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ORNITHOLOGICAL FAUNA OF THE WASTE WATER TREATMENT PLANTS IN THE NORTHERN LEFT BANK UKRAINE (CHERNIHIV AND KYIV REGIONS): WINTER POPULATIONS AND ECOLOGICAL STRUCTURE

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Ornithological Fauna of the Waste Water Treatment Plants in the Northern Left-Bank Ukraine (Chernihiv and Kyiv Regions): Winter Populations and Ecological Structure. Fedun, O. M., Davydenko, I. V. — The article discusses winter bird populations of the waste water treatment plants (WWTP) located in the North of Left-bank Ukraine. The said population comprises 12 orders and 29 families. The most numerous are Passeriformes (37 species), Anseriformes (16 species) and Falconiformes (6 species). *Parus major* was registered at all types of facilities while most of the others house *Passer montanus*, *Carduelis carduelis*, *Turdus pilaris*, and *Parus caeruleus*. The largest number of wintering birds was registered at Bortnychi aeration station, Chernihiv municipal WWTP and Chernihiv wool processing factory — 79. 51 and 15 species respectively. The nuclear part of the bird numbers are the species residing at the facilities all year around (65.8 %); species occurring there in winter only account for 34.2 %. Dendrophilous (38 species) and hydrophilous (35 species) dominate among them. The primary role in forming the winter fauna of the waste water treatment plants belongs to the zones of water bodies and dams.
Key words: winter bird populations, waste water treatment plants, the North of Left-bank Ukraine.

Introduction

Waste water treatment plants (WWTP) as anthropogenic objects are responsible for forming unique ornithological complexes (Avilova, Eremkin, 2000). The said objects impact on forming and sustaining bird-population during both nesting and winter periods rather positively (Koshelev, 1988; Spiridonov, 2009). Present-day research registers accumulation of bird-population in a number of areas in Ukraine where warm sewage waters are dumped in winter (Kutchinska, Buchko 2004; Shevtsov, 2005). There are data concerning birds wintering in the areas surrounding waste water treatment plants near Kyiv, Ternopil, Odesa, Melytopol (Reva, Semenyuk, 1975; Talposh, 1978; Davydenko, Sypko, 2002; Korzyukov et al., 2002). However we lack systemic studies of the birds using the facilities themselves for wintering. This article considers species types, bird groups density and their distribution within certain technological areas as well as peculiarities of bird-population formation in winter at waste water treatment plants in Chernihiv and Kyiv regions.

Material and methods

Over the period of 2006–2013 (mid November — end of February) we studied the bird-populations of 13 WWTP in Chernihiv region (objects monitored and serviced by municipal WWTP of the towns of Chernihiv, Nizhyn, Horodnia, Ripky, Kulykivka, Mena and Nizhyn dairies, Koriukivka paper-mill factory, Nosivka and Bobrovytsia sugar-refineries, the wool-processing factory "Chernihivvovna" (the town of Chernihiv), Kulykivka pig-farm and Bortnychi aeration station (BAS, Kyiv) (fig. 1).

According to facilities functional peculiarities, respective landscape diversity and biotopic factor we have defined four zones (Fedun et al., 2015).

Water bodies zone comprises watered or wetland areas of the facilities that are ice-covered in winter. We have attributed the BAS dumping channel and its defined area to the said zone. These zones differ in the degree of higher aquatic plants vegetation while they are primarily dominated by *Phragmites australis, Typha latifolia* and *T. angustifolia* (fig. 2).

Fig. 1. Region of investigations.

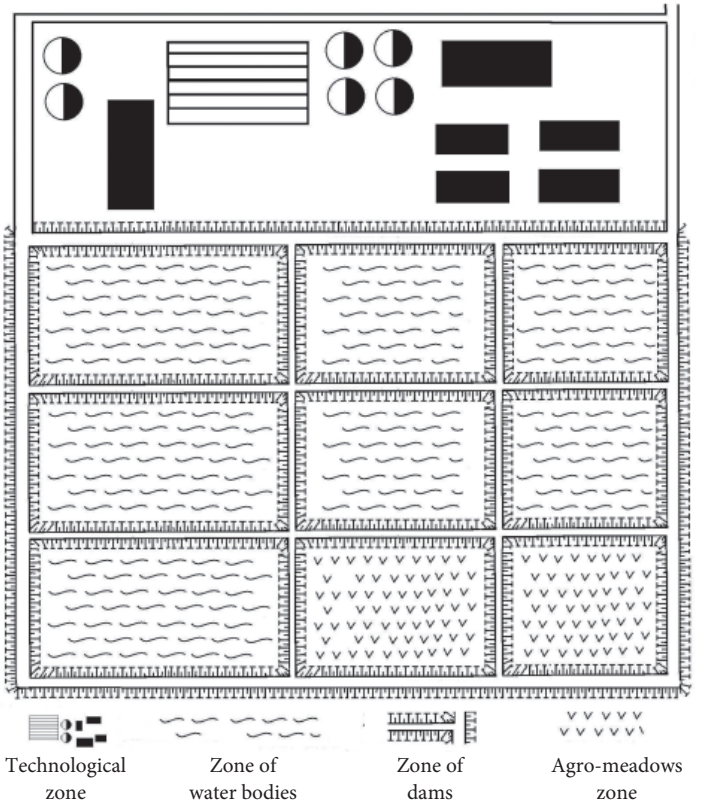

Fig. 2. Sketch of waste water treatment plants.

Dam zone separate water areas from other zones. These are usually covered with ruderal vegetation with thickets and isolated tree-clusters. We attribute the bank lane along the purified water channel to the BAS dam zone.

Agro-meadows zone includes meadow biotopes formed as a result of the decrease in water dumping. These territories are spontaneously overgrown, sometimes they are used as private gardens and hay fields.

Technological zone includes technological constructions (sand traps, aero-tanks, radial settling tanks) and buildings, often accompanied by cultural plantations.

Calculations of bird-populations were conducted via classical methods (Gudina, 1999). The said calculations considered the birds zonal distribution. The analysis of treatment facilities' wintering ornithological fauna involved the correlation of the bird-populations density in regard to zones space.

Species registered in the zones of over 60 % of facilities are identified as background ones. Species comprising 10 % or more of the total quantity were considered dominant.

The space occupied by waste water treatment plants was calculated on the basis of the data provided by Google Earth and Mapinfo Professional software and a GPS-navigator device. Systematic allocation of birds follows the "Conspectus of the ornithological fauna of Russia and adjacent territories" (Stepanyan, 2003).

The status of the species residing at the territory of sewage facilities was defined in categories introduced by H. V. Fesenko and A. A. Bokotey (Fesenko, Bokotey, 2002) and applied to specific contexts that resulted into identifying two groups of birds.

The first group is observed at the territory of the waste water treatment plants all year long yet its allocation is uncertain during the winter and migration periods. This could be a periodic rotation of the group.

The second group is observed in winter only.

We have also calculated the species taxonomic wealth index (ST) following (Emelyanov et al., 1999); similarities of species lists were analyzed according to the Shannon index (H') and Piyelu equitability index (Pesenko, 1982); the Simpson poli-domination index was calculated as $D'=1/\Sigma p_i^2$, where p_i is a relative percentage of the i-species population.

The Sorensen index was utilized for the cluster analysis of the similarity of bird populations species composition in regard to the above mentioned zones.

Mathematical processing of the data was performed via Microsoft Excel's "Analysis Pack" and PAST software (Hammer et al., 2001).

Results and discussion

Over the indicated period of observation 79 species of birds were registered as wintering at WWTP in the northern part of Left-bank Ukraine which accounts for approximately 29 % of species living in Kyiv and Chernihiv regions (Fedun, Kornienko, 2008). The registered wintering birds belong to 12 orders and 29 families. Regarding the increasing quantity of species within families the latter form the following taxonomy: Phalacrocoracidae, Phasianidae, Charadriidae, Columbidae, Alcedinidae, Laniidae, Bombycillidae, Sturnidae, Troglodytidae, Prunellidae, Sylviidae, Paradoxornithidae, Aegithalidae, Sittidae, Certhiidae (1 species), Podicipedidae, Ardeidae, Passeridae, Emberizidae, Paridae (2 species), Motacillidae, Rallidae, Muscicapidae — 3, Picidae, Laridae — 4, Corvidae, Accipitridae (6 species), Fringillidae (8 species), Anatidae (16 species). The most numerous are Passeriformes (37 species), Anseriformes (16 species) and Falconiformes (6 species). Of all the species only *Parus mayor* is registered at all facilities while *Passer montanus*, *Carduelis carduelis*, *Turdus pilaris* and *Parus caeruleus* occur at more than a half of the facilities.

Although waste water treatment plants are uniform in structure, the distribution of bird populations is different. The largest number of wintering species is registered at Bortnychi aeration station, Chernihiv municipal WWTP and Chernigivvovna WWTP — 78, 51 and 15 species respectively (table 1).

Species residing in WWTP throughout the year constitute the nucleus of the wintering birds' population — 52 species (65.8 %). Most of the species occur at the facilities of Bortnychi aeration station (50), Chernihiv WWTP (37), Chernigivvovna WWTP— 11 (table 1). Within this group predominating are dendrophilous (28 species, 34.18 %), wetland birds (20 species, 25.3 %), synanthropic (3 species, 3.8 %), and field birds (1 species, 1.27 %). Out of 27 species registered as solely wintering 15 (19 %) are wetland birds, 10 species (12.6 %) are dendrophilous, 2 species (2.53 %) refer to field birds.

Availability of forage resources corresponding to the birds' nutrition type in winter determines the regularity of birds belonging to various trophic types visiting the observed territories. Among the said types 43 species (54.4 %) are polyphagous, 23 species (29.1 %)

Table 1. Species composition, relative density (in %), ecological structure and indicators of diversity of the birds population at water sewage treatment facilities in the North Left-bank Ukraine in winter

Birds species	Facilities													Ecological groups			
	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	XIII	Status	Manner of residing	Nutrition type (trophic groups)	Landscape biotopical relation
Podiceps ruficollis	1.21	0.63												ry	or	zf	hf
Podiceps cristatus	0.06													w	sp	zf	hf
Phalacrocorax carbo	0.51													ry	sp	zf	hf
Egretta alba	0.13													ry	sp	zf	hf
Ardea cinerea	0.19	0.11												ry	sp	zf	hf
Anser albifrons	0.13	0.07												w	sl	pf	hf
Anser anser	0.19													w	sl	pf	hf
Cygnus olor	0.38													w	sp	pf	hf
Cygnus cygnus	0.13													w	sp	pf	hf
Anas platyrhynchos	15.79	26.83			1.53									ry	or	pf	hf
Anas querquedula	0.32													ry	or	pf	hf
Anas penelope	0.06	0.04												w	sl	pf	hf
Anas crecca	0.19													w	sp	pf	hf
Anas clypeata	0.26													ry	sl	pf	hf
Aythya ferina	0.96	4.08												ry	or	pf	hf
Aythya fuligula	0.13	0.07												ry	or	pf	hf
Aythya marila	0.13													w	sl	pf	hf
Clangula hyemalis	0.13													w	sl	pf	hf
Bucephala clangula	0.06	0.04												w	sp	pf	hf
Mergus albellus	0.19													w	sl	zf	hf
Mergus merganser	0.19													w	sp	zf	hf
Accipiter gentilis	0.16	0.11												ry	or	zf	df
Accipiter nisus	0.32													ry	or	zf	df
Buteo buteo	0.32	0.28								1.17				ry	sp	zf	df

Buteo lagopus	0.16	0.14										w	sp	zf	df
Circus cyaneus	0.16											w	sp	zf	fd
Haliaeetus albicilla	0.06											ry	or	zf	df
Perdix perdix	1.24	2.07										ry	or	ff	fd
Rallus aquaticus	0.19	0.07										ry	sl	zf	hf
Gallinula chloropus	0.38											ry	or	pf	hf
Fulica atra	0.19											ry	or	pf	hf
Tringa ochropus	0.06	0.04										ry	sp	zf	hf
Larus ridibundus	5.39											ry	or	pf	hf
Larus cachinnans	1.44											ry	or	pf	hf
Larus marinus	0.06											w	sl	pf	hf
Larus canus	3.64											ry	or	pf	hf
Columba livia	0.96											ry	or	ff	sn
Alcedo atthis	0.06	0.04										ry	sp	zf	hf
Picus canus	0.16	0.14										ry	sp	pf	df
Dendrocopos major	0.32	0.28	1.80		2.49	2.85		2.10				ry	or	pf	df
Dendrocopos syriacus	0.16											ry	sp	pf	df
Dendrocopos minor	0.16	0.14	2.10								0.54	ry	or	pf	df
Anthus pratensis		0.04										ry	sl	zf	hf
Motacilla cinerea	0.19											w	sl	zf	hf
Motacilla alba	0.06											ry	sl	zf	hf
Lanius excubitor	0.16	0.14	2.85									w	sp	zf	fd
Stunus vulgaris	2.04	0.42										ry	sp	pf	df
Garrulus glandarius	0.32	0.28	1.80			5.54		2.10			1.42	ry	or	pf	df
Pica pica	2.97	0.74	1.80		1.53		3.99				2.71	ry	or	pf	df
Corvus corax	0.16	0.28	7.05	1.46		5.54		2.10				ry	or	pf	df
Corvus cornix	4.47	11.67					7.98					ry	or	pf	df
Corvus monedula	1.85	9.46										ry	or	pf	df
Corvus frugilegus	3.38	6.29										ry	or	pf	df
Bombycilla garrulus	2.20	3.45										w	sp	ff	df
Troglodytes troglodytes	0.19	0.49										w	or	pf	df
Prunella modularis	0.16	0.04										w	sl	zf	df
Phylloscopus collybita	0.06	0.04										ry	sl	zf	df
Erithacus rubecula	0.16	0.04										ry	sp	pf	df
Turdus pilaris	15.73	1.97	12.14		12.37	22.47		15.03	29.52		3.18	ry	or	pf	df

Turdus merula	0.32	0.42												ry	sp	pf	df
Panurus biarmicus	0.57	0.28												w	sp	pf	hf
Aegithalos caudatus	1.08	1.65	5.25					10.66						w	or	pf	df
Parus major	4.82	5.56	37.78	6.94	19.94	27.37	30.54	18.88	70.48	5.87	40.08	14.16	8.58	ry	or	pf	df
Parus caeruleus	0.96	1.65	5.25		15.15	16.77	11.70					5.62		ry	or	pf	df
Parus palustris	0.96	0.56				5.54		4.20				2.85		w	or	pf	df
Sitta europaea	0.16	0.91	1.80								6.18			ry	or	pf	df
Certhia familiaris	0.32	0.28	3.45											w	or	zf	df
Passer domesticus	1.60	4.25					27.87				23.03	21.68		ry	or	pf	sn
Passer montanus	6.00	5.03	8.25	85.94	29.34		17.92	27.80		92.95	30.71	37.94	71.42	ry	or	pf	sn
Fringilla montifringilla	1.88	2.64												w	sp	ff	df
Fringilla coelebs	0.48	0.28												ry	sp	ff	df
Chloris chloris	2.36	0.42												ry	or	ff	df
Spinus spinus	0.80													w	or	ff	df
Carduelis carduelis	1.08	0.98	5.25	5.66	10.07	13.92		6.47				9.89	20.01	ry	or	ff	df
Acanthis cannabina	1.56	0.42												ry	or	ff	df
Pyrrhula pyrrhula	0.32	1.09	3.45					10.66						w	or	ff	df
Coccothraustes coccothraustes	2.68	2.36												ry	sp	ff	df
Emberiza citrinella	0.80	0.70			7.57									ry	or	ff	df
Emberiza schoeniclus	0.19													ry	sl	ff	hf
Order	12	10	2	1	3	2	1	2	1	2	1	2	1				
Family	29	26	10	4	8	5	3	7	2	3	3	6	3				
Species	78	51	15	4	9	8	6	10	2	3	4	10	3				
Taxonomic richness index *(ST)*	170	126	40	13	28	21	14	28	7	11	11	25	10				
Simpson_1-D	0.93	0.89	0.82	0.25	0.82	0.82	0.78	0.83	0.46	0.13	0.69	0.77	0.44				
Shannon_H	3.30	2.76	2.15	0.54	1.87	1.85	1.61	1.99	0.65	0.29	1.22	1.76	0.77				
Polydominance index	14.55	8.99	5.67	1.34	5.52	5.47	4.45	6.04	1.84	1.15	3.21	4.41	1.79				
Pyielo Equitability index_J	0.76	0.70	0.79	0.39	0.85	0.89	0.90	0.86	0.94	0.26	0.88	0.77	0.70				
Berger-Parker Index	6.33	3.73	3.01	1.16	3.41	3.65	3.27	3.60	1.54	1.08	2.88	2.64	1.40				
Total area, ha	129.8	155.7	87.6	15.1	16.2	25.3	12	45.2	2.6	38.5	2.9	29.9	1.26				

Note. I — Bortnychi aeration station; II — Chernihiv MWWTP; III — Chernigivvovna WWTP; IV — Nizhyn dairy WWTP; V — Nizhyn MWWTP; VI — Gorodnia MWWTP; VII — Mena dairy WWTP; VIII — Nosivka sugar factory WWTP; IX — Ripky MWWTP; X — Bobrovytsia sugar factory WWTP; XI — Kulykivka MWWTP; XII — Koriukivka paper-mill WWTP; XIII — Kulykivka pig-farm WWTP; ry — reside all the year round; w — wintering; or — ordinary; sp — sporadically; sl — seldom; zf — zoophagous; ff — phytophagous; pf — poliphagous; df — dendrophilous; hf — hydrophilous; fd — field; sn — synanthropic.

are zoophagous while 13 species (16.5 %) are phytophagous (table 1). Representatives of these groups amount for 87.2 %, 1.07 %, and 11.71 % respectively.

The analysis of species residing at the waste water treatment plants allowed identifying both the impact of each zone onto the formation of birds population and the factors that define the structure of the facilities birds population in general.

In the water bodies zone we registered 47 species of birds (59.5 % of those wintering at the facilities). Within the zone the number of species ranged from 2 to 37. The largest quantities were marked at Bortnychi aeration station (37) and Chernihiv WWTP (20). Respective water areas remain unfrozen in winter due to constant dumping of warm sewage waters. There quantitatively dominant is *Anas platyrhynchos,* (12.5 per hectare), *Carduelis carduelis*, (5.56 per hectare) and *Passer montanus*, (3.78 per hectare). Hydrophilous constitute the nucleus of the bird population (35 species). Except for the *Anas platyrhynchos*, this group also includes *Aythya ferina* (1.46 per hectare) and *Podiceps ruficollis* (0.56 per hectare). Near-bank zones and partially central parts of the mentioned water areas are often covered with high and ruderal vegetation. This contributes to the variety of species residing there, including 11 species of dendrophilous. In search for food the birds used the near-bank stripe and clusters of reed in the central segments of the pools. Here we registered *Parus major* (1.79 per hectare), *T. troglodytes*, *Panurus biarmicus*. However, segments of silt-accumulators and partially the ponds themselves do freeze in winter. Yet, due to the ruderal vegetation flocks of *Carduelis carduelis* and *Passer montanus* tend to cluster there. Of 47 species registered in the water bodies zone 30 (63.8 %) occur at the territory of the facilities all year round. They are mostly polyphagous (28 species, 60 %), though the number of zoophagous is also rather large — 17 (36.1 %). There are only 2 species (4.25 %) of phytophagous in this zone (table 2).

In the dam zones of all tackled facilities we registered 40 species of birds (51.9 % of the total species number). The largest quantity of species was observed around the dams

Table 2. Distribution of bird species in landscape zones of sewage treatment facilities in the Northern Left-bank Ukraine in winter

Area	General area of facilities and their specific zones	Bortnychi aeration station	Chernihiv MWWTP	Chernihiv wool processing factory WWTP	Nizhyn dairy WWTP	Nizhyn MWWTP	Gorodnia MWWTP	Mena dairy WWTP	Nosivka sugar factory WWTP	Ripky MWWTP	Bobrovytsia sugar factory WWTP	Kulykivka MWWTP	Koriukivka paper-mill WWTP	Kulykivka pig-farm WWTP
General area, ha	562.2	129.8	155.7	87.6	15.1	16.2	25.3	12	45.2	2.6	38.5	2.9	29.9	1.26
Water bodies zone														
Zone area, ha	309.5	50.53	108	66.6	6.6	6.23	19.6	4.6	22.5	0.9	14.025	0.33	11.9	0.72
Number of species		37	20	3	2	1	1	0	2	0	0	0	2	1
Dam zone														
Zone area, ha	94.5	20.3	25.4	8.6	2.1	3.8	5.65	1.5	8.17	0.8	11.24	1.64	4.8	0.54
Number of species		40	26	14	1	5	8	2	10	2	3	4	5	3
Technological zone														
Zone area, ha	80.7	45.5	22.3	0	0	6.2	0	2.2	0	0.9	0	1	2.5	0
Number of species		10	9	0	0	4	0	5	0	1	0	0	3	0
Agro-meadows zone														
Zone area, ha	77.5	13.5		15.9	6.5	0	0	3.7	14.5	0	13.2	0	10.7	0
Number of species		0	0	1	2	0	0	0	0	0	0	0	1	0

of Bortnychi aeration station (40) Chernihiv WWTP (26), Chernigivvovna WWTP (14) and Nosivka sugar factory (10). 23 species (57.5 % of species occurring in the area) reside in the zone throughout the year. *Passer montanus* appears to dominate the zone (62.37 per hectare) though it was registered at 5 facilities only. The other registered species were the following: *Parus major* (25.26 per hectare), *Carduelis carduelis* (12.14 per hectare), *Turdus pilaris* (10.52 per hectare) and *Parus caeruleus* (7.26 per hectare). Representatives of the dendrophilous group (35 species) are responsible for ornithological diversity in these zones. A number of species belonging to it like *Parus major* (92.3 %) and *Carduelis carduelis* (61.5 %) constitute the of background set. Sporadic species here are *Erithacus rubecula*, *Prunella modularis*, *Circus cyaneus*. Most of these species are poliphagous (20) while we also registered 12 phytophagous and 8 zoophagous.

We registered 13 species of birds (16.4 % of the total number) wintering in the technological zones. Most of the species were registered at the Bortnychi aeration station (10), Chernihiv WWTP (9) and Mena dairy (5). The following species appear to be dominant: *Passer montanus* (22.9 per hectare) and *Passer domesticus* (17.3 per hectare). There are also considerable numbers of great tit (15.7 per hectare), *Corvus corax* (5.75 per hectare), *Corvus monedula* (3.02 per hectare), *Corvus frugilegus* (2.65 per hectare) and *Larus ridibundus* — (1.67 per hectare). The representatives of *Corvidae* tend to concentrate in the technological zones in winter. 4 species are background ones: *Passer montanus* and *Parus major* (both account for 85.7 %), *Passer domesticus* and *Pica pica* (each accounts for 71.4 %). Specific conditions are favourable for the dendrophilous (7 species), hydrophilous (4 species) and synanthropic (2 species) groups. All 13 species occur in the technological zones all year around and are identifies as poliphagous according to their trophic characteristics.

In the meadows-agricultural zones we registered only 4 species: *Carduelis carduelis*, *Turdus pilaris*, *Corvus corax*, *Lanius excubitor* i. e. 5.1 % of the total number of species occurring at the territories of the waste water treatment plants. This zone occupies considerable area yet is insignificant for the formation of fauna.

At the dendrogram (fig. 3) shows, the zones are marked by a low similarity index. Most similarities in species composition are registered between the dam and technological zones ($I_{Sr} = 0.3$).

As these zones are adjacent, certain species use them both for forage and rest. The populations of the meadows agricultural zones differed most from the other areas ($I_{Sr} = 0.1$). Peculiarities of clusters formation testify to the specific structure of each zone bird populations. Except for the landscape-biotopic features, the size of the facilities, location of the sewage pipes and technology of water purification impact the species composition.

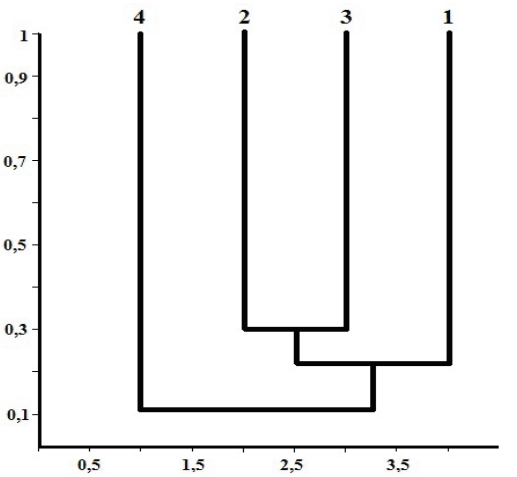

Fig. 3. Similarity clusters of bird populations' species composition in winter according to the water treatment facilities' biotopic zones: 1 — zone of water bodies; 2 — dam zone; 3 — technological zone 4 — meadows agricultural zone.

Discussion

Waste water treatment plants (obviously together with general climatic transformations) influence the patterns of typically migrating birds life as a number of them regularly or sporadically wintering there. Among these species are: *Anas platyrhynchos*, *Aythya ferina* and *Aythya fuligula*, *Rallus aquaticus*, *Fulica atra*, *Gallinula chloropus*, *Larus ridibundus*, *Larus canus*, *Larus cachinnans*, *Alcedo atthis*, *Troglodytes troglodytes*, *Tringa ochropus*, *Ardea cinerea, Egretta alba*, *Sturnus vulgaris*, *Motacilla alba*. Facilities, located at Bortnychi aeration station and Chernihiv WWTP demonstrate these tendencies most vividly.

Water bodies and dams where 78 species of birds are concentrated provide most impact onto the formation of bird population.

Water bodies zones are present in all studied facilities. Most of the species residing there in winter tend to use the areas devoid of constant ice-covering in winter. However, non-freezing water areas are present only at Bortnychi aeration station, Chernihiv WWTP and Nizhyn WWTP, because of constant dumping of warm sewage waters.

Wherever dumping of warm water is irregular (Chernihivvovna WWTP, Horodnia WWTP, Koriukivka paper-mill WWTP, Nizhyn dairy WWTP, Nosivka and Bobrovytsia sugar-refineries WWTP, Kulykivka pig-farm WWTP) water bodies are covered with ice at insignificant below-zero temperature. In case of large water areas (the Desna, the Dnipro rivers) in the vicinity of the waste water treatment plants most of the water birds tend to stay at open temporarily unfrozen areas rather than stay at the waste water treatment plants. After these water areas get frozen *Anas platyrhynchos* and other water birds move to the water purification facilities. Clusters of *Anas platyrhynchos* and *Podiceps ruficollis* remain relatively stable till the end of winter.

At Bortnychi aeration station and Chernihiv WWTP we registered species, that normally wintering in far more to the south: *Tringa ochropus*, *Phylloscopus collybita*, *Anthus pratensis* and *Prunella modularis*. Warm sewage waters (approximately + 15–17 °C) provide favourable conditions together with insects and their larvae as forage. These birds look for food in the near-bank areas and reed mace patches.

At some facilities dam zones occupy considerable areas (table 2). As bigger areas a harder to keep in order, they are often covered by trees, bushes and weed-like ruderal vegetation. Their proximity to the water bodies zone partially changes the micro-climate in the respective adjacent segments. This consequently impacts the structure of bird populations in the dam areas. The dams attract birds as forage territories (*Parus major*, *Dendrocopos major*, *Chloris chloris*, *Sitta europaea* etc.) as well as areas used for rest (*Corvus cornix*, *Corvus monedula*, *Corvus frugilegus*, *Accipiter gentilis* etc.).

Technological zones are also intensively used by flocks of *Corvus cornix*, *Corvus monedula*, *Corvus frugilegus*, *Larus ridibundus*, *Pica pica*, *Larus canus*, *Larus cachinnans* that concentrate along the sewage canals, circular precipitation tanks and sand-filters. Here they catch floating food-products remnants. The birds use buildings and trees for rest. *Parus major* and *Motacilla cinerea* catch insects and various invertebrates in the canals' niches. At Chernihiv WWTP facility circular precipitation tanks are occupied by dozens of *Anas platyrhynchos* in different periods of winter.

Primary differences in the structure and quantity of the water treatment facilities bird populations are determined by their geographic location, technologies of sewage purification, sewage water temperature and the area occupied by structures.

Conclusions

At facilities located in Chernihiv and Kyiv regions we registered 79 wintering species of birds that constitute about 29 % of the region's ornithological fauna. The species taxonomy encompasses 12 rows: Passeriformes (37 species), Anseriformes (16 species), Falconiformes (6 species) and 29 families. The nuclear part of the bird numbers are the

species residing at the facilities all year around (52 species, 65,8 %) and species occurring there in winter only (27 species, 34.2 %). Dendrophilous (38 species) and hydrophilous (35 species) dominate among them. The most significant for the formation of bird population are the facilities water bodies zone and dam zone. 98.7 % of the birds wintering at the water purification facilities occur within these zones. The meadows-agricultural zones cover large areas and house fewer species while the technological zones that are rather compact may house a larger number of species characterized by a wider range of ecological types.

Therefore, water treatment facilities as quasi-natural habitats peculiar for non-freezing water areas and forage resources allow sustaining a considerable number of bird species in winter. The said facilities specific micro-climate impact sporadic or regular wintering of migrating species. However this impact is local for the areas are rather moderate in size.

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