Vestnik zoologii, **49**(2): 125–134, 2015
DOI 10.1515/vzoo-2015-0014

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UDC 598.2:591.9 (477.52/.54)

BREEDING AVIFAUNA OF THE WASTE WATER TREATMENT PLANTS, LOCATED IN NORTHERN LEFT-BANK PART OF UKRAINE

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Breeding Avifauna of the Waste Water Treatment Plants, Located in Northern Left-Bank Part of Ukraine. Fedun, O. M., Usov, O. Ye., Gavris, G. G. — Over the years 2005–2012 avifauna was studied of 17 waste water treatment plants, located in the Chernihiv and Sumy Regions (northern left-bank) of Ukraine. 81 species of 30 families and 14 orders were registered. Taking into account landscape and technological peculiarities of the waste water treatment plants the follows zones of the birds' distribution were distinguished: zone of water areas, agro-meadows zone, zone of dams, technological zone. It was noted that birds occurred in different zones unevenly. Maximal species number and diversity of ecological structure of the breeding avifauna was noted within the water bodies and dams. In terms of landscape-biotopic characteristic in waste water treatment plants dominated dendrophilous and wetland birds.

Key words: breeding avifauna, composition of species, ecological structure, waste water treatment plants, northern left-bank part of Ukraine.

Гнездовая орнитофауна очистных сооружений северного Левобережья Украины. Федун А. Н., Усов А. Е., Гаврись Г. Г. — В течение 2005–2012 гг. исследовали гнездовую орнитофауну очистных сооружений, расположенных в Черниговской и Сумской областях Украины. Был зарегистрирован 81 вид птиц из 30 семейств и 14 отрядов. Учитывая ландшафтные и технологические особенности очистных сооружений, предложено выделять в них зону водоёмов, зону дамб, агролуговую и технологическую зоны. Показано, что птицы распределены по зонам неравномерно. Максимальное количество видов и разнообразие экологических групп отмечены в зоне водоёмов и дамб. На очистных сооружениях доминировали птицы из групп дендрофилов и гидрофилов.

Ключевые слова: гнездовая орнитофауна, видовой состав, экологическая структура, очистные сооружения, северное Левобережье Украины.

Since start of their functioning technogeneous ecosystems serve as new habitats for the living organisms (Soloviova, et al., 2006), particularly they are centers for forming of complexes of avifauna (Avilova, 2000). For instance, waste water treatment plants (WWTP) are of special importance for maintaining of species diversity, including rare birds of regional and international Red Lists (Davidenko, 2008). Actually most scientific publications about avifauna of the WWTP pay main attention to the inventory; at this only one element of the technogeneous territory is considered, namely — water areas. Only few made an attempt to analyze composition of avifauna along different stages of the wastes' treatment (Glue, Bodenham, 1974) and to determine effects of certain factors on its distribution (Spiridonov et al., 2009). In Ukraine systematic investigations of avifauna of WWTP were not carried out. Several publications consider separate aspects of breeding birds' occurrence within such objects (Davidenko, 2008). So, the aim of this work was to establish composition of species and peculiarities of spatial distribution of birds nesting in the territories of WWTP of the northern left-bank part of Ukraine.

Material and methods

Material was collected over the breeding season (April–June) 2005–2012. The follows 17 WWTP were investigated: municipal WWTP of the towns of Chernihiv, Sumy, Nizhyn, Shostka, Horodnia, the villages of

Ripky, Kulykivka and Desna; dairy factories (the towns of Mena and Nizhyn), "Pozhspetsmash" Plant (the village of Ladan), Koryukivka paper-mill factory (the town of Koryukivka), sugar factories (the town of Nosivka and Linovytsia village), the wool-processing factory "Chernihivvovna" (the town of Chernihiv), alcohol distilleries (the villages of Kholmy and Popivka), the Oster quartermaster unit (the village of Desna), the pig farm (the village of Kulykivka) (fig. 1).

Within the WWTP limits the follows zones with similar landscapes and nesting habitats of birds were distinguished. Boundaries between zones were determined visually, taking into account various biotopic characteristics (fig. 2).

Zone of water bodies — water or wetland area (disposal fields) with periodic fluctuations of water level, to a different degree overgrown by higher aquatic plants, dominated by common reed (*Phragmites australis* Cav.) and bulrushes (*Typha latifolia* L. and *T. angustifolia* L.) (fig. 2).

Agro-meadows zone — meadow biotopes, formed as a result of stop of several water areas use. These territories are spontaneously overgrown, sometimes they are used as private gardens and hay fields.

Technological zone — complex technological constructions (sands traps, aerotanks, radial settling tanks) and buildings, often with the cultural trees.

Zone of dams — dams, which separate water areas from other. Usually they are covered by ruderal plants with thickets and isolated groups of trees.

The belonging to a category of nesting birds was determined according to recommendations of the European Ornithological Atlas Committee (Hagemeijer, 1997). Birds were accounted by standard methods (Gudina, 1999), at this localities of the males' vocalizing, nests and nestlings were registered. Systematic of birds is given according to the "Conspectus of the ornithological fauna of Russia and adjacent territories" (Stepanian, 2003). Species' belonging to ecological groups are given according to (Kuzmenko, 2000). Area of the WWTP and separate zones were calculated using data of Chernihiv regional nature protection authority, using the GPS navigator and Google Earth and Mapinfo Professional software.

Index of taxonomic richness (Emelyanov et al., 1999), Pielou and Simpson indexes (Pesenko, 1982) were calculated. Similarity of species lists was assessed by the Sørensen index (Pesenko, 1982).

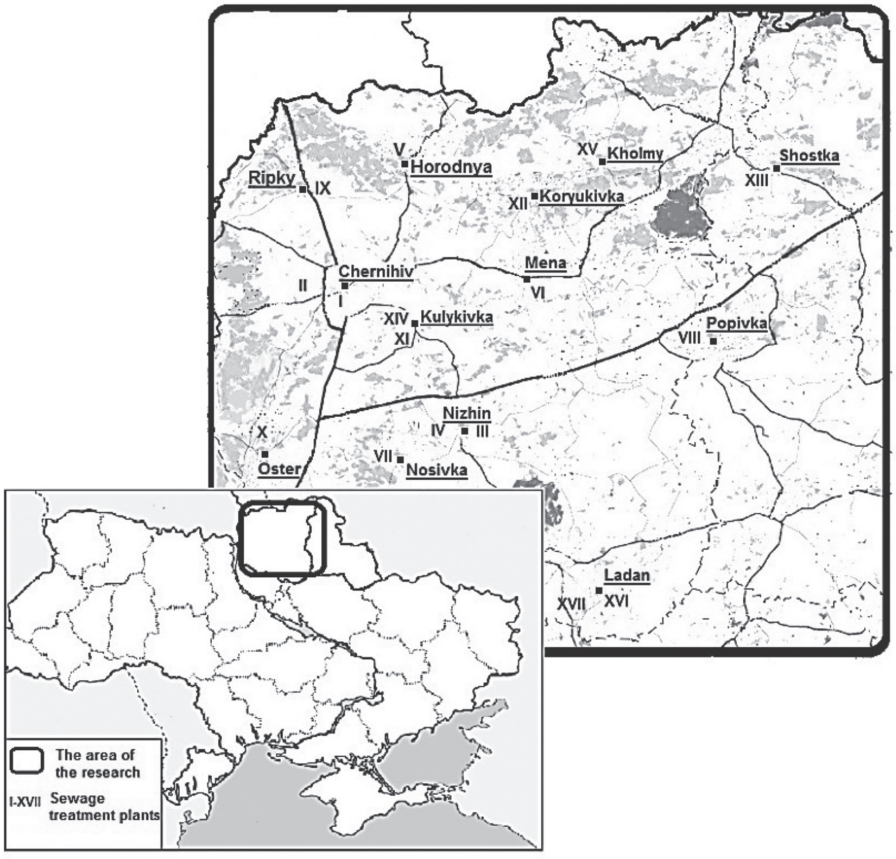


Fig.1. Schematic map the region of investigations.

Рис. 1. Карта-схема района исследований.

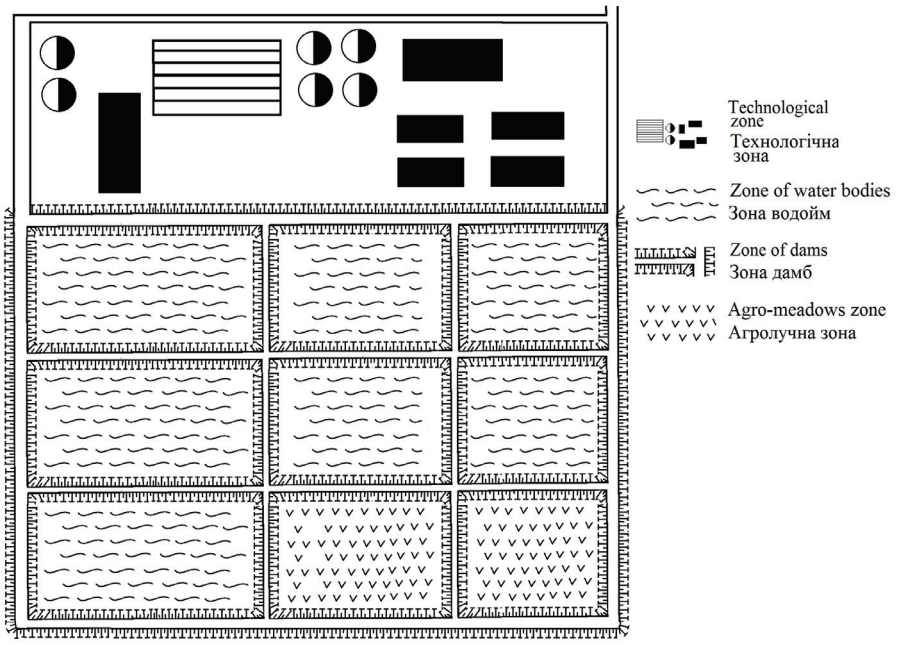


Fig. 2. Sketch of waste water treatment plants.

Рис. 2. Схема очистных сооружений.

Obtained results are presented as *Me* (*LQ, UQ*), where *Me* — median, *LQ* and *UQ* — accordingly lower and upper quartiles; or as $M \pm m$, where *M* — arithmetic mean, *m* — medium error. Variation was assessed using the coefficient of variation. In calculations of the species' density data were used of zone area not less than 1 hectare.

Mathematical processing was carried out using Microsoft Excel with "Packet Analysis" superstructure and PAST (Hammer et al., 2001).

Results

Within the limits of the considered WWTP 81 species of nesting birds of 14 orders and 30 families were registered (table 1). Families: Sylviidae — 14 species, Muscicapidae — 11, Fringillidae — 6, Anatidae — 5, other families included 1–3 species were the richest. Maximal species number included orders Passeriformes — 50, Charadriiformes — 9 and Anseriformes — 5 species.

Maximal species number was registered in the Chernihiv municipal WWTP, Chernigivvovna WWTP, Nosivka sugar factory — accordingly 73, 44, and 34, and minimal species number was registered in the WWTP of the villages Ripky, Kholmy and Popivka — accordngly 6, 8 and 9 species.

To the most degree were presented dendrophilous and wetland birds — accordingly 33 (40.7 %) and 32 (39.5 %) species. Synanthropic birds included 7 species, field birds — 6, sclerophilous birds (2) and nest parasites — 1 species. Average number of ecological groups per WWTP amounted to 4 *Me* = 4 (3; 4).

In terms of nesting habitats eight groups were registered: birds nesting on ground — 34 species (42 %), birds nesting in tree crones — 15 (18.5 %), birds nesting in shrubs and lower layer — 12 (14.8 %), birds nesting in hollows — 8, birds nesting on buildings and constructions — 7, birds nesting in barrows and birds with floating nests — 2 species each, nest parasites — 1 species. On average in each WWTP four groups were registered, *Me* = 4 (3; 5).

Different WWTP were characterized by different total area and internal zoning of the territory, all this affected spatial distribution of the nesting birds within the WWTP limits (table 2).

As it is evident, different zones are inhabited by nesting birds to different degree.

Table 1. Species composition, relative density (%), and taxonomic structure of the breeding avifauna of WWTP of the northern left-bank part of Ukraine

Таблица 1. Видовой состав, относительная плотность (%) и таксономическая структура гнездовой орнитофауны очистных сооружений северного Левобережья Украины

Birds species	Water treatment plants																
	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	XIII	XIV	XV	XVI	XVII
Podiceps ruficollis		0.46	1.93		2.24											1.62	
Podiceps nigricollis	0.22	0.46															
Ixobrychus minutus	0.07	0.15			0.72							1.06				0.80	
Botaurus stellaris	0.07																
Anas querquedula	0.07	0.46			0.72		0.66										
Anas platyrhynchos	0.26	0.98	1.93		2.24	2.16	0.33			0.96		2.11				1.62	4.02
Anas strepera	0.15	0.46															
Aythya fuligula	0.22	0.98			1.45												
Aythya ferina	0.07	0.67			1.45							1.06				0.80	
Circus aeruginosus	0.07											1.06					
Lanius collurio	0.90	3.35		2.75	5.13	6.69	7.16		15.01	8.72	3.85	1.18	1.64		18.05	3.39	6.99
Crex crex	0.45	0.31			0.72		0.33			0.96		2.11	1.25			1.62	4.02
Fulica atra	0.34	0.31	1.93		2.24	2.16	0.33					2.11					1.98
Gallinula chloropus	0.34	1.29	3.93	1.66	3.68	2.16	0.66			0.96		3.11	2.51	5.54	4.17	2.41	6.00
Haematopus ostralegus	0.07																
Charadrius dubius	0.15	0.31	7.99	3.32		2.71	1.83	0.86		1.87		2.11	2.51	5.54			4.02
Vanellus vanellus	0.97	1.44	5.86	3.32		2.16	2.92			3.74		3.11	5.01	5.54		2.41	7.98
Tringa totanus	0.49	1.13					0.99	0.86				1.06	1.25			0.80	1.98
Xenus cinereus	0.22	0.98															
Actitis hypoleucos	0.07	0.31											1.25				
Larus ridibundu	2.99	21.08															
Chlidonias hybrida	0.97																
Sterna hirundo	1.23	6.49															
Columba palumbus	0.60	1.19					0.88				2.35		1.08			2.04	
Cuculus canorus	0.60	1.19					0.88					1.06				2.04	
Asio otus	0.30																
Apus apus	1.01												4.32				

Upupa epops	0.30																
Alcedo atthis	0.30																
Jynx torquilla	0.34																
Dendrocopos major	0.30																
Dendrocopos medius	0.34																
Riparia riparia	37.40																
Hirundo rustica	1.68			6.70		9.15			26.65		15.39	4.97	6.48			12.64	
Delichon urbica													8.64				
Alauda arvensis		1.34										1.18					
Motacilla flava	1.46	3.35	3.99	4.99		8.14	6.25		15.01	12.28	2.35	3.48	4.88		4.55	5.36	1.86
Motacilla alba	0.90	6.65		5.04	5.13	13.73	5.37		13.33	16.53	7.70	9.94	2.16	7.37		2.10	
Oriolus oriolus	0.60	1.19															
Stunus vulgaris	1.46			3.38													
Pica pica	0.64						0.88										
Corvus cornix	0.30																
Locustella luscinioides	0.07																
Locustella fluviatilis	1.23	0.15			2.24							2.61	1.64				
Locustella naevia	0. 07																
Acrocephalus schoenobaenus	0.82		3.99		0.72	4.37							3.76	18.44			
Acrocephalus scirpaceus	2.43	3.09	30.22	4.99	3.68	2.16	8.44	35.66		3.74	11.66	7.33	5.01	12.91	8.35	2.41	7.98
Acrocephalus palustris	0.90										14.01		2.51				4.02
Acrocephalus arundinaceus	0.49	3.56	1.93	1.66	8.89	2.16	0.33			1.87		6.28		5.54		1.62	4.02
Hippolais icterina	0.30																
Sylvia atricapilla	0.90				7.66		5.37	2.28			2.35					4.21	
Sylvia nisoria		4.02					2.67			4.36						2.04	4.64
Sylvia communis	3.81	1.34	12.24	3.32	2.53	2.71	4.46	41.44		13.07	2.35	8.64	3.24	14.76	27.10	6.18	15.84
Phylloscopus collybita	0.60				2.53		0.88				2.35						
Phylloscopus trochilus	0.30			2.75	7.66		0.88										
Phylloscopus sibilatrix	0.30																
Muscicapa striata	0.30	1.19							15.01		3.85						
Ficedula hypoleuca							0.88										

Birds species	Water treatment plants																
	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	XIII	XIV	XV	XVI	XVII
Saxicola nibetra	0.30	3.35	2.00	5.45			1.50			13.19		5.78		7.37	21.08	2.04	3.65
Oenanthe oenanthe	0.34		6.12														
Phoenicurus ochruros	0.34			1.66		4.58							2.16				
Erithacus rubecula	0.30																
Luscinia luscinia	5.61	1.19		2.75	5.13		10.74	2.28			2.35	2.61	1.64			6.11	4.64
Luscinia svecica	4.11	0.46	5.86	6.65	2.96	10.31	2.26	7.42		1.87	4.69	9.32	5.01	11.47	12.52	2.41	6.00
Turdus pilaris	0.30	1.19					4.46					1.18					
Turdus merula		1.19			2.53		2.67										
Turdus philomelos	1.76	2.42									11.54		6.48			4.07	
Aegithalos caudatus					2.53												
Remiz pendulinus	0.52				5.13		2.67										
Parus mayor	1.83			1.66		4.58						9.94	2.16			4.14	
Passer domesticus	1.01			5.04									6.48				
Passer montanus	3.70			10.08									7.56				
Fringilla coelebs	3.85	5.98		11.74	7.66	6.69	4.46			4.36	4.69	1.18	3.24			14.54	
Serinus serinus	0.34																
Chloris chloris	0.67	2.42		1.66	2.53		6.25			4.36			1.08			2.10	2.35
Carduelis carduelis	0.30	1.19					1.79				3.85					2.04	
Acanthis cannabina	0.67					6.69		6.92									
C. coccothraustes	0.30	3.61					0.88										
Emberiza calandra		0.67															
Emberiza citrinella	1.57	5.98	6.12	4.42	7.66		8.04	2.28	15.01	4.36	4.69	2.30				4.07	
Emberiza schoeniclus	0.71	0.46	3.93	4.99	2.24	6.69	0.99			2.83		2.11	5.01	5.54	4.17	1.62	7.98
Orders	14	8	5	3	6	4	7	2	1	4	2	7	6	3	2	7	4
Families	28	17	8	11	12	11	15	7	5	10	8	17	14	6	6	16	10
Genera	56	33	13	18	20	16	27	8	5	15	13	24	23	9	8	24	15
Species	73	44	16	23	28	19	34	9	6	18	17	28	28	11	8	30	19
Index of taxonomic richness	171	102	42	55	66	50	83	26	17	47	40	76	71	29	24	77	48

N o t e. Here and below: I — Chernihiv MWWTP; II — Chernigivvovna WWTP; III — Nizhyn dairy WWTP; IV — Nizhyn MWWTP; V — Gorodnia MWWTP; VI — Mena dairy WWTP; VII — Nosivka sugar factory; VIII — Popivka alcohol distillery; IX — Ripky MWWTP; X — Desna MWWTP; XI — Kulykivka MWWTP; XII — Koriukivka paper-millo WWTP; XIII — Shostka MWWTP; XIV — Kulykivka pig farm WWTP; XV — Kholmy alcohol distillery WWTP; XVI — "Pozhspetsmash" WWTP; XVII — Linovytsia sugar factory.

Table 2. Distribution of birds species over WWTP elements in the breeding season

Таблица 2. Распределение видов птиц по зонам в период гнездования

Water treatment plants	WWTP elements								Total	
	water bodies zone		agro-meadow zone		technological zone		zone of dams			
	area (ha)	species	area	species	area	species	area	species	area	species
I	108	29	–	–	22.3	15	25.4	36	155.7	73
II	63.6	23	15.4	9	–	–	8.6	14	87.6	44
III	6.6	9	6.5	4	–	–	2.1	4	15.1	16
IV	6.2	9	–	–	6.2	10	3.8	5	16.2	23
V	19.6	15	–	–	–	–	5.6	13	25.2	28
VI	4.6	8	3.7	4	2.2	4	1.5	4	12	19
VII	22.5	12	14.5	2	–	–	8.2	21	45.2	34
VIII	17.3	4	1.3	0	–	–	6.2	6	24.8	9
IX	0.9	0	–	–	0.9	2	0.8	4	2.6	6
X	12.1	9	12.7	2	1.4	1	2.6	8	28.8	18
XI	0.3	2	–	–	1	6	1.6	10	2.9	17
XII	11.9	15	10.7	8	2.5	3	4.8	4	29.9	28
XIII	6.9	11	–	–	8	11	5.3	7	20.2	28
XIV	0.7	1	–	–	–	–	0.5	3	1.2	11
XV	2.6	4	7.2	2	–	–	1.2	3	11.0	8
XVI	5.5	13	3.3	2	2.1	7	2.2	12	13.1	30
XVII	6.2	12	20.2	3	–	–	5.3	5	31.7	19
Me	6.6	9	9	2.5	2.2	6	3.8	6	20.2	19
LQ	4.6	4	4.4	2	1.4	3	1.6	4	12	16
UQ	17.3	13	14.1	4	6.2	10	5.6	12	29.9	28

Note. Me — median; LQ — lower quartiles; UQ — upper quartiles.

Zone of water bodies is present in all WWTP; its part varies from 10 % to 73 %. In this zone 35 species of nesting birds were registered, on average — 9 (4; 13). Average value of the Pielou index was equal to 0.92 (0.84; 0.96). In this zone in most WWTP dominated *Acrocephalus scirpaceus* (1.7 individuals/ha) and *Luscinia svecica* (1.3 individuals/ha). Four species were the background — *Acrocephalus scirpaceus* (occurrence 100 %), *Luscinia svecica* (93 %), *Gallinula chloropus* (93%) and *Vanellus vanellus* (79 %). The most rich in species were wetland birds — 32; other groups were presented by single species of sporadical occurrence (fig. 3). In terms of the nest habitats the most diverse were birds nesting on ground — 24 species. It is worth to note that this group and birds with nests in shrubs and lower layer were present in this zone in all WWTP (occurrence 100 %), birds with floating nests occurred in 6 WWTP, birds of other groups occurred sporadically.

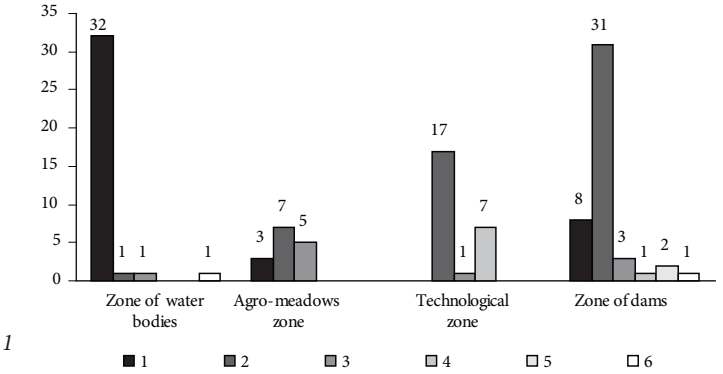
Zones of dams were also presented in all WWTP, their part in total area varies from 9 % to 55 %. In this zone 46 nesting birds were registered. Average species number per WWTP was equal to 6 (4; 12). Average value of the Pielou index was equal to 0.96 (0.91; 0.97). In terms of numbers in most (73 %) WWTP dominated *Sylvia communis* (3.2 individuals/ha) and *Fringilla coelebs* (1.6 individuals/ha). *Sylvia communis* was the background species, its occurrence amounted to 80 %. Dendrophilous birds were registered in the dam zone of all WWTP — from 2 to 25 species, totally 31. Also 8 species of wetland birds were noted; other groups were presented by single species (fig. 3, *1*). In terms of the nest habitats dominated birds nesting on ground (13 species) and birds nesting in tree crones (14 species). Birds nesting on ground, as well as birds nesting in shrubs and lower layer occurred in all WWTP, and birds nesting in tree crones — only in 12 WWTP. Species of other groups occurred rarely.

Agro-meadow zones were noted in 10 WWTP (59 %), they occupied 5 % to 65 % of the WWTP area. 14 species of nesting bird were registered. Average species number per WWTP amounted to 2.5 (2; 4). Average value of the Pielou index was equal to 0.91 (0.90; 0.95). In terms of numbers in most WWTP dominated *Motacilla flava* (1.6 individuals/ha) or *Saxicola rubetra* (0.7 individuals/ha). These species were background in this zone — their frequency of occurrence was equal accordingly to 89 % and 78 %. Ecological groups of birds were presented

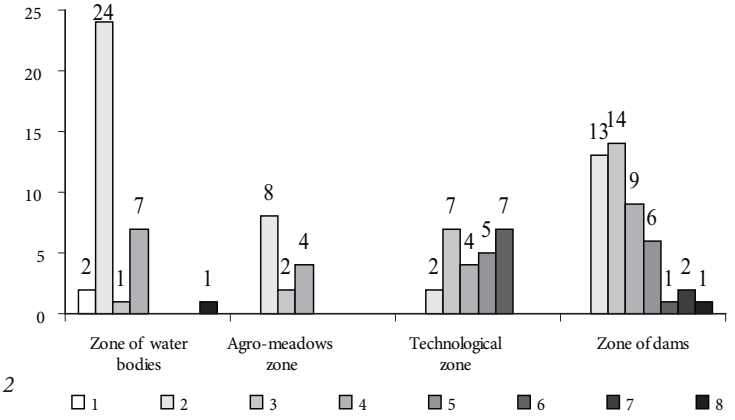
more evenly, among them 6 species of dendrophilous birds, 5 — field birds, and 3 — wetland birds (fig. 3, *1*). In terms of the nests' localization the most diverse were birds nesting on ground (8 species), their frequency of occurrence was equal to 100 % (fig. 3, *2*), birds nesting in shrubs and lower layer occurred in 67 %, and birds nesting in tree crones occurred sporadically.

Technological zones were presented in 9 WWTPs (53 %). Their part varied from 5 % to 40 % of the WWTP area. Totally 25 species of nesting bird were registered. Average species number per WWTP was equal to 6 (3; 10); average value of the Pielou index — 0.91 (0.88; 0.92). In terms of numbers dominated *Hirundo rustica* (3 individuals/ha) and *Motacilla alba* (2 individuals/ha). Maximal frequency of occurrence was character for *H. rustica* (100 %), *M. alba* (89 %) and *Parus major* (75 %). Maximal number of species belonged to synanthropic birds (7 species) and field birds (5 species), frequency of occurrence of these groups amounted to 89 % (fig. 3, *1*). Birds nesting in tree crones and birds nesting on buildings and constructions were presented by 7 species each (fig. 3, *2*). In this zone in all WWTP occurred birds nesting on ground. Also quite frequently occurred birds nesting on buildings and constructions (89 %) and birds nesting in hollows (78 %).

The most similar was composition of species of the dams' and technological zones (I_{Sr} = 0.45) and dams' and agro-meadow zones (I_{Sr} = 0.37). Minimal similarity was of the water



Note. *1* — landscape-biotopic characteristic: 1 — waterfowl and wetland birds; 2 — dendrophilous birds; 3 — meadow and field birds; 4 — synanthropic birds; 5 — sclerophilous birds; 6 — nest parasites.



Note. *2* — nests' location: 1 — birds with floating nests; 2 — birds nesting on ground; 3 — birds nesting in tree crone; 4 — birds nesting in shrubs and lower layer; 5 — birds nesting in hollows; 6 — birds nesting on buildings and constructions; 7 — birds nesting in barrows; 8 — nest parasites.

Fig. 3. Number of birds of ecological groups in zones: *1*— landscape-biotopic characteristic; *2* — nests' location.

Рис. 3. Представленность птиц различных экологических групп в зонах: *1* — по ландшафтно-биотопической характеристике; *2* — по месту размещения гнёзд.

area and technological zones (I_{Sr} = 0.03). Similarity of the composition of species between other zones was within the limits 0.20–0.27. Analysis of the obtained values of the Simpson's index indicated that 79 % of species of the agro-meadow zone and 64 % of species of technological zone are included into the composition of species of the dam zone.

Discussion

The breeding avifauna of the considered WWTPs comprised about 40 % of the avifauna of the northern left-bank part of Ukraine. Occurred species of 14 orders and 30 families, that is more than 65 % of families, registered in the considered region in breeding season.

The most widely presented were families Sylviidae, Muscicapidae, Fringillidae, Emberizidae. In Chernihiv WWTPs species were registered, included into the Red Book of Ukraine — gadwall (*Anas strepera*) and oystercatcher (*Haematopus ostralegus*). Occurrence of the latter can be explained by closeness of the Desna River flood land, where this species is quite abundant (Gavris, 2009).

Monitoring of habitats showed significant differences within the certain zone of different WWTP. The water bodies' zone was characterized by different overgrowth of the water areas. The follows species form the core of avicomplex of this zone: *Anas platyrhynchos*, *Gallinula chloropus*, *Fulica atra*, *Vanellus vanellus*, *Acrocephalus palustris*, *Acrocephalus scirpaceus*, *Acrocephalus arundinaceus*, *Emberiza schoeniclus*.

Maximal species number was registered in the dam zone. It was characterized by different relation of grassy, shrubby and woody vegetations, thickets of higher aquatic plants, and this conditioned different relations of ecological groups of the birds. The core of this avicomplex was formed by *Sylvia communis*, *Sylvia atricapilla*, *Lanius collurio*, *Luscinia luscinia*, *Fringilla coelebs*, *Chloris chloris*, *Emberiza citrinella*, *Motacilla flava*, *Columba palumbus*, *Cuculus canorus*.

Plant cover of the agro-meadow zone in different WWTP was quite different: from the meadow biotopes to young trees, and this provided relatively even occurrence of field and dendrophilous birds. Use of these zones as gardens and hay-fields deteriorated their topical resource. Within these zones the least number of species was registered. The core of this avicomplex was formed by only three species: *Motacilla flava, Saxicola rubetra*, *Sylvia communis*.

Avifauna of technological zones is similar to those of settlements. Its forming depended on combination of plants and technological and utility constructions. Synanthropic birds occurred only in this zone. The core of this avicomplex comprised *Hirundo rustica*, *Motacilla alba*, *Parus major*, *Phoenicurus ochrurus*, *Chloris chloris*.

Area of the certain zone and birds habitats in different WWTP significantly varied, at the same time complex of background and dominating species of the certain zone was practically identical. It can be stated that there is principal differences between zones, in spite of the fact that summarized species lists of different zones were quite similar.

Analysis of lists of the nesting birds in different zones showed that zone of water areas and dam zones were the most important for forming of avifauna of WWTP. These zones were present in all WWTP, and 86 % of total species number of the considered WWTP occurred in them. The agro-meadow and technological zones were present in several WWTP and their significance in avifauna forming is different. Thus, area of agro-meadow zone is bigger than of technological zone, whereas number of bird species in the first was low, and the latter provides more localities for birds with different nesting habitats.

Conclusion

In the territory of WWTPs of the northern left-bank part of Ukraine 81 species of breeding birds were registered, that is about 40 % of total avifauna of the considered region. They belong to 30 families of 14 orders, maximal species number included Passeriformes — 50 species, Charadriiformes — 9 and Anseriformes — 5 species.

In terms of landscape-biotopic characteristics in WWTPs dominated dendrophilous and wetland birds. In terms of nests' location dominated birds nesting on ground, birds nesting in tree crones and birds nesting in shrubs and lower layer.

Over analysis of avifauna of the waste water treatment plants it is reasonable to distinguish their territory into zones with different biotopic characteristics: zone of water bodies, zone of dams, agro-meadow and technological zones.

Species diversity, nesting density and ecological structure of the breeding birds' populations significantly varies over treatment plants and zones, due to differences of the habitat conditions in the same zone of different treatment plants. At the same time background and dominant species were peculiar for the certain zone.

Species were presented in the treatment plants relatively uniformly. Average part of dominants in terms of numbers was equal to 0.25.

Maximal species number and diversity of ecological structure of the breeding avifauna were noted within the zones of water bodies and dams, where 86 % of total species number was registered.

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Received 2 June 2014
Accepted 24 March 2015