

Water Bodies of Kazan and Their Significance in the City's Avifauna Conservation

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Abstract. Water bodies that serve as habitats for semi-aquatic birds have been preserved in the city of Kazan, which contributes to the conservation of the city's avifauna diversity. Previously, special studies of birds in the water bodies of Kazan were not conducted. The study is aimed at the investigation of the species composition and distribution of the avifauna in water bodies of Kazan, as well as the ecological features of specific semi-aquatic fauna species of the city. The research carried out over the past twenty-five years has made it possible to identify the species composition, their distribution, and ecological features of particular bird species associated with aquatic ecosystems. In total, 64 bird species of nine bird orders are recorded within the city of Kazan. The number of particular species and their spatial distribution in the city's water bodies depends on the specific conditions of the water object, where human activity is the major limiting factor. The most numerous species during the breeding period are the black-headed gull and the mallard. Nesting of 26 species has been recorded. A number of species, such as the mallard, show broad potential for synanthropization. The great-crested grebe, the coot and several species of ducks actively colonize the city reservoirs. A number of rare bird species listed in the Red Book of Tatarstan were recorded, including nesting of the mute swan, the moorhen.

1 Introduction

Historically, cities have always been built near water bodies, which were water sources for their residents, while major rivers and lakes served as transport routes for water transportation of people and cargo. As the city grew, more and more water bodies and coastal areas were included in the urban area. Meanwhile, some semi-aquatic birds typical of those ecosystems left the territories developed by humans, but some species still inhabited urban areas, forming an ornithocene of species that were tolerant or adapted to new conditions. Water bodies play a role of great importance to preserve the biological diversity of territories. The above is especially relevant for the city of Kazan having its numerous water bodies, to different extents affected by human activity, and preserving the entirety of aquatic and marshy habitats with characteristic avifauna. No special studies of birds on the water bodies of Kazan were conducted by ornithologists during the previous study period, there are only some fragmentary data on bird sightings at those places. The purpose of the research was to study the composition and distribution of the avifauna of

Kazan's water bodies and the ecological features of particular semi-aquatic faunal form in the process of their synanthropization.

2 Material and Methods

Outcomes of long-term research of water bodies of the city of Kazan since the late 1990s provided the material for this article. The study object is ornithocenosis of water bodies with different conditions for bird habitats. Field records included observations of avifauna, species composition and population, spatial distribution and ecological features of particular bird species. Avifauna and bird population were studied through multiple route surveys along the coastline in areas with varying degree and nature of anthropogenic transformation.

Kazan is a city with a million-plus population located on the left bank of the Volga at the core of the Middle Volga region, which is a major industrial center. A distinctive feature of Kazan is its numerous water bodies, differing in their origin, duration of existence and severity of anthropogenic impact.

Research has provided new data on the bird population in the rivers and lakes within the boundaries of Kazan. The avifauna of 16 different reservoirs, ranging from the Volga River to small lakes in urban areas, has been studied. The main observations were held on the Volga, directly approaching the city (the Kuibyshevsky Reservoir), the Kazanka, on the city's three central Kaban Lakes (Lower, Middle, Upper), the Bulak Channel and dozens of urban lakes in the Kazanka valley. In recent years, several artificial and anthropogenic-natural small lakes have appeared in Kazan. Approximately 250 reservoirs and watercourses are located within the confines of Kazan [1]. Figure 1 shows a map of Kazan with observation points on the city's main water bodies.



Fig. 1. Map of Kazan with observation points (1- Kuibyshevsky Reservoir; 2- Kazanka River; 3- Lebyazhye Lakes system; 4- Kharovoe Lake; 5- Auto Market Area Lake; 6- Chaikovo Lake; 7- Bulak Channel; 8- Kaban Lakes system; 9- the Volga River Bay near the Pobedilovo Settlement; 10- Blue Lakes.

3 Results and Discussion

Reservoirs and watercourses of Kazan are used for recreational purposes, for sporting events and holidays, they also serve as habitats for many species of waterfowl and aquatic birds. Stability of food, nesting sites and a low number of predators attracts birds to the urban landscape and contributes to their adaptation to humans and transportation [2]. A significant part of the city's avifauna is made-up of semi-aquatic bird species, mainly Laridae. Thus, 34.4% of the avifauna in Kazan belongs to this ecological group.

The composition and natural formation of Kazan's ornithocene is determined by zonal features of the city location and anthropogenic impact on specific areas. The species composition and population of particular species in water body depend on the ecological conditions of the habitat, the water surface area, weediness of the coastal zone, the water body accessibility for humans and domestic dogs, and other forms of water body use. In general, the research outcomes have shown relatively diversity of the avifauna in Kazan. Most species were observed during nesting, but they are usually found in the least disturbed habitats. For example, islands on the Kazanka, on the Volga. Table 1 presents comparative data on the diversity of bird orders in Tatarstan and water bodies of Kazan.

Table 1 Distribution of the ornithocene of water bodies of Kazan and Tatarstan by order.

№	Order	Species noted in Tatarstan	Species noted in Kazan
1.	<i>Podicipediformes</i>	3	2
2.	<i>Ciconiiformes</i>	6	3
3.	<i>Anseriformes</i>	16	8
4.	<i>Falconiformes</i>	25	4
5.	<i>Gruiformes</i>	9	4
6.	<i>Charadriiformes</i>	32	23
7.	<i>Strigiformes</i>	11	2
8.	<i>Piciformes</i>	9	2
9.	<i>Passeriformes</i>	102	16
	Total species	345	64

Most birds occupy the most protected areas of rivers and lakes coastal zone for their habitat. These are places along banks far from busy streets and crowded areas. Biotopes densely overgrown with near-water plants. Nesting of the orders of Anseriformes, Gruiformes, Ciconiiformes, Charadriiformes was recorded. The waters of the Kazanka and the Volga, as well as large lakes, are actively occupied by species of larids. The most common species are the black-headed gull *Larus ridibundus* and the common tern *Sterna hirundo*. More rare on water bodies are predatory birds. The coastal zone is used as a hunting area by a number of diurnal predators. Flights of the kite *Milvus migrans*, marsh harrier *Circus aeruginosus* and sparrowhawk *Accipiter nisus* were recorded regularly. Over the past few years, white-tailed eagle *Haliaeetus albicilla* has been regularly flying over the Kazanka river waters in the autumn. Nocturnal predators include the long-eared owl *Asio otus* and the great owl *Strix uralensis*. Nesting of 26 species has been recorded, which represents 40.6% of semi-aquatic inhabitants ornithocene. During spring and autumn migrations, the species composition of waterfowl increases due to the passage and stops of

many migratory birds at urban reservoirs. These are various geese, ducks, larids, terns and waders. The flocks of grey cranes *Grus grus* are regularly spotted in the Kazanka river valley.

Particularly noteworthy is the role of water bodies in the distribution of larids. With the creation of the Kuibyshevsky Reservoir, when water reached Kazan, the number of many larids and terns has increased and the emergence of new species has been observed. The creation of the Kuibyshevsky Reservoir resulted in the increase of population of great black-headed gull *Larus ichthyaetus*, lesser black-backed gull *Larus fuscus*, herring gull *Larus cachinnans*, common gull *Larus canus* etc. Table 2 presents comparative data on the occurrence of larids in the Kuibyshevsky Reservoir over the past 50 years based on research materials by T.I. Vodolazhskaya, V.S. Zaletaev [3], I.V. Askeeva, O.V. Askeeva. [4].

Table 2. Gull birds of the Kuibyshev Reservoir.

Виды	T.I. Vodolazhskaya, V.S. Zaletaev (1977)	I.V. Askeeva, O.V. Askeeva (1999)	Our data (2023)
<i>Larus ichthyaetus</i>	flies in	nests	nests
<i>Larus minutus</i>	nests	nests	nests
<i>Larus ridibundus</i>	nests	nests	nests
<i>Larus fuscus</i>	during the migration period	during the migration period	during the migration period
<i>Larus cachinnans</i>	nests	nests	nests
<i>Larus hyperboreus</i>	flying, very rare	flies in	flies in
<i>Larus argentatus</i>	nests	nests	nests
<i>Larus heuglini</i>	-	during the migration period	during the migration period
<i>Larus marinus</i>	flying, very rare	flies in	flies in
<i>Larus canus</i>	nests	nests	nests
<i>Rissa tridactyla</i>	flying, very rare	flies in	flying, very rare
<i>Chlidonias nigra</i>	nests	nests	nests
<i>Chlidonias leucopterus</i>	nests	nests	nests
<i>Chlidonias hybrida</i>	-	flies in	flies in
<i>Sterna hirundo</i>	nests	nests	nests
<i>Sterna albifrons</i>	-	flies in	flies in
Total	13	16	16

As can be seen from the table, 9 species have not changed their settlement status over the past 50 years and consistently nest in Tatarstan. These are little gull, black-headed gull, herring gull, silver gull *Larus argentatus*, common gull, black tern *Chlidonias niger*, white-winged tern *Chlidonias leucopterus*, common tern *Sterna hirundo* and little tern *Sternula albifrons*. Regularly seen only on migration: lesser black-backed gull. Great black-headed gull (D) of the list of migratory birds became nesting one. In Kazan, one of the republic's largest colonies of the black-headed gull was observed. In 2023, at least 100 pairs of this species nesting on Chaikovo Lake and nearby lakes were observed.

Over the past ten years, the city's water bodies became inhabited by great-crested grebe *Podiceps cristatus*, coot *Fulica atra* and some ducks: common pochard *Aythya ferina*, tufted duck *Aythya fuligula*, gadwall *Mareca strepera*, etc. [5].

The great-crested grebe was very rare in urban reservoirs of Tatarstan. The nesting of the great-crested grebe was first recorded in 2001 on the Kazanka river. In recent years, there has been an upward drift in this species population, and its nesting has been observed in dozens of water bodies. In 2024, more than 15 pairs nested on Middle Kaban Lake. In the last decade, the coot has been actively inhabiting the city. Coot nesting in Kazan has become regular and annually 3-4 nesting pairs of coots are recorded on Kaban Lakes, the Kazanka river and other urban reservoirs. The moorhen of the Gruiformes order shows the tendency to populate urban water bodies. They were observed even on the central city lake, Middle Kaban Lake.

The most common species in water bodies of Kazan is the mallard *Anas platyrhynchos*. At least 600 duck broods were observed in the city. These species are so unafraid of humans that they swim safely among those riding catamarans and boats in the recreation area of central urban water bodies.

Like in many Russian regions, mallards successfully winter in Kazan [6]. Availability of nonfreezing water bodies, microclimate (air temperature in urban center in winter is slightly higher than in the surrounding landscape), artificial lighting (increases the duration of daytime feeding) create conditions for wintering of some waterfowl species. It is worth noting that the main factor, however, is the feed resources, and the abundance of feed plays a significant role, as well as its stability. City residents regularly feed ducks wintering in Kazan reservoirs. As the species populate the urban landscape, the birds' behavior changes. The mallards display a reduced flight distance. Thus, according to observations, birds allow approach at a distance of up to 1 m and willingly accept hand-feed. The same behavior was observed even for females with ducklings, who also safely accepted feeding. Part of the urban population of mallards shows sedentary behavior and successfully winter on non-freezing water bodies of the city. About 1 thousand birds wintered in the city in winter 2023-2024.

Since 2014, nesting of the mute swan *Cygnus olor* has been observed. Currently, broods of these birds have been recorded in three urban reservoirs, including Middle Kaban Lake. In recent years, occasions of the great cormorant *Phalacrocorax carbo* flights into the urban waters of the Kazanka and Volga rivers have become more frequent. The species inhabits the Lower Volga and has been actively spreading northwards in the last decade. In 2023, flocks of cormorants numbering up to 30-40 were regularly observed on the Kazanka, near the Kazan Kremlin. The species is an active ichthyophagist and is undesirable for colonization not only in Kazan, but throughout the Republic of Tatarstan. Pond fisheries are common in some areas, where this species can cause significant damage to the fish farming of the region.

A number of rare and protected semi-aquatic bird species were observed in Kazan during the study period and deserve special attention. These are the Eurasian bittern *Botaurus stellaris*, the moorhen *Gallinula chloropus*, the red shank *Tringa nebularia*, the little gull *Larus minutus*, the little tern *Sterna albifrons*. These bird species are listed in the Red Book of the Republic of Tatarstan. 2016 [7].

4 Conclusions

Thus, the conducted research on water bodies in Kazan allowed to determine the species composition of semi-aquatic birds and waterfowl and draw the following conclusions

In total, 64 bird species of nine bird orders were recorded in Kazan. Nesting of 26 species has been recorded, which represents 40.6% of the city ornithofauna. This ecological group of birds constitutes 34.4% of the total bird fauna in the city. The population of particular species and their spatial distribution depend on specific conditions of the water body, where the main limiting factor is human activity and involvement. The most

numerous species during the breeding period are the black-headed gull and the mallard. In recent decades, city water bodies have been colonized by new species of the avifauna of Kazan. These are the great-crested grebe, the coot, the moorhen, the common pochard, the gadwall, the mute swan. The great cormorant flights into the waters of the Kazanka have been recorded. The water bodies of Kazan preserve the species diversity of waterfowl and semi-aquatic in the city and serve as a place where birds can nest, feed, and rest during seasonal migrations. Numerous wintering evidences have been recorded for mallards. During the process of settling and colonizing urban water bodies, birds acquire adaptations that allow them to successfully exist in transformed habitat.

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