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PROTECTED WATERBIRD SPECIES ON THE AZOV-BLACK SEA COAST IN THE WINTER SEASONS 2009–2022

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Protected Waterbird Species on the Azov-Black Sea Coast in the Winter Seasons 2009–2022. Kostiushyn, V. A. & Andryushchenko, Yu. O. — The article presents data on waterbirds from the Red Data Book of Ukraine wintering in the Azov-Black Sea coastal wetlands during 2009–2022. A total of 27 protected waterbird species were recorded during the International Waterbird Census. The average number of protected birds was 13,631 ± 2,828 ind., the maximum — 35,768 ind. Detailed information on species composition and bird numbers is given for 14 wetlands, the most valuable for waterbirds.
Key words: Azov-Black Sea coast, Ukraine, water birds, winter counts.

Introduction

Full-scale monitoring of wintering waterbirds through the International Waterbird Census (IWC) began in the late 1980s, and covered all the key wetlands of the Azov-Black Sea region of Ukraine from the Krivaya Spit on the Azov Sea to the Danube Delta.

The IWC in Ukraine is based entirely on the voluntary participation of a large number of ornithologists working in research institutes, universities and protected areas.

A significant proportion of the birds counted are species included in the Red Data Book of Ukraine (RDB). Considering that the latest 3rd edition of the RDB was published in 2009 (Akimov, 2009), the purpose of this publication is to summarise all data on protected species collected during the winters 2009–2022.

To summarise the census data, the list of protected species approved for the 4th edition of the RDB in 2021 was used.

Material and Methodology

The IWC according to the generally accepted methodology is carried out in January, but some small data collected in December or in February have also been used for this publication.

The results of the waterbird counts are regularly published mainly in the ROM Bulletin and some other publications (Results…, 2011, 2017, 2023; Kostiushyn et al., 2011). Therefore, this paper is based on an analysis of information sources, all of which were prepared and published with the participation of the authors of this publication.

Small and medium-sized wetlands generally were fully covered by counts, while large water bodies were only partially covered.

In total 55 wetlands or parts of large water bodies were covered by counts in 2009–2022 (fig. 1).

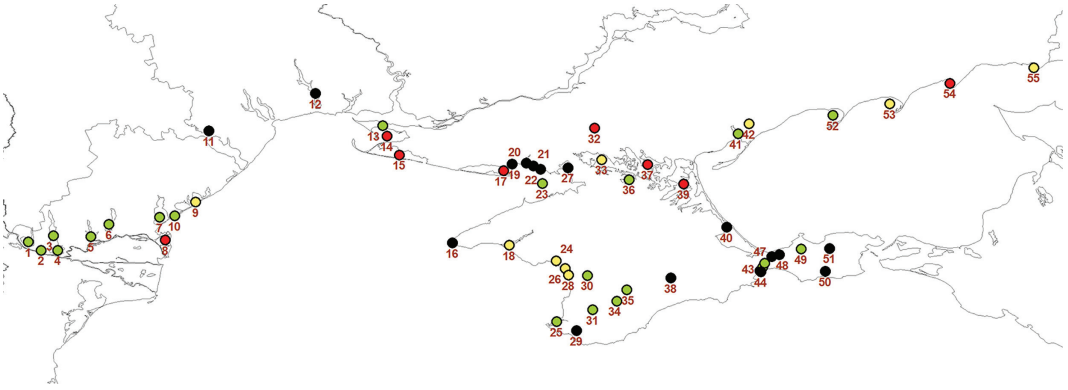


Fig. 1. Wetlands covered by IWC counts in 2009–2022. Name of the wetlands: 1 — Kagul Lake; 2 — Kartal Lake; 3 — Yalpug Lake; 4 — Kugurlui Lake; 5 — Katlabukh Lake; 6 — Kitai Lake; 7 — Sasyk Liman; 8 — Danube Delta; 9 — Shagany & Alibei & Burnas limans; 10 — Malyi Sasyk & Dzhantsheiskiy limans; 11 — Dniester Delta; 12 — Tiligulskii Liman; 13 — Kinburnskaya Spit wetlands; 14 — Yagorlytskii Bay; 15 — Tendrovskii Bay; 16 — Tarkhankut wetlands; 17 — Dzarylgachskii Bay; 18 —Donuzlav Lake; 19 — Karzhinskii Bay; 20 — Kalanchkskii Bay; 21 — Karadaiskii Bay; 22 — Shyrokii Bay; 23 — Northern part of Karkinitskii Bay; 24 — Sasyk Lake (Crimea); 25 — Sevastopol Bays; 26 — Sakskoe Lake; 27 — Perekopskii Bay; 28 — Kuzul-Yar Lake; 29 — Gosforta Lake; 30 — Mezhgornoe Reservoir; 31 — Egiz-Oba Reservoir; 32 — Bolshoi Chapelskii Pod; 33 — Western Sivash; 34 — Partizanskoe Reservoir; 35 — Simferopolskoe Reservoir; 36 — Southern part of Central Sivash; 37 — Northern part of Central Sivash; 38 — Taiginskoe Reservoir; 39 — Northern part of Eastern Sivash; 40 — Southern part of Eastern Sivash; 41 — Utlukskii Liman; 42 — Molochnyi Liman; 43 — Adzigol Lake; 44 — Feodosiya Bay; 45 — Kamyshin Meadow Pond; 46 — Frontovoe Reservoir; 47 — Semisotka Area; 48 — Alibai Area; 49 — Samarli Reservoir; 50 — Southern Wetlands of Kerch peninsula; 51 — Northern Wetlands of Kerch peninsula; 52 — Obitochnaya Spit & Bay; 53 — Berdianskaya Spit & Bay; 54 — Belosarayskaya Spit & Bay, 55 — Krivaya Spit & Bay.
Number of count years: black circles — 1 year, green — 2–5 years, yellow — 6–10, red — 10–14 years.

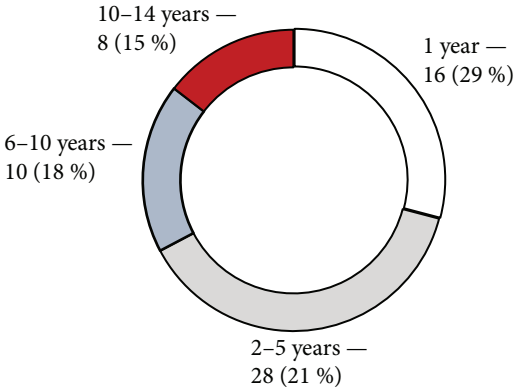


Fig. 2. The ratio of wetlands by the number of years when they were surveyed.

The number of wetlands or their parts covered by the counts varied from year to year, reaching a maximum of 28 in one winter season. The counts on key wetlands of the region were carried out quite regularly, but for small water bodies the degree of irregularity was quite high. The ratio of water bodies to the number of years they were counted is shown in fig. 2.

It should be noted that in some waterbodies, two or, more rarely, three counts were carried out in the same winter by different teams of researchers. In such cases, we have combined the count data by selecting the maximum values for each of the species recorded. In a few cases we have also combined data from the same count in different parts of the same large wetland.

Results and discussion

Total number of birds

For the period 2009–2022, a total of 2,565,677 waterbirds were counted, of which 190,838, or 7.44 %, were protected birds of the 27 Endangered, Vulnerable and Rare species listed in the Red Data Book (table 1).

The number of recorded birds of protected species varied considerably from year to year — from 836 to 35,768 ind. (fig. 3). Such dynamics are the result of the several factors — the coverage of wetlands by surveys, the number of repeated counts on some wetlands, as well as weather conditions. Analysis of the contribution of each of these factors to changes in bird numbers is a separate issue, which we do not consider in this article. The average number of birds recorded over the period analysed was 13,631 $\pm$ 2,828 ind.

Table 1. The ratio of the number of species of different conservation categories and their abundance

Red Data Book categories*	Species number	Amount of birds, ind.	Percentage, %
Endangered (E)	8	4,026	2.11
Vulnerable (V)	10	115,798	60.68
Rare (R)	9	71,014	37.21

*Red Data Book of Ukraine includes the following categories: Extinct, Extinct in Wild, Endangered (*could extinct in nature without conservation measures*), Vulnerable (*because of decreasing could be included soon in E*), Rare (*more safety than E and V, but also has negative tendency*), Not Evaluated (*possibly belong to E, V or R*), Not Enough Known (*not enough data to classify them*).

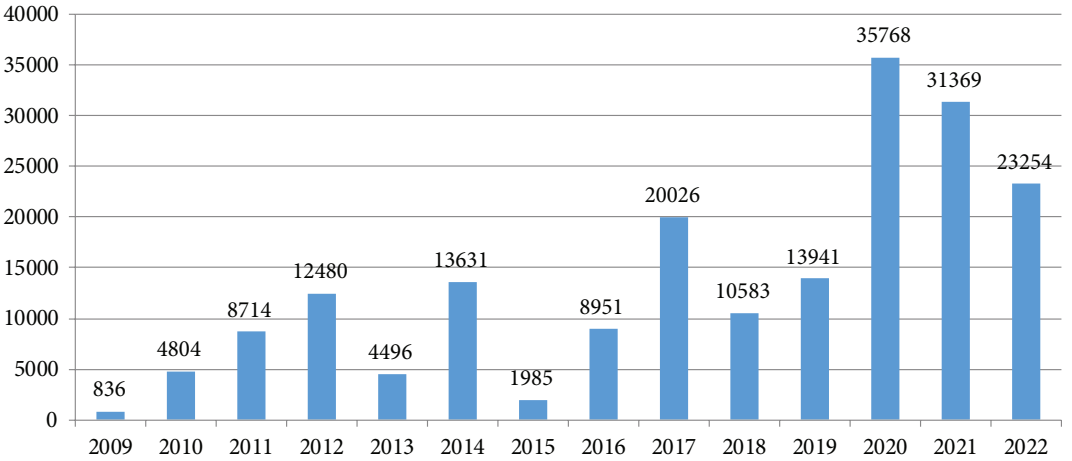


Fig. 3. Number of RDB water birds accounted in different winters (ind.).

Number of the bird species

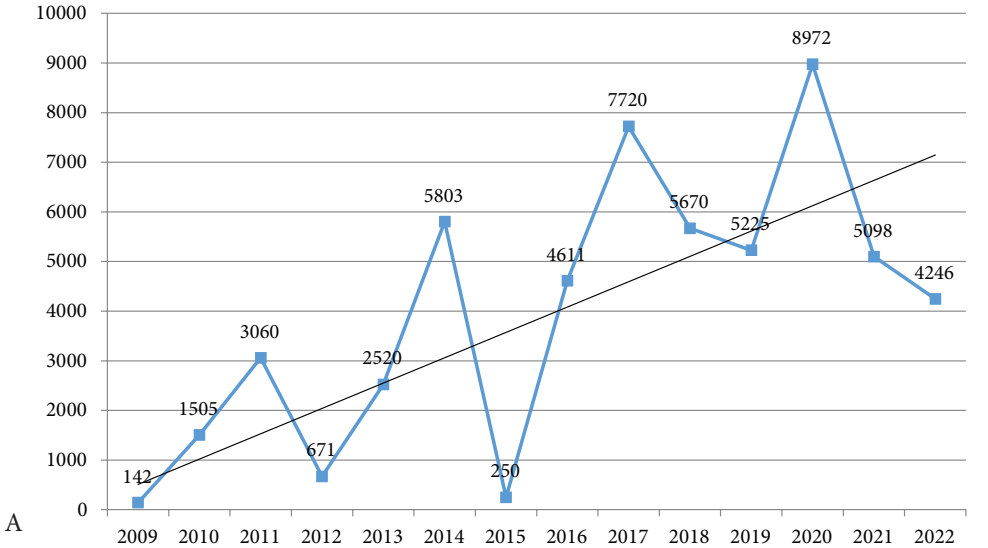
All protected species recorded during the IWC can be divided into three groups: numerous (average number at the level of thousands individuals), common (average number from tens to several hundreds) and small number (a few individuals) (table 2).

If the species are ranked according to the number of recorded birds, then *Tadorna ferruginea* was the most numerous among the RDB species — 29.42 % of the total number of waterbirds counted in 2018–2022, *Bucephala clangula* — 27.93 % and *Branta ruficollis* — 21.36 %, *Mergus serrator* — 9.73 %, *Netta rufina* — 8.21 %.

The number of single species, as a total number of birds, also significantly varied over the years. To illustrate this we used data for the most numerous species (fig. 4).

Table 2. The number of protected bird species for the period 2009–2022

Species	Mean	Std. error	%	Min	Max	Sum
Tadorna ferruginea	4,011.57	737.23	29.42	142	8,972	56,162
Bucephala clangula	3,808.79	1,367.69	27.93	0	15,270	53,323
Branta ruficollis	2,912.86	903.43	21.36	0	10,495	40,780
Mergus serrator	1,326.64	696.60	9.73	8	9,028	18,573
Netta rufina	1,119.79	761.94	8.21	1	10,700	15,677
Phalacrocorax pygmaeus	148.14	42.55	1.09	0	517	2074
Numenius arquata	88.64	28.05	0.65	0	367	1,241
Haliaeetus albicilla	70.21	6.89	0.51	16	114	983
Anas strepera	29.64	12.66	0.22	0	145	415
Grus grus	29.07	24.83	0.21	0	350	407
Pelecanus crispus	26.57	13.55	0.19	0	190	372
Cygnus (columbianus) bewickii	17.36	7.34	0.13	0	76	243
Larus ichthyaetus	16.43	4.10	0.12	0	50	230
Aythya nyroca	13.71	13.11	0.10	0	184	192
Oxyura leucocephala	8.50	5.27	0.06	0	73	119
Somateria mollissima	3.79	1.84	0.03	0	25	53
Haematopus ostralegus	1.57	0.85	0.01	0	10	22
Podiceps auritus	0.50	0.50	0.004	0	7	7
Podiceps grisegena	0.43	0.36	0.003	0	5	6
Charadrius hiaticula	0.36	0.29	0.003	0	4	5
Numenius .	0.29	0.29	0.002	0	4	4
Recurvirostra avosetta	0.29	0.29	0.002	0	4	4
Platalea leucorodia	0.21	0.15	0.002	0	2	3
Charadrius alexandrinus	0.14	0.14	0.001	0	2	2
Numenius phaeopus	0.14	0.14	0.001	0	2	2
Pelecanus onocrotalus	0.14	0.10	0.001	0	1	2
Phalacrocorax aristotelis	0.14	0.14	0.001	0	2	2
Ardeola ralloides	0.07	0.07	0.001	0	1	1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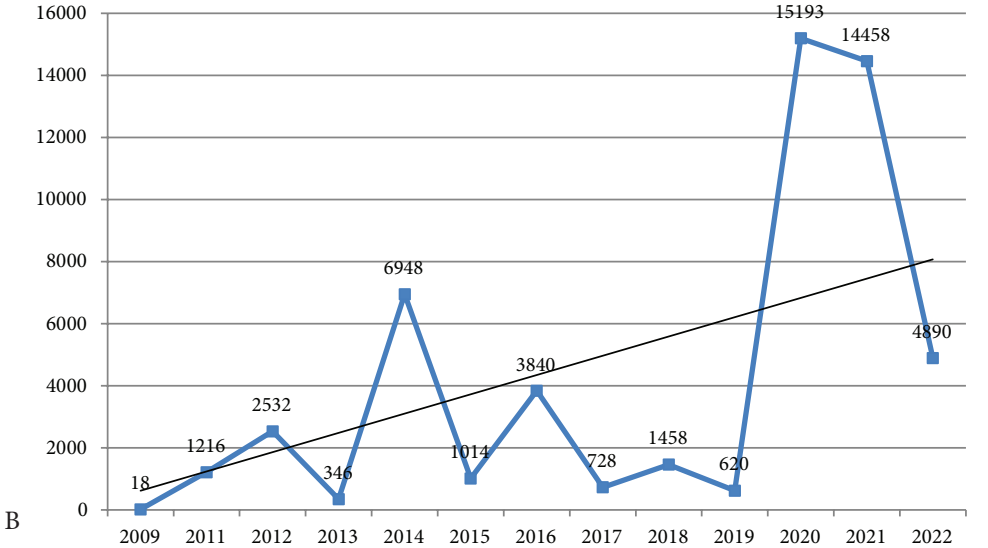
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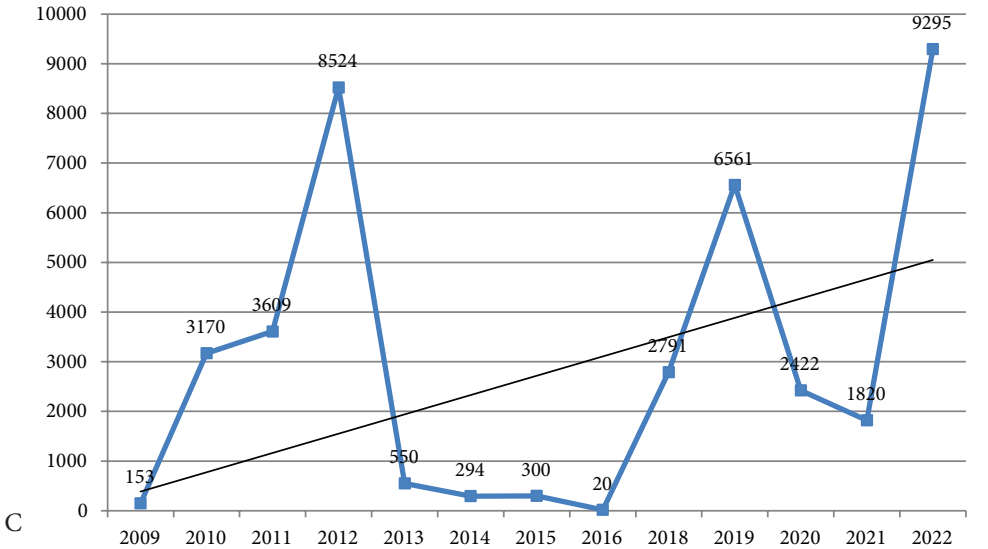
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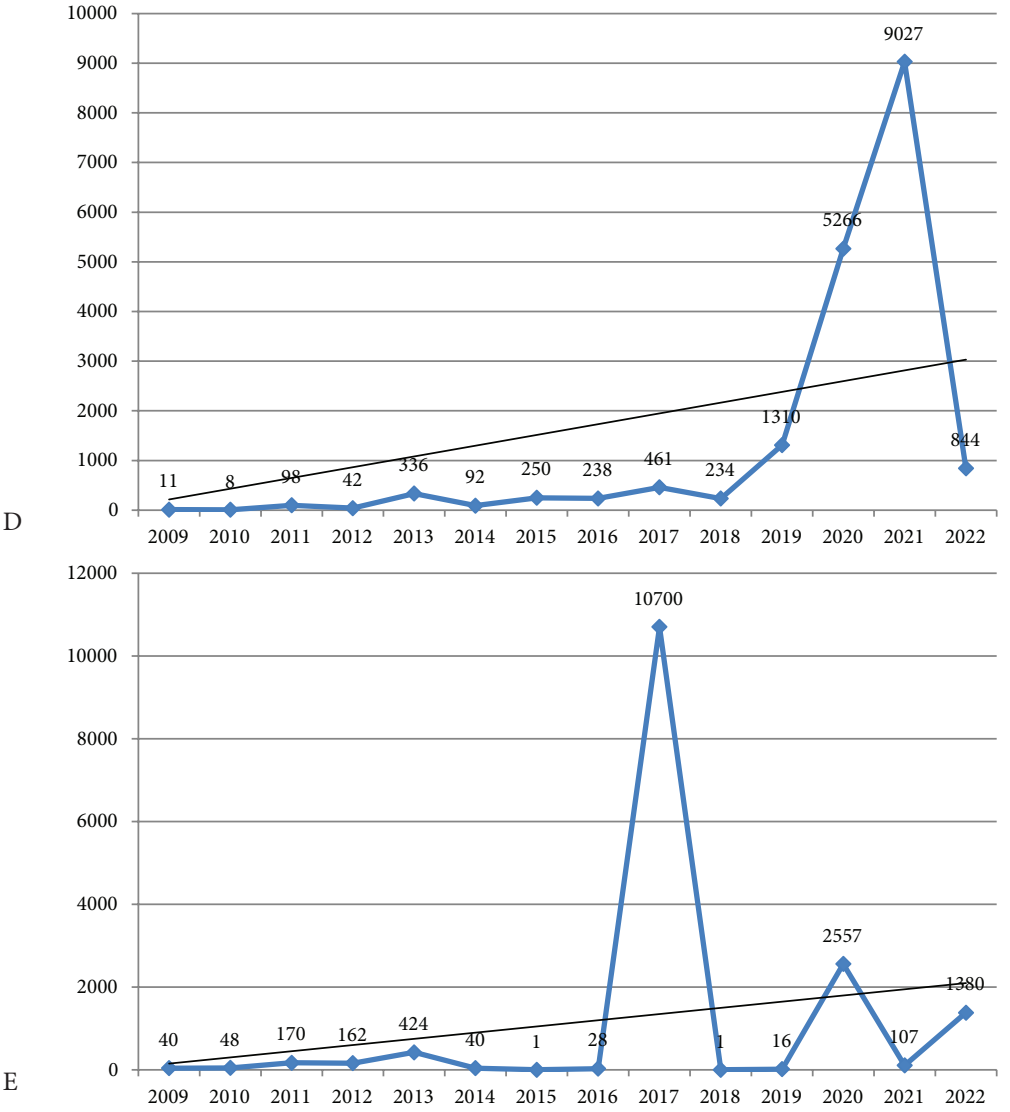

Fig. 4. Change in the number of the most numerous species of wintering birds in 2009–2022. A — *Tadorna ferruginea*; B— *Bucephala clangula*; C— *Branta ruficollis*; D— *Mergus serrator*; E— *Netta rufina.*

Importance of individual wetlands for wintering water birds

To evaluate the role of the most important water bodies for wintering protected bird species it was calculated the average number of birds for each of them. As a result, out of 55 wetlands (or their parts in the case of large waterbodies), were selected 14 wetlands, in which of each an average number of protected birds exceeded 100 ind. (fig. 5). Undoubtedly, that in the case of using for analysis of the maximum recorded number of birds, the picture would be somewhat different. However, in our opinion, the use of average values gives a more correct estimate importance of the wetlands, since characterises the role of them for the entire observation period.

Average bird abundance characterises only one aspect of the importance of a particular wetland for protected bird species and its high value may be the result of a high abundance of just one or a few species. That is why we also ranked the wetlands using the Shannon

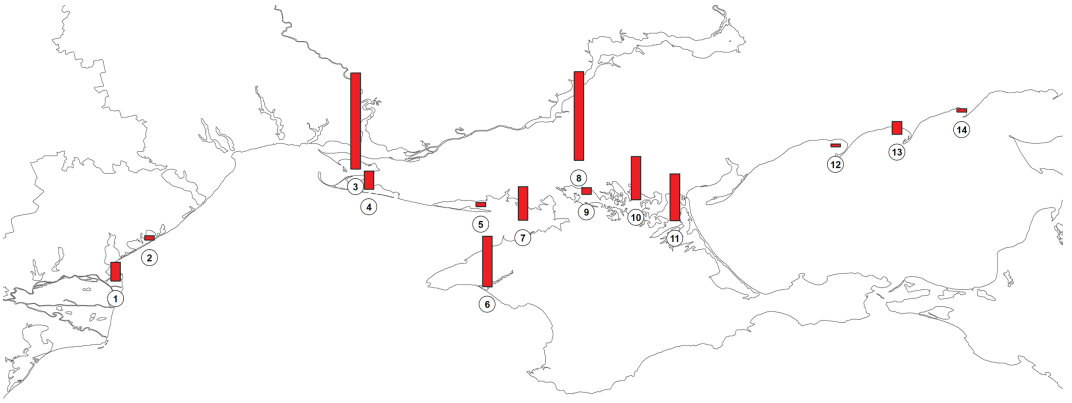

Fig. 5. An average number (ind.) of wintering protected birds in the most important wetlands of the region and their location. 1 — Danube Delta (705 ind. /16 species); 2 — Shagany & Alibei & Burnas limans (157 / 7); 3 — Yagorlytskii Bay (3609 / 8). 4 — Tendrovskii Bay (685 / 9); 5 — Dzarylgachskii Bay (155 / 7); 6 — Donuzlav Lake (1893 / 8); 7 — Northern part of Karkinitskii Bay (1261 / 12); 8 — Bolshoi Chapelskii Pod (3335 / 4); 9 — Western Sivash (250 / 5); 10 — Northern part of Central Sivash (1629 / 8); 11 — Northern part of Eastern Sivash (1755 / 8); 12 — Obitochnaya Spit & Bay (104 / 4); 13 — Berdianskaya Spit & Bay (487 / 4); 14 — Belosarayskaya Spit & Bay (120 /6).

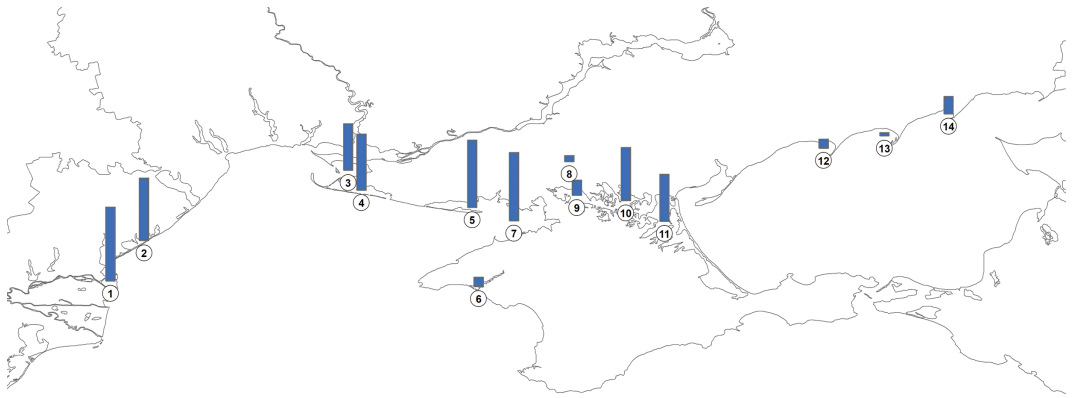

Fig. 6. Shanon (H) index values for the most important wetlands of the region: 1 — Danube Delta (H = 1.16); 2 — Shagany & Alibei & Burnas limans (0.98); 3— Yagorlytskii Bay (0.74); 4 — Tendrovskii Bay (0.89); 5 — Dzarylgachskii Bay (1.06); 6 — Donuzlav Lake (0.15); 7 — Northern part of Karkinitskii Bay (1.08); 8 — Bolshoi Chapelskii Pod (0.10); 9 — Western Sivash (0.24); 10 — Northern part of Central Sivash (0.84); 11 — Northern part of Eastern Sivash (0.74); 12 — Obitochnaya Spit & Bay (0.14); 13 — Berdianskaya Spit & Bay (0.05); 14 — Belosarayskaya Spit & Bay (0.27).

index (H), which takes into account both the abundance of birds and richness of the species composition (fig. 6).

In accordance to this index the most valuable wetlands for RDB waterbirds are Danube Delta (1.16), Northern part of Karkinitskii Bay (1.08) and Dzarylgachskii Bay (1.06). Close to them are Shagany & Alibei & Burnas limans. Tendrovskii Bay and Northern part of Central Sivash.

An assessment of the similarity of wetlands was also made based on the species composition and number of wintering birds on them. Similarity was calculated using Bray-Curtis index and clustering was done using algorithm UPGMA. As seen in the figure 7 the analyzed wetlands are divided into 2 large groups. The first one includes Donuzlav Lake (6), Northern part of Karkinitskii Bay (7), Bolshoi Chapelskii Pod (8), Western

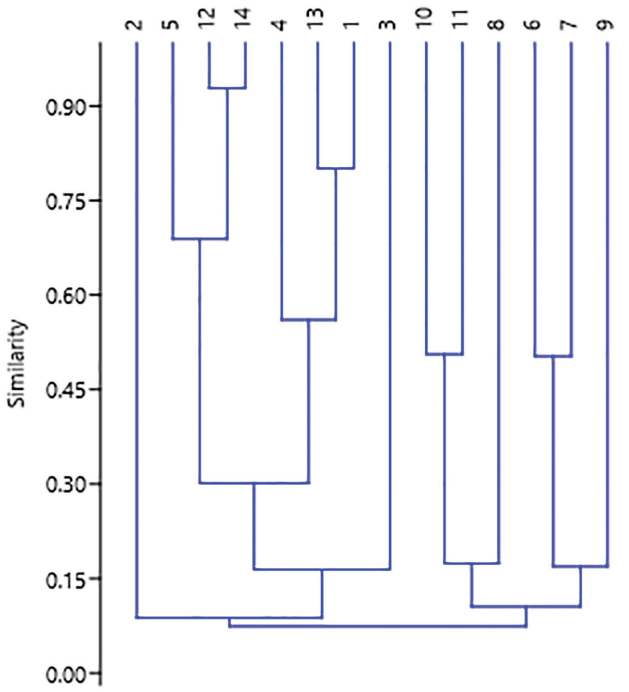

Fig. 7. Similarity of wetlands (algorithm — UPGMA, similarity index — Bray-Curtis): 1 — Danube Delta; 2 — Shagany & Alibei & Burnas limans; 3— Yagorlytskii Bay; 4 — Tendrovskii Bay; 5 — Dzarylgachskii Bay; 6 — Donuzlav Lake; 7 — Northern part of Karkinitskii Bay; 8 — Bolshoi Chapelskii Pod; 9 — Western Sivash; 10 — Northern part of Central Sivash; 11 — Northern part of Eastern Sivash; 12 — Obitochnaya Spit & Bay; 13 — Berdianskaya Spit & Bay, 14 — Belosarayskaya Spit & Bay.

Sivash (9), Northern part of Central Sivash (10) and Northern part of Eastern Sivash (11), which are located close to each other and in the central part of the studied region. The biggest similarity within the group we can see for 10 and 11, which have similar ecological conditions (hallow saline lagoon) and are parts of one big waterbody separated by dam. Bolshoi Chapelskii Pod (8) is closely located to them, but has different biotopes — this is big inland depression temporary wet. 6, 7 and 9 another subgroup closely located wetlands, but environmental characteristics of Western Sivash (9), are quite different from others since that last one is a hypersalty wetland. The second big cluster of wetlands includes wetlands from different parts of the region: western — from Danube delta to Dzharylgach island and eastern — wetlands of Azov sea coast. Here is the general picture is more complicated for explanation. If in first group majority of wetlands are not only close to each other geographically, but, excluding 6 and 7, are closed waterbodies, not linked with the sea or have very small connection to it, then the second group is mainly (3, 4, 5, 12, 13, 14) are big marine bays. Exclusion in this group is Shagany & Alibei & Burnas limans (2), which are shallow water bodies separated from the Black Sea by long sandy spit. That is why 2 have low similarity with other wetlands in the group. Another situation with the Danube Delta (1), which, at first glance, has unexpectedly big similarity with Berdianskaya Spit & Bay (13). We suppose that there are two reasons of this. First, bird counts cover in fact not totally the Danube Delta, but only its shallow part bordering with the sea. Second, counting area of 13 includes not only part of Berdianskiy Bay of Azov Sea, but also quite big part of the delta of Berda River. Thus, counting areas 1 and 13 have some similarities in biotopes.

Table 3. Average number (ind.) of different RDB wetland species in the most important wetland of Azov-Black sea coast of Ukraine

Species \ Wetlands	1. Danube Delta	2. Shagany & Alibei & Burnas limans	3.Yagorlytskii Bay	4. Tendrovskii Bay	5. Dzarylgachskii Bay	6. Donuzlav Lake	7. Northern part of Karkinitskii Bay	8. Bolshoi Chapelskii Pod	9. Western Sivash	10. Northern part of Central Sivash	11. Northern part of Eastern Sivash	12. Obitochnaya Spit & Bay	13. Belosarayskaya Spit & Bay	14. Berdianskaya Spit & Bay
Podiceps auritus	–	–	–	–	–	–	1.40	–	–	–	–	–	–	–
Podiceps grisegena	–	–	–		0.07	–	–	–	–	–	–	–	–	–
Pelecanus onocrotalus	–	–	–		–	–	0.20	–	–	–	–	–	–	–
Pelecanus crispus	29.00	–	–		–	–	–	–	–	–	–	–	0.08	–
Phalacrocorax pygmaeus	109.58	–	–		–	3.33	0.20	–	–	–	6.07	–	–	–
Platalea leucorodia	0.08	–	–		–	–	–	–	–	–	–	–	–	–
Branta ruficollis	–	112.50	26.73	10.00	0.21	–	32.60	58.85	–	841.75	1090.14	–	–	–
Cygnus (columbianus) bewickii	3.33	5.25	–		3.86	–	2.80	0.08	–	–	0.14	–	–	1.67
Tadorna ferruginea	–	2.00	–		–	–	334.20	3272.85	238.00	738.50	4.28	–	–	–
Anas strepera	23.58	–	–		–	–	0.20	–	–	–	–	–	–	–
Netta rufina	3.25	–	–		–	1845.33	761.20	–	1.50	8.25	3.57	–	–	0.83
Aythya nyroca	0.33	–	–	0.08	–	–	–	–	–	–	–	–	–	–
Bucephala clangula	473.50	9.25	2310.45	347.33	87.36	14.17	100.00	–	8.75	2.50	641.85	101.33	113.58	483.50
Somateria mollissima	–	–	4.09	0.50	–	–	–	–	–	–	–	–	–	–
Oxyura leucocephala	–	–	–			0.33	–	–	–	–	–	–	–	–
Mergus serrator	0.58	2.88	1243.82	309.00	49.43	26.67	16.00	–	–	–	–	1.00	3.33	–
Haliaeetus albicilla	15.08	1.88	14.09	6.42	4.07	2.67	1.00	–	0.13	3.08	6.00	1.33	2.25	1.33
Grus grus spp.	–	–	–			–	–	3.15	2.00	29.17	–	–	–	–
Charadrius hiaticula	0.42	–	–			–	–	–	–	–	–	–	–	–
Charadrius alexandrinus	–	–	0.18			–	–	–	–	–	–	–	–	–
Recurvirostra avosetta	0.33	–	–			–	–	–	–	–	–	–	–	–
Haematopus ostralegus	–	–	0.36	0.08		–	–	–	–	–	–	–	–	–
Numenius arquata	37.33	23.13	9.27	11.42	9.64	0.50	11.20	–	–	0.75	3.35	0.33	0.67	–
Numenius phaeopus	0.17	–	–			–	–	–	–	–	–	–	–	–
Numenius spp.	0.33	–	–			–	–	–	–	–	–	–	–	–
Larus ichthyaetus	8.00	–	–	0.08		0.33	–	–	–	3.75	–	–	0.17	–
TOTAL	704.89	156.89	3,608.99	684.91	154.64	1,893.33	1261.00	3,334.93	250.38	1,627.75	1,755.40	103.99	120.08	487.33

More detail information on protected waterbird species in 14 the most important wetlands for them is presented in the table 3.

Conclusion

As a result of the International Waterbird Census 2009–2022 it was shown that during winter season wetlands at Azov-Black Sea coast are used by 27 Red Data Book species of Ukraine. The average number of protected birds was 13,631 ± 2,828 ind., with maximum — 35,768 ind. The most abundant species are *Tadorna ferruginea* (29.42 % of the total amount), *Bucephala clangula* (27.93 %), *Branta ruficollis* (21.36 %), *Mergus serrator* (9.73 %) and *Netta rufina* (8.21 %). In general, the most important wetlands for protected water birds in the region are the Danube Delta, Tuzlovskie limans (Shagany & Alibei & Burnas), Yagorlytskii Bay, Tendrovskii Bay, Dzarylgachskii Bay, Northern part of Karkinitskii Bay and Sivash. This general assessment should be followed by an analysis of the spatial distribution of individual species and their coverage by protected areas.

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