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WINTERING WATERBIRDS IN THE WETLANDS OF THE AZOV-BLACK SEA REGION OF UKRAINE AT THE BEGINNING OF THE 21ST CENTURY — SPECIES COMPOSITION, ABUNDANCE, DISTRIBUTION AND TENDENCIES

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Wintering Waterbirds in the Wetlands of the Azov-Black Sea Region of Ukraine at the Beginning of the 21st Century — Species Composition, Abundance, Distribution and Tendencies. Andryuschenko, Yu. O. & Kostiushyn, V. A. — Data collection on wintering waterbirds in the wetlands of the Azov-Black Sea region of Ukraine began in the late 1980s, mainly thanks to the International Waterbird Census (IWC), which has become more extensive and regular since about 2005. This article is devoted to generalization of data on species composition, abundance of birds and their spatial distribution in that region based on the results of the winter census 2005–2022. The long-term dynamics of the waterbirds number and the peculiarities of the species distribution are mostly analyzed for abundant bird species. General information about common and rare species is also given.
Key words: Azov-Black Sea region, wintering waterbirds, species composition, abundance, spatial distribution.

Introduction

Retrospective information on wintering birds in the Azov-Black Sea region of Ukraine is very sketchy. Publications dealing directly with wintering birds did not appear until the middle of the 20th century, and they were largely based on unsystematic local observations. (Sabinevskii & Sevastianov, 1975; Sabinevskii, 1985; Sabinevskii et al., 1977, 1984; Ardamatskaya et al., 1978; Ardamatskaya, 1983; Sabinevskii & Ardamatskaya, 1984). Since the mid-1990s, wetland wintering bird censuses have been carried out regularly throughout the Azov-Black Sea region of Ukraine (Wildlife ecosystems…, 1997; Winter bird counts..., 1998, 1999, 2001; Winter 2002/2003…, 2004). The first publications, which summarized results of the censuses, are appeared (Kostiushyn et al., 2011, Andryushchenko et al., 2019). However, the largest annual winter waterbird census in the region only began in 2005, and its results have been regularly published in special editions of the Bulletin of Regional Ornithological Monitoring (Results of the mid-winter counts…, 2009; Results of mid-winter counts…, 2011; Results of winter counts…, 2017; Results of international winter…, 2023). In these publications, a large amount of data has been collected, allowing an overview of the species composition, population trends and territorial distribution of waterbirds wintering in the Azov-Black Sea region of Ukraine. It is necessary to emphasize that based on the analysis of the above-mentioned materials, an article on wintering waterbirds included in the Red Data Book of Ukraine has already been published for the period 2009–2022 (Kostiushyn &Andryushchenko, 2023), but this is a comparatively small part of all wintering waterfowl. Therefore, the present article aimed at a general analysis of data on all wintering waterbirds in the region.

Material, Methods and Study Area

The article is based on the authors' own data, since they have actively participated in the IWC, as well as on the data of many other ornithologists for the period 2005–2022, published in Bulletin ROM (Results of mid-winter counts..., 2009; Results of mid-winter counts..., 2011; Results of winter counts..., 2017; Results of international winter..., 2023) and some other issues. In total, the number of counted wetlands exceeds 80, but for the analysis of the census results, the territory of the Azov-Black Sea region of Ukraine was divided into twenty-seven subregions of relatively equal size, in which small wetlands are grouped, but some large ones were split (e. g., Syvash, Karkinitskii Bay), and in some cases the borders of individual wetlands coincide with the borders of subregions (fig. 1). In addition to water bodies, the counts included adjacent land areas (e. g. fields with resting or feeding geese, gulls, etc.) as well as islands and sandy spits (Andryuschenko, 2009).

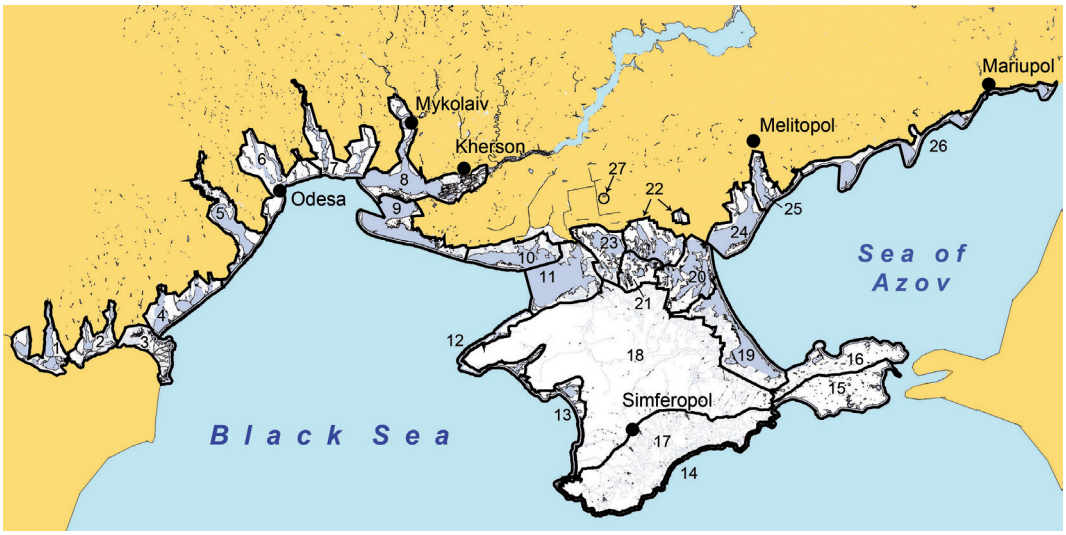

Fig. 1. Division of the Azov-Black Sea region into accounting subregions: 1. Western Prydunavia, 2. Eastern Prydunavia, 3. Danube Wetlands, 4. Tuzlovski Limans, 5. Dniester Wetlands, 6. Odesa Limans, 7. Tiligulsko-Berezanski Wetlands, 8. Dnipro-Bugski Wetlands, 9. Tendrovsko–Yagorlytski Wetlands, 10. Dzharylgachski Wetlands, 11. Karkinitski Wetlands, 12. Tarkhankutski Wetlands, 13. Western coast of Crimea, 14. Southern coast of Crimea, 15. Southern Wetlands of Kerch peninsula, 16. Northern Wetlands of Kerch peninsula, 17. Crimean Mountain Wetlands, 18. Crimean Plain Wetlands, 19. Southern part of Eastern Syvash, 20. Northern part of Eastern Syvash, 21. Southern part of Central Syvash, 22. Northern part of Central Syvash, 23. Western Syvash, 24. Utlyukski Wetlands, 25. Molochanski Wetlands, 26. Northern Pryazovia, 27. Northern Prisyvashshia (Velykyi Chapelskyi Pid)

Unfortunately, the coverage of wetlands by annual winter counts has fluctuated considerably. For example, they have not been conducted in the Odesa Limans since 2008, in the Dniester wetlands since 2012 (except for 2022), and in most of the Crimean wetlands since 2018. On the other hand, regular mid-winter censuses have been conducted in Velykyi Chapelsky Pid since 2011, in Karkinytskii Bay since 2017, and in Western and Eastern Prydunavia since 2018. However, despite such instability in the coverage of wetlands by censuses, the obtained material is unique and allows drawing some conclusions on the species composition, population dynamics and territorial distribution of waterbirds in the Azov-Black Sea region of Ukraine at the beginning of the 21st century.

Bird counts were carried out on the routes along the wetlands, using all-terrain vehicles and, in some cases, on foot (Delani, 2011; Andryushchenko, 2009). Birds were counted at regular stops at good vantage points using 10–12× binoculars and 30–60× telescopes. Bird counts were carried out during all daylight hours from 7:00–7:30 am to 3:30–4:00 pm (depending on the quality of lighting).

The following gradations of bird numbers were used to analyse the data: < 10 individuals — rare, 10–100 ind. — few, 100–1000 ind. — common, 1,000–10,000 ind. — numerous and > 10,000 ind. — abundant.

The multi-year spatial distribution and population trends in 2005–2022 were analyzed for numerous and mass waterbird species, as well as for *Circus aeruginosus* and *Haliaeetus albicilla*. For other categories of the species only general information was provided.

Results

During the 2005–2022 winter censuses, 92 waterbird species (including *C. aeruginosus*, *H. albicilla* and *Alcedo atthis*) belonging to 11 orders were recorded in the Azov-Black Sea region of Ukraine.

Gaviiformes. *Gavia arctica* is a rare wintering species in the region. Only 120 individuals were recorded between 2005 and 2022, more than half of them in the early years (35 individuals in 2005 and 44 individuals in 2007), but almost none in the last few years. *Gavia stellata* — only single birds were recorded in the Odesa Limans in 2005 and in the Dniester wetlands in 2010.

Podicipediformes. Five species of this order occur in winter time, of which only *Podiceps cristatus*, *Podiceps nigricollis* and *Tachybaptus ruficollis* were met regularly. The first two species are common, the third — in small number. During 2005–2022, the number of *P. cristatus* increased, while amount of *P. nigricollis* and *T. ruficollis* were relatively stable. *Podiceps grisegena* and *P. auritus* are rare and irregularly wintering species in the region, of which for the first species 2 ind. were recorded in 2006, 6 ind. in 2007 and 5 ind. in 2009, and for the second species — 28 ind. in 2007, 15 ind. in 2008 and 7 ind. in 2020

Procellariiformes. For 18 years only 1 ind. of *Puffinus puffinus* was registered in the northern part of Eastern Syvash on 19.01.2005.

Pelecaniformes. Five species of this taxonomic group occurred during the winter of 2005–2022, of which only *Phalacrocorax carbo* and *P. pygmaeus* were regularly encountered, the first being abundant and the second common. The multi-year population trend for *P. carbo* is increasing, while *P. pygmaeus* is slightly decreasing. *Phalacrocorax aristotelis* winters relatively regularly in small numbers, but almost exclusively on the coast of Southern Crimea. Recently, *Pelecanus crispus* began wintering in the region, mainly in the Western Prydunavia and the Danube Wetlands, and single individuals of *Pelecanus onocrotalus* were observed only twice — in 2020 at Lake Kagul in the Western Prydunavia subregion and in 2021 in the Karkinitski Wetlands.

Ciconiiformes. Eight species of this order winter in the region, of which only *Ardea cinerea* and *Casmerodius albus* are regular — the first species is in small number, the second is common, and their numbers tend to increase over the years. Other species of Ciconiiformes are rare in winter time, of which only *Egretta garzetta* and *Botaurus stellaris* occur regularly, while *Ardeola ralloides, Nycticorax nycticorax, Ciconia ciconia* and *Plata-*

lea leucorodia were met not every winter. Thus, for 18 years of winter censuses, *A.ralloides* was observed only once in 2020 at Lake Kagul in the Western Prydunavia, *P. leucorodia* — twice: 1 bird in 2020 on the Danube River and 2 birds in 2022 in the Western Prydunavia subregion, *C. ciconia* were met three times — 1 ind. in 2011 on the Western coast of Crimea, 1 ind. in 2012 in the Southern part of Eastern Syvash and 1 ind. in 2020 on the Danube River.

Phoenicopteriformes. *Phoenicopterus roseus* only occasionally winters in the Azov-Black Sea region of Ukraine, mainly in the plain part of Crimea (Tarasova, 2006; own observations), so it is not surprising that only 1 ind. was recorded during the winter counts 2005–2022 — on the Tuzlovskii Limans in 2018.

Anseriformes. A total of 31 species belonging to this order were recorded during the winter periods spanning 2005 to 2022. These included five goose species, three swans, and 23 ducks, which could be classified into the following groups: two species of Tadornini, eight of Anatini, five of Aythyini, seven of Mergini, and one of Oxyurini.

Among the geese, *Anser fabalis, A. erythropus*, *A. anser*, *A. albifrons* and *Rufibrenta ruficollis* were met during winter counts, of which the first two species were rare (occurring only a few times), the third was abundant and occurred in almost all counts, and the last two species were abundant or sometimes numerous. In the last two decades there has been a significant reduction in the number of *A. albifrons, A. anser* and *R. ruficollis* wintering in the region (Andryushchenko et al., 2019), which is also confirmed by the winter censuses 2005–2022 (fig. 2): the decline in the number of *A. albifrons* was rapid, the number of *R. ruficollis* decreased significantly, but gradually, and the number of *A. anser* first decreased, but in recent years it gradually began to recover. The largest number of *A. albifrons* was regularly concentrated in Northern Prisyvashshia, mainly in the area of Velykyi Chapelsky Pid (17.1 %) and in the south of Eastern Syvash (16.5 %), somewhat less — in the Northern part of Central Syvash (9.5 %), in Western Prydunavia (9.0 %) and in the Tuzlovskii Limans (8.5 %), as well as in the Northern Wetlands of Kerch peninsula (6.7 %), in the Southern part of Central Syvash (5.7 %) and in the Northern part of Eastern Syvash (4.6 %), in which in total up to 77.4 % of individuals of the this species were located. The vast majority of *A. anser* located in the Danube Wetlands subregion (64.5 %), as well as in the north of the Karkinitskii Wetlands (7.9 %), in the Southern part of Eastern Syvash (7.5 %), in the

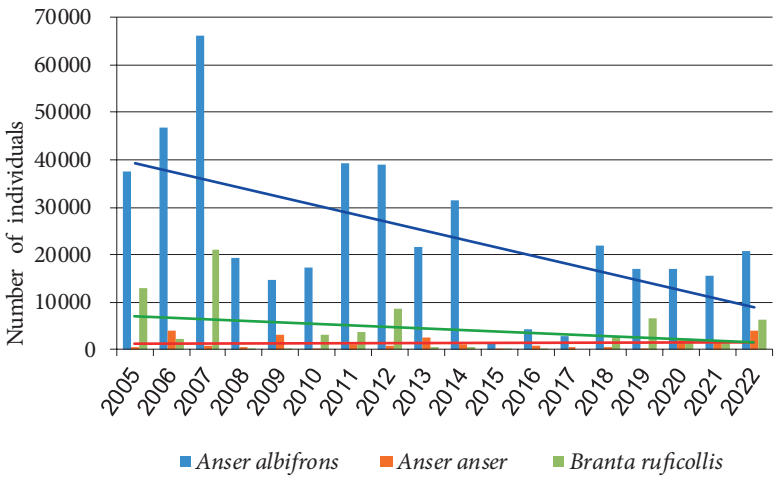

Fig. 2. Long-term dynamics of the number of the most numerous Anserinae according to the results of winter censuses of 2005–2022 in the wetlands of the Azov-Black Sea region of Ukraine (lines — trends in the number of individuals).

Western Prydunavia, (5.1 %) and in the area of Velykyi Chapelsky Pid, in which together 90.9 % of birds of the species were concentrated. *R. ruficollis* mostly located in the south of Central Syvash (27.4 %), in the north of Central Syvash (21.3 %) and in the Southern part of Eastern Syvash (20.6 %), somewhat less in the Northern part of Eastern Syvash (11.7) and in the Northern Wetlands of Kerch peninsula (11.3 %), in which in total 92.4 % of birds of the species were concentrated. The maximum number of birds observed in a single census was 26,704 ind. of the species *A. albifrons* in the northern part of Central Syvash in 2008, 26,670 ind. in the northern wetlands of the Kerch peninsula in 2012, 21,500 and 20,000 ind., respectively, in the Velykyi Chapelskyi Pid in 2011, and in 2013. The number of *A. anser* observed in the Danube Wetlands was 3,858 in 2006, 3,050 in 2009 and 3,244 in 2022. The species was exclusively observed in this area. For *R. ruficollis*, the number of ind. observed in the Northern part of Central Syvash in 2007 was 14,783, in the Southern part of Central Syvash in 2005 it was 12,116 and in the Northern Wetlands of Kerch peninsula in 2012 it was 8,300.

Three species of the swans — *Cygnus cygnus, C. olor* and *C. bewickii* were recorded in winter censuses. *C. cygnus* is a common, and in some years numerous wintering species in the region, the number of which has slightly increased over the last decade. During 2005–2022, the most birds of the species were concentrated in the north of the Karkinytski Wetlands (22.0 %) and in the Tendrovsko-Yagorlytski Wetlands (21.9 %), slightly less — in the Dzharylgachski Wetlands (11.2 %), in the Tuzlovski Limans (10.5 %), and in the Danube Wetlands (9.7 %), as well as in Tarkhankutski and Tiligulsko-Berezanski wetlands (5.3 % and 4.7 %, respectively), where in total up to 85.3 % of individuals of the species were located. The maximum number of *C. cygnus* per one count was 6,294 ind. in 2020 and 2,298 ind. in 2022, which were observed in Tendrovsko-Yagorlytski Wetlands, as well as 1,964 birds in 2006 in Danube Wetlands, 1,490 birds in 2006 and 1,401 birds in 2020 in the Karkinytski Wetlands and 1,275 ind. in 2022 at Dzharylgachski Wetlands. *C. olor* is a numerous wintering species in the region, which in the absence of ice cover is spread throughout this territory. During 2005–2022, the most individuals of the species were concentrated in the Karkinytski Wetlands (34.7 %), as well as in the south and north of Eastern Syvash (10.0 % and 9.6 %, respectively), in Tendrovsko-Yagorlytski and Dzharylgachski wetlands (8.1 % and 7.6 %, respectively), where in total up to 70.1 % of individuals of the species were located. The maximum number of *C. olor* per one cencus were 7,580 ind. in 2022 and 7,192 ind. in 2020 was observed in the Karkinitski Wetlands, as well as 6,864 ind. in 2006 and 5,400 ind. in 2007 — in the Northern part of Eastern Syvash. In general, the number of *C. olor* and *C. cygnus* wintering in the region is slowly increasing (fig. 3), although in the late 2000s — the first half of the 2010s, it temporarily decreased, apparently due to a series of cold winters, during which almost all shallow water bodies were covered by a strong ice cover.

C. bewickii regularly winters in small numbers in the studied region (Andryushchenko, Popenko, 2015), the first records of it during winter censuses were from 2013, after which its number gradually increased. During 2013–2022 163 individuals of the species were observed, the vast majority of which (90.7 %) — in the Tuzlovski Limans subregion (50.5 %), in the Danube Wetlands (23.6 %) and in the north of the Karkinytski Bay (15.7 %), and less birds in the Northern Pryazovia (4.9 %), in the Northern part of Eastern Syvash (3.1 %), in Dzharylgachski Wetlands (1.3 %) and Western Prydunavia (0.9 %). The maximum number of *C. bewickii* per one winter census was 38 ind., which were observed in 2022 in the Tuzlovski Limans and 32 ind. in 2018 Danube Wetlands.

Tadornini. *Tadorna ferruginea* — earlier the number of the species was small, but in the last decade, due to artificial breeding in the Biosphere Reserve "Askania-Nova" (Zub-

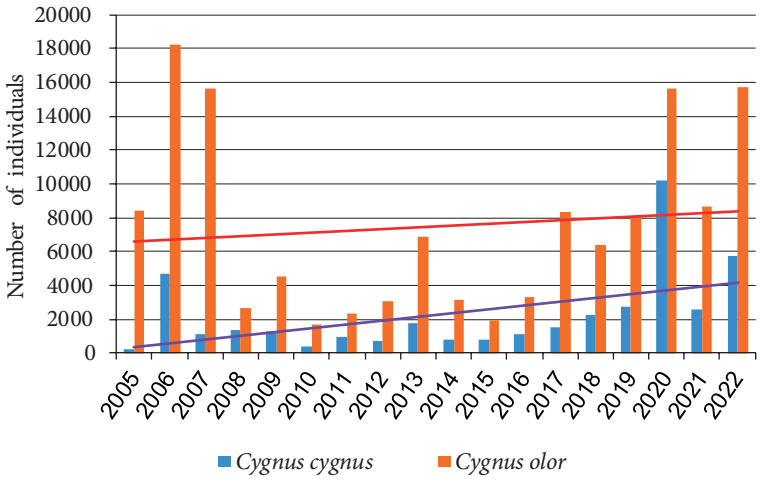

Fig. 3. Long-term dynamics of the number of *Cygnus olor* and *C. cygnus* according to the results of winter censuses of 2005–2022 in the wetlands of the Azov-Black Sea region of Ukraine (lines — trends in the number of individuals)

ko et al., 1998, 2003), has become a common species that regularly winters in the region (Mezinov, 2014). During the 2005–2022 censuses, the vast majority of the birds were located in the area of Velykyi Chapelskyi Pid (70.4 %), as well as in the Northern part of Central Syvash (17.8 %), in the Karkinitski Wetlands (5.4 %) and in the Western Syvash (5.2 %). The maximum numbers of *T. ferruginea* per one winter census were observed in the area of the Velykyi Chapelskyi Pid — 8,900 ind. in 2020, 5,600 ind. in 2018, 4,500 ind. in 2021 and 4,300 ind. in 2019, as well as in the Northern part of Central Syvash — 5,920 ind. in 2017. *Tadorna tadorna* is a mass resident species of the Azov-Black Sea coast of Ukraine.The majority birds wintering in the region may belong to populations migrating from the eastern part of the breeding area. According to the results of the winter censuses 2005–2022, the majority birds of the species (84.1 %) was concentrated in five subregions — mostly in the Southern part of Central Syvash (24.6 %), in the Northern part of Eastern Syvash (18.2 %) and in the Tuzlovski Limans (17.7 %), as well as in the Northern part of Central Syvash (14.6 %) and in the Molochanski Wetlands (8.8 %). The following maximum numbers of *T. tadorna* per one winter census were recorded: 18,210 ind. in 2006 in the Southern part of Central Syvash, 17,485 ind. in 2020 on the Molochny Liman, 14,516 ind. in 2007 in the Northern part of Eastern Syvash and 10,468 ind. in 2020 in the Tuzlovski Limans. In general, during 18 years of the counts, the number of both species have been increasing — slowly in *T. tadorna* and relatively rapidly in *T. ferruginea* (fig. 4).

Anatini. In winter censuses 2005–2022 were recorded 7 species of this taxonomic group — *Anas penelope, A. strepera, A. crecca, A. querquedula, A. platyrhynchos, A. acuta*, and *A. clypeata.* Among them, *A. platyrhynchos* was the most numerous and widespread species, the vast majority of it (66.2 %) was concentrated in several subregions: in the Karkinytski Wetlands (23.1 %), in the Northern part of Eastern Syvash (10.5 %), in the Southern part of Eastern Syvash (7.5%), as well as in the Danube Wetlands (6.6 %), Northern Pryazovia (6.4 %) and in the Northern part of Central Syvash (6.0 %). It was observed that the maximum numbers of this species per census were present in the northern part of Eastern Syvash, with 45,312 ind. recorded in 2005 and 38,080 in 2007, in the Karkinytski Wetlands. In the lands, the number of ind. observed in 2017 was 42,255, while in 2021 this figure was 39,957. Additionally, in the northern part of Central Syvash, the number of ind. observed in 2010 was 30,912. During 18 years of winter counts, the number of *A. platyrhynchos* fluctuated significantly: from 117,151 ind. in 2006, 102,363 ind. in

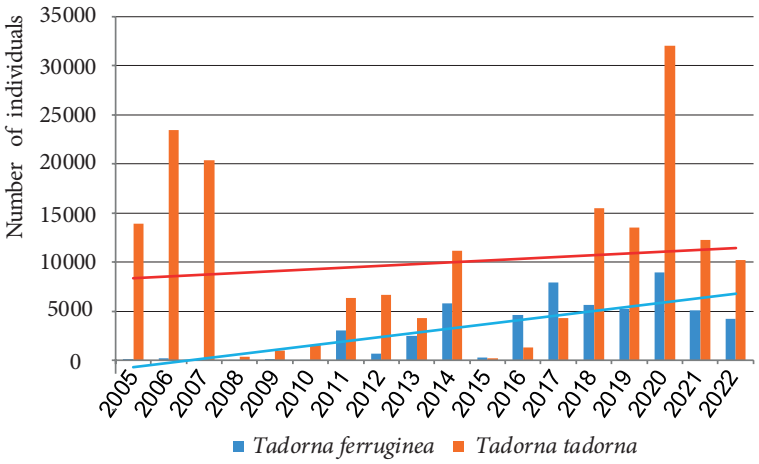

Fig. 4. Long-term dynamics of the number of *Tadorna ferruginea* and *T. tadorna* according to the results of winter censuses of 2005–2022 in the wetlands of the Azov-Black Sea region of Ukraine (lines — trends in the number of individuals).

2005 and 102,812 ind. in 2020, till 12,988 ind. in 2009, 10,516 ind. in 2008 and 5,961 ind. in 2015, but the general trend of the population number was quite stable (fig. 5).

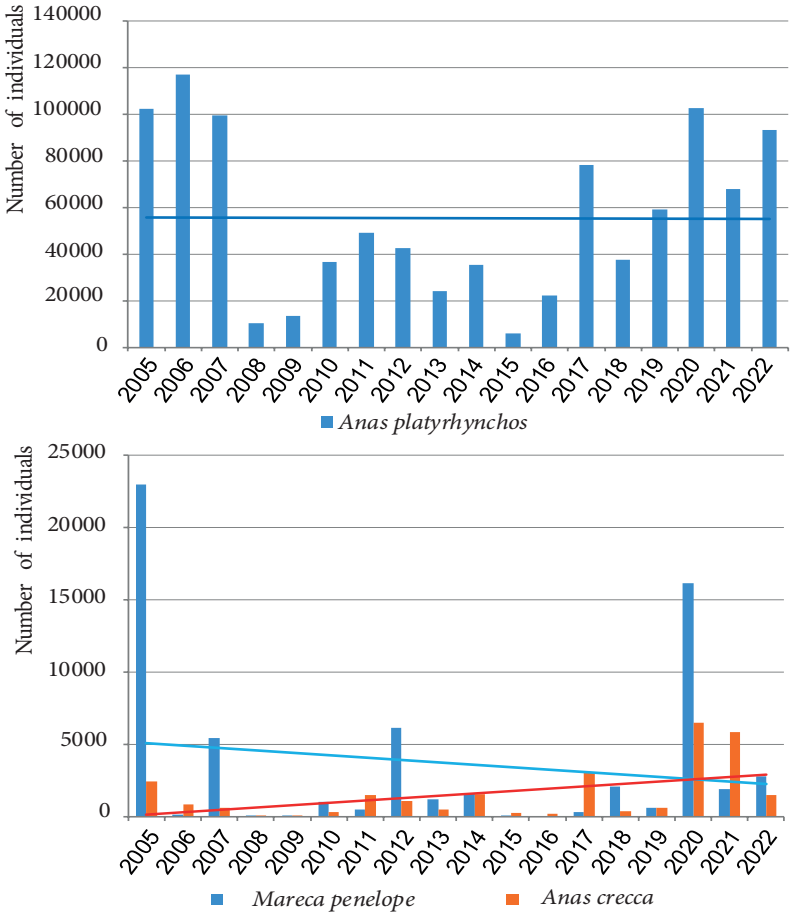

Fig. 5. Long-term dynamics of the number of the most numerous dubling ducks according to the results of winter censuses of 2005–2022 in the wetlands of the Azov-Black Sea region of Ukraine (lines — trends in the number of individuals).

Anas penelope and *A. crecca* were also abundant wintering species in the Azov-Black Sea region. The majority of *A. penelope* (94.2 %) was concentrated in four subregions — in the Southern part of Eastern Syvash (59.0 %), in the Northern part of Eastern Syvash (19.2 %), in the Karkinytski Wetlands (9.0 %) and in Tendrovsko-Yagorlytski Wetlands (6.9 %). It can be observed that the maximum numbers of this species per census were recorded in the southern part of Eastern Syvash (20,870 ind. in 2005), the Northern part of Eastern Syvash (12,400 ind. in 2005, 6,008 ind. in 2020 and 6,000 ind. in 2012), as well as in the Tendrovsko-Yagorlytski Wetlands (6,166 ind. in 2020). The majority of *A. crecca* (72.1 %) was concentrated in five subregions: in the Danube Wetlands (25.9 %), in the Karkinytski Wetlands (22.8 %), in the Tendrovsko-Yagorlytski Wetlands (9.9 %), in the Crimean Mountain Wetlands (7.0 %) and in the Tuzlovski Limans (6.5 %). The maximum numbers birds of this species per winter census were observed in the Danube Wetlands — 4,472 ind. in 2021 and 1,036 ind. in 2020, in the Karkinytski Wetlands — 3,012 ind. in 2017, in Tendrovsko-Yagorlytski Wetlands — 2,612 ind. in 2020 and in the Tuzlovski Limans — 1,109 ind. in 2020. In general, for 18 years, in the Azov-Black Sea the region has seen increasing of the number of *A. crecca* and a decreasing the number of *A. penelope* (fig. 5). Other species of river ducks — *A. acuta*, *A. strepera* and *A. clypeata* winter in the region regularly, but in small numbers, and *A. querquedula* — occurs there extremely rare and in very small numbers (during 18 years were recorded only 268 ind. in 2011 in the Danube Wetlands and 150 ind. in 2018 in the Tuzlovski Limans).

Aythyini. During the winter censuses 2005–2022 *Netta rufina, Aythya ferina*, *A. nyroca*, *A. fuligula* and *A. marila* were counted in the wetlands of the Azov-Black Sea region of Ukraine, of which the second and third species were the most numerous and widespread, making up 40.7 % and 41.1 % of all recorded of Aythyni, respectively. *A. ferina* is a common or, under favorable weather conditions, a numerous wintering species in the region. The majority of its individuals (59.6 %) in 2005–2022 were concentrated in three subregions — in the Danube Wetlands (32.9 %), Tarkhankutski Wetlands (16.3 %) and the Karkinitski Wetlands (10.4 %). The highest recorded numbers of *A. ferina* in a single winter census were observed in the Danube Wetlands, with 20,024 ind. in 2016, 15,304 in 2020 and 10,063 in 2011. The Northern part of Central Syvash also recorded high numbers, with 8,506 ind. in 2007, while the Tarkhankutski Wetlands and the Karkinytski Wetlands each recorded 5,436 ind. in 2013 and 5,680 in 2020, respectively. Northern Pryazovia also had a notable population, with 5,000 ind. recorded in 2006. *A. fuligula* was mainly located in sea water areas and other salty water bodies. In 2005–2022, the majority of individuals of this species (63.9 %) were concentrated in six subregions — in the Tiligulsko-Berezanski Wetlands (27.5 %), the Karkinytski Wetlands (15.0 %), in the Northern part of Eastern Syvash (11.3 %) and in the Danube Wetlands (10.0 %). The greatest number of *A. fuligula* observed in a single census was in the northern part of Eastern Syvash, with 13,891 ind. recorded in 2007 and 13,520 in 2005. Similarly, the Karkinytski Wetlands hosted 10,415 ind. in 2020 and 6,800 in 2022. The Danube Wetlands and Tiligulsko-Berezanski Wetlands also exhibited notable populations, with 9,550 and 9,000 ind., respectively, recorded in 2013 and 2008. Over the course of 18 years winter censuses, the number of the most numerous Aythyni had the opposite trends: number of *A. ferina* is increasing, and number of *A. fuligula* is decreasing (fig. 6). The amount of other Aythyni in the 2005–2022 winter censuses was small. *N. rufina* occurred irregularly and in small numbers — usually tens of individuals, sometimes hundreds, and, mostly, in the Crimea. Nevertheless, on occasion, the number of birds observed reached considerable levels. In 2017, a total of 10,500 ind. were observed in the Tarkhankutski Wetlands. In 2005, 6,132 ind. were recorded in the southern part of

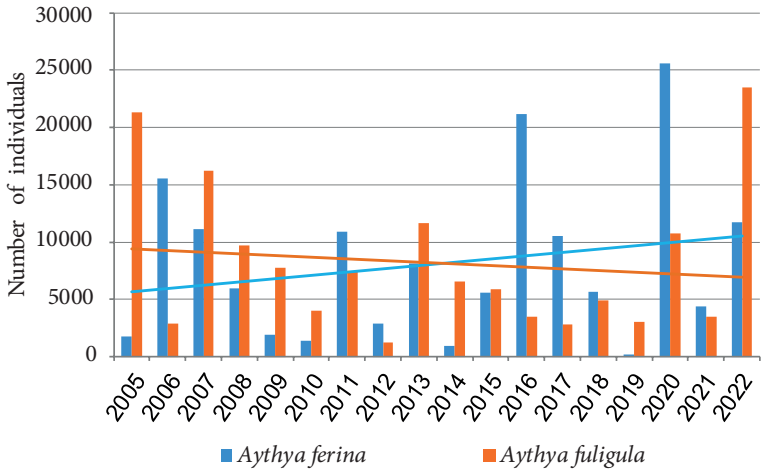

Fig. 6. Long-term dynamics of the number of the most numerous diving ducks according to the results of winter censuses of 2005–2022 in the wetlands of the Azov-Black Sea region of Ukraine (lines — trends in the number of individuals).

Eastern Syvash. In 2020, 2,500 ind. were observed in the Karkinitski Wetlands. Finally, in 2007, 2,170 ind. were recorded in the Utlyukski Wetlands. *A. nyroca* did not occur every year and only in single individual, very rarely in tens of individuals, and only three times more than a hundred birds were observed: 120 ind. — in the Odesa Limans in 2005, 180 ind. — in Tarkhankutski Wetlands in 2009 and 2,590 ind. — in the Danube Wetlands in 2006. *A. marila* also occurred irregularly and in small numbers (up to dozens of individuals), but during the rapid formation of ice cover or strong storms in the waters of the Black and Azov Seas, the birds moved to the coastal areas, where several times were observed large flocks of them: 300 ind. in 2013, 12,660 ind. in 2007 and 23,300 ind. in 2005 — in the Molochanski Wetlands, 609 ind. in 2014 in the Tuzlovski Limans, 350 ind.in 2016 in the Danube Delta and 300 ind. in 2017 in Northern Pryazovia.

Mergini. *Bucephala clangula* regularly winters in the Azov-Black Sea Region of Ukraine, the majority of the birds (79.2 %) in 2005–2022 was concentrated in five subregions — in the Tendrovsko-Yagorlytski Wetlands (23.3 %), in the Southern part of Eastern Syvash (20.2 %), in the Tiligulsko-Berezanski Wetlands (13.5 %), in the Northern part of Central Syvash (12.0 %) and in the Danube Wetlands (10.1 %). In some winters, the species formed large concentrations — 13,760 ind. in 2020 and 12,800 ind. in 2021 in the Tendrovsko-Yagorlytski Wetlands, 7,080 ind. in 2005 — in Molochanski Wetlands, 6,100 ind. in 2014 in the Northern part of Eastern Syvash and 6,068 ind.in 2005 in the Southern part of Eastern Syvash. Over the course of 18 years winter censuses, the number of *B. clangula* fluctuated significantly from year to year, but in general slightly increased (fig. 7). *Mergellus albellus*, *M. serrator* and *M. merganser* regularly winter in the region. *M. albellus* is a common species in wintertime in the region, the number of which can sometimes reach tens thousands under favorable weather conditions. The vast majority of individuals of this species (94.7 %) in 2005–2022 were concentrated in three subregions — in the Southern part of Eastern Syvash (85.9 %), in the Northern Pryazovia (4.7 %) and in the Danube Wetlands (4.1 %). In some winters, the species forms a concentrations of more than several thousands individuals, with maximum numbers per one census: 22,528 ind. in the Southern part of Eastern Syvasin in 2005, 4,250 ind. in the Northern Pryazovia in 2014, 3,586 ind. in the Northern part of Eastern Syvash in 2007 and 1,924 ind. in the Danube Wetlands in 2006.

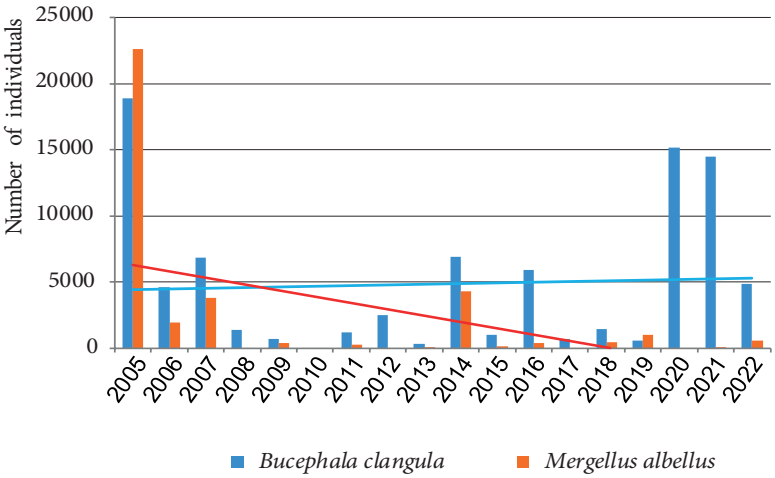

Fig. 7. Long-term dynamics of the number of the *B. clangula* and *M. albellus* according to the results of winter censuses of 2005–2022 in the wetlands of the Azov-Black Sea region of Ukraine (lines — trends in the number of individuals).

During 18 years of winter censuses, the number of *M. albellus* fluctuated greatly between years, but, in general, rapidly decreased (fig. 7). Other mergansers, *M. serrator* and *M. merganser*, are common wintering species in the region, the number of which in 2005–2022 usually not exceed hundred individuals per census, albeit in some cases was more than one thousand birds. High number of *M. serrator* was most often observed in the Tendrovsko-Yagorlytski Wetlands — 304 ind. in 2013, 345 ind. in 2017, 1,310 ind. in 2019, 5,061 ind. in 2020, 9,020 ind. in 2021 and 842 ind. in 2022, as well as in the Southern part of Eastern Syvash — 637 ind. in 2005, Dnipro-Bugski Wetlands — 360 ind. in 2005 and Dzharylgachski Wetlands — 300 ind. in 2022. The high number of *M. merganser* during winters 2005–2022 was in the Tuzlovski Limans — 300 ind. in 2009, in the Northern part of Eastern Syvash — 497 ind. in 2014, in Dzharylgachski Wetlands — 1,770 ind. in 2006, in the Northern Pryazovia (in the Bilosaraiskii Bay) — 2,131 ind. in 2014, 612 ind.in 2016 and 1,500 ind. in 2018.

Other species of Mergini — *Somateria mollissima, Melanitta fusca, Clangula hyemalis* are rare irregular wintering birds in the Azov-Black Sea region of Ukraine. *S. mollissima* from the beginning of the second half of the 20th century begun to nest in the region (Puzanov & Nazarenko, 1962) — almost exclusively in the Dnipro-Bugski and Tendrovsko-Yagorlytski Wetlands, where at the beginning of the 21st century its population already reached 7,000 ind. (Petrovich, 1999). In these subregions the species winters regularly, however, mostly in small numbers — up to several dozen individuals, with the exception of 910 ind. in 2005, 585 ind. in 2007 and 208 ind. in 2009. *C. hyemalis* irregularly occur to the region (Petrovich, Redinov, 2009; Kucherenko et al., 2017), and in winter census 2005–2022 it was recorded only three times — 2 ind. in Dnipro-Bugski Wetlands in 2005, 8 ind. in the Danube Delta in 2015 and 1 ind. in Tarkhankutski Wetlands in 2017. In the early 2000s, *M. fusca* wintered in the studied region almost every year, mostly in the area of the Dnipro-Bugski Liman and the Kinburnska Spit (Petrovich, 2003; Petrovich, Redinov, 2009), but in winter censuses 2005–2022 it occurred only one time — 6 ind. in the Danube Delta in 2015.

Oxyurini. *O. leucocephala* in the last decade winters in the Azov-Black Sea region more often than in previous years (Andryushchenko et al., 2013), and in winter censuses 2005–2022 it occurred only exclusively in the Crimea: 22 ind. in 2013, 12 ind. in 2016 and 71 ind.

in 2017 — on the western coast of Crimea (Lake Sakske), 10 ind. in 2012 in the north of the Kerch Peninsula, 1 ind. in 2014 in the Crimean Mountain Wetlands (Simferopol Reservoir), 2 ind. in 2017 in Tarkhankutski Wetlands (Lake Donuzlav) and 1 ind. in 2008 and 2015 — on the Southern coast of Crimea (Sevastopol bays).

Falconiformes. *Circus aeruginosus* and *Haliaeetus albicilla* regularly winter in the Azov-Black Sea region of Ukraine, although they are not numerous (Andryushchenko et al., 2006; Andryushchenko et al., 2012). The majority of C. *aeruginosus* (80.4 %) during 2005–2022 were concentrated in six subregions — in the Danube Wetlands (24.8 %), in the Southern part of Eastern Syvash (20.7 %), in the Western Prydunavia (15.8%), in the Western coast of the Crimea (7.4 %), in the Tuzlovski Limans (5.9 %) and in the Northern part of Central Syvash (5.8 %). Accordingly, the maximum number of this species were observed: in the Southern part of Eastern Syvash — 59 ind. in 2005, in the Danube Wetlands — 45 ind. in 2006, 38 ind. in 2021, 22 ind. in 2020 and 21 ind. in 2013 and 2018, in the Tuzlovski Limans — 25 ind. in 2020 and in the Western Prydunavia — 20 ind. in 2022. The majority of *H. albicilla* (68.8 %) during 2005–2022 were concentrated in six subregions: in the Southern part of Eastern Syvash (18.3 %), in the Tendrovsko-Yagorlytski Wetlands (13.7 %), in the Dnipro-Bugski Wetlands (11.6 %), in the Tiligulsko-Berezanski Wetlands (10.9 %), in the Danube Wetlands (8.5 %) and in the Northern part of Eastern Syvash (5.8 %). Accordingly, the maximum numbers of this species were observed at the following subregions: in the Tendrovsko-Yagorlytski Wetlands — 121 ind. in 2009 and 50 ind. in 2015, in the Dnipro-Bugski Wetlands — 73 ind. in 2008, in the Northern part of Eastern Syvash — 69 ind. in 2006 and in the Southern part of Eastern Syvash — 60 ind. in 2006 and 50 ind. in 2005. Over the course of 18 years, the number of *H. albicilla* in general rapidly decreased, while *C. aeruginosus* gradually increased (fig. 8).

Gruiformes. During winter censuses of 2005–2022, five species of this taxonomic group were recorded — *Grus grus, Rallus aquaticus, Porzana porzana, Gallinula chloropus* and *Fulica atra*, of which only the last one was numerous, and in some years even mass. After the formation of a solid ice cover on fresh water bodies, *F. atra* concentrated in large flocks in open marine shallow water areas. During 2005–2022 the majority of birds of this species (83.3 %) was concentrated in six subregions — in the Southern part of Eastern Syvash (30.4 %), in the Tarkhankutski Wetlands (19.1 %), in the Karkinytski Wetlands (12.9 %), in

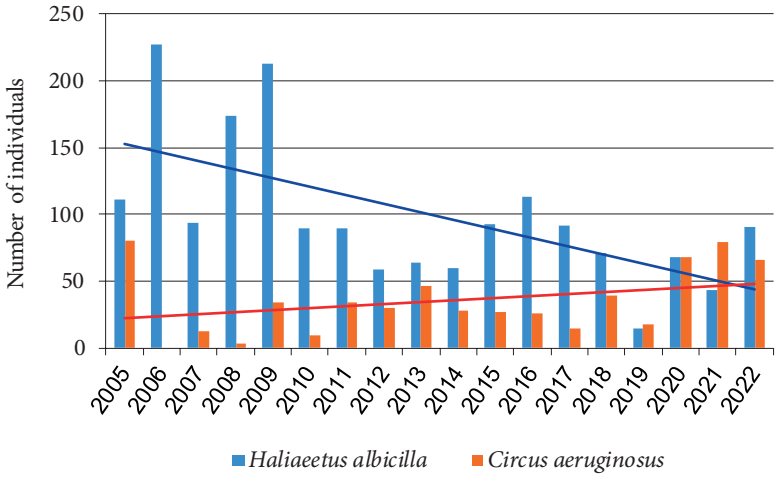

Fig. 8. Long-term dynamics of the number of the *Haliaeetus albicilla* and *Circus aeruginosus* according to the results of winter censuses of 2005–2022 in the wetlands of the Azov-Black Sea region of Ukraine (lines — trends in the number of individuals).

the Dniester Wetlands (8.4 %), on the Southern coast of Crimea (6.9 %) and in the Western Prydunavia (5.6 %). Accordingly, in these areas the maximum numbers per census of *F. atra* were observed: 69,480 ind. in 2005 — in the Southern part of Eastern Syvash; 26,000 ind. in 2011 — in the Northern part of Eastern Syvash; 22,833 ind. in 2009, 21,000 ind. in 2012 and 20,960 ind. in 2017 — in the Tarkhankutski Wetlands; 17,402 ind. in 2017 and 24,958 ind. in 2022 — in the Karkinytski Wetlands; 19,250 ind. in 2007 and 10,500 ind. in 2008 — in the Dniester Wetlands; 15,091 ind. in 2007 — in Utlyukski Wetlands; 13,540 ind. in 2022 — in the Western Prydunavia. Over the course of 18 years, the number of the species fluctuated somewhat over the years and generally decreased significantly (fig. 9). *G. grus* winters irregularly in the region in small numbers. In the censuses of 2005–2022 it occurred only five times: 2 ind. in 2005 — in the Southern part of Central Syvash; 16 ind. in 2017 and 23 ind. in 2021 — in Velykyi Chapelsky Pid; 16 ind. in 2017 and 350 ind. in 2022 — in the Velykyi Chapelskyi Pid (Northern Prisyvashshia). *R. aquaticus, P. porzana* and *G. chloropus* — are mostly kept in dense thickets of vegetation and therefore are almost never recorded, which makes it impossible to estimate even their approximate number, and its long-term trends. So, during 18 years were recorded only 37 ind. *R. aquaticus*, 2 ind. *P. porzana* and 290 ind. *G. chloropus*.

Charadriiformes. During winter censuses 2005–2022 were recorded 32 species of this taxonomic order, among which: 18 species of waders (*Haematopus ostralegus, Recurvirostra avosetta, Vanellus vanellus, Pluvialis apricaria, P. squatarola, Charadrius hiaticula, C. alexandrinus, Numenius phaeopus, N. arquata, Tringa totanus, T. ochropus, Arenaria interpres, Scolopax rusticola, Gallinago gallinago, Lymnocryptes minimus, Calidris canutus, C. alba, C. alpina*), 1 species of squa (*Stercorarius pomarinus*), 10 species of gulls (*Larus canus, L. argentatus, L. cachinnans, L. fuscus, L. ichthyaetus, L. melanocephalus, L. ridibundus, L. genei, L. minutus, Rissa tridactyla*) i 3 species of terns (*Chlidonias hybridus, C. leucopterus, Sterna sandvicensis*).

Among waders, regularly, but in small numbers winters *P. squatarola, V.vanellus, R. avosetta, G. gallinago* and *S. rusticola*, as well *C. alpina* and *N. arquata*, which in some years are common. The majority of *C. alpina* (86.5 %) during 2005–2022 was concentrated in five subregions: — in the Dnipro-Bugski Wetlands (40.5 %), in the Tuzlovski Limans (13.9 %), in the Tendrovsko-Yagorlytski Wetlands (12.9 %), in the Southern part of Central Syvash (12.3 %) and in the Danube Wetlands (6.9 %). Accordingly, the maximum num-

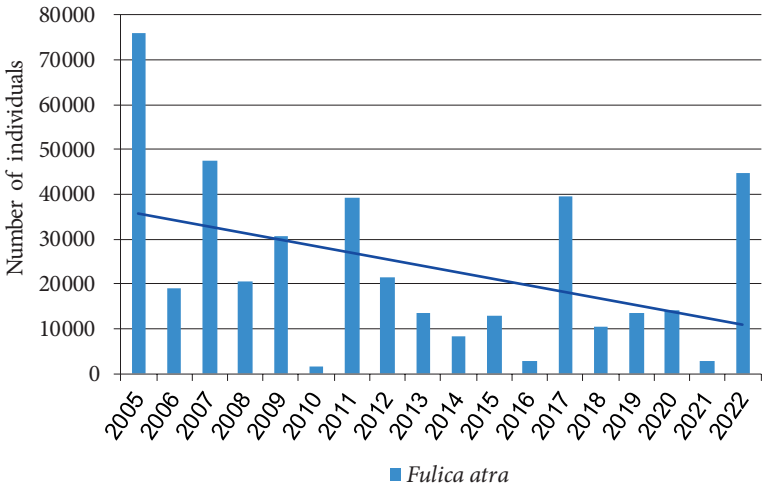

Fig. 9. Long-term dynamics of the number of the *F.atra* according to the results of winter censuses of 2005–2022 in the wetlands of the Azov-Black Sea region of Ukraine (lines — trends in the number of individuals).

bers of *C. alpina* per one winter census were recorded: 1,100 ind. in 2014 and 1,000 ind. in 2007 in the Dnipro-Bugski Wetlands, 1,000 ind. in 2005 in the Dnipro-Bugski Wetlands and 980 ind. in 2020 in the Tuzlovski Limans. *N. arquata* during 2005–2022 mainly concentrated (73.3 %) in four subregions: Danube Wetlands (29.2 %), Dnipro-Bugski Wetlands (18.5 %), Tendrovsko-Yagorlytski Wetlands (15.4 %) and Tuzlovski Limans (10.3 %). In these areas were observed the maximum numbers of birds per one census: 123 ind. in 2007 in the Dnipro-Bugski Wetlands, 118 ind. in 2019 and 100 ind. in 2012 in the Tendrovsko-Yagorlytski Wetlands, 100 ind. in 2014 and 99 ind. in 2006 in the Danube Wetlands. Over the course of 18 years, the number of *C. alpina* and *N. arquata* fluctuated significantly between years and generally decreased, quite rapidly in the case of the first species and gradually in the case of the second one (fig. 10).

Numbers of other species of waders in the winter period are very few in the Azov-Black Sea region of Ukraine and occur quite irregularly or only occasionally attended it (Petrovich, Redinov, 2006; Diadicheva, Zhmud, 2013; Andryuschenko, Popenko, 2016), which is confirmed by the winter censuses 2005–2022. (table 1). The ice cover of shallow water areas, where waders feed, is a main limitation for the presence of them in the studied region (Andryuschenko, 2015).

Skuas. During winter censuses 2005–2022 only *Stercorarius pomarinus* was recorded once — 1 individual in the Molochanski Wetlands in 2011.

Gulls. Among gulls wintering in the region, *Larus canus*, *L. ridibundus* and *L. cachinnans* are regularly the most numerous, *L. ichthyaetus* winters irregularly and in small numbers, and *L. genei* and *L. minutus* usually presented by single or a few individuals, *L. argentatus* and *L. fuscus* — are very rare in winter time. The majority *of L. canus* (86.8 %) during winters 2005–2022 was concentrated in five subregions: Molochanski Wetlands (48.9 %), Odesa Limans (7.5 %), Utlyukski Wetlands (7.5 %), Northern part of Eastern Syvash (6.8 %), Southern coast of Crimea (6.3 %), Northern Pryazovia (5,5 %) and Northern part of Central Syvash (4.3 %). The maximum numbers of this species per one winter census were observed: in the Molochanski Wetlands — 25,843 ind. in 2007, 22,765 ind. in 2005, 22,570 ind. in 2013, 17,620 ind. in 2016 and 15,056 ind. in 2011; in the Utlyukski Wetlands — 7,580 ind. in 2007; in the Northern part of Central Syvash — 6,142 ind. in

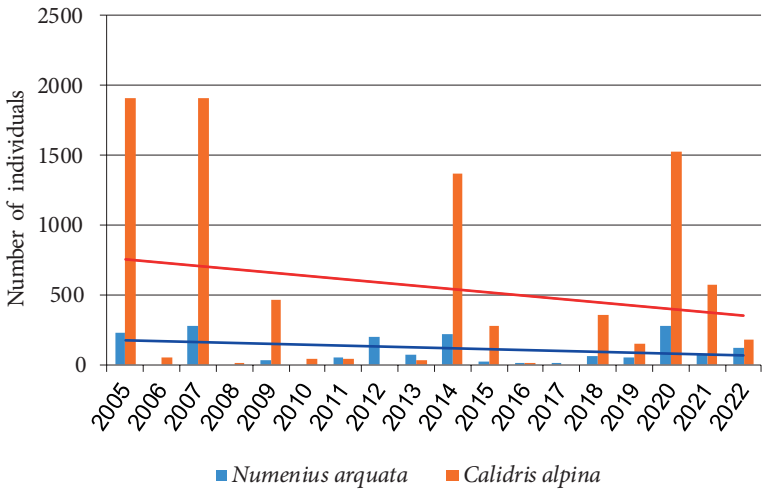

Fig. 10. Long-term dynamics of the number of the *Numenius arquata* and *Calidris alpina* according to the results of winter censuses of 2005–2022 in the wetlands of the Azov-Black Sea region of Ukraine (lines — trends in the number of individuals).

Table 1. The number and areas of occurrence of small number and rare wader species according to the results of winter censuses 2005–2022 in the wetlands of the Azov-Black Sea region of Ukraine

Species	Number of individuals		Sub-regions
Haematopus ostralegus	37	32	Dnipro-Bugski Wetlands
		5	Tendrovsko-Yagorlytski Wetlands
Recurvirostra avosetta	8	8	Danube Wetlands
Vanellus vanellus	18	12	Karkinitski Wetlands
		2	Southern coast of Crimea
		2	Danube Wetlands
		1	Tendrovsko-Yagorlytski Wetlands
		1	Northern part of Central Syvash
Pluvialis apricaria	120	110	Tarkhankutski Wetlands (Lake Donuzlav)
		10	Crimean Mountain Wetlands (Mizhgorne reservoir)
Pluvialis squatarola	451	150	Southern part of Eastern Syvash
		78	Dnipro-Bugski Wetlands
		77	Tendrovsko-Yagorlytski Wetlands
		74	Tuzlovski Limans
		25	Northern part of Eastern Syvash
		24	Molochanski Wetlands
		23	Danube Wetlands
Charadrius hiaticula	7	5	Danube Wetlands
		2	Dnipro-Bugski Wetlands
Charadrius alexandrinus	3	2	Tendrovsko-Yagorlytski Wetlands
		1	Dnipro-Bugski Wetlands
Numenius phaeopus	3	1	Northern part of Eastern Syvash
		2	Danube Wetlands
Tringa totanus	1204	1201	Tarkhankutski Wetlands (Lake Donuzlav)
		2	Southern coast of Crimea
		1	Danube Wetlands
Tringa ochropus	4	3	Northern part of Central Syvash
		1	Danube Wetlands
Arenaria interpres	11	6	Dnipro-Bugski Wetlands (Kinburn Peninsula)
		5	Tuzlovski Limans
Scolopax rusticola	2	1	Northern part of Eastern Syvash
		1	Molochanski Wetlands
Gallinago gallinago	53	18	Danube Wetlands
		14	Tuzlovski Limans
		8	Tendrovsko-Yagorlytski Wetlands
		4	Northern part of Central Syvash
		3	Northern part of Eastern Syvash
		2	Southern part of Eastern Syvash
		2	Tarkhankutski Wetlands
		1	Northern Wetlands of Kerch peninsula
		1	Southern coast of Crimea
Lymnocryptes minimus	1	1	Northern part of Eastern Syvash
Calidris canutus	322	125	Dnipro-Bugski Wetlands
		118	Tuzlovski Limans
		51	Danube Wetlands
		23	Karkinitski Wetlands
		4	Northern part of Eastern Syvash
		1	Tendrovsko-Yagorlytski Wetlands
Calidris alba	121	54	Dnipro-Bugski Wetlands
		51	Dnipro-Bugski Wetlands (Kinburn Peninsula)
		15	Danube Wetlands
		1	Tendrovsko-Yagorlytski Wetlands

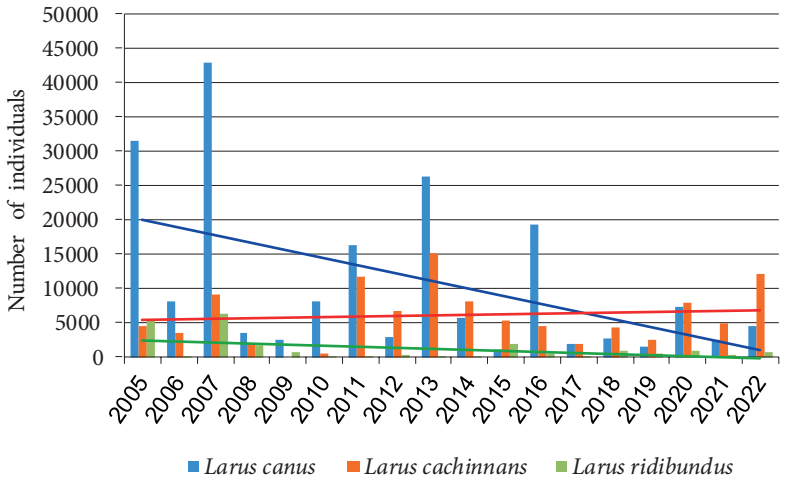

Fig. 11. Long-term dynamics of the number of the most numerous gulls according to the results of winter censuses of 2005–2022 in the wetlands of the Azov-Black Sea region of Ukraine (lines — trends in the number of individuals).

2010; in the на Northern part of Eastern Syvash — 5,154 ind. in 2007. *L. ridibundus* during winters 2005–2022 mainly (78.0 %) was concentrated in three subregions — Odesa Limans (42.2 %), Southern coast of Crimea (26.8 %) and Dniester Wetlands (9.1 %). The maximum numbers of this species per one winter census were observed in the Odesa Limans — 3,700 ind. in 2005 and 2,062 ind. in 2007 p., in the Dniester Wetlands — 2,800 ind. in 2007, as well as at the Southern coast of Crimea — 2,144 ind. in 2008. *L. cachinnans* in winters 2005–2022 mainly (64.6 %) was located in five subregions: Northern Pryazovia (23.7 %), Dnipro-Bugski Wetlands (11.5 %), Crimean Plain Wetlands (9.2 %), Molochanski Wetlands (7.1 %), Tendrovsko-Yagorlytski Wetlands (7.0 %) and Danube Wetlands (6.2 %). The maximum numbers of the species per one winter census were observed in the Northern Pryazovia — 9,478 ind. in 2022, 7,907 ind. in 2013 and 3,326 ind. in 2012; in the Dnipro-Bugski Wetlands — 6,300 ind. in 2014; in the Molochanski Wetlands — 4,891 ind. in 2011 and 3,349 ind. in 2013; in the Tendrovsko-Yagorlytski Wetlands — 4,501 ind. in 2020. Over the course of 18 years, the number of *L. canus*, *L. ridibundus* and *L. cachinnans* greatly fluctuated between years, and for the first two species it in generally decreased (rather rapidly for *L. canus*), and slightly increased in the last species (fig. 11).

Coraciiformes. *Alcedo atthis* quite rare winters in the Azov-Black Sea region of Ukraine, during censuses 2005–2022 only 5 individuals were registered.

Discussion

Summarizing the data of the winter censuses 2005–2022, regularly mass (> 10,000 ind. per census) water birds in the Azov-Black Sea Region of Ukraine were *Anser albifrons*, *A. platyrhynchos*, *Fulica atra* and *Larus canus*, which total share was 60.9 % of the amount of all counted species. The most numerous of them was *Anas platyrhynchos* (table 2), and the most widespread in the region — *L. canus.*

Cygnus olor, Rufibrenta ruficollis, Tadorna tadorna, Anas penelope, Aythya ferina, A. fuligula, A. marila, Larus cachinnans were usually numerous (1000–10000 ind. per census), and in some winters *Netta rufina, Bucephala clangula* and *Mergellus albellus* also belonged to this category. The total share of these species reached 37.3 % of the amount of all counted species.

Table 2. Gradation of the number of water birds in the Azov-Black Sea region of Ukraine according to winter census 2005–2022

N	Species	Number of ind. per census	Nunber range	Category by number
1	*Anas platyrhynchos*	55,491.06	>10000	mass
2	*Anser albifrons*	24,122.06		
3	*Fulica atra*	23,323.00		
4	*Larus canus*	10,572.83		
5	*Tadorna tadorna*	9,897.06	1,000–10,000	numerous
6	*Aythya fuligula*	8,154.00		
7	*Aythya ferina*	8,087.94		
8	*Cygnus olor*	7,483.50		
9	*Larus cachinnans*	5,898.94		
10	*Bucephala clangula*	4,879.56		
11	*Branta ruficollis*	4,076.06		
12	*Anas penelope*	3,495.94		
13	*Tadorna ferruginea*	3,038.06		
14	*Cygnus cygnus*	2,245.50		
15	*Aythya marila*	2,098.78		
16	*Mergellus albellus*	2,024.89		
17	*Anas crecca*	1,520.94		
18	*Phalacrocorax carbo*	1,483.94		
19	*Anser anser*	1,410.50		
20	*Netta rufina*	1,351.11		
21	*Larus ridibundus*	1,253.33		
22	*Mergus serrator*	1,141.44		
23	*Mergus merganser*	583.72	100–1,000	common
24	*Calidris alpina*	495.28		
25	*Anas acuta*	378.72		
26	*Phalacrocorax pygmaeus*	262.44		
27	*Podiceps cristatus*	216.50		
28	*Aythya nyroca*	161.61		
29	*Casmerodius albus*	127.28		
30	*Podiceps nigricollis*	118.56		
31	*Somateria mollissima*	106.44		
32	*Haliaeetus albicilla*	98.22	10–100	small number
33	*Numenius arquata*	95.89		
34	*Larus minutus*	78.17		
35	*Ardea cinerea*	72.28		
36	*Tringa totanus*	67.17		
37	*Anas clypeata*	44.06		
38	*Larus ichthyaetus*	34.61		
39	*Circus aeruginosus*	34.28		
40	*Tachybaptus ruficollis*	25.33		
41	*Pluvialis squatarola*	25.06		
42	*Phalacrocorax aristotelis*	24.00		
43	*Anas querquedula*	23.28		
44	*Grus grus*	22.61		
45	*Pelecanus crispus*	20.17		
46	*Calidris canutus*	18.61		
47	*Anas strepera*	16.17		
48	*Gallinula chloropus*	16.11		
49	*Cygnus (columbianus) bewickii*	9.06	< 10	rare
50	*Larus genei*	7.78		
51	*Calidris alba*	6.89		
52	*Numenius phaeopus*	6.78		
53	*Pluvialis apricaria*	6.72		
54	*Gavia arctica*	6.67		
55	*Oxyura leucocephala*	6.67		
56	*Anser fabalis*	6.00		
57	*Larus melanocephalus*	5.06		
58	*Larus argentatus*	3.89		
59	*Gallinago gallinago*	3.22		
60	*Egretta garzetta*	3.00		
61	*Podiceps auritus*	2.78		
62	*Haematopus ostralegus*	2.61		
63	*Rallus aquaticus*	2.06		
64	*Botaurus stellaris*	1.72		
65	*Vanellus vanellus*	1.00		
66	*Anser erythropus*	0.94		
67	*Chlidonias leucopterus*	0.83		
68	*Podiceps grisegena*	0.72		
69	*Arenaria interpres*	0.72		
70	*Chlidonias hybridus*	0.72		
71	*Sterna sandvicensis*	0.72		
72	*Clangula hyemalis*	0.61		
73	*Tringa ochropus*	0.50		
74	*Recurvirostra avosetta*	0.44		
75	*Melanitta fusca*	0.39		
76	*Charadrius hiaticula*	0.39		
77	*Alcedo atthis*	0.28		
78	*Ciconia ciconia*	0.17		
79	*Platalea leucorodia*	0.17		
80	*Charadrius alexandrinus*	0.17		
81	*Stercorarius pomarinus*	0.17		
82	*Gavia stellata*	0.11		
83	*Pelecanus onocrotalus*	0.11		
84	*Porzana porzana*	0.11		
85	*Scolopax rusticola*	0.11		
86	*Puffinus puffinus*	0.06		
87	*Ardeola ralloides*	0.06		
88	*Nycticorax nycticorax*	0.06		
89	*Phoenicopterus ruber roseus*	0.06		
90	*Lymnocryptes minimus*	0.06		
91	*Larus fuscus*	0.06		
92	*Rissa tridactyla*	0.06		
	Total	186,307.7		

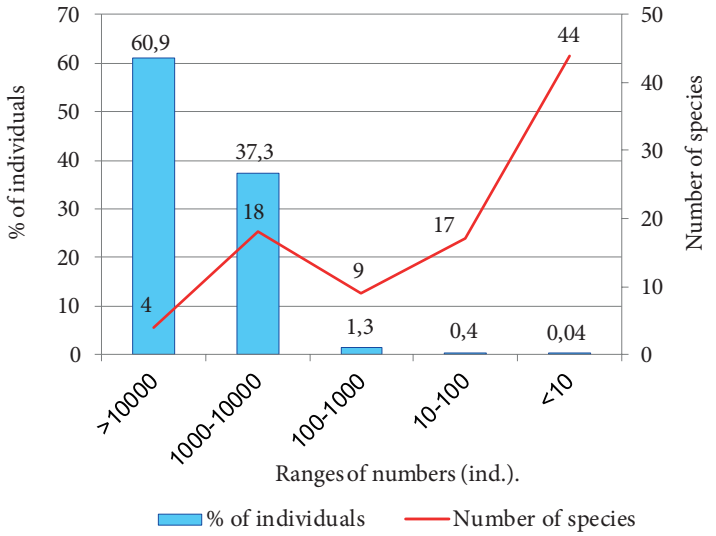

Fig. 12. Ratio of different quantitative categories of waterbirds in the Azov-Black Sea region of Ukraine according to the results of winter censuses 2005–2022.

The total share of 4 mass and 18 numerous species was more than 98 % (60.9 % and 37.3 %, respectively) of the total amount of all counted water birds and determine the long-term trends of the total number of wintering birds in the region (fig. 12).

Common waterbird species (100–1000 ind. per census) were as follows: *Podiceps cristatus, Phalacrocorax carbo, P. pygmaeus, Calidris alba, Anser anser, Cygnus cygnus, Tadorna ferruginea, Anas crecca, A. acuta, A. clypeata,* and in some winters also — *Mergellus serrator, M. merganser, Calidris alpina, Larus ridibundus, L. minutus, Somateria mollissima*. The total share of them was 1.3 % of all wintering water birds.

Other wetland bird species in the studied region were either in small numbers (10–100 ind. per census) or very rare (< 10 ind. per census)) and their shares were 0.4 % and 0.1 % respectively (fig. 12).

The multi-year number of water birds wintering in the studied region fluctuated significantly and in generally decreased (fig. 13). The largest total number of birds was counted in 2005 — 423,955 ind. and with birds not identified to species — 593,226 ind. Other years with big amount of birds were the following (in descending order): 2007 — 397,008 / 441,866 ind., 2020 — 310,047 / 352,746 ind., 2006 — 281,574 / 308,478 ind. and 2022 — 278,289 / 290,409 ind. The small numbers of birds were noted in 2009 – 88,097 / 95,660 ind., in 2008 — 85,068 / 87,566 ind., in 2010 — 79,498 / 80,391 ind. and in 2015 — 47,406 / 56,772 ind.

The highest numbers of species (in descending order) were recorded in the following years: 2007 — 63 species, 2005 — 59 and 2020 — 58. The lowest numbers of species were recorded in 2017 — 41, 2012 — 39 and 2010 — 38.

The most valuable for maintaining the wintering birds were the Southern part of Eastern Syvash (up to 20.0 % of all wintering waterbirds of the region), the Karkinytski Wetlands (up to 11.5 %) and the Northern part of Eastern Syvash (up to 11.5 %) (fig. 14). In total all parts of Syvash (Western, Central and Eastern) support up to 38.1 % of birds wintering in the Azov-Black Sea region of Ukraine. Among other areas important for wintering birds it is worse to mention Tendrovsko-Yagorlytski Wetlands (4.9 %), Danube Wetlands (4.7 %) Tarkhankutski Wetlands (4.3 %) and Molochanski Wetlands, including adjacent part of Azov Sea (4.2 %).

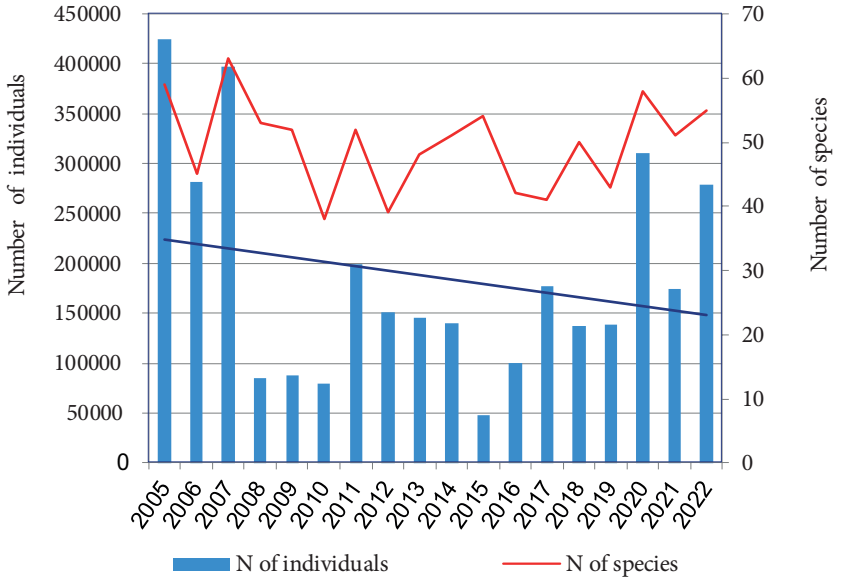

Fig. 13. Long-term dynamics of the number of the waterbirds according to the results of winter censuses of 2005–2022 in the wetlands of the Azov-Black Sea region of Ukraine (lines — trends in the number of individuals).

The spatial distribution of wintering waterbirds birds in the wetlands of the Azov-Black Sea region depends mostly on the presence of large shallow water bodies without ice cover and for species that feed mainly on dry land (geese, some swans and gulls etc.), also from closeness of feeding areas to such water bodies (Andryushchenko, 2015). In all the mentioned wetlands, important for wintering water birds, large areas are occupied by shallow saline and hypersaline waters, which during the winter are almost not covered by ice and therefore are available for

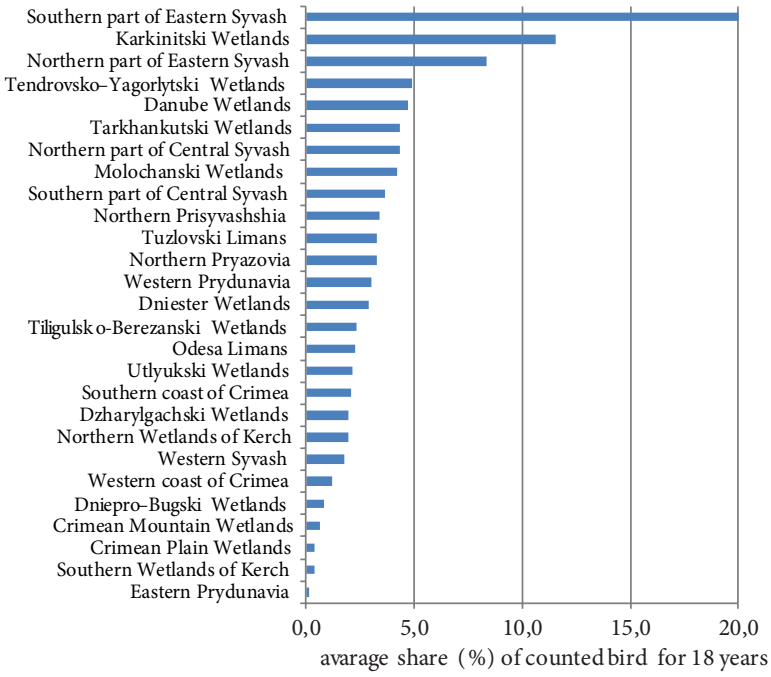

Fig. 14. The ratio of the number of waterbirds between the subregions of the Azov-Black Sea region of Ukraine according to the results of winter censuses 2005–2022.

feeding and resting of a significant number of birds. In the case of the formation of a strong ice cover on fresh and moderately salty water bodies, a significant number of water birds concentrate on such water bodies (Andryuschenko et al., 2012), or even move beyond the borders of the Azov-Black Sea region of Ukraine, mainly to the Western and Southern Black Sea Regions (Balkan and Asia Minor coast of the Black Sea). For a short time local redistribution occurs during large storms, when birds mostly from large shallow water sea areas (for example, from the remote areas of the Karkinitski Bay and the Sea of Azov) move to small bays, lakes and estuaries protected from the wind, where their numbers temporarily reaches large values.

Conclusions

The results of the winter censuses conducted between 2005 and 2022 indicate a significant fluctuation in the number of water birds in the Azov-Black Sea region of Ukraine, with a general decline in the total population. The long-term trends were determined by four mass and eighteen numerous species, which collectively accounted for approximately 98 % of the total number of wintering birds (60.9 % and 37.3 %, respectively).

The most significant factors influencing the maintenance of wintering birds were identified as Syvash and several subregions, predominantly the Danube Wetlands, Tendrovsko-Yagorlytski Wetlands, Karkinitski Wetlands and Tarkhankutski Wetlands. In particular, they provided a habitat for numerous rare species of birds (Red Book of Ukraine, 2009), which regularly form large winter concentrations in the Azov-Black Sea region of Ukraine, including *Branta ruficollis, Bucephala clangula, Phalacrocorax pygmaeus, Tadorna ferruginea, Mergellus serrator, Somateria mollissima*, and others.

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