversity assumed with Simpson index by linear transects ( $A = 5$  ha) in urban greenery in Lviv. The interquartile range is shown as a box, the ends of the whiskers represent the minimum and maximum of all of the data, black dots are the outliers

**Рис. 1.** Річна динаміка чисельності птахів усіх видів, видового багатства та різноманіття (за індексом Сімпсона) птахів на лінійних трансектах ( $A = 5$  га) у зелених зонах Львова. Міжквартильний розмах зображено як "коробку", кінці "вусів" відповідають загальному розмаху даних, крапки позначають викиди



**Fig. 2.** Between-months, bird community stability was assessed with paired comparison similarity indices: species composition stability was assessed by Jaccard index and community structure stability was assessed by Bray-Curtis index (the higher it is, the more stable communities are between months)

**Рис. 2.** Стабільність угруповань птахів між місяцями оцінено за допомогою індексів подібності попарних порівнянь (бінарних мір подібності): стабільність видового складу відображає індекс Жаккара, стабільність чисельної структури угруповань відображає індекс Брея-Кьортіса (чим більші значення індексів, тим стабільніші угруповання між роками)

A similar situation was observed in community structure comparisons: significant step in community structure stability during the spring part of the non-breeding season



and breeding season beginning (for  $BC_{Mar/Apr}$  and  $BC_{Apr/May}$   $t = -6.25$ ,  $p\text{-value} = 2.95 \cdot 10^{-7}$ ) is accompanied by a descending of stability in June–July (for  $BC_{May/Jun}$  and  $BC_{Jun/Jul}$   $t = 7.52$ ,  $p\text{-value} = 1.32 \cdot 10^{-8}$ ). It is important that the stability value between months has two main contributing components: real variability of the community composition and probability factor (as at one linear transect one census per month was performed, all birds which were really residents at the moment were not observed). Notable, that by-months comparisons look smooth, i.e. there are no significant dissimilarities in community composition during long period, although there does exist strong dissimilarities between community composition in long perspective.

**Table 1. Mean values of the Jaccard species composition similarity index and the Bray–Curtis community structure similarity index assessed for bird communities between months**

**Таблиця 1. Середні значення індексу подібності видового складу Жаккара та індексу подібності структури угруповань Брея–Кьортіса, обчислені для угруповань птахів між місяцями**

Months	Jaccard index		Bray–Curtis index	
	Mean	±SD	Mean	±SD
Jan/Feb	0.403	0.146	0.521	0.145
Feb/Mar	0.356	0.158	0.443	0.157
Mar/Apr	0.347	0.082	0.394	0.113
Apr/May	0.500	0.102	0.599	0.094
May/Jun	0.478	0.110	0.624	0.063
Jun/Jul	0.381	0.124	0.428	0.098
Jul/Aug	0.436	0.135	0.472	0.148
Aug/Sep	0.438	0.135	0.484	0.146
Sep/Oct	0.355	0.124	0.452	0.145
Oct/Nov	0.383	0.113	0.423	0.143
Nov/Dec	0.399	0.129	0.415	0.126
Dec/Jan	0.382	0.157	0.411	0.157

Similarities between communities in different months decreases with difference in time ( $\Delta\tau = [0; 6]$  months). Both Jaccard index values (regression equation is  $J = 0.603 - 0.077 \cdot \Delta\tau$ ,  $p\text{-value} < 0.005$ ,  $R^2 = 0.360$ ,  $R^2_{adj} = 0.359$ ) and Bray–Curtis index values (regression equation is  $BC = 0.647 - 0.078 \cdot \Delta\tau$ ,  $p\text{-value} < 0.005$ ,  $R^2 = 0.353$ ,  $R^2_{adj} = 0.359$ ) are related with months difference. Thus, it can be assumed that dynamical similarity is a function of difference in time, inflection point is approximately in  $\Delta\tau = 3$  ( $R^2$  values for models with  $\Delta\tau > 3$  omitted are  $R^2 = 0.493$  for Jaccard index and  $R^2 = 0.500$  for Bray–Curtis index).

European zoogeographical fauna type is most common for species of birds that are breeding and residents for urban greenery in Lviv (Table 2). Absolute number of individuals of European species varies from  $18.85 \pm 10.26$  ind./5 ha in October to  $69.4 \pm 15.23$  ind./5 ha in April; generally, European species are the most abundant during the breeding season, but their abundance is 2–4 times lower during the non-breeding season (August–March). Anyway, those species are the most abundant in all months.

Mediterranean species are common during the non-breeding season (June–March, abundance varies from  $4.50 \pm 3.32$  ind./5 ha in June to  $23.20 \pm 22.75$  ind./5 ha in December), but unreliable peak in April (from  $4.60 \pm 4.62$  ind./5 ha in March to  $12.75 \pm 21.5$  ind./5 ha in April, Welch Two sample *t*-test  $t = -0.599$ ,  $p$ -value = 0.555) shows the breeding occasions among those species. Only three Mediterranean species were registered: not common in urban greenery in Lviv *Dendrocopos syriacus*, *Serinus serinus* and extremely distributed *Columba livia f. domestica*. Although abundance of Mediterranean species is high, this data is unrepresentative.

Table 2. Mean abundance ( $n \pm SD$ , ind./5 ha) and total occurrence (%) of species of different zoogeographical types, according to Stegmann

Таблиця 2. Усереднена сумарна щільність населення ( $n \pm SD$ , ос./5 ha) та загальна частота траплення (%) видів різних зоогеографічних типів за Штегманом

Month	SIB		EU		TRP		MON		MID		ND	
	$n \pm SD$	%	$n \pm SD$	%	$n \pm SD$	%	$n \pm SD$	%	$n \pm SD$	%	$n \pm SD$	%
Jan	2.38 $\pm 2.07$	40	24.75 $\pm 10.29$	100	5.95 $\pm 5.55$	95		0	20.00 $\pm 17.35$	15		0
Feb	3.18 $\pm 2.79$	55	26.85 $\pm 14.57$	100	6.63 $\pm 3.61$	95		0	12.60 $\pm 11.15$	25		0
Mar	4.36 $\pm 3.07$	55	32.75 $\pm 14.17$	100	4.65 $\pm 3.75$	100		0	4.60 $\pm 4.62$	25		0
Apr	5.00 $\pm 3.49$	55	69.40 $\pm 15.23$	100	4.82 $\pm 2.35$	85	2.00 $\pm 0.00$	15	12.75 $\pm 21.5$	20		0
May	4.22 $\pm 1.86$	45	53.30 $\pm 12.14$	100	4.41 $\pm 1.84$	85	2.00 $\pm 0.00$	10	7.50 $\pm 8.54$	20		0
Jun	3.43 $\pm 1.90$	35	44.00 $\pm 11.48$	100	4.71 $\pm 2.91$	85	2.00 $\pm 0.00$	20	4.50 $\pm 3.32$	20		0
Jul	2.50 $\pm 1.00$	20	31.35 $\pm 12.73$	100	6.70 $\pm 3.37$	100	1.50 $\pm 0.71$	10	3.00 $\pm 1.00$	15		0
Aug	1.25 $\pm 0.50$	20	22.00 $\pm 12.86$	100	7.15 $\pm 7.06$	100	1.00	5	11.75 $\pm 12.18$	20	1.00	10
Sep	10.00 $\pm 11.53$	15	25.95 $\pm 12.66$	100	8.00 $\pm 8.31$	100	1.00	5	16.17 $\pm 23.21$	30		0
Oct	3.33 $\pm 2.24$	45	18.85 $\pm 10.26$	100	7.85 $\pm 12.78$	100		0	13.75 $\pm 14.22$	20		0
Nov	8.40 $\pm 12.2$	50	29.45 $\pm 16.66$	100	9.79 $\pm 14.32$	95		0	5.50 $\pm 6.14$	20		0
Dec	8.57 $\pm 13.21$	35	33.4 $\pm 17.36$	100	4.56 $\pm 3.33$	90		0	23.20 $\pm 22.75$	25		0

**Comments:** Codes of zoogeographical fauna types are SIB – Siberian, EU – European, TRP – Transpaleartic, MON – Mongolian, MID – Mediterranean, ND – not defined

**Примітки:** Коды зоогеографічних типів фауни такі: SIB – Сибірський, EU – Європейський, TRP – Транспалеарктичний, MON – Монгольський, MID – Середземноморський, ND – не визначений



An abundance of Siberian species is larger in the autumn and winter period than in the breeding period ( $10.00 \pm 11.53$  ind./5 ha in September and  $8.57 \pm 13.21$  ind./5 ha in December compared with  $5.00 \pm 3.49$  ind./5 ha in April – the peak value in the breeding period). However, the total occurrence of Siberian species is low both in the breeding season (20–55 %) and the non-breeding season (15–55 %).

Paying attention to occurrence distribution, European species are ubiquitous in all months, Transpalearctic species are spread too. The rarest fauna type are Mongolian (includes *Phoenicurus ochruros* only) and type of not defined origin (includes *Streptopelia decaocto* only – this species was observed in urban greenery only after the departure of migrant *Columba palumbus*, the species that recently became typical synanthropic in Lviv).

Invertebrate-eaters are the dominant trophic group among birds in urban greenery (see Table 3 and Fig. 3), their abundance is the largest in April (firstly, because the general birds abundance is the largest, secondly because the specific diet of the vast majority of songbirds in the period of feeding chickens). Obviously, the abundance of invertebrate-eaters is low in the winter period, only Paridae and Piciformes are common in this time. Seed-eaters are the subdominant group, the abundance of whose correlates slightly with the abundance of invertebrate-eaters ( $r = 0.364$ ,  $p = 6.08 \cdot 10^{-9}$ ; Spearman rank correlation  $r = 0.371$ ,  $p = 3.05 \cdot 10^{-9}$ ).

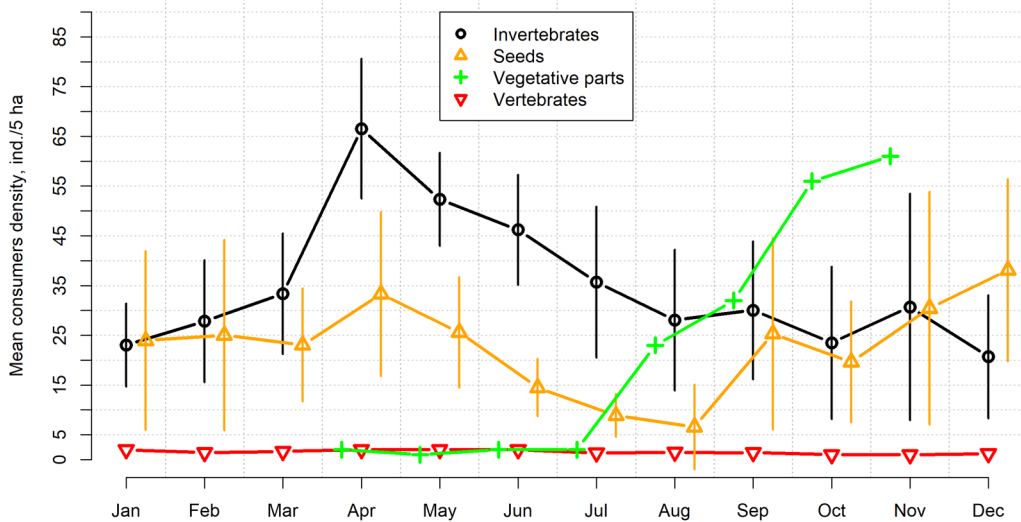


Fig. 3. Annual dynamics of abundance of birds of different trophic groups (according to food resources types)

Рис. 3. Річна динаміка чисельності птахів різних трофічних груп (за типом корму, завдяки споживанню якого задовольняються енергетичні потреби)

Vegetative parts of plants are concerned as food resources by birds in the after-breeding season with a strong rise in autumn (abundance goes up from 2 ind./5 ha in July to 61 ind./5 ha in November, but the occurrence of species with this diet – *Anas platyrhynchos* – is low, just 5–10 %; *Anas platyrhynchos*, obviously, was registered only on plots with ponds). Abundance of vertebrate-eaters, or raptors – *Accipiter nisus*, *Accipiter gentilis*, *Buteo buteo*, *Strix aluco*, *Strix uralensis* (important that owls abun-

dance was not the main object of this research as this requires special censuses; registrations of those two species are accidental and their occurrence is underestimated) and partial raptor *Corvus corax* – is low and stable through the year: 1–2 ind./5 ha, CV of means = 0.249. Occurrence of raptors is low – 10–45 % and do not depends on season (ANOVA  $F(2, 9) = 1.534$ ,  $p$ -value = 0.267 for groups of March–June, August–November and December–February).

The presentation of data on trophic demands structure would be more informative in relative scale, i.e. parts of individuals of defined ecological groups' species in the community, but this meets a deficiency of available classification – groups' intersection, which means that the sum of percentages of different groups would be greater than 100 % calculated in a certain community. The fact that used classification was developed in the Siberian region also means that it could be inaccurate for individuals of the population present in Ukraine, thus, ecological classification of Ukrainian birds' species should be reviewed.

**Table 3. Mean abundance ( $n \pm SD$ , ind./5 ha) and total occurrence (%) of species of different trophic groups, by food resources type**

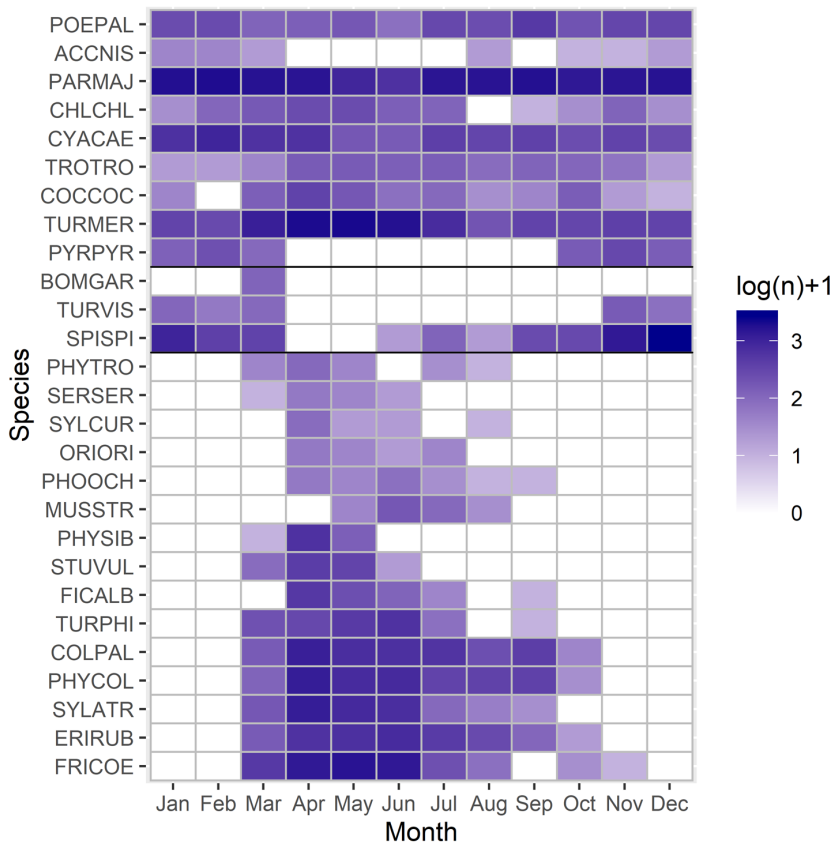
**Таблиця 3. Усереднена сумарна щільність населення ( $n \pm SD$ , ос./5 ha) та загальна частота траплення (%) видів різних трофічних груп за типом корму, завдяки споживанню якого задовольняються енергетичні потреби**

Month	Invertebrates		Seeds		Vegetative parts		Vertebrates	
	$n \pm SD$	%	$n \pm SD$	%	$n \pm SD$	%	$n \pm SD$	%
Jan	23.05±8.34	100	23.95±17.99	100		0	2.00±1.26	30
Feb	27.85±12.27	100	25.05±19.15	100		0	1.43±0.79	35
Mar	33.35±12.14	100	23.05±11.38	100		0	1.67±1	45
Apr	66.55±14.07	100	33.30±16.53	100	2.00	5	2.00±0.00	35
May	52.35±9.35	100	25.60±11.12	100	1.00	5	2.00±0.00	35
Jun	46.20±11.09	100	14.50±5.81	100	2.00	5	2.00±0.00	15
Jul	35.70±15.19	100	8.89±4.31	95	2.00	5	1.33±0.58	15
Aug	28.05±14.17	100	6.60±8.54	75	23.00±1.41	10	1.50±0.71	10
Sep	30.05±13.88	100	25.30±19.27	100	32.00	5	1.40±0.89	25
Oct	23.50±15.35	100	19.65±12.19	100	56.00	5	1.00±0.00	20
Nov	30.70±22.77	100	30.45±23.42	100	61.00	5	1.00±0.00	20
Dec	20.70±12.41	100	38.10±18.30	100		0	1.20±0.45	25

Seasons classified as winter – December, January and February, Spring – March, Breeding – April, May, June and July, autumn – August, September, October and November, affects densities of several species, as results of ANOVA tests show.

Thus, season affects (in terms of ANOVA results) individuals density in common migrant songbirds species such as *Fringilla coelebs* ( $F(3, 236) = 88.57$ ,  $p$ -value < 0.001), *Erithacus rubecula* ( $F(3, 236) = 59.16$ ,  $p$ -value < 0.001), *Sylvia atricapilla* ( $F(3, 236) = 53.36$ ,  $p$ -value < 0.001), *Phylloscopus collybita* ( $F(3, 236) = 38.44$ ,  $p$ -value < 0.001), *Columba*

*palumbus* ( $F(3, 236) = 30.11$ ,  $p\text{-value} < 0.001$ ), *Turdus philomelos* ( $F(3, 236) = 28.58$ ,  $p\text{-value} < 0.001$ ), *Ficedula albicollis* ( $F(3, 236) = 20.24$ ,  $p\text{-value} < 0.001$ ), *Sturnus vulgaris* ( $F(3, 236) = 12.28$ ,  $p\text{-value} < 0.001$ ), *Phylloscopus sibilatrix* ( $F(3, 236) = 11.43$ ,  $p\text{-value} < 0.001$ ), *Muscicapa striata* ( $F(3, 236) = 8.76$ ,  $p\text{-value} < 0.001$ ), *Phoenicurus ochruros* ( $F(3, 236) = 7.06$ ,  $p\text{-value} < 0.001$ ), *Oriolus oriolus* ( $F(3, 236) = 5.83$ ,  $p\text{-value} < 0.001$ ), *Sylvia curruca* ( $F(3, 236) = 4.31$ ,  $p\text{-value} = 0.006$ ), *Serinus serinus* ( $F(3, 236) = 3.89$ ,  $p\text{-value} = 0.010$ ) and *Phylloscopus trochilus* ( $F(3, 236) = 3.82$ ,  $p\text{-value} = 0.011$ ) (see Fig. 4).



**Fig. 4.** Annual dynamics of  $(\log_{10}+1)$ -modified [1] averaged abundance (ind./km<sup>2</sup>) of different birds species which show a dependence on season

**Рис. 4.** Річна динаміка модифікованої [1] усередненої чисельності (ос./км<sup>2</sup>) видів птахів, що виявляють залежність чисельності від сезону

The same is observed with common wintering species: *Spinus spinus* ( $F(3, 236) = 13.46$ ,  $p\text{-value} < 0.001$ ), *Turdus viscivorus* ( $F(3, 236) = 7.61$ ,  $p\text{-value} < 0.001$ ), *Bombus garrulus* ( $F(3, 236) = 5.36$ ,  $p\text{-value} = 0.0013$ ; unreliable result due to this species observation is singleton), *Pyrrhula pyrrhula* ( $F(3, 236) = 5.33$ ,  $p\text{-value} = 0.0014$ ).

Variability of some resident species abundances can be explained by season too (this wording is unsure for ANOVA method): *Turdus merula* ( $F(3, 236) = 67.31$ ,  $p\text{-value} < 0.001$ ), *Coccothraustes coccothraustes* ( $F(3, 236) = 10.62$ ,  $p\text{-value} < 0.001$ ),

*Troglodytes troglodytes* ( $F(3, 236) = 10.22$ ,  $p$ -value  $< 0.001$ ), *Cyanistes caeruleus* ( $F(3, 236) = 9.05$ ,  $p$ -value  $< 0.001$ ), *Chloris chloris* ( $F(3, 236) = 7.01$ ,  $p$ -value  $< 0.001$ ) etc.

For some species this variability can be explained by changing biotopes preferences, which should be proven by the results of special research. For example, the abundance of *Turdus merula* in April is  $10.4 \pm 4.28$  ind./ 5 ha and  $11.1 \pm 4.18$  ind./ 5 ha in May, but  $2.69 \pm 2.06$  in December; moreover, the occurrence of this species is 100 % during the breeding season, but it is 50–60 % in winter. Further statistical analysis is needed to make specific conclusions about common synurbanized forest bird species ecology dynamics.

## CONCLUSIONS

79 birds' species were found to occur in urban greenery in Lviv throughout the year.

The highest diversity level and abundance of birds is observed during the breeding period, especially in April, when many species begin breeding. A slight peak of abundance is observed during winter season, inasmuch as urban habitats afford special conditions, such as food resources and softer weather, to outlive this period successfully. Nonetheless, in this particular case the diversity of birds in urban greenery declines during the non-breeding season. This could mean that urban greenery is the more preferred biotope type by some bird species for breeding than for residence during the non-breeding season.

Between-months, community stability among birds in urban greenery is higher both for presence-absence species composition and numerical structure during the breeding season that shows that most of the birds are highly attached to their nesting sites, especially in April, May and June. Similarities between communities in different months decrease with difference in time.

European bird species make a nucleus of community structures in all months. Siberian, Mediterranean and Transpalearctic species are also common in urban greenery. Their role becomes more important during the non-breeding season, but separately by types all of them subdominate compared with European.

Invertebrates are the main food resources for most individual birds. Their role is especially important for birds of urban greenery while feeding nestlings; naturally, in cold months, the majority of birds predominantly use other food resources, particularly seeds. The abundance of raptor species is low and stable in all months.

Season can be considered as a factor related with the abundance of several species. Thus, bird species that are typical for urban greenery in Lviv can be divided into three groups. First, there are songbirds species that only breed in examined sites, such as *Fringilla coelebs*, *Erithacus rubecula*, *Sylvia atricapilla*, *Phylloscopus collybita*, *Columba palumbus*, *Turdus philomelos*, *Ficedula albicollis*, *Sturnus vulgaris*, *Phylloscopus sibilatrix*, *Muscicapa striata*, *Phoenicurus ochruros*, *Oriolus oriolus*, *Sylvia curruca*, *Serinus serinus* and *Phylloscopus trochilus*. Second group is wintering species that are not typically breed in those locations: *Spinus spinus*, *Turdus viscivorus*, *Bombycilla garrulus*, *Pyrrhula pyrrhula*. Third are species whose abundance varies as response on season, which can indicate unrevealed spatial-seasonal dynamics in terms of different habitat types. Those species are might be resident in Lviv: *Turdus merula*, *Coccothraustes coccothraustes*, *Troglodytes troglodytes*, *Cyanistes caeruleus*, *Chloris chloris*, *Parus major*, *Poecile palustris*. Spatial dynamics of different populations and subpopulations of those species needs special study.

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## РІЧНА ДИНАМІКА УГРУПОВАНЬ ПТАХІВ У ЗЕЛЕНИХ ЗОНАХ ЛЬВОВА: ПОПЕРЕДНІЙ АНАЛІЗ ВАРІАБЕЛЬНОСТІ РІЗНОМАНІТТЯ І СТРУКТУРИ

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Проаналізовано видовий і чисельний склад угруповань птахів у зелених зонах Львова за результатами щомісячних обліків, проведених на 20 трансектах на восьми модельних ділянках. Протягом періоду досліджень зареєстровано 79 видів птахів, що належать до восьми рядів. Різноманіття птахів, оцінене за кількістю видів та індексом Сімпсона, варіює протягом року і є найвищим у гніздовий сезон. Аналогічно, щільність птахів найвища у гніздовий сезон, проте менший пік чисельності спостерігається і в зимовий період. Це вказує на те, що біотопні преференції окремих видів птахів до зелених зон особливо виражені лише у гніздовий сезон, тоді як

у позагніздовий більшість птахів залишаються осілими в межах міста, проте перемищуються в біотопи інших типів. Проаналізовано міжмісячну стабільність видового складу угруповань птахів (за індексом Жаккара) та чисельного їхнього складу (за індексом Брея–Кьортіса): угруповання найбільш стабільні у гніздовий період, оскільки птахи в переважній більшості прив'язані до гніздових ділянок. За зоогеографічним поділом, європейські види птахів домінують у всі місяці. Сибірські, транс-палеарктичні та середземноморські види також відіграють значну роль у формуванні структури угруповань. Основним типом корму, завдяки споживанню якого компенсуються енергетичні витрати птахів у гніздовий сезон, є безхребетні, що вказує на особливу роль птахів у контролі чисельності безхребетних в урбанізованих середовищах. У позагніздовий сезон важливим компонентом кормової бази птахів є також насіння рослин. Варіабельність чисельності багатьох видів пов'язана зі сезоном. Виділено три основні групи таких видів: гніздові мігранти (переважно співочі птахи, зокрема, *Fringilla coelebs*, *Erithacus rubecula*, *Sylvia atricapilla*, *Phylloscopus collybita* тощо, також *Columba palumbus*), зимуючі мігранти (*Spinus spinus*, *Turdus viscivorus*, *Bombycilla garrulus*, *Pyrrhula pyrrhula*) і типові осілі, чисельність яких значно варіює за сезонами (*Turdus merula*, *Coccothraustes coccothraustes*, *Troglodytes troglodytes*, *Cyanistes caeruleus* тощо). Останні, ймовірно, в позагніздовий період дифундують в інші біотопи міста.

**Ключові слова:** сезонна варіабельність, міські екосистеми, синантропні види, видовий склад населення птахів, міські насадження, угруповання птахів

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**Annual dynamics of density (N, ind./5 ha) and frequency (%) of bird species in urban parks in Lviv, Ukraine by months**  
**Річна динаміка за місяцями щільності населення (N, ос./5 га) і частоти реєстрацій на трансектах (%) птахів різних видів**  
**у зелених зонах міста Львова**

	Jan		Feb		Mar		Apr		May		Jun		Jul		Aug		Sep		Oct		Nov		Dec	
	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%
<i>Anas platyrhynchos</i>		0		0		0	2	5	1	5	2	5	2	5	23 ±1.41	10	32±	5	56±	5	61±	5		0
<i>Accipiter nisus</i>	1.33 ±0.58	15	1±0	20		0		0		0		0		0	1±0	10		0	1	5	1	5	1±0	10
<i>Accipiter gentilis</i>		0		0		0		0		0		0		0		0	1	5		0		0		0
<i>Buteo buteo</i>	1.5 ±0.71	10	1	5	1	5		0		0	2	5	2	5	1	5	1.33 ±0.58	15	1±0	10	1	5	1	5
<i>Columba livia</i>	29.5 ±7.78	10	12.6 ±11.15	25	5.5 ±4.8	20	45±	5	13 ±9.9	10	7 ±2.83	10	3±1	15	11.5 ±12.34	20	16.17 ±23.21	30	13.75 ±14.22	20	5.5 ±6.14	20	28.75 ±22.02	20
<i>Columba palumbus</i>		0		0	2.67 ±2.73	30	7.73 ±4.65	75	4.24 ±3.07	85	4 ±2.74	85	3.87 ±1.92	75	2.4 ±1.35	50	3.82 ±5.74	55	2 ±1.41	10				0
<i>Columba oenas</i>		0		0	1	5	2±0	15	2±0	10	2	5	2	5	1.5 ±0.71	10		0	0	0				0
<i>Streptopelia decaocto</i>		0		0		0		0		0	0	0	0	0	1±0	10		0	0	0				0
<i>Cuculus canorus</i>		0		0		0	2±0	20	2	5	0	0	0	0		0		0	0	0				0
<i>Scolopax rusticola</i>		0		0	1	5		0		0	0	0	0	0		0		0	0	0				0
<i>Strix aluco</i>		0		0		0	1	5		0	0	0	0	0		0		0	0	0				0
<i>Strix uralensis</i>		1	5		0	0		0		0	0	0	0	0		0		0	0	0				0
<i>Jynx torquilla</i>		0		0	1	5	4	5		0	2	5	2	5		0		0	0	0				0
<i>Dryocopus marilus</i>		0	1	5	2	5	1	5		0	0	0	0	0	1	5	1±0	10		0	1±0	15	1±0	10
<i>Picus canus</i>	1.33 ±0.58	15	1.25 ±0.5	20	1±0	15	2±0	10	2	5	2±0	10		0	2	5	1	5	1±0	10			0	1
<i>Dendrocopos major</i>	1.78 ±0.83	45	2.06 ±1.24	80	2±1.35	60	2.25 ±0.71	40	2.15 ±0.55	65	2.2 ±0.63	50	2.29 ±0.85	85	1.33 ±0.49	75	1.25 ±0.62	60	1.27 ±0.47	55	1.58 ±1	60	1.56 ±1.01	45
<i>Dendrocopos syriacus</i>		1	5		0	0		0		0	2	5	0	0	1	5		0	0	0				0
<i>Leipicus medius</i>	1±0	25		0	1±0	15	2	5	2±0	10	0	0	1.75 ±0.5	20	1.33 ±0.58	15	1±0	15	1	5			0	2
<i>Dendrocopos leucotos</i>		1	5	1	5		0	0		0	2	5	0	0		0		0	0	0		1	5	0
<i>Dryobates minor</i>	1±0	10	1±0	10	1±0	10		0		0	0	0	2	5		0	1±0	15		0	1	5	1.5 ±0.71	10

	Jan		Feb		Mar		Apr		May		Jun		Jul		Aug		Sep		Oct		Nov		Dec	
	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%
<i>Delichon urbicum</i>		0		0		0		0		0	2	5		0		0								0
<i>Hirundo rustica</i>		0		0		0		0		2	5		0			0								0
<i>Alauda arvensis</i>		0		0	1.5	10		0			0			0		0								0
<i>Motacilla alba</i>		0		0		0		0		0	2	5		0		0								0
<i>Lanius collurio</i>		0		0		0		0		2	4±2.83	10		0		0								0
<i>Oriolus oriolus</i>		0		0		0		2±0	15	2±0	2	5	2±0	10		0								0
<i>Sturnus vulgaris</i>		0		0	1.8	±0.84	25	4.4	50	3.4	50	2	5											0
<i>Garrulus glandarius</i>	1.85	65	2.86	70	2.5	60	±1.83	±2.07	±0.9	2±0	2±0	15	2±0	65	2.07	2.18	85	2.15	1.9	50	2.15	65	2.33	75
<i>Pica pica</i>	1±0	20	2.8	25	1.29	35	±0.45	±0.45	2±0	2±0	2	5		0	3±2.65	15	1±0	4.14	1.83	30	4.14	35	1.88	40
<i>Corvus monedula</i>		0		0		0								0		0								5
<i>Corvus frugilegus</i>	6	5	9.5	10		0								0		0		3	8.6	5	8.6	25	12	5
<i>Corvus cornix</i>		0	2	5	1	5	2	5	0	0	2	5		0		0								10
<i>Corvus corax</i>	1.33	15	1.67	15	2	5	2	5			2±0	10	1±0	10		0	1±0	1.2	1	5	1±0	10	1.5	10
<i>Troglodytes troglodytes</i>	1±0	10	1±0	10	1±0	20	2±0	2±0	40	2±0	2±0	35	2.14	35	1.5	30	1.2	50	1.38	40	1.17	30	1±0	10
<i>Bombus pascuorum</i>		0		0	6±5.66	10								0		0								0
<i>Hippoboscus ictericus</i>		0		0		0				2	5		2	5		0								0
<i>Sylvia atricapilla</i>		0	4.5	20	6.3	100	±2.54	4.42	95	4.8	75	3.33	15	1.25	20	1.5	10							0
<i>Sylvia borin</i>		0		0		0		0	2	5	2	5		0		0								0
<i>Sylvia curruca</i>		0		0	1.8	25	±0.45	2	5	2	5		0	1	5		0							0
<i>Sylvia communis</i>		0		0		5									0									0
<i>Phylloscopus trochilus</i>		0	4	5	2±0	25	2±0	10					3	1	5		0							0
<i>Phylloscopus sibilatrix</i>		0	1	5	4.92	65	±2.25	2.8	25	±1.1					0									0
<i>Phylloscopus collybita</i>		0	2±2	30	6.63	95	±3.71	5.2	75	±2.11	5.12	80	3.18	55	4.11	45	3.45		1.5	10				0

	Jan		Feb		Mar		Apr		May		Jun		Jul		Aug		Sep		Oct		Nov		Dec		
	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	
<i>Ficedula albicollis</i>		0		0		0	4.33 ±1.67	60	3±1.51	40	2±0	30	2±0	10	10	0	1	5		0	0	0	0	0	
<i>Ficedula hypoleuca</i>		0		0		0		0		0		1	5		0	0	0	0		0	0	0	0	0	
<i>Muscicapa striata</i>		0		0		0		0	2±0	10	2.25 ±0.71	40	2.5 ±0.58	20	1.5 ±0.71	10	0	0	0	0	0	0	0	0	0
<i>Regulus regulus</i>	3±1.41	10	4.5 ±0.71	10	1±0	10		0		0	0	0	0	0	0	0	0	0	4.8 ±2.28	25	7±2.65	15	4.5 ±3.54	10	
<i>Phoenicurus phoenicurus</i>		0		0		0		5	2±0	10	0	0	0	0	1	5	0	0		0	0	0	0	0	
<i>Phoenicurus ochruros</i>		0		0		0	2±0	15	2±0	10	2±0	20	1.5 ±0.71	10	1	5	1	5		0	0	0	0	0	
<i>Erithacus rubecula</i>		0		0	2±0.76	40	4.43 ±2.1	70	4.53 ±1.19	75	4.21 ±2.1	95	3.13 ±1.55	75	3.11 ±2.32	45	1.83 ±1.33	30	2	5	0	0	0	0	
<i>Luscinia luscinia</i>		0		0		0	2	5	2	5	0	0	0	0	0	0	0	0		0	0	0	0	0	
<i>Turdus pilaris</i>	1±0	15	3.67 ±2.31	15	2.8 ±2.17	25	6.86 ±3.02	35	3.78 ±1.56	45	3.33 ±2.07	30	2±0	10	2	5	14 ±11.31	10	2.2 ±1.3	25	7.14 ±11.58	35	6	5	
<i>Turdus merula</i>	3.09 ±2.95	55	2.8 ±2.39	50	6.11 ±5.44	95	10.4 ±4.28	100	11.1 ±4.18	100	9±2.38	100	4.75 ±2.72	80	2.22 ±1.09	45	3.18 ±3.46	55	2.67 ±1.61	60	3.25 ±3.44	60	2.69 ±2.06	65	
<i>Turdus philomelos</i>		0		0	2.2 ±1.23	50	3±1.94	50	3.69 ±2.43	65	4.13 ±2.2	75	2.67 ±1.15	15		0	1	5		0	0	0	0	0	
<i>Turdus viscivorus</i>	1.57 ±0.79	35	1.2 ±0.45	25	1.67 ±0.82	30		0		0	0	0	0	0	0	0	0	0		0	1.6 ±0.97	50	1.6 ±0.89	25	
<i>Turdus iliacus</i>		0		0		0		0		0	0	0	0	0	0	0	0	0		0	1	5	0	0	
<i>Aegithalos caedatus</i>	6.33 ±3.21	15	7±0	10	3±1.41	10	2	5	2	5	0	8	8	5	4	5	5.75 ±1.71	20	8.5 ±7.78	10	9.75 ±2.06	20	6	5	
<i>Cyanistes caeruleus</i>	3.88 ±2.12	85	5.16 ±2.89	95	3.26 ±1.85	95	4.13 ±1.6	75	2.57 ±0.98	35	2.29 ±0.76	35	3.08 ±1.71	65	2.54 ±1.51	65	2.53 ±1.36	75	2.5 ±1.51	50	2.06 ±0.75	85	2.36 ±1.03	55	
<i>Poecile montanus</i>	2	5		0	1±0	15	2±0	15	2±0	10	2±0	10	3±1.41	10	1±0	10	0	0	1.5 ±0.71	10	1	5	2	5	
<i>Poecile palustris</i>	2.6 ±2.41	50	2.25 ±1.71	60	2±0.89	30	2±0	35	2.25 ±0.71	40	2.67 ±1.15	15	2.73 ±1.85	55	1.92 ±0.86	65	3.57 ±1.7	70	1.75 ±0.75	60	2.29 ±1.44	70	2.67 ±1.78	60	
<i>Lophophanes cristatus</i>		0		0		0		0		0	0	0	0	0	0	0	0	0		0	2	5	0	0	
<i>Periparus ater</i>	3.5 ±2.12	10	4.5 ±7.61	30	3±1.73	15	2±0	15	0	0	2±0	10	2.71 ±0.95	35	2.43 ±1.51	35	3.6 ±3.21	25	3.2 ±1.79	25	2.2 ±0.45	25	6±3.92	20	
<i>Parus major</i>	10.33 ±5.53	90	10.05 ±4.58	100	8.7 ±4.22	100	8.1 ±3.01	100	5.22 ±2.67	90	3.76 ±2.11	85	7.95 ±4.77	100	8.74 ±5.06	95	10.22 ±3.78	90	7.35 ±4.75	100	8.78 ±4.19	90	9.16 ±8.11	95	
<i>Sitta europaea</i>	2.78 ±1.31	90	3.32 ±1.67	95	2.81 ±1.6	80	3.09 ±1.38	55	2.62 ±0.96	65	2.27 ±0.7	75	3.63 ±2.17	95	3.15 ±1.35	100	3.89 ±1.7	95	2.76 ±1.6	85	2.82 ±1.51	85	2.75 ±1.73	80	

	Jan		Feb		Mar		Apr		May		Jun		Jul		Aug		Sep		Oct		Nov		Dec	
	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%
<i>Certhia familiaris</i>	1.86 ±1.07	35	1.14 ±0.38	35	1.6 ±0.89	25	2.33 ±0.82	30	2±0	10	2±0	10	1.67 ±0.52	30	1±0	35	1.14 ±0.38	35	1.36 ±0.5	40	1.36 ±0.5	55	1.6± 0.55	25
<i>Certhia brachydactyla</i>	1±0	10	1±0	10	1	5	2±0	15	2	5	2	5	2±0	25	1.4 ±0.55	25	1±0	25	1±0	20	1±0	15	1±0	20
<i>Passer montanus</i>	5	5		0		0		0		0		0		0		0		0		12	5	0		0
<i>Fringilla coelebs</i>		0		0	3.85 ±2.38	65	7.53 ±3.44	95	8.3 ±3.33	100	7.2±3	100	3.83 ±1.6	30	8	5		0	1.5 ±0.71	10	1	5		0
<i>Fringilla montifringilla</i>		0		0	0	1	5	0		0		0		0		0				0		0		0
<i>Linaria cannabina</i>		0		0		0	0	0		0			0	0		0				0		0	1	5
<i>Acanthis flammea</i>		0		0	2±1.41	10		0		0				0		0				0		0	35±	5
<i>Carduelis carduelis</i>		0	2	5	1	5	2	5	2	5			2	5	1	5				0	3.5 ±3.54	10	2	5
<i>Serinus serinus</i>		0		0	0	1	5	2±0	15	2±0	10	2	5	0		0				0		0		0
<i>Spinus spinus</i>	7.77 ±6.42	65	5.57 ±4.5	35	5.14 ±4.34	35		0		0	2	5	4±3.46	15	2	5	5.4 ±6.07	25	2.64 ±1.69	55	10.77 ±8.67	65	18.47 ±14.55	75
<i>Chloris chloris</i>	3	5	2.75 ±2.22	20	1.42 ±0.79	60	2.36 ±1.21	55	2.6 ±0.97	50	2.8 ±1.1	25	4±2	15		0	1	5	1.5 ±0.71	10	4±4.36	15	3	5
<i>Loxia curvirostra</i>		0		0	0	2	5	0		0		0		0		0				0		0		0
<i>Pyrrhula pyrrhula</i>	2.6 ±1.52	25	2.88 ±2.1	40	1.67 ±1.21	30		0		0				0		0			3.2	25	4.29 ±3.35	35	2.14 ±0.69	35
<i>Coccothraustes coccothraustes</i>	1.33 ±0.58	15		0	1.75 ±0.89	40	2.25 ±0.68	80	2±0	45	2±0	20	2±0	25	1.5 ±0.71	10	1.33 ±0.58	15	2.14 ±2.61	35	1±0	10	1	5
<i>Emberiza citrinella</i>		0		0		0	0	0		0	2	5		0		0				0		0		0