AVIFAUNA ALONG URBAN GRADIENT OF SUCEAVA CITY

Constantin ION[1] and Mihai HUŢULEAC[1]

[1] “Alexandru Ioan Cuza” University, Department of Biology, str. Carol 20A, Iaşi, 700505, costinbio@gmail.com

Abstract. The aim of the paper is to find out if we could identify an ecological model regarding the distribution of the breeding pairs in the urban area of Suceava city. In this context we have checked if the birds are influenced by the degree of urbanization. The birds of Suceava city are more abundant in the centre of the city, but the diversity is greater in the periphery. The abundance of birds is greater in the anthropic areas than in the natural ones. Regarding the groups' association of ecological birds with certain types of land use in urban area, it can be noted that the birds could be seen also in habitats less common for their ecological preferences in the condition of Suceava city. The urbanization gradient could represent actually a direct consequence on the abundance and the diversity of birds' species present in the city, as it is considered in the case of Suceava. In the meantime, the continuous increase of the city's degree of development does not affect dramatically the presence of the birds' species, having in view the fact that they have an increased adaptability in the urban areas, with the condition that the areas having natural vegetation in the city are maintained.

Keywords: bird's distribution, urban gradient

Rezumat. Avifauna în lungul unui gradient urban din oraşul Suceava. Scopul lucrării constă în identificarea unui model ecologic al distribuţiei perechilor clocitoare în zona urbană a Sucevei. În acest sens, am verificat dacă păsările sunt influenţate de gradul de urbanizare. Păsările din Suceava sunt mai abundente în centrul oraşului, dar diversitatea specifică este mai ridicată la periferie. Abundenţa speciilor este mai mare în zonele antropice, decât în cele naturale. În privinţa asocierii grupelor ecologice de păsări cu anumite tipuri de utilizare a terenurilor din zona urbană, se observă că speciile de păsări sunt prezente şi în habitate mai puţin caracteristice. Gradientul de urbanizare ar putea avea consecinţe directe asupra abundenţei şi diversităţii speciilor din oraş, aşa cum rezultă în cazul Sucevei. Dezvoltarea continuă a oraşului, din ultimul timp, nu afectează dramatic prezenţa speciilor de păsări, datorită capacităţii ridicate de adaptare la condiţiile mediului urban, cu condiţia menţinerii unor perimetre cu vegetaţie naturală.

Cuvinte cheie: distribuţia păsărilor, gradient urban

Introduction

The birds in the cities have been studied along time in many papers (Grimm et al, 2000); Croitoru, 2009), proving the existence of numerous species of birds, which can adapt to the conditions of the urban landscape. In general, cities are preferred for nesting and raising the nestlings of omnivores, granivores or those birds which use hollows for nesting (Chace & Walsh, 2004). To these, there are added the birds which eat the corpses of animals dead in car crash or constructions or those birds which hunt other species of birds, such as day or night predators. Besides, the more the degree of urbanization increases, the more the number of bird individuals are, but the number of species decreases (Chace & Walsh, 2004; Savard et al., 2000).

Furthermore, most species of birds breed in urban green spaces, especially parks and gardens. (Melles et al., 2003). For instance, the presence of forest bodies is essential for the presence of bird species in the urban areas (DeGraaf & Wentworth, 1996, Hedblom & Söderström, 2010). At the same time, the species of birds are present in a big number in those areas in which the socio-economic development is greater (Melles, 2005). Although you might assume that the human impact is very increased in built up areas and can affect the

presence of birds. In reality, birds accommodate near buildings or in them. Thus, they can find many leftovers to eat among the buildings. In the same time, in some built up areas, where there is a high density of birds, the chance to hunt other species is bigger.

Although species of birds could be a common presence in the urban spaces, only a few papers describe the avifauna from cities (Lancaster & Rees, 1979, Croitoru, 2009). Moreover, in the conditions of a more and more accelerated urbanization, the populations of birds seem to be more and more affected (Fuller et al., 2009), hence resides the importance of the ornithological studies, which could bring new arguments for the preservation of nature, closely related to the continuous development of cities. At the same time, birds are an environmental bioindicator for the biologic models, which could be easily observed (Clergeau et al., 2001). So, the presence of a great number of birds from different species would show an ecological balance. In this context, inside cities there is the need to create some spaces which are populated by birds and which are as close as possible to those in the natural environment.

Regarding Romania, there are few references to the avifauna inside the cities (Papadopol, 1975; Croitoru, 2009), which include information about the inhabited areas. This is the reason for which we presented, using Geographical Informational System (GIS), a current image of the distribution of breeding species in Suceava (Romania).

The general aim of the paper is to find out if in our study is an ecological model regarding the distribution of the nesting pairs from the urban area of Suceava city. In this context, we have analysed if the birds are influenced by the degree of urbanization. Starting from this idea we wanted to verify if there is a difference between the presence of the species of birds and their abundance among the centre, peri-central and peri-urban areas. In the conditions of restraining the polluting industrial activities in the cities of Romania, can birds occupy the imperviousness spaces in a bigger number than the green areas? Do birds respect their general ecological preference inside the city?

Material and Methods

Study Area. The study area is represented by Suceava city and its surroundings. Suceava is situated in the north-east of Romania, on Suceava Plateau, a subunit of the Moldavian Plateau. Hydrographically, it is laid in the Basin of Siret River. The river Suceava flows through the area. The minimum altitude in the area is of 270 m in the meadow of Suceava river and the maximum altitude is of 435 m.

Following the analysis of urbanization degree, there were delimited 3 areas: central, peri-central and peri-urban areas. The centre (downtown) is dominated by buildings, especially administrative. In the peri-central area there are both buildings and green spaces, but the imperviousness areas are dominant. The peri-urban area presents many compact green areas, especially forests, but also areas with housing constructions. However, the green areas are dominant in peri-urban.

Birds count. During 2011-2012, in the breeding period, May - June, we estimated the presence of bird species using two types of transects. In bird surveying we used line transects and point transects (Gregory & Baillie, 2004). We established the transects and point transects regarding our previous information. The line transect involves traveling on a predetermined route and recording birds on either side of the observer. The birds are seen or heard from the transect line, at the distance of maximum 100 m. The walking speed was almost the same. Each season, the same persons did a minimum of two visits to a transect.

The data were also collected within plots using the point count method (Gibbons and Gregory, 2006). The point count sampling design consisted of a series of points at which birds were counted within a defined radius. Birds that are seen flying over the census area (aerial species) are recorded separately because they cannot be included in the standard estimation. We could identify passerines and non-passerine species, in open areas, forests areas, riparian, aquatic or built-up areas. Each plot was visited several times for a ten-minute observation period (Bibby et al, 2000). Visits to each plot were done early in the morning (6:30–11.00) or in the evening (15:00–18:30). As the weather can influence the occurrence of some bird species, working during rain or strong wind was avoided (Bibby et al, 2000).

A 10 × 50 resolution binocular (Olympus mark) and a field guide book were also used to identify the species of birds observed (Svensson et al., 2010). Five minutes after the plot was located, we started to observe birds. This time delay was in place to allow birds to return to their natural behaviour or to nest in order to minimize potential impacts of human presence on the survey. The following variables were recorded during each 10 min observation period: the type of micro landscape, the name of the bird species observed, the number of observed individuals from each bird species. The birds encountered outside our study plots were recorded only when it was a local new species that had never been observed in the area before. These records were only considered for compiling a bird checklist of Suceava city.

We avoided double counting the same individual birds at a point count or within a transect section. We used careful observation and common sense as suggested by Gregory & Baillie, 2004. For the centre, peri-central and peri-urban areas there was quantified the number of species, their abundance and the diversity index Shannon-Winner (Krebs, 1989) was calculated.

GIS Analysis. During the breeding period birds are restricted to some specific areas. We mapped with GPS the nest position of the species (Gregory & Baillie, 2004). For bird - habitat geodatabase, the projection system used was Stereo 70, using ESRI ArcGis v.9.3 software. The geodatabase for habitats was generated based on Urban Atlas, 2012 (Figure 1).

The principal habitats that are delimitated: continuous urban fabric (S.L. : > 80%); discontinuous dense urban fabric (S.L. : 50% - 80%); discontinuous medium density urban fabric (S.L. : 30% - 50%); discontinuous low density urban fabric (S.L. : 10% - 30%); discontinuous very low density urban fabric (S.L. : < 10%); isolated structures; industrial, commercial, public, military and private units; mineral extraction and dump sites; construction sites; land without current use; green urban areas; sports and leisure facilities; arable land (annual crops); pastures; complex and mixed cultivation patterns; forests; open spaces with little or no vegetation (beaches, dunes, bare rocks, glaciers); water; railways and associated land; other roads and associated land. Some species of bird’s nest in isolated trees or groups of trees or shrubs which are differently identified in Urban Atlas, 2012. This is the reason for which we have separated some compact areas with trees or shrubs where bird species breed.

We built up the maps for all ecological groups identified: aquatic, built-up, open area, forest and riparian birds. Nesting guild should provide useful information about habitat restrictions and should allow more powerful statistical tests than when considering each species separately (Melles et al 2003a). We excluded the data referring to Jackdaw (*Corvus monedula*), because the individuals are too dispersed in the urban area. We chose to build up separated maps for analysis, depending on the type of habitat preferred during the breeding

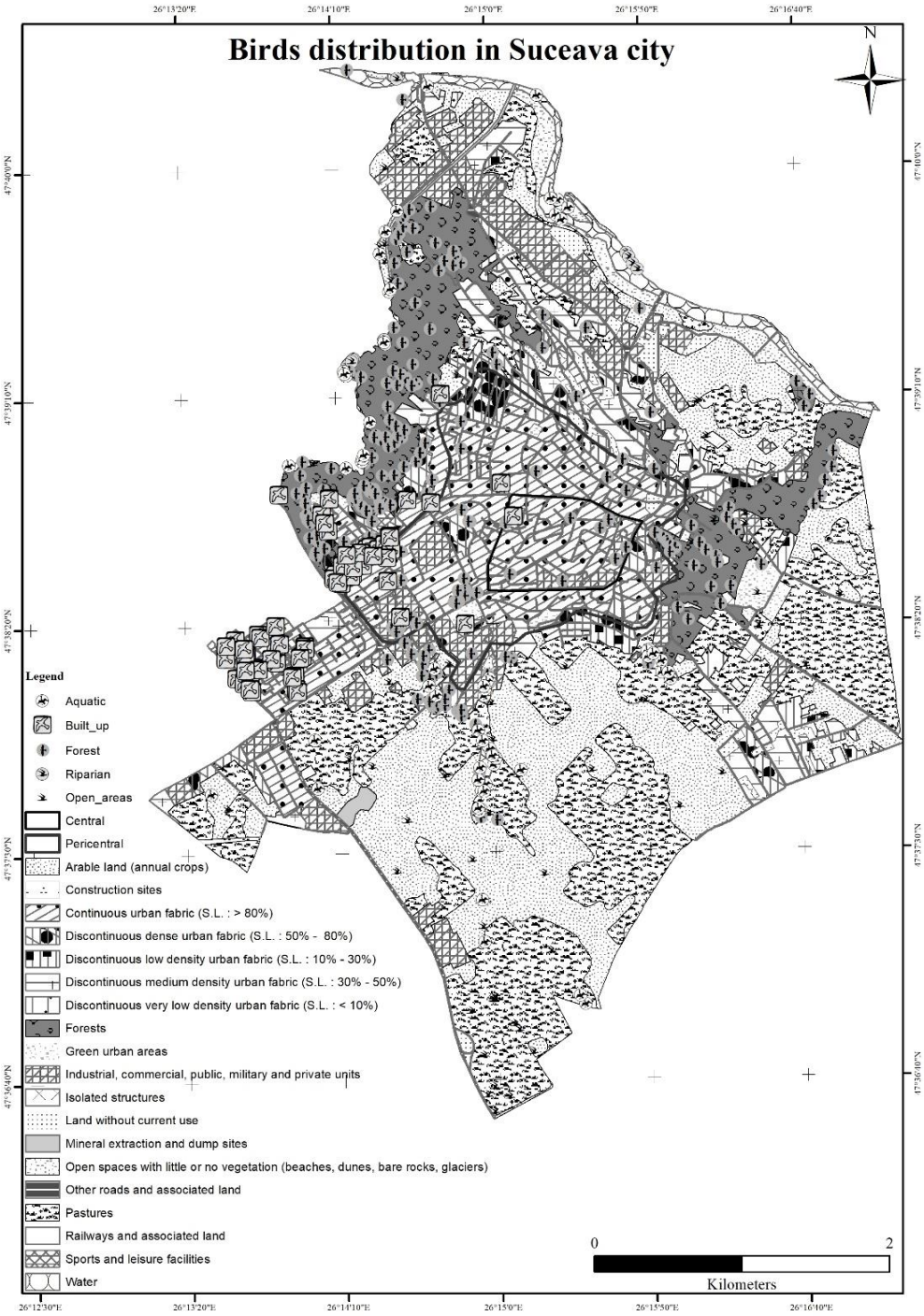

Figure 1. Birds distribution and land use in Suceava city.

period by the bird species we identified in the field and not to overcharge the maps. For every nesting place there was applied a buffer with a radius of 100 m, considered as a minimum area in which the identified birds carry out their activities. Within the buffer, there were identified the number and types of habitat in which the nesting birds carry out their activities.

Statistical analyses. We have compared the diversity, the evenness and the abundance of birds in the central, peri-central and peri-urban areas through Kruskal-Wallis to see if the number of species and the abundance decreases at the same time with the degree of urbanization. The p-value has been computed using 10000 Monte Carlo simulations.

We have applied the same type of tests to see if birds prefer more the spaces which include natural green spaces or the anthropic ones built, with houses or blocks. We have applied the same tests on each ecological group of birds. We have not taken into account the year effect, as we have made average ratings on the populations of birds overall on the two years.

We have applied a Correspondence analysis (CA) to see the connection between the types of habitat and the bird ecological groups. MultiVariate Statistical Package (MVSP) was used to calculate diversity of birds. We have used R-statistics, XLSTAT and Microsoft Excel for the statistical analysis of data (tests and CA).

Results and Discussion

There were identified 88 species (Table 1).

Table 1. Birds species from peri-urban, peri-central and centre of Suceava city.

No.	Peri-urban		No.	Peri-urban	
	Name	abundance		Name	abundance
1.	Accipiter gentilis	6	35.	Erithacus rubecula	52
2.	Accipiter nisus	6	36.	Falco subbuteo	7
3.	Acrocephalus arundinaceus	19	37.	Falco tinnunculus	23
4.	Acrocephalus scirpaceus	5	38.	Fringilla coelebs	8
5.	Aegithalus caudatus	14	39.	Fulica atra	89
6.	Alauda arvensis	47	40.	Gallinula chloropus	36
7.	Alcedo atthis	6	41.	Galerida cristata	26
8.	Anas platyrhynchos	72	42.	Garrulus glandarius	6
9.	Apus apus	1019	43.	Hippolais icterina	2
10.	Ardea cinerea	62	44.	Ixobrichus minutus	28
11.	Ardea purpurea	2	45.	Jynx torquilla	5
12.	Asio otus	18	46.	Lanius collurio	50
13.	Athene noctua	7	47.	Lanius excubitor	7
14.	Buteo buteo	4	48.	Merops apiaster	54
15.	Linnaria cannabina	4	49.	Motacilla alba	23
16.	Carduelis carduelis	8	50.	Motacilla cinerea	3
17.	Chloris chloris	26	51.	Motacilla flava	43
18.	Certhia familiaris	4	52.	Oenanthe oenanthe	11
19.	Ciconia ciconia	9	53.	Oriolus oriolus	42
20.	Circus aeruginosus	2	54.	Panurus biarmicus	30
21.	Columba livia f.domestica	990	55.	Pariparus ater	4
22.	Columba oenas	12	56.	Cyanistes caeruleus	18
23.	Columba palumbus	12	57.	Parus major	16
24.	Corvus frugilegus	1090	58.	Passer montanus	168
25.	Corvus cornix	60	59.	Perdix perdix	28
26.	Corvus corax	10	60.	Phasianus colchicus	3

No.	Peri-urban	
	Name	abundance
27.	Coturnix coturnix	7
28.	Cuculus canorus	48
29.	Cygnus olor	5
30.	Delichon urbicum	2216
31.	Dendrocopos major	14
32.	Dendrocopos syriacus	6
33.	Emberiza citrinella	9
34.	Emberiza schoeniculus	2

No.	Peri-urban	
	Name	abundance
61.	Phylloscopus collybita	28
62.	Picus canus	7
63.	Pica pica	22
64.	Picus viridis	3
65.	Podiceps cristatus	10
66.	Rallus aquaticus	12
67.	Remiz pendulinus	3

No.	Peri-central	
	Name	abundance
1.	Apus apus	121
2.	Apus melba	12
3.	Asio otus	4
4.	Athene noctua	4
5.	Linaria cannabina	6
6.	Chloris chloris	4
7.	Certhia familiaris	6
8.	Coccothraustes coccothraustes	4
9.	Columba livia f. domestica	1980
10.	Corvus frugilegus	275
11.	Delichin urbicum	360
12.	Dendrocopos major	6
13.	Erithacus rubecula	4
14.	Fringilla coelebs	16
15.	Hippolais icterina	6
16.	Parus major	52
17.	Passer montanus	2
18.	Phylloscopus collybita	14
19.	Sitta europae	8
20.	Strptopelia decaocto	50
21.	Sylvia communis	16

No.	Centre	
	Name	abundance
1.	Asio otus	8
2.	Columba livia f._domestica	1270
3.	Delichin urbicum	160
4.	Dendrocopos major	3
5.	Parus major	14
6.	Phylloscopus collybita	6
7.	Sylvia communis	12

Between peri-urban, peri-central and centre area are significant statistical differences concerning birds' presence (Table 2). The results of the z-test show that there are significant differences among the three areas which compose the city (p=0.002). The number of species increases from the centre to the periphery, and the highest number of individuals is in the central area.

Table 2. Diversity, evenness, species richness and abundance of bird species in peri-urban, peri-central and centre areas of Suceava city.

	Peri-urban	**Peri-central**	**Centre**
Index	1,202	0,538	0,224
Evenness	0,609	0,401	0,265
No. of Sp.	67	16	7
Abundance	1473	2950	7887

Between the green areas and the anthropic ones there are significant statistical differences (p=0.008) concerning birds' presence. The abundance of birds is greater in the anthropic areas than in the natural ones. If we look at the diversity and the number of species the situation is reversed (Table 3).

Table 3. Diversity, evenness, species richness and abundance of bird species in green and built-up areas of Suceava city.

	Diversity index	Evenness	Species Richness	Abundance
Green	1.582	0.816	87	1577
Built-up	0.881	0.463	80	13055

The most numerous groups of species is the one of forest birds with 44 species (33%), also the most abundant group (44%). The fewest species (4,54%) belong to the riparian birds.

Forest birds prefer most types of habitat and most types of patches which delimit and are met especially to the periphery. Built-up birds are more numerous in the centre than to the periphery. Open area birds are more numerous to the periphery and the riparian and aquatic birds prefer the restricted areas with clay shores or respectively with water, found to the periphery (all results $p<0,05$).

CA shows that through some groups of ecological birds with a less common habitat if we have in view their biological preference for certain habitats. Forest birds prefer, beside forests, more green urban areas, discontinuous dense urban fabric, industrial, commercial, public, military and private units. Built-up birds could nest in imperviousness areas with continuous urban fabric, other roads and associated land. Taking into account that aquatic passerines prefer for breeding the habitats from the edge of the aquatic areas, associate with discontinuous very low-density urban fabric, discontinuous medium density urban fabric and arable land. The same association is observed also for the open area birds. Riparian birds associate with open spaces with little or no vegetation and isolated structures. The least preferred habitat is mineral extraction and dump sites, being also the type of field with the smallest share in Suceava city.

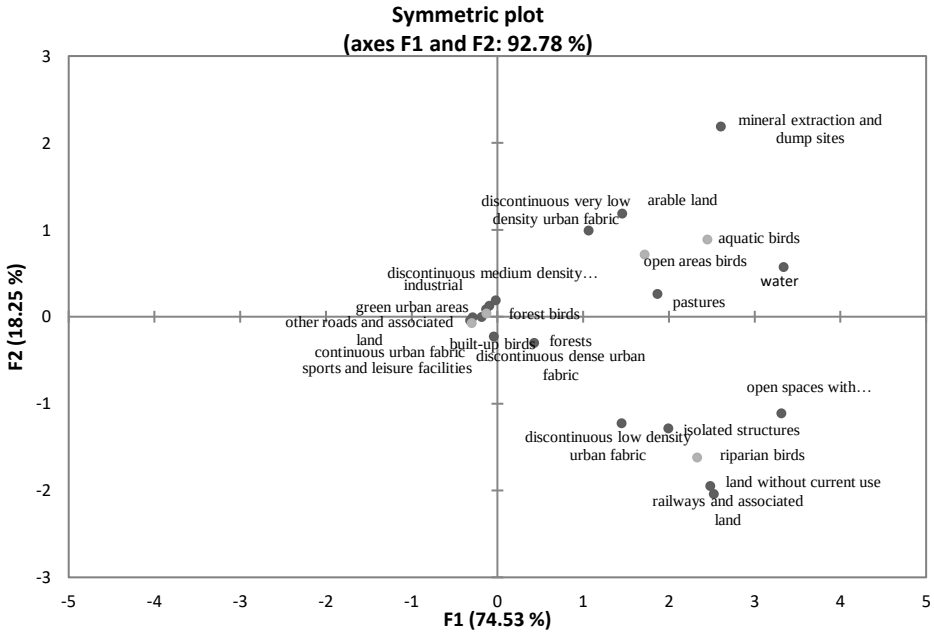

Figure 2. CA among ecological group of birds and habitats from Suceava city.

Regarding the fact that the abundance of birds differ between the centre and the periphery, contrary to what has been said by (Lancaster & Rees 1979), who stated that birds' density does not change along the urban gradient and the birds' diversity is greater in the areas in which habitats' diversity is lower. On the other hand, Blair, 2004, revealed that the species richness and the bird diversity is higher at intermediate levels of urbanization.

Afterwards, the results regarding a more numerous presence of the bird species in green spaces, wooded, from the periphery are in concordance with those specified by (Lancaster and Rees 1979) (Sandström et al 2006) that the number of species is smaller in the centre and it increases to the periphery (Chace & Walsh 2006). Also, at peri-urban region, sometime, birds stay in old abandoned industrial areas, where they are not disturbed, taking into account that Suceava's industry from that areas have been in a dramatic decline for more than 20 years (Tomasciuc, 2016).

Furthermore, in central and peri-central areas, most often, birds prefer in high number to have nests on high camouflaged supports (especially building or high electricity poles) with visibility to the feeding fields (open areas), but also to the surroundings, to see the appearance of some predators. The results chime with those specified by (Gatesire et al., 2014) (Lancaster & Rees, 1979) (Chace & Walsh, 2006), who affirm that in the urban areas with constructions the birds' abundance is greater. The buildings' conformation facilitates the birds' presence in a big number, adapted to the urban environment (e. g. pigeons, crows, sparrows). In this case the buildings represent either nesting places, either they create together with the surrounding natural vegetation, a shield against the wind or a screen against the sun. However, the number of species is small towards the centre of the city and in the urban areas it is still preferable to maintain a great diversity of birds, which is also a good clue of people's quality life (Savard et al, 2000) (McKinney, 2002) (Clergeau et al, 2001).

Indeed, maintaining a continuous monitoring of the avifauna and an increase of the percentage of green spaces through buildings is desirable for the city of Suceava, situation similar for other cities in the West of Europe, which do not fulfil the surface of parks or alignments of trees that have to exist in a city, according to the things specified by the recommendations of the European Community, 2017.

Regarding the groups' association of ecological birds with certain types of land use, birds can be seen also in habitats less common for ecological preferences due to the lack of places suitable for nesting in some preferred habitats. The density of individuals could be very high or the structure of buildings could not present possible niches to nest. At the same time, the biogeographical origin, the density of bird communities, the habitat of origin determines the versatility of bird species in choosing also another type of habitat for nesting than the one usually occupied in the urban areas (Conole, 2014).

In addition, in Suceava city non-passerines aquatic birds populate most flowing and standing streams mostly in the areas surrounding the city, where the anthropic impact is less invasive and where the ecological conditions permit the different species to populate these areas, either the entire year or just for breeding, feeding or wintering. The species less sensitive to the human disturbance like the big duck (*Anas platyrhynchos* - Mallard) make the most of any water eye, especially in the industrial area, where after the closing of some industrial facilities (Tomasciuc, 2016), there remained many water basins, which represent a refuge for many species of water birds.

As respects storks, they are poorly represented on the territory of Suceava city: first, because of the lack of nesting places; and second, due to the agriculture intensification within

the periphery of Suceava city. During this study there was identified a small number of nesting pairs (4), all being located in the periurban area of the city, where they nest either on the chimney of some houses (Șcheia, Lipoveni), or on decommissioned buildings (Iţcani).

Regarding aquatic and semi-aquatic passerines, they are widely spread in the studied area, occupying most palustrian habitats. The most significant populations can be met in the peri-urban areas, where the conditions are more favourable. Among the areas with a pronounced importance for this group of birds there are: lakes Icar, stream Scheia, lake Lipoveni and Suceava river (the location of the areas can be seen in Tomasciuc, 2016). These territories include a gathering of lacustrine, forestry habitats and open spaces, where birds can nest and feed themselves safely during breeding period.

Afterwards, built-up area birds are represented among others by Common swift (*Apus apus*) and House martin (*Delichon urbicum*). There are well-represented on the radius of Suceava city, being strongly represented numerically in the neighbourhoods: Obcini, George Enescu, Mărășești and Burdujeni. These neighbourhoods own a series of architectural particularities which offer places favourable for built up birds' species to nest. As particularities, these buildings are older, containing different cracks and the windows' carpentry is made of wood (most windows do no open, so that birds are not disturbed). For example, the area George Enescu (Tomasciuc, 2016), populated by some bird species, has a particular feature. It was once a huge swamp, and most blocks are flooded in the basement because of the underground springs. The accumulations of water in the basement serve as real nurseries for mosquitoes, aspect which can favour the occupancy of the area by the birds which feed themselves directly or indirectly with them.

For instance, Common swift occupies in a greater number the areas where the blocks have bridge and the access to it is blocked for human beings. In the same way, House martins occupy especially schools and other big buildings which provide nesting places.

Also, Domestic pigeons (*Columba livia* forma *domestica*) and Eurasian Collared Dove (*Streptopelia decaocto*) are a common appearance in Suceava city. Besides, in the studied area, these birds constitute large colonies, especially in the old buildings and in the neighbourhoods: Obcini, George Enescu, Center, Burdujeni and the industrial area. They nest in inaccessible places like terraces, building bridges, cracks in walls and less often in hollows (in Central Park). Particularly, the most important populations are in the central area, where they nest in the bridge of the prefecture and the catholic cathedral. Moreover, the population of pigeons and Collared doves from the centre of the city is protected by the community police and the mayor's office has entrusted a civil servant to feed the birds daily with a bag of grain.

Concerning open-area birds, they are well-represented as a number of species and individuals on the entire peri-urban area of Suceava city. For exemplification, more important populations can be met in the Icar, Burdujeni, Iţcani and Șcheia neighbourhood.

Next, forest birds are distributed on the radius of the city. Such as, the biggest concentrations can be found to the periphery of the city, in the small forest George Enescu – Zamca, where birds find favourable life conditions.

In the same way, some more antropofile species (e.g. woodpeckers) occupy green spaces in the city, especially the parks and yards of the institutions which have trees (the County Hospital, the Agricultural and Development Research, the area the Citadel of Chair and the parks of the city).

Afterwards, diurnal predators nest mostly in the peri-urban areas. Anyway, they are poorly represented in number the peripheral area than other bird species, because of the strong persecution of people. Also, they are few inside the urban area because of the lack of ecological conditions. Generally, diurnal birds of prey nest in the forests or on buildings, but on the edge of some open-spaces (del Hoyo et al., 1994). For instance, the peri-urban areas are nevertheless the most accessed by these birds, as they embody the minimum of ecological conditions for diurnal predators, forests and buildings are surrounded by some open spaces.

On the other hand, regarding, nocturnal predators, cities can be an attractive place for a series of species like some owls, because urban habitats include a great number of rodents and also the old buildings are good places for nesting, as it is the case in Suceava. TSuch as, the species which accept better the anthropic impact are Little owl (*Athene noctua*), Tawny owl (*Strix aluco*) and Long-eared Owl (*Asio otus*), species which live in the city throughout the year. In the peripheral areas of the city, as it is the small forest George Enescu – Zamca nest both as well as Long Eared Owl and as Ural Owl – *Strix uralensis*).

Concerning woodpeckers such as Syrian woodpecker (*Dendrocopus syriacus*) and Great Spotted Woodpecker (*Dendrocopus major*) are present in a relatively great number on the radius of Suceava. For instance, they nest especially in parks, like the University Park or the one within Suceava Municipal Hospital, but also sporadically in trees from different places in the city. Moreover, the species which support less the human disturbance are the woodpecker (*Picus* sp.), which stay in the periurban areas, in the woods of this area.

Last but not least, riparian birds occupy a limited area at the edge of the city, where they can find favourable ecological conditions. Especially, the most important areas for these species in Suceava city are: Suceava River, lakes Icar, Lake Lipoveni and Șcheia stream.

In the view of results, the more numerous presences towards the centre of the city and the abandoned industrial areas can be the effect of a lack of threats or of the nest's position, which is often away from the sun, wind, being situated in places well-hidden from buildings or trees. At the same time, the easier access to the leftovers nearby can be one of the causes of the increased abundance of the birds towards the centre. As consequence, the urbanization gradient can represent actually a direct consequence on the abundance and the diversity of birds' species present in the city, as it is considered in the case of Suceava. In the addition to, the continuous increase of the city's degree of development does not affect dramatically the presence of the birds' species, having in view the fact that they have an increased adaptability in the urban areas (Bonier et al, 2007), with the condition that the areas having natural vegetation in the city are maintained (Melles, 2005) (Melles et al, 2003b). However, the diversity of birds is preferred instead of a high abundance of a small number of species. For this goal it is necessary to increase the percentage of green spaces in the central areas and protect them in the peri-urban areas.

At the same time, this paper can be useful for the following plans of territorial arranging closely aligned with the conservation of the green spaces and of the places where species of birds live, which beside the ecological importance, are charismatic and can represent touristic attractions and good indicator for quality life of the inhabitants (Savard et al, 2000) (McKinney, 2002) (Clergeau et al, 2001).

Conclusions

The birds in Suceava city are more abundant in the centre of the city, but the diversity is greater in the periphery.

The abundance of birds is greater in the anthropic areas than in the natural ones.

Regarding the groups' association of ecological birds with certain types of land use, it can be noted that the birds can also be seen in urban area in habitats less common for ecological preferences.

The urbanization gradient can represent actually a direct consequence on the abundance and the diversity of birds' species present in the city, as it is considered in the case of Suceava.

The continuous increase of the city's degree of development does not affect dramatically the presence of the birds' species, having in view the fact that they have an increased adaptability in the urban areas, with the condition that the areas having natural vegetation in the city are maintained.

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