

SPECIES DIVERSITY OF WETLAND BIRDS, DEPENDING ON AREA, OVERGROWTH OF WATER BODIES ON THE EXAMPLE OF SOVSKIE PONDS (UKRAINE)

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The influence of macrophyte pond overgrowth conditions on the formation of wetland avifauna was considered. The model reservoirs were Sovsky ponds (Kyiv, Ukraine). In the course of the research it was established that the largest number of species and the density of nesting pairs of wetland birds on pond with an overgrowth area of up to 45%. In turn, the pond with an overgrowth area of up to 10% was characterized by the smallest species diversity. In ponds with macrophyte overgrowth areas of 45-65%, the dominant species was found to be the common martin, the share of which was 27-51.72%, respectively. At the pond with an overgrowth area of 90%, the dominant species were coots and mallards, which accounted for 25%. To assess biodiversity, the Shannon Index was calculated, which was the highest in ponds with overgrowth areas of 55-65%. Taking into account the peculiarities of avifauna formation in conditions of natural succession on Sovskie ponds, it is possible to predict the negative and positive consequences of overgrowing areas in other water bodies of the metropolis. The data obtained can be used to further improve the ecological state of individual water bodies of the cascade by managing water resources.

Key words: waterfowl, ponds, area overgrown, macrophytes, Shannon Index, biodiversity.

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INTRODUCTION

Anthropogenic transformation of the natural environment is gaining momentum in the countries of Eastern Europe. The city of Kiev is no exception. There are many natural and artificial reservoirs here. A significant part of water bodies is in unsatisfactory condition or is load to excessive recreation. It is known that artificially created reservoirs, in particular rates, can support and enhance natural biodiversity freshwater providing the complexity of wetland ecosystems. Aquatic macrophytes play a

leading role in this. (Damjanović et al. 2018, (Oertli 2018). As a result of the uncontrolled destruction of thickets of higher aquatic plants, there is a fluctuation in the number and species composition of aquatic animals, since their habitat is destroyed (places of feeding, breeding, hiding places). The transformation of biotopes is one of the main reasons for the disappearance of various species of animals, including birds. (Dudgeon et al. 2006). It is the macrophyte groupings that create the numerous settlements that are important for the conservation of biological diversity (Thomaz

&, da Cunha 2010). Therefore, monitoring the state of populations of waterbirds under the influence of overgrowth of water bodies with macrophytes is one of the main priorities for the development and improvement of the water resources management system in large cities, in particular those affected by urbanization. That is why the purpose of the work was to study the biological diversity of waterfowl, depending on the overgrowth of reservoirs with higher aquatic plants.

MATERIAL AND METHODS

The areas for research were the reservoirs of the Sovskie ponds located in the city of Kiev (Ukraine). The reservoirs have the following coordinates $50^{\circ} 24'33''$ «n.1 $29^{\circ}54''$ » e. l. The cascade of reservoirs includes 11 ponds with an area of 19.1 hectares (Fig 1).

This is a former fish farm, where fish breeding activities have not been carried out for more

than 30-40 years. That is why processes of natural succession take place in reservoirs, which consists in uncontrolled overgrowing of reservoirs with higher aquatic plants, as well as processes of silting of the bottom. The reservoirs are used as sport fishing. To determine the composition and abundance of avifauna, a modified method of double control was used (Bejek et al. 1990). At each of the ponds during the season (half of May and the first half of June), two counts were carried out. The estimation of the number was carried out on the basis of counting birds, taking into account individual approaches and taking into account the characteristics of the nesting herd of certain species. -Non-nesting species are not included. They were considered the dominant species, accounting for more than 10%. To assess the degree of overgrowth the method of route mapping of coastal water macrophytes using aerophotosemming. For the study, 5 ponds were selected with different areas of overgrowth with macrophytes, in particular, communities of the following species: common reed, narrow-



Fig.1. Map of the study areas.

leaved cattail and broad-leaved cattail. The first pond - 45% overgrown, the second - 90%, the third - 55%, the fourth - 65%, the fifth - 10%. The objects of the study were waterfowl and waterfowl. The overgrown area was estimated using a drone. Statistical processing of data, in particular the Shannon index, was carried out according to (Shannon & Weaver 1949).

RESULTS AND DISCUSSIONS

Studying the aquatic environment, in particular the taxa of organisms confined to wetland ecosystems, one must carefully pay attention to the peculiarities of the relationships in them between its various components. The disappearance of one of these components can lead to the destruction of these bonds, will be reflected in the future on biological diversity. It is macrophytes that play an essential role in ensuring the ecological balance in the aquatic environment. Small ponds are especially valuable in city parks, where it is quite easy to monitor their condition and, if necessary, improve it. It should be noted that due to the conservation of biotopes, Sovsky Ponds, located in the urbanized part of Kyiv, form refugia of biological diversity. They play an important role in the existence and migration of waterfowl. Among the registered species were those protected by the Berne and Bon Conventions, which confirms the importance of this area.

In total, 27 species were registered at Sovsky ponds. According to the residence status, migratory species were the most represented group. An important component of waterfowl groups is the flying group. A striking example of such birds were large teals, common tern, gray heron. Let us dwell in more detail on the analysis of nesting species of waterfowl. During the research, we identified 10 breeding species belonging to 5 rows, in particular Podicipediformes (1), Ciconiiformes (1), Anseriformes (3) (1), Gruiformes (3) and Charadriiformes (1) (Fig.2).

The research results showed that the largest number of species was registered at the pond, which had an area of overgrowth with macrophytes of 45% (9 species). In contrast to this, ponds, where the area of overgrowth with macrophytes was 10 or 90%, respectively, the number of species decreased proportionally (4 and 5, respectively) (Fig 3.). One of the important indicators for characterizing groups of animals, in particular birds, is the density of their groupings. It was shown that the largest number of nesting pairs of waterbirds was recorded in a water body with an overgrown area of up to 45% (37 pairs). Interestingly, under conditions of insignificant overgrowth of the reservoir with aquatic plants, the density of nesting groups is also the lowest (5 pairs) (Fig. 4).

Subsequently, we considered the structure of nesting groups in each of the studied water bodies. Differences in the avifauna of the

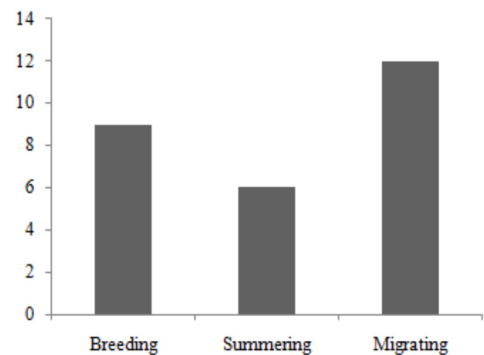
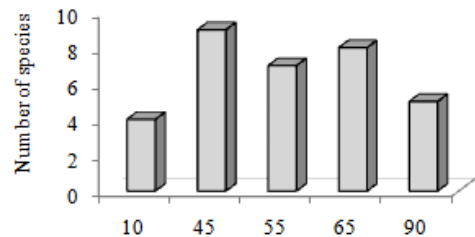


Fig. 2 The status of birds in the study area.



□ The percentage of overgrowing of the ponds

Fig. 3. The number of nesting bird species depending on the area overgrown with macrophytes.

studied ponds are associated with the formation of macrophyte cenoses. The following species were common to all the studied ponds: Coot *Fulica atra*, Water Hen *Gallinula chloropus*, and Mallard *Anas platyrhynchos*. This is due to the high level of plasticity and lability of these species with respect to environmental factors. In ponds with areas overgrown with macrophytes of 45-65%, common gull were found as the dominant species, the share of which was 27-51.72%, respectively. On a pond with an area of overgrowth of 90%, the dominant species were coot and mallard, the proportion of which was 25% (Fig. 5).

In the future, to assess the species diversity, we determined the Shannon index. It is known that this index is informative, since it reflects the complexity of the structure of communities. Not being an index of species richness, it reveals a complex dependence on the number of species. Therefore, it is suitable for assessing species diversity. According to the results of the study, it was found that in water bodies where the area of overgrowth was 55 and 65%, respectively, the Shannon index was high and amounted to 3.08 and 2.86, respectively. The lowest species richness was characterized by the rates of overgrowth areas of 5 and 90%, respectively (Fig. 6). This can be explained by the lack of a number of necessary conditions for specialized species (Crested Duck *Aythya fuligula*, little grebe *Podiceps ruficollis*, Black-headed Gull

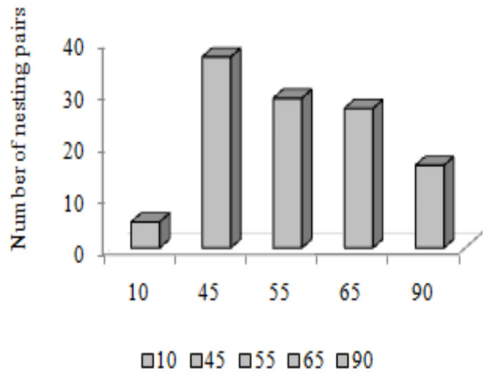


Fig. 4. The number of nesting pairs depending on the area overgrown with macrophytes.

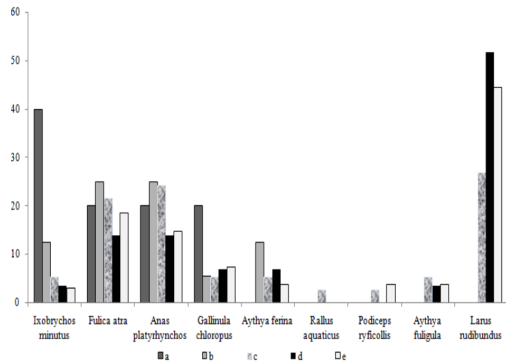


Fig 5. Percentage of species under conditions of overgrowth of a reservoir with macrophytes, a - 5% overgrowth, b - 90% overgrowth, c - 45% overgrowth, d - 55% overgrowth, e - 65% overgrowth.

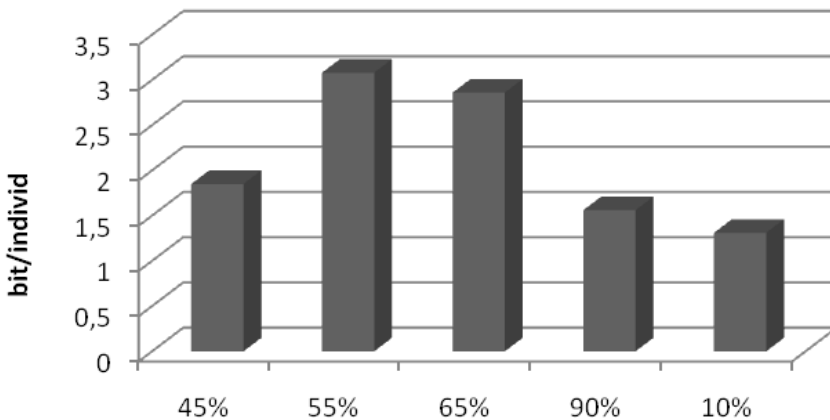


Fig 6. Shannon Index of nesting bird species depending on the area overgrown with macrophytes.

Larus ridibundus). It should be noted that there are no colonies of black-headed gulls in reservoirs with an overgrown area of 10 and 90%. A sufficient number of underwater plants, in particular *Ceratophyllum submersum*, are required for nesting of the little grebe. These plants were absent in the pond, the overgrown area of which was 90%. In addition, to build a nest, this species uses dense thickets of coastal vegetation, which was absent in a reservoir with an overgrown area of up to 10%.

The results obtained show that excessive overgrowth of water bodies with macrophytes negatively affects the ecological conditions and determines the structure of the ornithocenosis. Management activities are a priority, since the excess of aquatic vegetation in the city's water bodies is an irrational use of natural resources, ultimately reducing biological diversity. Controlled removal of higher aquatic plants to a certain amount will increase the biological diversity of invertebrates, fish and birds, in particular in the era of global climate change and lack of fresh water sources (Borgwardt et al. 2019).

The importance of macrophytes in the formation of the trophostructure of the avifauna was considered. 3 trophogroups were found:

panthophages, panthozophages, ichthyophages. In the pond, where the overgrowth area was 90%, pantozoophages were absent in the group of nesting species. The highest ratio of ichthyophages was found in water bodies with overgrowth areas of 65 and 45%, respectively. It should be noted that panthophages are most represented on the ponds (10 and 90% of overgrowth) and amounted to 75 and 80%, respectively (Fig 7).

The results obtained indicate that the grouping of macrophytes, in particular reed and cattail, affects not only the number and species composition of waterfowl, but also play an important role in the formation of the ecostructure of the avifauna, in particular the trophostructure.

CONCLUSIONS

1. The results of the research showed that the largest number of species was registered at the pond, which had an area of overgrowth with macrophytes of 45% (9 species). In turn, at rates that had an area of overgrowth of 10 or 90%, the number of species was 4 and 5, respectively.
2. It was found that the highest density of nesting

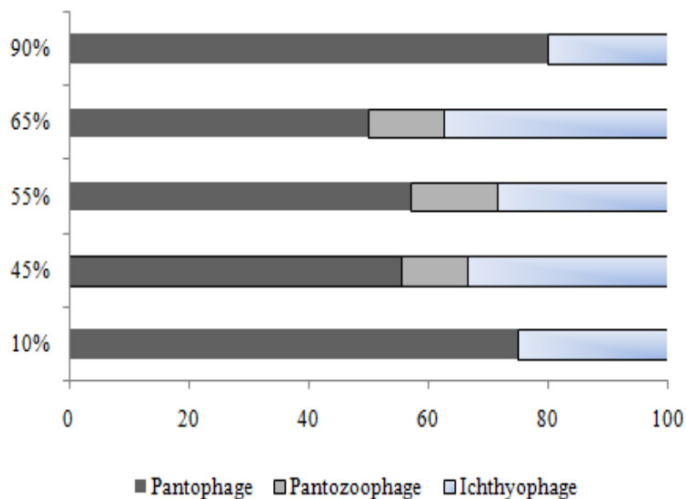


Fig 7. Trophostructure of waterfowl on the studied ponds.

groups was characteristic of pond in terms of overgrowth 45-65% (27-37 pairs).

3. The characterization of the structure of the ornithocenosis of the investigated ponds was carried out. It was stated that the Black-headed Gull was the dominant nesting species in ponds with overgrown areas of 45-65%. On a pond with areas of overgrowth 90% Mallard and Coot.

4. As a result of a quantitative assessment of biological diversity according to the Shannon index, it was shown that high diversity in ponds with overgrown areas of 55-65% (3.08 and 2.86 bits / specimen, respectively)

5. The obtained data can be used to further improve the ecological state of individual water bodies of the cascade by managing water resources.

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