EVOLUTION OF THE BIRD FAUNA DIVERSITY IN THE PERIMETER OF THE ARCUDA STATION (JOIȚA - GIURGIU, ROMANIA) DURING 2012 - 2019

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Abstract. We performed this ornithological study through the monitoring of bird fauna on the territory of the Arcuda Station in two periods, i.e. 2012-2013 and 2018-2019. We identified 111 bird species during our study in this perimeter. We notice a slight decrease in the diversity of birds from 100 species recorded during 2012- 2013 to 95 species during 2018-2019. We also present quantitative data for breeding bird species, mentioning their dynamics from one period to another. The typical forest species are dominant in terms of specific diversity and population. The list of bird fauna includes 17 bird species that appear in Annex 1 to the Birds Directive. Eight bird species appear in the Romanian Red Book of Vertebrates: *Tadorna ferruginea*, *Egretta garzetta*, *Nycticorax nycticorax*, *Ciconia ciconia*, *Pernis apivorus*, *Streptopelia turtur*, *Jynx torquilla* and *Corvus corax*.

Keywords: bird fauna, dynamic, urban green areas.

Rezumat. Evoluția diversității ornitofaunei în perimetrul Stației Arcuda (Joița – Giurgiu, România) în perioada 2012 - 2019. Studiul nostru ornitologic s-a derulat în două etape, acoperind câte doi ani de monitorizare a păsărilor de pe teritoriul Stației Arcuda: 2012 – 2013, respectiv, 2018 – 2019. De-a lungul studiului nostru, am identificat 111 specii de păsări în acest perimetru. Remarcăm o ușoară reducere a diversității păsărilor de la 100 de specii înregistrate în anii 2012 – 2013 la 95 de specii întâlnite în intervalul 2018 – 2019. Prezentăm și informații cantitative pentru speciile clocitoare, urmărind dinamica acestora între cele două perioade ale studiului. Păsările caracteristice pădurilor sunt dominante prin diversitatea specifică și efectivele populaționale, înregistrând evoluții pozitive. Lista ornitofaunistică include 17 specii care apar în Anexa 1 a Directivei Păsări. Opt specii apar în Cartea Roșie a Vertebratelor din România: *Tadorna ferruginea*, *Egretta garzetta*, *Nycticorax nycticorax*, *Ciconia ciconia*, *Pernis apivorus*, *Streptopelia turtur*, *Jynx torquilla* și *Corvus corax*.

Cuvinte cheie: avifaună, dinamică, spații verzi urbane.

INTRODUCTION

The presence or absence of some bird species, but also their populations living within one territory represent key-factors that permit us to assess the quality of the ecosystem, providing us with data on the quality of the elements that create the ecological niche of these key-species within the biocenosis. These data regard the sheltering, foraging and resting sites, suitable habitats for nesting, feeding territories with sufficient trophic resources for the individual survival, but also for the reproductive success necessary to the long-term survival of the species.

The birds and the humans are inhabitants of the same space from times lost in the darkness of evolution and history, too. The life of most of the birds is undergoing on in a more or less visible manner inside various habitats, with quite small interference with the daily life of man. Gradually, almost all the activities undertaken by man have led to more or less profound alterations of the ecosystems and habitats suitable for birds. In these conditions, some bird species have settled in the urban green areas, exploiting the suitable breeding habitats inside the parks, gardens and orchards, but also various and easily accessible trophic resources in these anthropogenic ecosystems.

In Romania, the first ornithological studies regarding the bird fauna from the green urban areas and anthropogenic ecosystems appeared in the second part of the 20th century (KORODI GAL, 1958a, 1958b; PAPADOPOL, 1960; STĂNESCU, 1971; ION & VALENCIUC, 1982; ION & GACHE, 1997; GIURGINCĂ, 1997; TONCEAN, 1997; GLĂVAN & TOADER, 2001; LAIU & PAȘOL, 2001; COROIU & RADULOVICI, 2002). During the last two – three decades, results of some long-term studies appeared as papers (PAPADOPOL & PETRESCU, 1990; BĂLESCU, 2000; BĂLESCU & RIDICHE, 2001; GACHE, 2007, 2015), monographs (CROITORU, 2009) and guides of bird fauna or breeding birds atlases for specific cities (STĂNESCU & PÂRVULESCU, 2008; FERENC et al., 2017).

There are not previous data about the bird fauna from the Arcuda Station for Treating and Drinking Water Production, before the results of our first study developed between the years 2012 – 2013 and published as a monograph (SÂRBU et al., 2014).

METHODS AND PERIOD OF STUDY

The Arcuda Station for Drinking Water Treatment and Production is located on the administrative territory of the Joița village (Calea București – DJ 601 A, no. 10), in the north-eastern part of Giurgiu County ($44^0$29’29” northern latitude and $25^0$51’35” eastern longitude) in the Romanian Plain (southeast of Romania). Access is possible by car on the county road DJ 601A (about 19 kilometres to west from Bucharest).

Our field investigations on the birds’ fauna from the perimeter of the Arcuda Station for Drinking Water Treatment and Production were done during May 2012 – December 2013, respectively, March 2018 – September 2019

with regular visits monthly (December – February) or twice per month (during the breading season in June – July, and in migration time in March – May, respectively, August – November).

The birds were monitored by means of the methods of transect and fixed points, covering the whole territory of the Arcuda Station. We used the same transects and fixed points during the both periods of study. We identified the birds (BRUUN et al., 1999, SVENSSON et al., 2017) through direct observation by binoculars (Olympus 8-16x40 and Nikon Akulon 8 – 24x). We estimated the bird populations, too, by counting the observed birds and their songs (males' calling activity and territorial songs). In the analysis of our results, we are using SIBLEY & AHLQUIST taxonomic system (1995) with subsequent additions and modifications (http://avibase.bsc-eoc.org/).

The principal aims during the first part of our study were to assess the diversity of bird fauna, to estimate the birds' population and its' seasonal dynamic. During the second part, we aimed to identify the evolution of bird fauna's diversity and of the birds' population compared with the previous data, and to identify the reason of this evolution.

RESULTS AND DISCUSSIONS

The Dâmbovița River is the source of water for the Arcuda station through the Brezoaiele-Arcuda pipe channel. The main administrative building is a historical monument (it was opened in 1900), surrounded by a large arboretum with some secular trees. The investigated perimeter is not very large (136 hectares) but presents a mosaic of ecosystems and habitats. The forest ecosystem covers the largest surface on the territory of the Arcuda Station for Drinking Water Treatment and Production. The flooding meadow forests, gallery-forest with white poplar, willows and various deciduous climber species, dry meadow forest with different deciduous tree species and dens bushes, acacia plantation, arboretum and an old orchard represent the forest habitats in the area. The aquatic ecosystem has two components: the drinking water treatment and production basins (overflow or storage basin, pre-decanter basin and four decanter basins, covering about 12 ha), respectively, the Brezoaiele-Arcuda pipe channel opened in the Arcuda Station and forming the eastern border of the drinking water production station, crossing the meadow forest from the southern side of the territory. The dry and humid meadows appear as stripes between and on the western side of the mentioned basins. A large open area, covered by agricultural and abandoned lands, forms the eastern neighbourhood of the station.

We identified 111 bird species during the whole study period (table 1), and the typical woodland bird species present the highest diversity on the territory of the Arcuda Station due to the large surfaces covered by forest ecosystems. We notice a reduction in bird fauna diversity from 100 bird species during 2012 – 2013 (SÂRBU et al., 2014) to 95 bird species observed during the period 2018 – 2019. Significant differences appear for the bird species related to the aquatic ecosystems due to some changes in the management of the water basins and reed beds vegetation. The practice of complete removal of the paludous vegetation, including the reed beds, around the decanter basins determines the birds to leave that territory, losing the resting place, nesting place or feeding territory. The near-complete disappearance of the passerine species that prefer the habitats of reed beds and open dry or humid meadows as breeding species in the investigated area is the result of this regular practice. We also observed the disappearance of quails (*Coturnix coturnix* Linnaeus 1758) in the open lands from the eastern vicinity of the Arcuda Station, correlated with a significant decrease for this species in the eastern part of Romania.

Table 1. List of bird species identified in the perimeter of the Arcuda Station for Drinking Water Treatment and Production and its neighbourhood.

No.	Species	Presence		Breeding population (pairs)		Birds Directive		Romanian Red Book of Vertebrates
		2012-2013	2018-2019	2012-2013	2018-2019	Annex 1	Annex 2	
1.	*Phasianus colchicus*	+	+	2 - 3	1 - 2	-	+	-
2.	*Coturnix coturnix*	+	-	3 - 5	-	-	+	-
3.	*Anser anser*	-	+	-	-	-	+	-
4.	*Anas platyrhynchos*	+	+	0 - 2	1 - 2	-	+	-
5.	*Anas crecca*	-	+	-	-	-	+	-
6.	*Mareca strepera*	+	-	-	-	-	+	-
7.	*Tadorna ferruginea*	-	+	-	-	+	-	CE
8.	*Phalacrocorax carbo*	+	+	-	-	-	-	-
9.	*Microcarbo pygmeus*	+	-	-	-	+	-	V
10.	*Nycticorax nycticorax*	+	+	-	-	+	-	V
11.	*Egretta garzetta*	-	+	-	-	+	-	E
12.	*Ardea cinerea*	+	+	-	-	-	-	-
13.	*Ciconia ciconia*	-	+	-	-	+	-	V
14.	*Buteo buteo*	+	+	-	-	-	-	-
15.	*Buteo lagopus*	+	-	-	-	-	-	-
16.	*Pernis apivorus*	+	+	-	-	+	-	V
17.	*Accipiter gentilis*	+	+	-	-	-	-	-
18.	*Accipiter nisus*	+	+	-	-	-	-	-
19.	*Circus cyaneus*	+	-	-	-	+	-	-
20.	*Falco subbuteo*	+	+	1	1	-	-	-

21.	*Falco vespertinus*	+	-	-	-	+	-	V
22.	*Falco tinnunculus*	+	+	1	1	-	-	-
23.	*Gallinula chloropus*	+	-	-	-	-	+	-
24.	*Fulica atra*	+	-	-	-	-	+	-
25.	*Larus cachinnans*	+	+	-	-	-	+	-
26.	*Chroicocephalus ridibundus*	+	+	-	-	-	+	-
27.	*Chlidonias hybrida*	+	-	-	-	+	-	-
28.	*Sterna hirundo*	+	+	-	-	+	-	-
29.	*Podiceps cristatus*	+	-	-	-	-	-	-
30.	*Podiceps grisegena*	+	-	-	-	-	-	-
31.	*Tachybaptus ruficollis*	+	-	-	-	-	-	-
32.	*Columba oenas*	+	-	2	-	-	+	-
33.	*Columba palumbus*	+	+	2 – 4	8 – 10	-	+	-
34.	*Streptopelia turtur*	+	+	4 – 6	2 – 3	-	+	V
35.	*Streptopelia decaocto*	+	+	8 – 10	3 - 4	-	+	-
36.	*Cuculus canorus*	+	+	7 – 10	6 – 10	-	-	-
37.	*Apus apus*	+	+	2 – 4	6 - 8	-	-	-
38.	*Asio otus*	+	+	-	1 – 2?	-	-	-
39.	*Alcedo atthis*	-	+	-	1 – 2?	+	-	-
40.	*Merops apiaster*	+	+	-	-	-	-	-
41.	*Picus viridis*	+	+	2	2	-	-	-
42.	*Dendrocopos major*	+	+	2	2 – 3	-	-	-
43.	*Dendrocopos syriacus*	+	+	3	2 – 3	+	-	-
44.	*Dryobates minor*	+	+	1	1 – 2	-	-	-
45.	*Jynx torquilla*	+	+	1 – 2	1 – 2	-	-	E
46.	*Oriolus oriolus*	+	+	4 – 6	3 – 6	-	-	-
47.	*Lanius collurio*	+	+	2	1 – 2	+	-	-
48.	*Lanius minor*	+	+	1	-	+	-	-
49.	*Pica pica*	+	+	7 – 9	7 – 9	-	+	-
50.	*Garrulus glandarius*	+	+	3 – 5	3 – 5	-	+	-
51.	*Corvus frugilegus*	+	+	-	-	-	+	-
52.	*Corvus cornix*	+	+	3	2 – 3	-	-	-
53.	*Corvus monedula*	+	+	3 – 4	2 – 4		+	-
54.	*Corvus corax*	-	+	-	-	-	-	E
55.	*Poecile palustris*	+	+	1 - 2	2 – 3	-	-	-
56.	*Parus major*	+	+	10 – 12	14 – 18	-	-	-
57.	*Cyanistes coeruleus*	+	+	2 – 4	3 – 6	-	-	-
58.	*Regulus regulus*	+	+	-	-	-	-	-
59.	*Alauda arvensis*	+	+	4 - 6	5 – 8	-	+	-
60.	*Galerida cristatus*	+	+	2 - 3	3 – 4	-	-	-
61.	*Riparia riparia*	+	+	-	-	-	-	-
62.	*Hirundo rustica*	+	+	5 – 7	4 – 6	-	-	-
63.	*Delichon urbicus*	+	+	6 – 8	6 – 8	-	-	-
64.	*Phylloscopus collybita*	+	+	5 – 6	6 – 8	-	-	-
65.	*Phylloscopus trochillus*	+	+	-	-	-	-	-
66.	*Phylloscopus sibilatrix*	-	+	-	-	-	-	-
67.	*Locustella luscinioides*	+	-	0 – 1	-	-	-	-
68.	*Acrocephalus arundinaceus*	+	+	0 – 2	1 – 3	-	-	-
69.	*Acrocephalus scirpaceus*	+	-	0 – 2	-	-	-	-
70.	*Acrocephalus schoenobaenus*	+	-	0 – 1	-	-	-	-
71.	*Hippolais icterina*	+	+	2	2 – 3	-	-	-
72.	*Sylvia curruca*	+	+	3 – 4	3 – 5	-	-	-
73.	*Sylvia borin*	+	+	2 – 4	2 – 4	-	-	-
74.	*Sylvia atricapilla*	+	+	3 – 5	3 – 5	-	-	-
75.	*Sylvia communis*	+	+	3 – 5	4 – 6	-	-	-
76.	*Sitta europaea*	+	+	3 – 4	5 – 7	-	-	-
77.	*Troglodytes troglodytes*	+	+	-	1?	-	-	-
78.	*Ficedula albicollis*	+	+	1	-	+	-	-
79.	*Ficedula parva*	+	+	-	-	+	-	-
80.	*Muscicapa striata*	+	+	1 – 2	2 – 3	-	-	-
81.	*Oenanthe oenanthe*	+	+	1 – 2	0 – 1	-	-	-
82.	*Saxicola rubetra*	+	+	2	1 – 2	-		-
83.	*Saxicola torquatus*	+	+	1 – 2	0 – 1	-	-	-
84.	*Phoenicurus phoenicurus*	-	+	-	1?	-	-	-
85.	*Phoenicurus ochruros*	+	+	2	2 – 3	-	-	-
86.	*Erithacus rubecula*	+	+	3 – 5	4 – 7	-	-	-

87.	*Luscinia luscinia*	+	+	4 – 5	2 – 3	-	-	-
88.	*Luscinia megarhynchos*	+	+	1 - 2	3 – 4	-	-	-
89.	*Turdus merula*	+	+	4 – 6	6 – 8	-	+	-
90.	*Turdus philomelos*	+	+	6 – 8	5 – 8	-	+	-
91.	*Turdus iliacus*	+	+	-	-	-	+	-
92.	*Turdus viscivorus*	+	+	-	-	-	+	-
93.	*Turdus pilaris*	+	+	-	-	-	+	-
94.	*Sturnus vulgaris*	+	+	18 – 22	22 - 26	-	+	-
95.	*Passer domesticus*	+	+	30 – 32	30 – 34	-	-	-
96.	*Passer montanus*	+	+	14 – 16	14 – 16	-	-	-
97.	*Anthus trivialis*	+	+	-	-	-	-	-
98.	*Anthus campestris*	+	+	2 – 3	1	+	-	-
99.	*Motacilla alba*	+	+	2	2	-	-	-
100.	*Motacilla flava*	+	+	1	1	-	-	-
101.	*Fringilla coelebs*	+	+	16 – 20	16 – 20	-	-	-
102.	*Fringilla montifringilla*	-	+	-	-	-	-	-
103.	*Pyrrhula pyrrhula*	+	+	-	-	-	-	-
104.	*Coccothraustes coccothraustes*	+	+	2 – 3	2 – 3	-	-	-
105.	*Chloris chloris*	+	+	5 – 7	7 – 9	-	-	-
106.	*Spinus spinus*	+	+	-	-	-	-	-
107.	*Carduelis carduelis*	+	+	10 - 12	8 – 12	-	-	-
108.	*Linaria cannabina*	+	+	1 - 2	0 – 1	-	-	-
109.	*Emberiza calandra*	+	+	3 - 5	3 – 6	-	-	-
110.	*Emberiza citrinella*	+	+	4 – 5	5 – 7	-	-	-
111.	*Emberiza schoeniclus*	+	+	0 – 2	-	-	-	-

Legend: *Romanian Red Book of Vertebrates*: CE – critically endangered species, E – endangered species, V – vulnerable species.

The winters were mild in the period 2018 – 2019, but we recorded five days of strong wintertime with high snowfalls and negative temperatures (about 8 – 10 degrees below 0 ^{0}C) during the last decade of March 2018 that affected, especially, the passerine birds. During the field visit on the 31st March 2018, we met 22 dead passerine birds representing the species *Turdus iliacus* Linnaeus 1766, *Turdus merula* Linnaeus 1758 and *Fringilla coelebs* Linnaeus 1758 along a transect about 2 kilometres. Probably, the losses to the population of the passerine birds were very high, but the dogs and the beech marten (*Martes foina* Erxleben 1777) from the area could eat part of these dead birds. The birds undertook a retro-migration phenomenon, too: some winter visitors in the area that left this perimeter during late February or in early March going towards their breeding territories from the mountain or northern areas came back. In this way, we could meet the bullfinch (*Pyrrhula pyrrhula* Linnaeus 1758) on the 31st March 2018, when the temperature was about 18 ^{0}C. After this late winter episode, the temperatures rose rapidly, and with the abundance of the reserve of water in the soil, favoured the real explosion of the vegetation and the early entry into the annual activity of various groups of poikilothermic animals that represent food for different bird species. In these conditions, we observed the rapid spring migration of the birds in the area, with early arrival for some species: we recorded the first territorial songs of the cuckoo (*Cuculus canorus* Linnaeus 1758) and chiffchaff (*Phylloscopus collybita* Vieillot 1817) on the 31st March 2018, respectively of the nightingale (*Luscinia megarhynchos* Brehm 1831) on the 14th April 2018.

In late January 2019, an ice rain fell which destroyed many trees on the territory of the Arcuda Station. Subsequent, the temperatures rose constantly starting with mid-February, so we met the first migration flocks of thrushes (*Turdus sp*.) during the first decade of March. In the morning of the 11th March 2019, we could count about 320 individuals of wood pigeon (*Columba palumbus* Linnaeus 1758) that spent the night in the southern sector of the meadow forest, flying in small groups about 18 – 30 towards the north – north-western directions immediately after our arrival in the area.

Some bird species from the list of the bird fauna from the perimeter of the Arcuda Station were present only during the migration time: *Nycticorax nycticorax* Linnaeus 1758, *Ciconia ciconia* Linnaeus 1758, *Pernis apivorus* Linnaeus 1758, *Circus cyaneus* Linnaeus 1766, *Lanius minor* Gmelin 1788, *Phylloscopus trochilus* Linnaeus 1758, *Phylloscopus sibilatrix* Bechstein 1793, *Ficedula parva* Bechstein 1792 and *Anthus trivialis* Linnaeus 1758. We notice the appearance of one flock about 147 greylag geese (*Anser anser* Linnaeus 1758) on the 2nd November 2018, flying above the perimeter of the Arcuda Station from the north to the south direction. Among the daily raptors, we observed the hawk species (*Accipiter gentilis* Linnaeus 1758 and *Accipiter nisus* Linnaeus 1758) and the red-footed falcon (*Falco vespertinus* Linnaeus 1766) perched in the trees from the eastern edge of the Arcuda Station. The birds use these trees as still-hunting points while the open fallow ground area from vicinity represents their feeding area.

During the whole period of 2018 year, the water level oscillated in the perimeter of the overflow basin due the silting phenomenon and, in 2019, it remained complete dry to begin a project to clean and restore this basin. A new storage basin was created at its immediately southern limit. In this situation, we could not meet some aquatic bird species that appeared during the migration time in 2012 – 2013, such as: *Mareca strepera* Linnaeus 1758, *Microcarbo pygmeus* Pallas 1773, *Gallinula chloropus* Linnaeus 1758, *Fulica atra* Linnaeus 1758, *Podiceps cristatus* Linnaeus 1758, *Podiceps grisegena* Boddaert 1783 and *Tachybaptus ruficollis* Pallas 1764.

The typical woodland species (MUNTEANU, 2012) dominate the breeding bird fauna from the territory of the Arcuda Station through their diversity and population, presenting a slight increase from the first part to the second one of our study, followed by open land bird species, while the aquatic ones are only accessory breeding bird species in this area. The suitable aquatic habitats cover limited surfaces within the investigated perimeter. If during the first part of our study, we recorded 66 breeding bird species, we identified only 58 certainly breeding bird species and other 4 probably breeding bird species in the period 2018 – 2019. Summarising the results of our monitoring study, there are 58 certainly breeding bird species, 6 irregular breeding bird species and 4 probably breeding bird species on the territory of the Arcuda Station.

The most significant change regards the birds related to the aquatic ecosystems, following the complete removal of the reed beds along the decanter basins and oscillations of the water level in the overflow basin. In 2018, we met two pairs of mallards (*Anas platyrhynchos* Linnaeus 1758) with chickens in the southern perimeter of the decanter basin, while in 2019 we observed only one female with three ducklings in the same area. From the group of passerines that use the reed beds to build their nests, only the great reed warbler (*Acrocephalus arundinaceus* Linnaeus 1758) was present with three pairs in 2018 and one pair in 2019, all the other species disappearing from the area compared with the first part of the study. If the administration will keep the old overflow basin preserving the reed beds after the restoration project and the new storage basin in the future, we cannot exclude the return as breeding bird species of passerine species such as *Locustella luscinioides* Savi 1824, *Acrocephalus scirpaceus* Hermann 1804, *A. schoenobaenus* Linnaeus 1758 and *Emberiza schoeniclus* Linnaeus 1758. The wagtails (*Motacilla alba* Linnaeus 1758 and *M. flava* Linnaeus 1758) were present as breeding species in the perimeter of the meadow stripes along the decanter basins. Previously, the breeding pair of yellow wagtails (*M. flava*) used as breeding territory the dry meadow area from the western side of the decanter basins.

We notice the increase of the breeding population for the wood pigeon (*Columba palumbus*) to the detriment of the turtle dove (*Streptopelia turtur* Linnaeus 1758) and collared dove (*S. decaocto* Frivaldszky 1838). The wood pigeon is bigger than these two dove species and is more sociable, forming flocks. Moreover, this species presents a process of urban expansion of its breeding area, especially in the southern part of Romania. This way, the wood pigeon can compete with the collared dove inside the anthropogenic ecosystems as parks and orchards, but also with the turtle dove inside the forest ecosystems. We met the last species only in the perimeter of the north-western gallery-forest and in the eastern riverside coppice.

The falcons were still present as breeding species: one pair of hobby (*Falco subbuteo* Linnaeus 1758) in the north-eastern sector of the riverside coppice and one pair of common kestrel (*F. tinnunculus* Linnaeus 1758) in the southern limit of the same woodland area. We met one individual of common buzzard (*Buteo buteo* Linnaeus 1758) in the perimeter of the southern meadow forest and in the southern sector of the riverside coppice during the breeding season, but we could not find the nest (we supposed that it is present in one tree from the southern meadow forest). For this reason, we believe that the bird was an immature one that used this area for resting and as a still-hunting point, while the fallow ground area from the eastern side of Arcuda Station served as hunting and feeding areas.

We assess the breeding presence of the long-eared owl (*Asio otus* Linnaeus 1758) through the pellets that we found during all our visits in the territory. We believe that there are one or two pairs of long-eared owls by discussions with the workers from the Arcuda Station. The kingfisher (*Alcedo atthis* Linnaeus 1758) could breed in this area, too. We recorded the first presence of the species in June 2018 through one adult bird that died in a collision with one double-glazed window. In late May 2019, we met a kingfisher hunting along the river from the eastern side of the station, in one area with suitable breeding habitat.

During the second part of the study, we did not observe the breeding presence of some species as *Lanius minor* Gmelin 1788, *Ficedula albicollis* Temminck 1815 and *Anthus campestris* Linnaeus 1758. We met one pair of the last one with three juvenile birds in the eastern limit of the Arcuda Station, but we believe that they used the open land from the eastern side of the station as breeding territory, coming inside the perimeter of station to feed. Previously, the lesser grey shrike (*Lanius minor*) was present with one breeding pair in the north-western side of the investigated perimeter. The administration removed part of the vegetation to create a new small pond in this area. The tawny pipit (*Anthus campestris*) lost the suitable breeding territory inside the area of Arcuda Station due to the regular mechanised mowing of the meadow on the western edge of the decanter basins.

The perimeter of the Arcuda Station represents a feeding area for species such as *Egretta garzetta* Linnaeus 1766, *Ardea cinerea* Linnaeus 1758 and *Sterna hirundo* Linnaeus 1758 that were a constant presence in the perimeter of the old overflow basin from late June to the late August 2018. During 2019, we observed these species only flying above the investigated area. The raven (*Corvus corax* Linnaeus 1758) appeared several times as crossing this territory during the breeding season; probably, one pair has the nest somewhere in vicinity and uses the eastern fallow ground area as feeding territory.

In wintertime, the ice-bed covers the all water basins of the Arcuda Station. We observed only solitary or small groups of aquatic birds (ducks and gulls) flying above the station or resting in small open holes in the water. On the 12th February 2019, we recorded the biggest population and the highest diversity for this ecological group in the investigated area, all the birds being present in the perimeter of the decanter basins. We could count 57 mallards (*Anas platyrhynchos*), two pairs of common teals (*A. crecca* Linnaeus 1758), one male of ruddy shelduck (*Tadorna ferruginea* Pallas 1764), two cormorants (*Phalacrocorax carbo* Linnaeus 1758) and five Caspian gulls (*Larus cachinnans* Pallas 1811). We notice the unusual winter presence of the ruddy shelduck and one rare bird species in Romania.

The wood pigeon (*Columba palumbus*) presents a progressive change of its phenology status in our country from summer visitor with rare wintering presence in a partial migratory species. This behaviour appeared in various bird species during the last about two decades, probably related to climate change. In the period 2018 – 2019, we met groups of 6 – 11 individuals during all the visits organised in the months of the wintering time in the perimeter of Arcuda Station.

In the list of bird fauna recorded on the territory of Arcuda Station (table 1), 17 bird species appear in Annex 1 of the Birds Directive (2009/147/EC), being species that need special conservation measures concerning their habitats in order to ensure their survival and the reproduction in their distribution range. Eight of them are species related to the aquatic ecosystems. We observed mostly of these bird species just in passage or stopping for a while to rest, during the migration period, in spring or autumn. Only eight species of these bird species are regular, irregular or probably breeding species inside the investigated territory. We also met 25 bird species included in Annex 2 to the Birds Directive (2009/147/EC) as hunting species under national laws without jeopardising conservation efforts in their distribution area. Most of them (table 1) are typical woodland or open land bird species and only eight species related to the aquatic habitats.

We notice the presence of eight bird species included in the Red Book of Vertebrates from Romania (BOTNARIUC & TATOLE, 2005). One is a critically endangered species - *Tadorna ferruginea*. Three of them are endangered species (*Egretta garzetta*, *Jynx torquilla* Linnaeus 1758 and *Corvus corax*), and four are vulnerable species (*Nycticorax nycticorax*, *Ciconia ciconia*, *Pernis apivorus* and *Streptopelia turtur*).

The anthropogenic activities do not have a significant impact on the bird fauna from the territory of the Arcuda Station for Drinking Water Treatment and Production. As an exception we mention the management of the stripes of vegetation, including the complete removal of reed beds along the decanter basins, the mechanised mowing of the meadow on the western edge of the decanter basins, and the oscillations of the water level in the overflow storage basin that have influence on the presence of aquatic bird species. All these activities are part of the current practices related to the production of drinking water.

CONCLUSIONS

On the territory of the Arcuda Station for Drinking Water Treatment and Production, we recorded 111 bird species during our study in the area. We consider that this diversity (about 27% from the list of bird fauna in Romania) is the result of the mosaic of habitats, respectively, of the low level of the anthropogenic activities in the perimeter of the Arcuda Station.

In the period 2012 – 2013, we observed 100 bird species, while during the period 2018 – 2019, we met 95 bird species. We notice the disappearance of some migrant bird species related to the aquatic habitat as the suitable feeding and refuge territories were not available due to the oscillations of water level during the year 2018, respectively, during the technical arrangements developed in the perimeter of the old silted overflow storage basin in the year 2019.

The breeding bird fauna includes 58 regularly breeding bird species, 6 with irregular breeding and 4 probably breeding bird species. During our study, the woodland bird species presented an increase of their breeding population, while the birds related to the aquatic habitats presented a negative trend of the breeding population and diversity. We correlated this negative trend with the changes that occurred in the suitable habitats through the removal of reed beds along the decanter basins, the silting phenomenon and the interruption of water evacuation in the old overflow storage basin.

Some bird species appear only at migration time due to the lack of suitable breeding or feeding habitats within the investigated area. We recorded the biggest fleet of waterfowls during the wintering time, in mid-February when the decanter basins represent open waters while the ice-bed covers completely other aquatic surfaces in the area.

The territory of the Arcuda Station is a suitable site for protected bird species, too. We identified 17 bird species (15.31% from all the recorded bird fauna in the area) that appear in Annex 1 to the Birds Directive, most of them migrant in the area, respectively, 25 bird species included in Annex 2 of the same directive. We also met one critically endangered species, three endangered species and four vulnerable bird species included in the Red Book of Vertebrates from Romania in the investigated perimeter.

The anthropogenic activities have a low impact on the birds' presence in the perimeter of the Arcuda Station. Only some current activities correlated with the production of drinking water have a negative impact on the presence of bird species: removal of vegetation along and around the decanter basins, respectively, oscillations of the water level in the overflow storage basin.

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