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FACTORS INFLUENCING STRUCTURAL CHARACTERISTICS OF WETLAND BIRD COMMUNITIES IN THE MIDDLE UZH RIVER FLOW

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Background. Long-term surveys of wetland bird communities of the Uzh mountain river in Zakarpattia region, along with an analysis of scientific data published over the past century enabled us to identify a set of anthropogenic factors that significantly influence the species and spatial structures of these communities. Two of the factors are specifically related to human disturbance of the riverbed and the floodplain. Namely, installation of hydraulic engineering structures aimed at water regulation and flood protection, as well as direct interventions in the river channel for smoothing the natural bed of the river bottom, removing small sedimentary islands and clearing the vegetation on the river banks. The factor of urbanization is favorable for species that tend to be synanthropic. For other wetland bird species, urbanization plays a positive role in winter.

Materials and Methods. The studies were conducted in the middle Uzh River flow, which has a mountainous character. As the highest diversity of the wetland birds in the middle flow of the river is observed within the city of Uzhhorod, the main surveys were conducted right there. Birds were monitored all year round during the years 1994–2002 and 2020–2021. From 2003 to 2019, the studies were conducted sporadically. An annual cycle was subdivided into 6 periods: winter (November 20 – February 20), early spring (February 21 – April 10), breeding (April 11 – June 30), post-breeding (July), early autumn (August–September) and autumn (October – November 19).

Results and Discussion. In the course of the monitoring activities on the Uzh River within the city of Uzhhorod, we identified 30 species of wetland birds belonging to 24 genera, 14 families and 10 orders. According to the pattern of their occurrence on the river throughout the year, they include resident nesting (3 species), wintering (3), migratory (4), wandering (4), summering (3) and occasional (13) bird species. Several



of these species are new to the river in urban areas, while some others were not spotted there for the past 10–20 years due to a dramatic change in the habitat conditions. Numbers of certain species have also undergone significant changes due to the effects of various anthropogenic factors. The analysis of the results obtained over 30 years of studies allows us to identify 3 factors influencing the species and spatial structure of the wetland birds on the Uzh River. The first is urbanization, attracting numerous bird species. The second is water regulation, i.e. the construction of dams and water storage facilities. This factor causes a negative impact on wetland birds by changing the river water dynamics, slowing the natural flow down, and raising the water level by retaining dams. The last one is a direct intervention into the river bed, which alters the river bottom, destroys riparian vegetation and alluvial islands that form additional micro-meanders in the riverbed, as well as shallow and deep water sections of the river.

Conclusion. For the wetland bird species of the mountain rivers, it is crucial to keep the mosaic nature of their habitat. Interventions in the morphology of the riverbed, as well as alterations in the water dynamics of the river due to water management measures, adversely affect the species structure of wetland bird communities and the nature of their presence on the river. The cascades of retaining dams along the mountain rivers can substantially decrease the diversity of typical mountain river species and lead to a decline of these species' population in the Carpathians. Cities, on the contrary, can serve as refuges for birds in critical winter periods.

Keywords: wetland birds, mountain river, dams, disturbances to riverbed processes

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INTRODUCTION

Currently, academic literature contains virtually no data on the impact of mountain river management activities on birds and on the structural characteristics of bird communities. Some research has been published on destruction of wetlands and wetland bird populations by dams and irrigation systems on large rivers (Kingsford, Thomas, 2004). The effects of floods and hydrotechnical alterations on bird communities in sub-montane river channels of Western Carpathians were also studied: data on habitat transformations, breeding bird species and population abundance within sub-montane river channels in southern Poland were compared before and after river regulation (Kajtoch & Piestrzynska-Kajtoch, 2008; Kajtoch & Figarski, 2013; Figarski & Kajtoch, 2015). For the mountain rivers of the Eastern Carpathians, no special studies of the impact of water regulation on wetland birds have been conducted so far. Nevertheless, long-term studies of the species and spatial structures of the bird communities closely associated with rivers and their floodplain ecosystems, as well as a retrospective comparison of current data with the existing literature sources, provide us with an insight into how they are affected by the disturbance of natural riverbeds and floodplain transformation.

From the available data on the occurrence of certain bird species in the middle Uzh River flow over the past 100 years we know that the species composition in this location has undergone some changes over this intervening period (Lugovoy *et al.*, 2001). As an example, the wintering of red-throated loon *Gavia stellata* was recorded in the vicinity of the former limits of the city of Uzhhorod in the early 20th century (Hrabár, 1932), and in the

mid-20th century the common sandpiper *Actitis hypoleucos* was a breeding species within the limits of the city (Talposh, 1974). We have not observed these species within Uzhhorod over the past 30 years, although the common sandpiper can be found in the neighbouring sites of riverbank riparian woodlands (Lugovoy, 2005; Stankiewicz-Volosianchuk, 2020), which are inundated with flood waters every season. Since the 1950s and 1960s, the city has started to be gradually and confidently populated by the mallard *Anas platyrhynchos* and the black-headed gull *Chroicocephalus ridibundus*, who were only found outside the city limits before (Lugovoy, 1994). Populations of these species reached their highest values in the 90s of the last century (Stankiewicz, 2001; Stankiewicz, 2004; Potiš & Stankevič, 1997); however, they are unstable today due to the influence of a number of factors. In the early 90s of the 20th century, the mute swan *Cygnus olor*, who had not been part of the avifauna of the region a hundred of years ago (Hrabár, 1932), began to winter regularly in the city, and starting from 2018, it has been nesting there. In the second half of the 20th century, the floodplain in the middle Uzh River flow was cut off from the river channel by the flood prevention dykes. Alteration of the hydrological conditions of the floodplain has resulted in the disappearance of the yellow wagtail *Motacilla flava* on this territory (Portenko, 1950).

In this paper, we aim to identify key factors that cause impact on the species and spatial structure of the wetland bird communities of the mountain river.

MATERIALS AND METHODS

The Uzh River, with a total length of 133 km, has its source at 970 meters above sea level in the mountains of the north-western part of Zakarpattia region of Ukraine, on the southern slopes of the Verkhovyna Watershed Range, near the Uzhotskyi Mountain Pass. The upper and middle parts of the Uzh River have a mountainous character. The mountainous characteristics of the river are also typical within the area of the city of Uzhhorod. Only leaving the city behind and entering the Pannonian Lowland near the Ukrainian-Slovak state border, the Uzh River acquires plain features.

In its middle part, the Uzh River is most densely populated by wetland birds right within the city of Uzhhorod. In this section, the Uzh riverbed is sinuate, yet it is limited by embankment dykes with city quays established on the top. The width of the riverbed varies from 50 to 70 meters, and the floodplain is narrowed to 10-25 m on both sides by dykes. The river flow is swift, the bottom is rocky and in low-flowing sections it is silted up. Average river depth ranges from 60 to 70 cm. There are shallow places, rifts, and deep-water pools where the depth reaches 1–1.5 meters. The alluvial sediments of the river form islands that are overgrown with aquatic vegetation such as sedge, cattail, and willow. The low-water season on the Uzh falls between August and October, and sometimes even through November. Flooding usually occurs in winter and early spring, and also occasionally in June and July. In these cases, water in the river can rise by 2 meters or more, covering the floodplain entirely.

There are 6 bridges that cross the river inside the city of Uzhhorod. Our studies were conducted on 5 sections of the river divided by bridges, totalling 6 km in length (**Fig. 1**). Regular monitoring was carried out on the all-year-round basis during the years 1994–2002 and 2020–2021. In 2003–2019, the research activities were sporadic. The annual cycle was divided into 6 periods: winter (November 20 – February 20), early spring (February 21 – April 10), breeding (April 11 – June 30), post-breeding (July), early autumn (August–September) and autumn (October–November 19) periods.



Fig. 1. Permanent monitoring trail along the Uzh River inside the city of Uzhhorod, divided by bridges (bridges are marked on the river with cross lines)

The studies were conducted by the route method in the morning time when the weather was clear. All wetland birds spotted on water, in flight, on the bank or in riparian scrubs within a 100-meter sampling zone (50 m on both sides of the monitoring trail, Ravkin & Chelintsev, 1990) were recorded. Data on the number of species are presented in averaged absolute numbers, and data on the population density are presented in the number of individuals per km². When determining the status of a species according to population abundance, we used the rating system proposed by A. P. Kuzyakin (1962): abundant – 100–1000 ind./km², numerous – 10–100 ind./km², common – 1.0–10 ind./km², rare – 0.1–1.0 ind./km², and extremely rare – 0.01–0.1 ind./km². The names of the birds are provided according to H. Fesenko and A. Bokotey (2007). Analysis of data and conclusions for a 30-year period of research on wetland birds on the Uzh River inside Uzhhorod take also into account data from research of the middle part of the river outside the city (Stankiewicz-Volosianchuk, 2020).

RESULTS AND DISCUSSION

In our research on the Uzh River within the city limits, we registered 30 species of wetland birds belonging to 24 genera, 14 families, and 10 orders (**Table 1**).

There are three residential nesting species: mallard duck, mute swan and common kingfisher *Alcedo attis*. Only the common kingfisher nests on the river. The mallard and the mute swan breed in ponds but not on the river within the urban areas (Stankiewicz-Volosianchuk, 2017). Mallard nesting sites had been known on the islands within the riverbed until the early 2000s, before the channel was cleared and the alluvial islands were removed (Stankiewicz-Volosianchuk, 2012). At present, there are no suitable nesting sites on the river inside the city.

Three of the species are wintering: the white-throated dipper *Cinclus cinclus*, the common coot *Fulica atra*, and the common moorhen *Gallinula chloropus*. As early as the beginning of the 1990s, two individuals of the white-throated dipper were consi-

tently coming to the city for overwintering from the mountainous parts of the river, which used to be almost entirely frozen. For the last 8 years, this species has not been spotted on the river in the winter. We suppose that this may be related to comparatively mild winters and short periods of ice coverage on the river. Presumably, the occurrence of the white-throated dipper on the Uzh River within the urban landscape is also influenced by the annual winter flooding, which has never happened in the past.

Table 1. Taxonomic diversity of wetland birds in the middle Uzh River flow inside the city of Uzhhorod

Order	Family	Genus	Species
Gaviiformes	1	1	1
Podicipediformes	1	1	1
Suliformes	1	1	1
Pelecaniformes	2	3	4
Ciconiiformes	1	1	1
Anseriformes	1	6	9
Gruiformes	1	2	2
Charadriiformes	3	6	8
Coraciiformes	1	1	1
Passeriformes	2	2	2
Total	14	24	30

In the 1990s, the common coot and the common moorhen flocked together in groups of as many as about 10 individuals each winter near the city's Botanical Quay. Before the flood of 1998, this bank of the river used to be covered with willow thickets. After clearing of the vegetation on the banks to allow the rapid passage of the high waters, these birds were no longer observed on the Uzh.

Four other species – the black-headed gull, the little grebe *Tachybaptus ruficollis*, the gray heron *Ardea cinerea*, and the little egret *Egretta garzetta* – belong to the wandering species that do not nest directly within the city, but are observed on the river virtually throughout the whole year. The little egret feeds on the river starting with early spring and until early autumn. The little grebe migrates into the city for the winter and can also be encountered during the post-breeding season. It resides in the deep-water sections of the river.

The summering species include three ones: the great egret *Ardea alba*, black stork *Ciconia nigra* and grey wagtail *Motacilla cinerea*. These species are regularly recorded on the river in the warm season. The latter two species are new to the river within the city limits – the black stork has been regularly observed staying here for feeding purposes for the last 7 years, and the grey wagtail appeared here only 2 years ago.

The mew gull *Larus canus*, the european herring gull *L. argentatus*, the caspian gull *L. cachinnans* and the little gull *Hydrocoloeus minutus* are the four migratory species that are regularly found on the Uzh River during spring migration (Lugovoy, 1999; Stankiewicz-Volosianchuk, 2017).

The most numerous group of the wetland bird species in Uzhhorod are the occasional ones, that have been spotted on the Uzh River just a few times over the period

of 30 years (**Table 2**). It includes 13 species, thus making it a rather diverse group of wetland birds, including rare species (Red Book of Ukraine, 2009) such as common goldeneye *Bucephala clangula* and common spoonbill *Platalea leucorodia*.

The situation with the wetland birds on the Uzh River inside Uzhhorod has been very dynamic over the last 3 decades, so the species structure of the community is unstable. The species composition of the wetland bird communities, their number and the nature of their occurrence on the river are being altered by a number of different factors, mainly those of anthropogenic nature.

Over a half of the wetland birds (16 species) found on the river in the city are recorded during the winter. At this time, the absolute number of birds on the Uzh within the city limits is on average 344.3 individuals, and the population density reaches 573.8 ind./km². The highest number of mallards in winter constituted above 500 individuals in January in absolute numbers, and this phenomenon was observed in the late 1990s and at the beginning of the 21st century (Stankiewicz, 2001; Stankiewicz, 2004). They were massively concentrated on the alluvial islands in the riverbed, inaccessible to people and dogs. Nowadays, in winter, particularly in January, aggregations of the mallards are slightly more than 200 individuals, but during the flooding period, which over the past 10 years has occurred usually in the winter months, the average number of mallards in winter is 150 individuals.

The seasonal population dynamics of the wetland species on the Uzh River clearly demonstrate that the birds gradually flock into the city in autumn for wintering and gradually leave the city again after the winter is over. During the breeding and post-breeding seasons, the population density of wetland birds on the Uzh is the lowest – 68.9 ind./km² and 55.1 ind./km². The poorest in terms of species diversity is the bird community in early autumn.

In autumn, early spring and especially in winter periods, the mallard is an abundant species. In winter, it is a super-dominant bird species, while the black-headed gull acts as a sub-dominant species due to being quite numerous as well. The share of these species in the wetland bird community in winter is 95.2 %. The other 14 species are common, rare and very rare, and their percentage in the community makes up 4.8 %. In early spring, the black-headed gull dominates due to the increase of its population by migratory birds. The black-headed gull and the mallard are highly numerous species during this period, with a share of 97.2% in the community. The remaining 10 species are common, rare and very rare; their share is 2.8% (**Fig. 2**).

Mallard and black-headed gull are dominant in other seasons as well. These species are abundant during the breeding and post-breeding periods: their populations decrease by an order of magnitude. During the breeding season, the share of other wetland species in this bird community is higher than the shares of the mallard and the black-headed gull. This is due to the fact that the latter leave the city for breeding. Among the mute swans, only those individuals who have not mated remain on the river during this period of time. Simultaneously, the wandering and summering species begin to appear on the river.

The wetland birds on the river are not uniformly distributed across the city. The analysis of the spatial structure reveals that the major concentration of the birds is recorded in the city center between the pedestrian bridge and the Masaryk transport bridge (**Fig. 3**).

Table 2. Seasonal aspect of wetland birds' species composition on the Uzh River in the limits of the city of Uzhhorod and their status over the period of 1994–2021

No	Spicies	Status	A	B	C	D	E	F
			number (averaged absolute value) / density (individuals per 1 km ²)					
1	2	3	4	5	6	7	8	9
1	<i>Anas platyrhynchos</i>	Res., Breed	307.24/511.95	105.3/175.5	24.4/40.6	10.8/17.9	90.6/150.9	138.7/231.15
2	<i>Chroicocephalus ridibundus</i>	Wan.	20.7/34.5	142.9/238.2	11.2/18.6	16.4/27.3	81.3/135.4	41.7/69.4
3	<i>Cygnus olor</i>	Res., Breed	8/13.3	2/3.3	0.4/0.7	1/1.7	2/3.3	7/11.7
4	<i>Alcedo atthis</i>	Res., Breed.	3/5	2.5/4.2	1/2	1/2	1/2	2.5/4.2
5	<i>Ardea cinerea</i>	Wan.	1.5/2.5	1.5/2.5	2/3.3	2/3.3	1.5/2.5	0.5/0.8
6	<i>Cinclus cinclus*</i>	Win.	1/1.7	-	-	-	-	0.5/0.8
7	<i>Tachybaptus ruficollis</i>	Wan.	1/1.7	-	-	0.5/0.8	-	-
8	<i>Phalacrocorax carbo</i>	Occ.	1/1.7	-	-	-	-	-
9	<i>Aythya ferina</i>	Occ.	0.3/0.5	-	-	-	-	-
10	<i>Fulica atra*</i>	Win.	0.3/0.5	-	-	-	-	-
11	<i>Anser erythropus</i>	Occ.	0.1/0.2	-	-	-	-	-
12	<i>Mergus merganser</i>	Occ.	0.05/0.08	-	-	-	-	-
13	<i>Larus canus</i>	Mig.	0.05/0.08	0.3/0.5	-	-	-	-
14	<i>Gallinula chloropus*</i>	Win.	0.02/0.03	-	-	-	-	-
15	<i>Anas acuta</i>	Occ.	0.02/0.03	-	-	-	-	-
16	<i>Gavia arctica</i>	Occ.	0.02/0.03	-	-	-	-	-
17	<i>Larus cachinnans</i>	Mig.	-	0.3/0.5	-	-	-	-
18	<i>Larus argentatus</i>	Mig.	-	0.2/0.4	-	-	-	-

1	2	3	4	5	6	7	8	9
19	<i>Egretta garzetta</i>	Wan.	-	0.1/0.15	0.6/1.1	0.8/1.2	6/10	0.02/0.04
20	<i>Hydrocoloeus minutus</i>	Mig.	-	0.1/0.15	-	-	-	-
21	<i>Bucephala clangula</i>	Occ.	-	0.02/0.03	-	-	-	-
22	<i>Mergellus albellus</i>	Occ.	-	0.02/0.03	-	-	-	-
23	<i>Aythya fuligula</i>	Occ.	-	0.02/0.03	-	-	-	-
24	<i>Charadrius dubius</i>	Occ.	-	-	0.5/0.8	-	-	-
25	<i>Motacilla cinerea</i> **	Sum.	-	-	0.1/0.15	0.1/0.15	-	-
26	<i>Ardea alba</i> **	Sum.	-	-	0.05/0.8	0.5/0.8	-	-
27	<i>Ciconia nigra</i> **	Sum.	-	-	0.05/0.8	0.5/0.8	0.5/0.8	-
28	<i>Platalea leucorodia</i>	Occ.	-	-	0.01/0.02	-	-	-
29	<i>Scolopax rusticola</i>	Occ.	-	-	-	-	-	0.01/0.02
30	<i>Tringa ochropus</i>	Occ.	-	-	-	-	-	0.01/0.02
Total number / density		Species	16	12	11	9	7	9
			344.3/573.8	255.6/425.5	40.3/68.9	33.6/55.9	182.9/304.9	190.9/318.1

Notes: A – winter season; B – spring; C – breeding; D – post breeding; E – early autumn; F – autumn.

Res. – residential, Breed. – breeding, Win. – wintering, Wan. – wandering, Occ. – occasional, Mig. – migratory, Sum. – summering.

* – the species that were consistently observed on the Uzh River in Uzhhorod during the 1990s and the first decade of the 2000s; ** – the species that first appeared in the city in the second decade of the 2000s and since then are regularly spotted on the Uzh every season

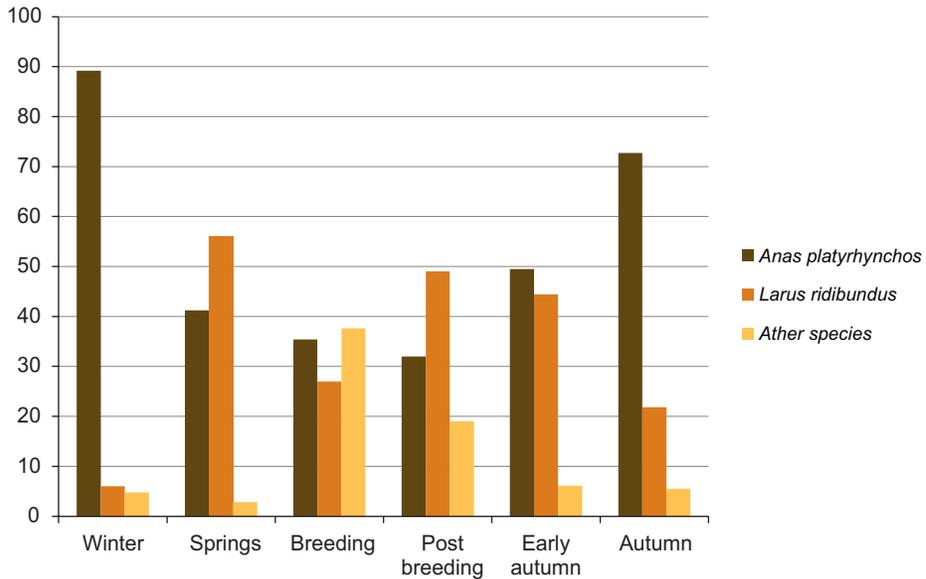


Fig. 2. The species population ratio in the wetland bird community on the Uzh River within Uzhhorod during the year seasons, %



Fig. 3. The distribution pattern of the wetland bird community along the Uzh River within the city of Uzhhorod: red – localization of residential birds; blue – localization of wandering species; green – localization of migratory species

The wandering and summering species – *Ardeidae* and the black stork, although they tend to focus on the stretch of the river between the pedestrian bridge in the city center and the Bozdosh transport bridge, can also occur upstream and downstream. Their favourite areas are the shallow sections, the riparian vegetation for camouflaging, and the small islands. The migratory species, in particular the gulls, can be observed in the places of black-headed gulls gathering – between the Ankudinov transport bridge and the Masaryk transport bridge. Other species, the very rare ones that are seen on

the Uzh in early spring and autumn, tend to inhabit the strips of riparian forests and bushes near the railway bridge or the Bozdosh Park. The occasional waterfowl species, who arrive in winter during the period of frosts, join the gatherings of mallards and mute swans.

The mallards and mute swans tend to concentrate on the section between the Ankudinov transport bridge and the Masaryk transport bridge, usually gathering near the pedestrian bridge. They find this area the most convenient – there are deeper places where water plants grow, as well as the places with the rapid flow. The bridge pillars are also very important for the ducks, as they feel safer there compared to the river banks. The typical mountain river species – the dippers and the grey wagtail – require fast flowing water and some stones for perching.

The analysis of the data collected over a 30-year period allows us to identify a range of the anthropogenic factors that directly affect the occurrence, number and nature of the wetland birds, as well as their distribution patterns along a mountain river. These factors involve: urbanization, water regulation, and alteration of the natural bottom of the riverbed and the floodplain.

Urbanization has a positive effect on the species that tend to be synanthropic, such as the mallard, the mute swan, and the black-headed gull. These species enjoy the best conditions for their stay on the river within the urban environment, forming numerous aggregations. This is due to the lack of physical danger (absence of predators or hunters) combined with people who enjoy feeding them. The mute swan and the black-headed gull do not occur on the Uzh River outside the city limits.

Urbanization is the most attractive for all the waterfowl birds during the frost season. Ice-free sections of the river inside the city, and also additional feeding by people, lead to the highest concentration of the birds and species that temporarily stay within the city on cold days. Therefore, preserving the natural flow of the river is a critical precondition to ensure that the urban environment becomes a refuge for the wetland birds during harsh winters.

Water regulation by building retaining dams changes the habitat conditions on the river. The hydrological conditions of the mountain river are altered and the seasonality of floodplain flooding is eliminated; the water level in the upper bay increases, reducing the velocity of the water flow. Upstream from the dam, the floodplain remains flooded throughout the entire year, although the water level may drop during the low water period. As a result, pebbles and sandy sediments in the riverbed get covered with water. This fact negatively affects the waders: the common sandpiper and the little ringed plover *Charadrius dubius*, who thus get deprived of their breeding grounds (Stankiewicz-Volosianchuk, 2020). Besides these species and the green sandpiper *Tringa ochropus*, the shallow water segments and rapid water flow are also necessary for the common mountainous wetland bird species, such as the white-throated dipper and the grey wagtail. These birds feed on invertebrates, which they catch in clear, pure water. This is a critical factor for the white-throated dipper. The shallow water areas are also essential for the black stork and the herons. These species are regular visitors to mountain rivers, since they cannot feed in water bodies with a depth of more than 35 cm.

Water storage reservoirs established upstream of the water regulation dams can attract waterfowl birds. However, the data obtained from our parallel studies of the birds of the middle Uzh River flow in the area of a retaining dam indicate that these reservoirs are too small to ensure bird safety in the mountainous conditions. During cold winters,

they get iced over. Therefore, such reservoirs are visited by waterfowl birds only during warm winters.

Natural riverbed and floodplain alterations severely affect the species composition of birds and their numbers. Levelling of the bottom and removal of alluvial sediments deprive the waterfowl birds, such as mallard, common sandpiper, and little ringed plover of breeding sites. Clearing off the riparian vegetation on river banks also ruin the shelters for the species that try to avoid human disturbance.

CONCLUSION

The species diversity of the wetland birds on a mountain river in its middle flow is highly dependent on the mosaic of habitats. The waterfowl birds need deeper water, with slower stream and plenty of aquatic plants, which are abundant in the middle parts of the mountain rivers. Most species require shallow water and rapid currents to provide them with good foraging conditions. The alluvial islands in the riverbed and the afforested riverbanks are important breeding sites for all the typical mountain river birds, including mallard. Maintaining the natural water flow is also important in winter, when water bodies are covered with ice. The availability of ice-free sections on the river due to the fast flow is the main factor that attracts the largest number of wetland species in the city of Uzhhorod, and is also a beneficiary factor for the growth of their populations on the river inside the city.

Interventions in the morphology of the riverbed, together with alterations in the hydrological conditions of the river due to water regulation activities, adversely affect the birds, including the species structure and the nature of their occurrence on the river. We assume that the cascade of retaining dams on the mountain rivers can significantly reduce the species diversity of wetland birds, in particular that of the species common to the mountain rivers, and lead to a decline in the population of these species in the Carpathians.

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COMPLIANCE WITH ETHICAL STANDARDS

Conflict of Interest: The author declares that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Animal Rights: This article does not contain any experimental studies with animal subjects.

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ФАКТОРИ ВПЛИВУ НА СТРУКТУРНІ ХАРАКТЕРИСТИКИ УГРУПОВАНЬ ВОДНО-БОЛОТНИХ ПТАХІВ СЕРЕДНЬОЇ ТЕЧІЇ РІЧКИ УЖ

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Вступ. Тривалі дослідження угруповань водно-болотних птахів гірської річки Уж у Закарпатті, а також аналіз наукових літературних даних за останнє століття, дали змогу виокремити низку антропогенних факторів, які мають суттєвий вплив на видову та просторову структуру цих угруповань. Два з цих факторів прямо стосуються господарського втручання у русло та заплаву річки. Це будівництво гідротехнічних споруд з метою водорегуляції та протипаводкового захисту, а також пряме втручання в русло з метою вирівнювання та зміни природного ложа дна, ліквідації наносних острівків і розчищення берегів від рослинності. Фактор урбанізації є сприятливим для видів, які мають тенденцію до синантропності. Для інших видів водно-болотних птахів урбанізація відіграє позитивну роль взимку.

Матеріали та методи. Дослідження проводили у середній течії річки Уж, яка має гірський характер. Оскільки найбільше різноманіття водно-болотних птахів у середній течії річки спостерігали саме у межах міста Ужгорода, основні дослідження проводили саме там. Птахів досліджували цілорічно протягом 1994–2002 та 2020–2021 років. Протягом 2003–2019 років дослідження були спорадичними. Річний цикл був поділений на 6 періодів: зимовий (20 листопада – 20 лютого), ранньовесняний (21 лютого – 10 квітня), гніздовий (11 квітня – 30 червня), післягніздовий (липень), ранньоосінній (серпень–вересень) та осінній (жовтень – 19 листопада).

Результати. За час досліджень на р. Уж у межах Ужгорода нами виявлено 30 видів водно-болотних птахів, які належать до 24 родів 14 родин і 10 рядів. За характером перебування на річці впродовж року серед них є осілі гніздові (3 види), зимові (3), пролітні (4), блукаючі (4), літуючі (3) та залітні (13). Деякі з цих видів є новими для річки в умовах міста, деякі за останні 10–20 років тут вже не спостерігали через різку зміну умов середовища. Суттєвих змін через впливи різних факторів антропогенного походження зазнала і чисельність окремих видів. Аналіз результатів 30-літніх досліджень дає змогу виділити 3 фактори впливу на видову та просторову структуру водно-болотних птахів річки Уж. Перший – урбанізація, яка приваблює багато видів птахів. Другий – водорегуляція через будівництво гідротехнічних споруд протипаводкового та водоакумулятивного характеру. Цей чинник негативно впливає на водно-болотних птахів унаслідок гідрологічного режиму, сповільнення природної течії, підняття рівня води у верхньому б'єфі підпірних гребель. Третій – пряме втручання в русло, яке змінює річкове дно, знищує прибережну рослинність і наносні острови, які формують додаткові меандри в руслі, мілководдя та глибоководні ділянки річки.

Висновки. Для водно-болотних видів птахів гірських річок є дуже важливим збереження мозаїчності природного середовища існування. Втручання у морфологію русла річки, а також зміна гідрологічного режиму річки внаслідок водорегуляції, негативно впливають на видову структуру угруповань водно-болотних видів птахів і характер їхнього перебування на ріці. Каскад гребель на гірських річках може суттєво збіднити видове різноманіття типових видів гірських річок і стати причиною скорочення чисельності цих видів у Карпатах. Міста, навпаки, у критичний для птахів зимовий період можуть слугувати для них рефугіумами.

Ключові слова: водно-болотні птахи, гірська річка, греблі, втручання у руслові процеси