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Research paper



Engineering Design of Bird Fauna of Water Spills in Kazalinsk

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Abstract

Preservation of biodiversity (interspecific, intraspecific) is one of the urgent tasks that requires a systematic, comprehensive, scientifically based approach. Engineering design of the bird life area, includes modeling, packaging the area and its effects on environment. For this purpose we design the procedure by finite element method for biological life of bird. A vivid example of restoration and preservation of biological diversity of fauna and flora should be considered the implementation of the environmental project "Regulation of the riverbed of the Syrdarya and the Northern Aral Sea". The project was initiated by well-known Russian and Kazakh scientists with the support of the government of Kazakhstan and world financial institutions. The aim of the project is the construction of new and reconstruction of existing hydrological structures. The result of this project, among other things (improving the economic, social, environmental situation) is the restoration of biological diversity. The process of recovery is gradual, depends on many external factors and requires detailed study, scientific justification for individual periods and phases. Bird fauna is considered conservative enough in the choice of habitats and is an indicator of the restoration of biodiversity. This paper is devoted to keeping track of bird in the water spills of the Baskara canal (the main left-bank channel of the Syrdarya river) in the eastern part of the Kazalinsky district (Kazakhstan's Aral Sea area). During the surveys, 13 species of birds were recorded, which are representatives of 8 orders. The most part (77%) of registered birds belongs to the limnophilic group - the wetland birds. Impoverished species composition is due to the climatic conditions of the accounting year, the lack of sufficient shelter, the isolation of the water body. Systematic, all-season bird monitoring is required.

Keywords: *the Syrdarya River, the main left-bank canal of Baskara, Kazalinsky district, wetland avifauna.*

1. Introduction

The Aral Sea is one of the two transboundary inland reservoirs of Kazakhstan [1], part of the estuary-shelf regional type of reservoirs of the southern seas of the CIS, which is characterized by "shallow water, strong desalination, great influence of atmospheric processes and river flow" [2]. The last regression of the Aral Sea, began in 1961 [3], due to anthropogenic impact on river runoff supporting the water balance of the reservoir - the Syrdarya and the Amudarya rivers [4]. The rapid decline in sea level entailed a whole chain of environmental, socio-economic problems, the solution of which coincided with the independence and the difficult economic situation of the post-Soviet states within the drainage basin of the Aral Sea [5-7]. In search of a solution to the problems of the Aral Sea area, the researchers proposed a RSRNAS project (Regulation of the Syrdarya River and the Northern Aral Sea), which was financially supported by the World Bank [8]. The result of this project is the construction of new or reconstruction of existing hydrological structures in the middle and lower reaches of the Syrdarya (in Kazakhstan) and the erection of the Kokaral dam. The last object was built in order to preserve the Northern Aral Sea [9].

The Syrdarya River flows through the territory of Kazakhstan in the middle and lower reaches and now flows into the Northern Aral Sea, forming an extensive delta on the estuary site [5]. The resulting watercourse is the only source of surface water in the Kazakhstani part of the Aral Sea area. It is quite logical that the biological diversity of the region is closely connected with this river. Currently, due to the activities carried out within the first phase of the PRRSAM project (rectification of some dangerous sections of the riverbed, construction of hydrological structures, etc.), the Syrdarya River now functions in a regular mode, without any significant fluctuations in its water level. This creates favorable conditions for the restoration of biodiversity, including bird fauna, in the region and directly in the river valley. As is known, one of the options for providing the national economy with water resources in an arid climate is the stretching of a multi-kilometer network of irrigation canals. In some places, small artificial lakes branch out from such canals, used for breeding fish, muskrats, birds. The material for this paper was bird monitoring conducted in the Kazalinsky district of Kyzylorda region of the Republic of Kazakhstan. The objective is to study the species diversity of the water spills bird fauna in the east of Kazalinsk.

2. Object and Research Methods

The object of research – water spills from the Baskar canal (LMC of the Syrdarya River from the Baskara Hydraulic Unit) located 8-10 km to the east of the kent of Aiteke bi of Kazalinsky district – is confined to a semi-desert landscape zone [5]. The relief of the investigated territory is flat, the coastline is slightly indented. The climate is sharply continental, which determines a very small amount of both solid (≈35 mm) and liquid (≈90 mm) precipitation, and with a constant northeasterly wind [1, 3-4].

Currently, the reservoir is used for breeding juvenile fish. The date of the study – 01.05.2018. The study of the fauna of birds was carried out on the basis of generally accepted methods, adjusted for open terrain [10-12]. The optical means of the counter includ-

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ed 8-fold binoculars and photographic equipment. The modeling of the bird flight based on the cloud modeling method is presented in figure 1.



Fig.1:. birds flight modeling

Birds were counted on a strictly fixed line along the shore of the reservoir [7]. The speed of the counter's travel is 2.5 km/h, the covered mileage is 5 km [8]. All birds registered on the route were recorded, with a distance in a straight line from the bird to the scorer, followed by a recalculation into the area by an interval method.

3. Results and Discussion

The pressure distribution for the analyzed structure of bird is shown in figure 2 as follows:

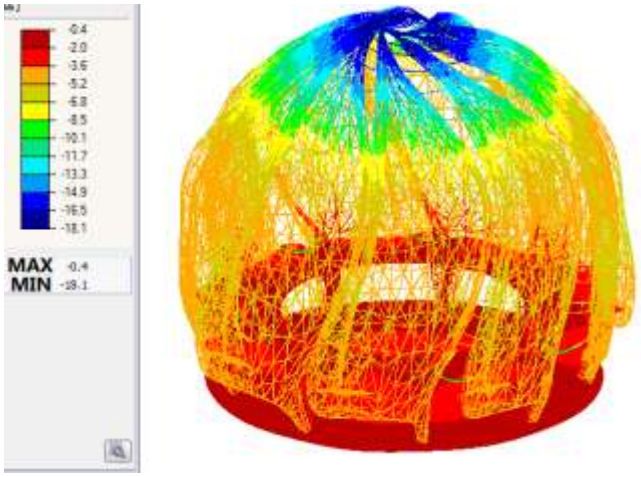


Figure 2:. Pressure analysis of bird structure.

The pressure distribution shows the best position of structure in the flight with low pressures. Species-based review of the fauna of birds recorded during the spring survey conducted on water spills in the eastern part of the kent of Aiteke Bi (Kazalinsky district) of Kazakhstan's Aral Sea:

1. Black-necked grebe *Podiceps nigricollis* – one specimen was found in the water area surrounded by dense thickets of emergent vegetation [13].
2. Purple heron *Ardea purpurea* – 1 specimen was found in the reed thickets *Phragmites australis (Cav.)* Trin. Ex Steud, slowly moving from time to time to open water areas [14].
3. Gadwall *Anas strepera* – found in dense thickets of reeds (5 specimens) and along the perimeter of the lake during the flight [15].
4. Marsh harrier *Circus aeroginosus* – one specimen was scared under a car bridge (Western Europe-Western China highway), located above the Baskara canal. The same specimen regularly circled the studied area in search of food, periodically landing in the bathing zone [16].
5. White-tailed lapwing *Vanellochettusia leucura* – the Mediterranean endemic of Central Asia [17], despite the fact that the valley of the lower reaches of the Syrdarya River is included in the nesting range of the species, very few (10 specimens) have been encountered in the study area. Considering the registration of large concentrations of this species in the system of lakes in the delta of the Syrdarya River (left-bank seaside), 50-100 specimens in each water body [1, 3, 9], the recorded number of specimens in water spills is a very poor indicator.
6. Black-winged stilt *Himantopus himantopus* – a secondary species in terms of the number of recorded birds (52 specimens), with dominance among the non-passerines bird fauna. We can assume that the accumulation of this species within the reservoir is facilitated by the comparatively rich resource of invertebrate fauna found in the littoral, which is part of the fodder base of the black-winged stilt [18].
7. Caspian gull *Larus cachinnans* – the only specimen was recorded flying within the investigated water body [19].
8. Common tern *Sterna hirundo* – 1 specimen was found above the water surface in search of food, several times unsuccessfully dived into the water, changed its location [20].
9. Roller *Coracias garrulus* – found south of the lake (2 specimens). Birds were sitting on the wires of power lines between the railway and the highway, periodically going down to the ground. The soil cover of the terrain is sandy, with a characteristic vegetative formation (calligonum *Calligonum aphyllum* (Pall.) Guerke; twin-leaved sandhill wattle *Ammodendron bifolium* (Pall.) Yakovl; *Argusia sibirica* (L.) Dandy; *Tamarix ramosissima* Ledeb.), with holes of small animals, probably there are their nesting grounds nearby [7, 13, 20].

10. Hoopoe *Upupa epops* – observed on the east coast of the reservoir, among the tamarisk bushes (2 specimens).
11. Sand martin *Riparia riparia* – the dominant species of birds found near the studied reservoir, more than 100 individuals were recorded flying over the water surface and hunting small insects [21].
12. Masked wagtail *Motacilla personata* – despite the fact that this species is widespread in these places, the only individual was found on the shore of the reservoir while searching for food.
13. House sparrow *Passer domesticus* - we associate registration of the species in the study area with the close location of cemeteries and high steeps in the local quarry; only 2 specimens were found during the counts [21].

In general, during the counts, a number of species peculiar to these places at this time of year were not found: *Falconiformes* - long-legged buzzard *Buteo rufinus; Charadriiformes* - stone curlew *Burhinus oedicnemus*, collared pratincole *Glareola pratincola; Coraxiiformes* - blue-cheeked bee eater *Merops persicus; Passeriformes* - magpie *Pica pica*, hooded crow *Corvus cornix*, common reed-bunting *Emberiza schoeniclus* and many others [3, 8-9, 11, 21].

We can assume that the absence of some species is associated with the climatic conditions of the study region. These are the distinctive features of sharply continental climate - a relatively late and cool spring, observed this year in the southwest of Kazakhstan, which undoubtedly introduces significant adjustments to the spring arrival of birds from wintering. Also important is the lack of shelter (sparse shoots of vegetation, shrubs) from the activity of constant winds (Voeikov axis). A certain role is played by the isolation of the reservoir. It is likely that the relatively recent start of the restoration of the biodiversity of Kazakhstan's Aral Sea contributes to its share.

4. Summary

1. The counts of the avifauna of water spills of the Baskara canal in the east of Kazalinsk were initiated with the aim of determining

the species diversity in the process of restoration of the biodiversity of the Aral Sea region.
2. A comparatively low species diversity of birds was found - 13 species, the representatives of 8 orders, which is undoubtedly a good indicator for a small pond.
3. The absence of some species characteristic for these places can be a consequence of abnormal climatic conditions - late spring, constant winds, etc.
4. To provide a complete picture, bird counts in the summer and autumn seasons are required.

5. Conclusion

The regulation of the Syrdarya River bed in the middle and lower reaches had a positive effect on the restoration and preservation of the biodiversity of the Kazakhstani Aral Sea area. At present, due to the increase in the capacity of the Syrdarya River, lakes systems are connected by a complex network of natural channels and artificial canals. Watering of previously drained reservoirs provides an opportunity for the formation of a coastal and aquatic plant formation, their invertebrate and vertebrate animals. These conditions requires fauna surveys, including birds, to determine species diversity. To this end, the authors made a trip to the spills of the Baskara canal, located in the east of Kazalinsk. As a result of the research preliminary data on the diversity of the ornithocenosis of this reservoir were obtained. Total 13 species of birds of 8 orders were recorded. Impoverished species diversity of avifauna can be associated, first, with a relatively late and cool spring, and secondly, sparse shoots of vegetation, shrubs or lack of shelter, and third, the isolation of the reservoir. Probably, the relatively recent start of the process of restoration of the biodiversity of Kazakhstani Aral Sea plays its part.

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