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ABSTRACT

of the dissertation for the degree of Doctor of Philosophy

SWAMP BIRDS OF NAKHCHIVAN AUTONOMOUS REPUBLIC, PERSPECTIVES OF USE OF SOME SPECIES AND EVALUATION OF ENVIRONMENTAL FACTORS

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INTRODUCTION

Actuality and usage rate of the research work. According to their ecological characteristics, representatives of the class of birds are relatively divided into several groups, one of the most important of which are wetland birds.

Based on the research conducted in the water basins of the Nakhchivan Autonomous Republic, it was determined that there are numerous and diverse groups of wetland birds ornithofauna, which determines their important role in water basins and biocenoses. Wetland birds belonging to settlement and different ecological groups have great hunting, commercial and aesthetic importance. Environmental factors constantly deviate from the optimal norms, especially the lack of precipitation in recent years, temperature exceeding the norm, and as a result, the constant decrease of the water level in water basins, violation of the water regime, an increase in the temperature in the water, the study of the lifestyle of water birds according to the current situation appears as a biological problem. In addition, typical waterfowl and domesticated birds living near water, especially Anseriformes Wagler, 1831 - Anatidae Vigors, 1825 - Duck family, have a significant relationship with the circulation of pathogens of bird flu and other infectious diseases in nature. This shows the need for research on wetland birds and studying their life cycle.

The object and subject of the research. Wetland birds distributed in the Nakhchivan Autonomous Republic are the object of the study, and the study parameters of wetland bird populations (species composition, daily activity, densities, nutritional characteristics, distribution by areas, reproduction conditions, sociology, distribution according to the type of development, etc.) are the subject of the study.

The purpose and tasks of the research: The purpose of the work was to determine the systematic composition of the wetland bird fauna in the territory of the Nakhchivan Autonomous Republic, to determine their population density, the main characteristics of the nesting dynamics, to determine their resources, changes in their distribution, to evaluate the prospects for the use of some species, conservation measures and environmental factors. In this regard, the following

tasks are planned:

1. Determining the species composition and settlement character of birds in the territory of the Nakhchivan Autonomous Republic, preparing a systematic spectrum;

2. Studying the dynamics of changes in the modern species composition of the avifauna, as well as the ecological characteristics of wetland birds in the conditions of the autonomous republic;

3. Features of the habitats of wetland birds, justification of their grouping according to ornithocomplexes;

4. Evaluation of the stock of game birds by route and stationary counting method;

5. Conducting an assessment of wetland bird use prospects, conservation issues and environmental factors.

Research methods. Field surveys were conducted in all regions of the autonomous republic. During the research, mainly binoculars, cameras, telescopes, etc. such equipment was used, the natural conditions of the area, the factors affecting the species and the habitat were studied, the reserve of the species, the perspectives of use and the ways of protection were determined. During the study, the distribution and number of wetland birds were studied using commonly accepted methods (on foot, on horseback, by boat and by car). To calculate the number or density of birds, the extrapolation method was used as a basis, using the total length of the coastline. The registration of counts of representatives of wetland and other systematic groups of birds was carried out by the method of registration on routes, regardless of the distance. The number of birds was recorded separately for noticeable groups.

In order to reveal the dynamics of daily migration and its other parameters, the records were repeated every half hour, the obtained data were processed for a period of five days. To determine the number of birds, the extrapolation method was used for the time outside of observation. Morphological signs, sounds, flight characteristics, habitat selection and nesting form were used to identify the species during the observations.

Main provisions defended.

1. Taxonomic spectrum of wetland birds in Nakhchivan Autonomous Republic was prepared, various parameters of migration

movement were studied;

2. The distribution of wetland birds in areas was studied, the nesting stage of some species of birds was studied;

3. The dynamics of changes in the composition of the modern bird fauna were studied, the ecological characteristics of wetland birds in the conditions of the autonomous republic were determined;

4. The characteristics of the areas where wetland bird species live have been studied, and their grouping according to the ornithocomplex has been justified;

5. Information on the use prospects of some types of wetland birds, biology of rare and endangered species was collected and environmental factors were evaluated.

Scientific novelty of the research. For the first time, the population dynamics and nesting of birds common in the main wetlands and wetlands of Nakhchivan Autonomous Republic were studied, and the taxonomic spectrum was prepared. For the first time, the process of formation of the modern bird fauna of Nakhchivan Autonomous Republic was analyzed in detail. General regularities of distribution of birds on different types of lakes, parameters of bird population in water sources belonging to different groups, characteristics of nesting, time of spring-autumn migrations were determined. Wetland bird resources were assessed, regional impact factors and rare species were identified.

During the research, species of Elanus caeruleus (Desfontaines, 1789), Vanellus spinosus (Linnaeus, 1758), Rissa tridactyla (Linnaeus, 1758) were discovered in the territory of the autonomous republic and added to the avifauna of Azerbaijan for the first time.

Theoretical and practical significance of research. The results of the research work fill the gaps in the study of the ornithofauna of the Nakhchivan Autonomous Republic. Species composition, dynamics of migration, feeding and breeding ecology of wetland birds distributed in the area were determined. Quantitative data on species, the impact of natural and anthropogenic factors on the population, rare and endangered species were specially studied, and suggestions were made for their protection and efficient use.

The results obtained during the research period were used in

writing the books "Taxonomic spectrum of the fauna of Azerbaijan (Vertebrates)" 2020 and "Information system of the fauna of Azerbaijan (Vertebrates)" 2023.

The research work can be the basis for long-term monitoring of the bird fauna of water basins due to the anthropogenic transformation of water and aquatic ecosystems under the influence of ongoing climate changes. The results of the research can be used in the preparation of the next edition of the "Red Book" of the Republic of Azerbaijan.

The obtained information is recommended for carrying out environmental protection measures in reservations. It can be used to develop a new set of recommendations and rules for hunting in the area. The results of the work are of special interest for the teaching process in school regional studies, biology faculties of universities and can be used in the implementation of zoology, ornithology, bird ecology, as well as educational programs. Research work can be used in teaching and field experience in vertebrate zoology, coursework, writing diploma theses.

Approbation and application of the work. The results of the work were heard and discussed at the Scientific Seminars of the Institute of Bioresources of the National Academy of Sciences (Nakhchivan), as well as at the following national and international scientific-practical conferences:

- IV International Scientific Conference "Actual problems of modern natural and economic sciences" (May 02-03, 2019, Ganja);
- IV International Scientific Conference called "Actual problems of modern natural and economic sciences" (May 01-02, 2020, Ganja);
- International conference held in Kyoto, Japan (April 28-30, 2021, Kyoto, Japan);
- IV International Scientific Conference called "Actual problems of modern natural and economic sciences" (May 2, 2022, Ganja);
- III International scientific-practical conference held in Penza (March 5, 2022 Penza);
- The 2nd International scientific-practical conference "Silk Road" held in Iğdır, Turkey (September 26-27, 2023, Iğdır).

12 articles related to the dissertation work (3 of them in journals

included in international index databases) and 6 conference materials were published.

The organization where the dissertation work was performed. The research work was carried out at the Zoological Research Department of the Institute of Bioresources (Nakhchivan) of the Ministry of Science and Education of the Republic of Azerbaijan.

The structure and volume of the dissertation. The total volume of the dissertation consists of 187 pages and 228145 characters. The main text consists of 177 pages, introduction (9176 characters), 6 chapters (203815 characters), conclusion (10386 characters), conclusion (3694), practical suggestions (1074 characters), bibliography and appendices. 157 reference materials were used in the dissertation. The text part of the dissertation contains 19 pictures, 45 graphs, 23 tables and 1 map-scheme.

I CHAPTER. BRIEF PHYSICAL-GEOGRAPHIC ESSAY OF THE RESEARCH AREA, CHARACTERISTICS OF WETLANDS

The chapter provides brief information about the physical and geographical features of the territory of the autonomous republic, the natural conditions that determine the characteristics of the habitat for wetland birds.

II CHAPTER. HİSTORY OF THE STUDY OF WETLAND BİRDS İN THE NAKHCHİVAN AUTONOMOUS REPUBLİC

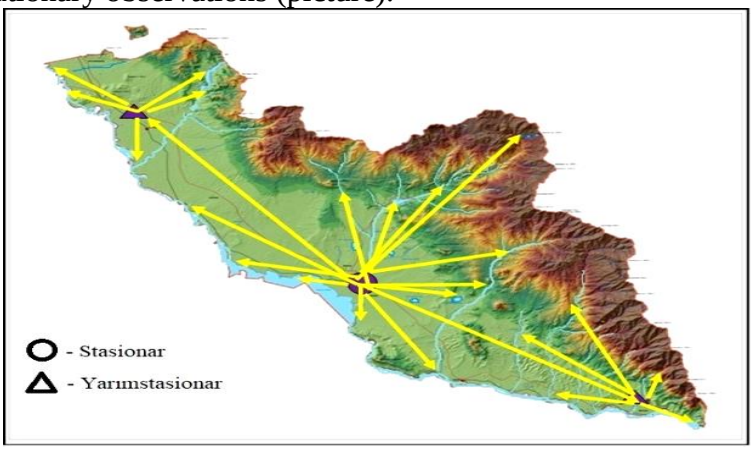
Planned scientific-research works on wetland bird species of Nakhchivan Autonomous Republic have not been carried out, and some works contain superficial information about the birds observed in that area.[1] Analysis of all available literature data on wetland bird species of the Autonomous Republic showed that 84 species belonging to 17 families were recorded until our study, which indicates that there

[1] Mammadov, A.F. The modern situation of ornithofauna in the Autonomous Republic of Nakhchivan // News of the Nakhchivan Department of ANAS, Natural and technical sciences series, - Nakhchivan: Tusi, - 2010. No. 4, - p. 191-196.

is insufficient information on wetland bird species in the area.[2]

III CHAPTER. RESEARCH MATERİAL AND METHODOLOGİES

Material from 2018 to 2022, including the winter season, the distribution and density of water and marsh birds were collected on foot, by boat and by car using generally accepted methods determined by stationary observations (picture).



Picture. Zoological expedition routes traveled in the territory of Nakhchivan MR in 2018-2022

The total length of the coastline was used as a basis for extrapolation to calculate the number or density of birds. The registration of the count of marsh and other systematic groups of birds was carried out along the routes regardless of the distance. The number of birds was recorded separately by significant groups[3].

When characterizing the bird population, A.P. The methodology of Kuzyakin (1962) was taken as a basis[4]. Here are numerous - 100 or

[2] Talibov, T.H. Taxonomic spectrum of vertebrate fauna of Nakhchivan Autonomous Republic / T.H. Talibov, A.F. Mammadov. - Baku: Teacher, - p. 2016, – 68 p.

[3] Равкин, Е.С. Методические рекомендации по комплексному маршрутному учету птиц / Е.С.Равкин, Н.Г. Челинцев. – Москва, – 1990. – 33 с.

[4] Кузякин, А.П. Зоогеография СССР // Ученые записки МОПИ им. Н.К.Крупской. – М., – 1962. (109), вып. 1, – с. 3-182.

more; ordinary - 10-99; few (regular) 1-9; rare 0.1-0.9; very rarely taken as less than 0.1.

A new extrapolation method for time off observation was used to estimate bird numbers[5]. The essence of this method is that in the calculation of counts during five-day observations, the time periods where the results of the data obtained for this or that hour are omitted are also included. For all localities, the number of recorded individuals of each species (N0) and the coefficient (K) for those who were excluded were calculated. The ratio was obtained by dividing the total number of hours spent counting by the number of hours spent counting each species.

The total number of hours at the observation point was 2.5 hours for a five-day period (0.5 hours x 5 days). For the last "quintet" of 31-day months (eg March), it was 3 hours (0.5 hours x 6 days). In this case, the number of birds actually counted for the given five-day period was equal to

$$N1+N2+N3....Ni \quad (3.1)$$

Here N1, N2, N3; K1, K2, K3 are the repeat counts, Ni is the actual count, and Ki is the under-recording factor. Estimated number of all migrating birds at the observation site for five days was equal to the total

$$NiK1+N2K2+N3K3...+NiKi \quad (3.2)$$

If 30% of the observation period is lost, such extrapolation is not considered correct.

In the shallow parts of the coastline, during the observations, wearing boots, sometimes hidden and sometimes openly, depending on the station. In April-May, Araz reservoir was entered by boat to observe the nesting. Chicks approached the nests without disturbing their parents, and the times when the parents were not present for observation were preferred. We stayed at the observation post for about

[5] Глущенко, Ю.Н., Бочарников, В.Н., Шибнев, Ю.Б. Опыт оценки численности водоплавающих птиц российского сектора Приханкайской низменности // Проблёмь сохранёния водно-болотный угодий международного значения: Озеро Ханка (Труды международной научно-практической конференции). – Спасск-Дальний, – 1995 а. – с. 35-45.

45-60 minutes. At that time, we were trying to collect all kinds of bi-oecological information about the lakes. Names of species observed in the lake, number of individuals and dates of observation are recorded. Photographs of some species were also taken during the observations and are listed in the observations section.

Characteristics such as morphological signs, sounds, flight characteristics, habitat selection and nesting forms were used to identify the species during the observations.

Stationary observation and moving along the route, registration methods were used. In order to specify the breeding and meeting places of birds, in addition to our own observations, literature and information from local environmental organizations (verbal survey) and websites were also used. Optical devices BSPB-10x40 binoculars, Swarovski telescope 60x80, camera and color detectors, counting methods were used to determine the species of birds.

$$K = \frac{40a + 10b + 3s + d}{L} \times 100\% \qquad (3.3)$$

Here: K - the total number of individuals per 1 km2 area, a - the number of individuals found up to 25 m from the researcher, b - the number of individuals found up to 25-100 m from the researcher, s - the number of individuals found up to 100-300 m from the researcher number, d - the number of individuals encountered at a distance of >300 m, L - the length of the route (in km). The width of the route was determined individually according to the distance from which the bird was seen. During the research, the number of the nearest species was increased by 40, the ones observed at a relatively distance by 10, and the ones observed at a further distance by 3 times. The average result of the conducted count was extrapolated to the total area of distribution of the species. Density categories of birds were determined according to A.P. Kuzyakin, 1962 and G.T. Mustafayev, 1985[6]. The species was determined from 25-100 m with binoculars, and from 1-2 km with a telescope.

[6] Мустафаев, Г.Т. Птицы наземных экосистем Азербайджана / Г.Т. Мустафаев, – Москва: МГУ, – 1985, – 54с.

The formulas for calculating the frequency of occurrence and dominance of the species found in the lake are given according to Kocataş, 1997.

To calculate species density, the number of individuals of a species in a defined study area is expressed as a percentage. The observed number of a species divided by the number of all observed species in the area and multiplied by 100 equals the density value.

Density:

It is calculated by the formula

$$(F) = Na/Nn \times 100 \quad (3.4)$$

Here: Na - the number of observations of the species, Nn - the number of observations of all species. Density levels of species in a census are determined in 5 categories:

These are; 1-20% rarely observed species, 21-40% rarely observed species, 41-60% commonly observed species; 61-80% majority species; 81-100% are continuously observed species.

For the calculation of dominant species, it is the ratio of individuals of one species to the individuals of all species in the nesting area, or the ratio between the number of individuals of a species and the total number of individuals of all species as a percentage[7].

$$(B) = Na/Nn \times 100 \quad (3.5)$$

B - Dominance, Na - the number of individuals belonging to one species, Nn - the total number of individuals belonging to all species.

Dominance is evaluated in 5 categories;

1. Species whose population is less than 5%; 2. Species whose population size is between 5-25%; 3. Species whose population size is between 25-50%; 4. Species whose population size is between 50-75%; 5. Species with more than 75% population.

Considering the hydro-meteorological conditions of the autonomous republic, the research works were started in March and sometimes earlier.

[7] Kocadaş, A. Ekoloji ve çevre biolojisi / A.Kocadaş – İzmir: Ege Ünversitesi Fen Fakültesi yayınları, – 1997. No 142, – 562 s.

IV CHAPTER. SYSTEMATİC ANALYSİS OF WETLAND BİRDS İN THE TERRİTORY OF NAKHCHİVAN MR

Based on the obtained observations and actual materials, photos, and literature data, the modern systematic units and taxonomy of wetland birds in the territory of Nakhchivan Autonomous Republic were prepared, and the taxonomic spectrum was prepared. (Table 1).

Table 1

Taxonomic spectrum of wetland birds of Nakhchivan Autonomous Republic

№	Ordo	The name of the chapters	Familia	Species number	With %
1	*Gaviiformes*	*Gavidae*	1	1	1,16
2	*Podicipediformes*	*Podicipedidae*	2	3	3,48
3	*Pelecaniformes*	*Pelecanidae*	1	2	2,32
		Phalacrocoracidae	2	2	2,32
4	*Ciconiformes*	*Ardeidae*	7	9	10,47
		Threskiornithidae	2	2	2,32
		Ciconiidae	1	1	1,16
5	*Phonicopteriformes*	*Phonicopteridae*	1	1	1,16
6	*Anseriformes*	*Anatidae*	10	19	22,1
7	*Gruiformes*	*Gruidae*	2	2	2,32
		Rallidae	5	6	6,98
8	*Charadriiformes*	*Burhnidae*	1	1	1,16
		Charadriidae	5	6	6,99
		Recurvirastridae	2	2	2,32
		Scolopacidae	8	12	13,96
		Glareolidae	1	2	2,32
		Laridae	5	15	17,45
	Conclusion	17	56	86	100

Thus, in the Autonomous Republic of Nakhchivan, wetland birds make up 44.4% of the total bird fauna (18), 32.7% of the families (53), 36.6% of the genera (150), and 31% of the species (268) makes up 7%.

Based on the results of the ornithological researches, the wetland birds of the Shorebirds group are currently represented by 38 species belonging to 6 families and 22 genera in the autonomous republic.

4.1. Overview of wetland birds of Nakhchivan MR by groups. 3 species of *Tachybaptus* and *Podiceps* belonging to the *Podicipediformes* family of *Podicipedidae* in the Nakhchivan Autonomous Republic *Tachybaptus ruficollis* Pallas, 1764, *Podiceps cristatus* Linn., 1758 and Black-necked Batagan - Podiceps nigricollis Brehm., 1831 species included.

The Pelican (*Pelecanus*) genus, which belongs to the Pelecanidae family, includes 2 species. Of these, the color of the Pink pelican (*Pelecanus onoscrotalus*) is white with a pink tint, as the name suggests.

The most widespread of these species is the curled pelican (*Pelecanus crispus*). The feathers of this species are grayish-white, and the tips of the wings are gray-brown. The feathers on the back of the neck are elongated and curled. The other 2 species included in the group of pelicans are the Great Cormorant (*Phalacrocorax carbo*) and the Lesser Cormorant (Phalacrocorax pygmaeus) belonging to the Phalacrocoracidae family. The great cormorant (*Phalacrocorax carbo*) lives in flocks.

In the autonomous republic, these birds belonging to the group Ciconiiformes are almost always found in the water reserves, and this group includes 12 species belonging to 3 families and 10 genera in the area. *Ardeidae* is the largest family of storks in the area. The heron family includes 7 genera in the territory of the autonomous republic. The Flamingo (*Phoenicopteris*) genus, included in the *Phoenicopteriformes* group, includes only one species in the fauna of the Nakhchivan Autonomous Republic. Common flamingo (*Phoenicopterus ruber*) is a species of the group of Flamingos (*Phoenicopteriformes*), which is included in the group of wetland birds in the autonomous republic. *Anseriformes* group is a large group of wetland birds, it consists of 18 species belonging to 1 family and 7 genera in Nakhchivan MR. The group of birds is traditionally divided into 3 large groups: swans, geese and ducks. Ducks (*Anatidae*) family includes 3 species belonging

to the Goose (Anser) genus.

Cranes (*Gruidae*) are one of the families included in the group of cranes. This family includes 2 species belonging to 2 genera. Among them, the Gray crane (*Grus grus*) belonging to the Crane (*Grus*) genus and the Called crane (*Anthropoides*) of the other genus, the same-named Called crane (Anthropoides virgo) are included.

In Nakhchivan MR, wetland birds of *Charadriiformes* are represented by 29 species belonging to 5 families and 16 genera.

V CHAPTER . CURRENT STATUS OF WATERFOWL POPULATİONS İN NAKHCHİVAN AUTONOMOUS REPUBLİC

17 families, 56 genera, and 86 species were recorded in 8 groups in the wetlands of the autonomous republic and along their coasts near them, which made up 31.95% of the total number of species recorded in the entire autonomous republic.

During the research period, we noted 19 species belonging to the Anseriformes group, which makes up 22.35% of the wetland species recorded in the autonomous republic. Of the other systematic groups of birds recorded in water basins and on their shores, the species belonging to the order Charadriiformes are more interesting; they are 43.52% compared to the total number of other species.

As you know, in the process of evolution, birds have adapted to many different environments. As a result, in the process of ecogenesis, various ecological groups and life forms of birds were formed, characterized by attachment to certain habitats, the development of unique adaptations to one degree or another to use and obtain food.

Ordo *Podicipediphormes*. During the research period, a total of 680 individuals of *Podicipediphormes* were recorded from observation points (Table 2).

The highest number indicator of these species were blacknecked grebe.

Ordo *Pelicaniphormes*. Almost 39567 pelicans were recorded from observation points during spring migration during the study period. There were 39,567 individuals of four species belonging to the group of pelicans, of which there were 236 pink pelicans, 3807 curled *Pelicans,* 32709

great cormorants, and 2812 lesser cormorants (Table 3).

Table 2

Results of annual census of shorebirds and wetland birds during migration

№	Ordo	The season	2018	2019	2020	2021	2022	Common
1.	*Gaviiformes*	Summer	-	-	2	-	-	2
		Autumn	-	-	-	-	-	-
2	*Podicipediformes*	Summer	96	119	83	56	122	476
		Autumn	45	25	44	34	56	204
3	*Pelecaniformes*	Summer	5266	4794	8076	6427	8396	32959
		Autumn	1176	1144	1631	1124	1533	6608
4.	*Ciconiiformes*	Summer	957	755	1501	1222	1203	5638
		Autumn	102	250	76	25	42	495
5.	*Phonicopteriformes*	Summer	15	38	7	12	21	93
		Autumn	10	8	45	2	34	99
6.	*Anseriformes*	Summer	15133	14960	11788	16155	14422	72458
		Autumn	1528	1277	6550	2493	1585	13433
7.	*Gruiformes*	Summer	10328	11035	9968	14833	15621	61785
		Autumn	1667	1399	2146	2392	2643	10247
8.	*Charadriiformes*	Summer	1571	1333	1538	1760	1379	7581
		Autumn	576	348	435	1503	1044	3906
Common		Summer	33366	33034	32961	39465	41164	179990
		Autumn	5104	9921	9884	5261	6937	37107
Total:			38470	42955	23031	42845	48101	217097

Table 3

The results of the assessment of Batagankims for the years of research

Species	Years of observations					General
	2018	2019	2020	2021	2022	
Great crested grebe	34	52	68	34	48	236
Little Grebbe	42	31	26	38	64	201
Black-necked Grebe	65	61	33	18	66	243
Conculision	141	144	127	90	178	680

Table 4

Results of the survey of pelicans for the research years

Species	Years of observations					General
	2018	2019	2020	2021	2022	
Wite pelican	34	52	68	34	48	236
Dalmaton pelican	242	689	926	886	1064	3807
Great Cormorant	5743	4767	8073	5919	8207	32709
Pigmy cormorant	423	430	640	712	610	2812
Conculision	6442	5938	9707	7551	9929	39567

Ordo *Ciconiformes.* For the entire period from 2018 to 2022, 6133 thousand individuals of ten species of storks were recorded from the monitoring station during spring migration (Table 4).

Table 5

Individual years of the migratory species of the stork group recorded from the observation station located in the research area sayı

Species	Years of observations					General
	2018	2019	2020	2021	2022	
Greater bitten	4	2	8	4	8	26
Little bitten	2	11	26	18	14	71
Black-crowned night neron	53	82	145	125	121	557
Squacco hero	23	68	83	65	57	296
Cattle egypt	163	166	278	196	216	1019
Great white egret	155	146	263	126	151	841
Little egret	44	112	143	145	114	558
Gray heron	213	156	163	156	143	800
Purple heron	14	40	86	73	78	291
Glossy ibis	12	54	71	61	72	270
Eurasion spoonbill	12	44	74	62	56	248
White stork	364	124	237	216	215	1156
General	1057	1005	1577	1247	1245	6133

Only the representatives of the species belonging to the herons family were the majority. These constituted 72.7% of the total number

of recorded species of the group. During the season, gray wagtail and large white heron were the most common species. The maximum number of herons was recorded in 2021 and 1195 individuals per year: for gray and great white herons it was 156 and 126, respectively. According to relevant calculations, it was estimated that about 1200 great white herons could fly in the territory of the observation station in the spring of that year. The first individuals and small groups of gray herons were recorded by us on March 16, 2018, March 2, 2019, March 14, 2020, March 15, 2021 and March 18, 2022. The Great White Whale was observed on March 6, 2018 and 2019, March 17, 2021, March 20, 2022, and March 22, 2022. Open migrations of the gray herons begin in mid-March

Ordo *Anseriformes.* The research work was carried out in the territory of the Nakhchivan Autonomous Republic, as well as in the Azerbaijani sector of the Araz Reservoir, Arpachay, Uzunoba, H.Aliyev Reservoir, Sirab, Gahab, reservoirs, Dastagol, Sedarak checkpoints and along the rivers. The difficulty of studying transit migration in the Araz reservoir is associated with the fact that this area is a border, as well as with the mixing of massive and long-term trophic delays of birds during their passing migration. Anseriformes were recorded (Table 4).

Both species diversity (20 species) and numbers were dominated by ducks. 59.3% of geese (*Anseriformes*) found in the entire area are observed here, while the number of swans was minimal (about 0.3%) (table 5).

Both species diversity (15 species; 78.94%) and numbers were dominated by ducks (66611 individuals; 77.5%).

The number of swans was minimal and made up 0.25%.

Migration of *Gruiformes*. Open daytime migration among cranes in the territory of the monitoring station is characteristic only for representatives of the crane family. For the entire period from 2018 to 2022, 2497 of two species of cranes were recorded during migration from the monitoring station, including 1476 in spring and only 1021 in autumn (Table 7).

Table 6

The results of the annual spring breeding of species belonging to the *Anserifromes* group recorded from observation points

S/№	Species	Number of registered birds					
		2018	2019	2020	2021	2022	Total:
1.	Greyland goose	1450	1500	1322	1000	1711	6983
2.	Grater white fronted goose	1850	1735	1840	1760	1661	8846
3.	Lesser white fronted goose	118	421	641	958	1063	3201
4.	Whooper swan	48	18	55	33	96	250
5.	Ruddy shelduck	4382	3535	3987	5917	2417	20238
6	Common Shelduck	123	178	211	120	320	952
7.	Common mallard	1111	1187	2180	1543	1637	7658
8.	Eurasion teal	1588	1521	1387	1733	1282	7511
9.	Gadwall	139	153	229	102	77	700
10.	Eurosion wigoen	112	181	234	121	45	693
11.	Nortern pintail	1122	1293	1115	928	1171	5629
12.	Garganey	1149	936	1241	1261	1118	5705
13.	Northern shoveler	1119	1072	1160	965	1237	5553
14	Marbled teal	12	1	8	4	1	26
15.	Common pochard	2112	2205	2415	1795	2003	10530
16	Tufted duck	204	284	299	386	168	1341
17.	Ferruginous duck	3	4	3	0	0	10
18	whte-headed duck	1	2	2	-	-	5
19	Smew	18	11	9	22	----	60
Common:		16661	16237	18338	18648	16007	85891

A group of jurors. Among the Charadriiformes order noted at the observation sites, significant diurnal migration is characteristic of several species of charadriiformes and gulls. During the study period, about 1385 individuals of 23 species of mullet were recorded from the spring migration monitoring station (Table 8).

Table 7

Results of annual census of cranes during their spring migration in the study area. (stations near the village of Karachug and Bulgan)

Species	Years of observations					General:
	2018	2019	2020	2021	2022	
Demoistelle crane	18	24	37	28	54	161
Common crane	3750	4422	4040	5338	5530	23080
Common moorhen	25	12	17	26	15	95
Water rail	16	8	13	18	8	63
Little crake	8	13	5	21	27	74
Corn grake	-	1	-	2	-	3
Spotted crake	5	8	12	11	8	44
Common coot	8173	7946	7990	11781	12623	48513
Total:	11995	12434	12114	17225	18265	72032

Table 8

The number of migratory species recorded in spring at observation points (Karachug and Bulgan points)

№	Species	Years of observations					Gen-eral
		2018	2019	2020	2021	2022	
1	Stone curlew	1	-	3	12	-	16
2	Golden plover	0	0	0	12	0	12
3	Ringed plover	12	8	4	15	21	60
4	Sociable plover	1	1	0	1	2	5
5	Little ringed plover	25	12	34	7	41	119
6	Lapwing	56	128	165	76	138	563
7	Spur-winged lapwig	0	0	1	0	0	1
8	Black-winged stilt	8	11	6	16	6	47
9	Pied avocet	32	82	26	45	54	239
10	Green sandpiped	0	1	1	0	0	2
11	Common redshank	12	18	26	23	24	103
12	Wood sandpiper	0	0	1	1	0	2
13	Nice grassy clippings	0	0	1	3	2	6
14	Spotted redshank	0	1	0	0	1	2
15	Red-necked phalarope	0	0	12	0	0	12
16	White-tailed lapwing	0	0	0	0	1	1
17	Little stint	12	34	28	23	36	133
18	Eurasian Woodcock	0	1	1	0	2	4
19	Common snipe	0	2	0	3	0	5

Table 8 continuation

20	Eurasion Curlew	0	13	9	4	8	34
21	Ruff	0	0	12	0	0	12
22	Collared pratincole	1	0	0	0	0	1
23	Black-winged pratincole	1	0	3	1	1	6
Total:		161	312	333	242	337	1385

Migration of herds usually occurs in large monospecific herds. On average, their number is much higher than the number of migratory groups of other duck species that migrate in spring along the Araz river valley. The flocks with the participation of only a small number of gulls (11.3%) are mixed with other species of river ducks (they migrate in a mixed state). If flocks of up to 50 are more common for other species of ducks that migrate here, and flocks of more than 500 birds are not recorded, the average number of species of mullet in one flock is more than 200. 66.2% of flocks of this species consisted of 11 to 150, and 64.3% of birds flew in flocks of more than 500.

During the research period, more than 10 thousand individuals of 9 species of seagulls were recorded from the spring migration observation point. These included: common lake gull, laughing gull, black-headed gull, Caspian gull, silver gull, Armenian gull, gray gull, three-toed gull, little gull, pigeon gull, black-headed gull, black-headed gull (Table 8).

Table 9

The number of migratory seagulls recorded in the spring over the years

Species	Years of observations					General
	2018	2019	2020	2021	2022	
Black-headed gull	295	164	171	533	431	1594
Caspian gull	738	487	515	1055	709	3504
Mediterranean gull	46	37	22	68	34	207
Black-backed gull	3	1	2	2	1	9
European herring gull	531	349	479	781	459	2599
Armenian gull	45	69	56	156	78	404
Common gull	191	214	197	218	237	1057
Black-legged gull	0	0	1	0	0	1
Little gull	137	48	197	208	137	727
Total:	1986	1369	1640	3021	2086	10102

Black-headed gull and Caspian gull, Silvery seagull, Gray gull were the most numerous. It can be said that these species accounted for 99.7% of birds recorded in all seasons. Other species of seagulls were very few, except the Little gull.

CHAPTER VI. WATERFOWL RESOURCES, REPRODUCTION, USE OPPORTUNITIES AND WAYS OF PROTECTION

6.1. Reserves and possibilities of use. Waterfowl distributed in the territory of the autonomous republic have a significant reserve, some of them are important for hunting. The distribution of birds across the region is extremely uneven.

6.2. Distribution of birds according to the nature of the water area. The vast majority of waterfowl prefer to nest or visit the lake first at certain times of their lives. They are found in smaller numbers in other types of water basins. Therefore, the nature of the habitats is explored in more detail using the example of lakes, which can be classified both according to their location and the composition of the birds that live there. Researchers propose to distinguish 3 groups in which a certain ratio of ecological groups of waterfowl is observed.

The first group includes large and deep lakes with clean water, high rocky shores of oligotrophic type with weak coastal vegetation. They are used as stopovers for most migratory bird species (near Araz, Gümüşlü lake, Saderak crossing point) and mainly as nesting sites for black-breasted gakar and great pazdimdik. In the shallowest areas, mallards and fichi ducks are found - areas covered with reeds and decaying reed stems (table 10).

Table 10

Proportion of ecological groups of waterfowl (%)

Groups of birds	Groups of the lake		
	I	II	III
Gagar, Wedge-beak	38,5	6,8	1,9
River ducks	36,7	42,7	31,1
Great crested grebbe	22,0	24,5	46,8
Black-necked grebbe	2,6	22,9	-

Type II small and relatively shallow lakes with an area of up to 500-100 hectares, slightly silted, rich aquatic vegetation consisting of uruti and ponds, with well-developed rafts, are very rich in birds in all seasons. 15 species are associated with them, 12 of which are nesting (green-headed and red-headed diver predominate). Lakes of the III group have an area of no more than 30 hectares, a depth of up to 2 meters, a very muddy bottom and a slight slope, the shores are often muddy, and there is a narrow strip of coastal vegetation. There are a large number of teal and laughing ducks, as well as grebes, red-headed grebes, etc. species nest. Group III lakes do not play a significant role for other birds during migration.

The table below shows 4 types of lakes for comparison (Table 11).

The richest in terms of fauna is the Araz and Arpachay reservoirs, where 12 species nest. For comparison, let's note that 7 and 8 species live in mountain and foothill lakes. In the first two, 8 species and 8-9 species in the foothills are not observed. Pazdimdik is a bird found only in foothill lakes. Among such rare species, rare species such as White-eyed diver and other rare species were observed only in the foothills and forest-steppe lakes. Green-headed ducks, red-headed ducks and teal ducks are recorded in all types of lakes.

This group of waterfowl belongs to the type of waterfowl that is ecologically plastic and resistant to anthropogenic influences. This distribution structure of birds is typical for all water bodies of the autonomous republic.

Compared to the optimal level of similarity (0.7), the correlation coefficient is lower than the threshold value between reservoirs of types 1 - 4 and 2 - 4, and higher in variants 1 - 2 and 1 - 3. A high degree of similarity was obtained between type 2 and type 3 reservoirs.

For further analysis, we identified 8 types of lakes based on population similarity. For this purpose, 30 lakes located in different landscape zones of the region were studied.

1. Lakes with different areas are usually quite deep with different degrees of shoreline development. The species and quantity composition of waterfowl is extremely poor.

Table 11

Pattern and number of birds staying in the lake (individuals per 10 km of coastline)

Groups and types	The type of lake			
	Mountain	Foothills	Forest-steppe	Steppe-plain
Anseriformes				
Whooper Swan			Ötk 1	Ötk 1
Graylag goose			Q,30-100	Q 3, 10-20
Graeter white-fronted goose	Ötk 1	Ötk 1	Ötk 1	Ötk 2
Lesser white-fronted goose	Ötk 1	Ötk 1	Ötk 1	Ötk 1
Ruddy shelduck			Q 3, 5-30	Q 2, 3-10
Common mallard				Q 1, 12-20
Eurasian teal	Q 3,4-20	Q 3, 10-20	Q 4, 10-50	Q 4, 10-30
Northern pintail	Q 3,3-5	Q 3,3-5	Q 3, 5-10	Q 3, 5-10
Gadwal	Ötk 2	Ug 2	Q 2, 5-7	Q 2, 4-9
Common pochard	Q 2, 2-3	Q 2, 2-3	Q 1, 1-2	
Northerin pineail		Ötk 3	Ötk 3	
Garganey	Ötk 2		Q 4, 10-40	Q 3, 5-20
Northern shoveler		Ötk 2	Q 2, 2-3	Q 3, 3-10
Red-crested pochard	Ötk 2	Q 2, 2	Q 3, 6-8	Q 3, 5-10
Tufted duck	Q 3,7-12	Q 2,10-12	Q 4, 20-70	Q 3, 10-30
Ferruginous duck	Ökk-1	Ötk -1 +	Ötk -1 +	Ötk -1
Smew	Q 1	Q 1	Ötk 2	
White-headed duck		+		
Rallidae				+
Common coot		+ 3-4	Q 4, 10-30	Q 3, 5-10

Note: Q - nests; Otk - passes by; Ug – flies away; 1 - very rare; 2 - rare; 3 - ordinary; 4 - numerous.

2. Lakes of medium depth with slightly curved shorelines and high banks. The aquatic vegetation is more developed than before and can occupy 50% of the total area. The species composition of birds is low.

3. Lakes with an area of 0.5 - 1.0 km^2 and a depth of no more than 3 m, with abundant and diverse thickets of underwater and air-aquatic plants. The coastline is poorly developed. It is distinguished

by its rich population of waterfowl (7-8 species).

4. River mouths. It is a special habitat where only ducks nest. Fauna includes 6-8 species.

5. Lakes with an area of more than 10 km^2 apply. The coastline is well developed. In fact, these lakes are of many species is a residential complex. Due to the large reservoirs, the nesting density of birds is low.

6. Reservoirs of different areas and depths differ greatly according to the nature of their shores and the abundance of aquatic plants. The bird population varies greatly in quality and quantity (3-7 nesting species).

7. Reservoirs with an area of 1.0 km^2, medium depth (up to 6 m) are distinguished by varying degrees of strength of the coastline. Aerial and underwater vegetation is well developed. 5-6 species nest here.

8. Small dystrophic reservoirs. The appearance of birds on them is random.

As can be seen from the table, reservoirs of types 3, 5, 6 and 7 are the most suitable for nesting. They contain the maximum number of species and high nest density, that is, they are also promising in terms of organizing an economically profitable hunting farm. Some species (grey duck, weasel) nest in only one type of water body. River ducks prefer reservoirs 3 and 5, and type 6 lakes account for the largest share of nesting diving ducks. No ducks have been recorded in water bodies of type 1: only the black-breasted grebe nests there. Greenhead can be found in lakes of type 2, 7, and they prefer water basins of type 3, 5, 6.

White duck inhabits type 3 water basins, and to a lesser extent and equally occurs in type 4 and 5 lakes. Not found in others. Gray duck was recorded in water bodies of type 5. Reservoirs of types 3-5 and 7 play the most important role in the distribution of red-headed duck. The distribution of the whitetail is limited to lakes of the 3rd type. The squeaker is fairly evenly distributed in 6 reservoirs, but prefers lakes of the 3rd and 4th type. The ruddy duck lives in type 3, 4 and 7 lakes, while the mallard mostly lives in type 6 and 7 water basins. The Great Pazdimdik is recorded only in lakes of type 5, it nests in lakes of type 3-7. Great pazdimdik, gray duck prefers open areas of type 5 sututars, it is not found in other

lakes. Such a high level of adaptation is also characteristic of the mallard. Choosing only one basin of water as a place of residence is typical for the herons (3 types of lakes).

The analysis of the composition of the fauna in the lakes shows the level of ecological plasticity of waterfowl. There are three, four and even six types of reservoir-dwelling species. These are the mallard and the teal, which have a high degree of anthropogenic tolerance. At the same time, some birds were found in two and even one type of water basins.

In the autumn period, the population structure of different habitats, as well as changes in different species, were significantly observed. This also applies to the distribution of species between habitats. The population of waterfowl is changing, which is manifested in the appearance of new species, a sharp increase in the proportion of a number of species (red-headed duck, mallard, etc.) in the total population, as well as a decrease in the number or disappearance of certain species. In addition, the distribution of species in water bodies is changing. In autumn, the nature of the habitats changes, which leads to an increase in the role of some water basins in the life of birds, and a decrease in the role of others.

The most common species during migration are the grebe, marek duck, grebe, mallard, teal and ruddy duck, of which the last 4 species nest more often than the others. The maximum population density of 14.3 to 31.6 per 1 sq. In some biotopes, the population density of gas-like animals reached 175 to 353 per 1 km^2.

Among Passeriformes, 6 species are included in the "Red Books" with different statuses. The migration patterns of waterfowl in the territory of the Autonomous Republic compared to the information given in the literature 25 years ago, the number of waterfowl has decreased by 3-5 times. Deformation of landscapes will further destabilize the unique fauna both qualitatively and quantitatively (table 12).

In autumn, a large number of birds are recorded in the Arazboyu reserve, created for waterfowl. Recently, mallards (up to 16%) and teal ducks (Gargeney) have taken an important place in the total number. The main part of the gray goose population is located near the Araz reservoir and the Sadarak crossing point. The number of geese in these

areas is estimated at about 1000-1500. A significant concentration of waterfowl is known in the lakes of the autonomous republic. A large number of birds are recorded in the reserve named after the Nakhchivan reservoir, created for waterfowl in autumn.

Table 12

Types of wetlands recorded during the migration period in the territory of the autonomous republic

The name of the species	Observation point			Route / person. /km^2/		
	Before and after	Frequency of encounter during the day	Average during the day	Surroundings	Around the river	Lake
Whooper swan	9		1,1	4,0		
Graylag goose	3-68	1	20,6	15,5		
Greater white-fronted goose		6		20,6		
Lesser white-fronted goose				4,3		
Common mallard	1-26	5	6,9	19,3	3,6	0,6
Eurasian teal	1-15	3	1,9	1.1	1,3	
Gadwall				0,5	2,3	
Eurasion wigeon				7,7		
Northerin pintail				14,3		
Gargeney	2-8	3	2,0	8,0		1,8
Northern shoveler	21	1	2,6	17,9		
Ruddey shelduck				8,3		
Tufted duck	4-52	4	13,4	31,6		0,2
Smew				1,6		

6.3. Reproduction. Let's consider the general factors that affect birds during the breeding season and their magnitude, because it is at this time that the state of the game fauna reserves is determined.

Nest density was higher in Nakhchivan reservoir. In 2019, a lack of suitable nesting sites was assessed due to a sharp increase in the water level in the Saderak border crossing. In the same year, increased mortality was observed in the area due to high nest density. As

concentration decreased, the percentage of species extinction decreased and nest productivity increased.

When water drops below normal, nesting sites do not increase because there is no vegetation in open shallow water.

Rising flood waters create mosaic flood plains. Many shallow pools of water are observed in flooded low-lying areas. The surface and bottom of these ponds are covered with vegetation. The meadows are covered with tall grass and the presence of sycamore trees created favorable conditions for nesting of waterfowl. The inaccessibility of these places indicates relatively low anthropogenic pressure.

The Araz reservoir is designed for a hydroelectric power station, so its hydraulic regime is more stable. Thus, the limiting factors in Araz, Uzunoba and Gümüşlü reservoirs are manifested in a better form.

The breeding efficiency is low in the Sirab and Nakhchivan reservoirs from the Sututars. Only 7-41% of chicks hatch. Thus, the breeding productivity is 30-55 birds, and the biomass is 24-150 kg per km^2. Low productivity indicators of duck species were noted for Benaniyar, Nehren, Dastgol reservoirs.

6.4. Measures taken to protect wetland birds in Nakhchivan AR. The first nature reserve in the territory of the autonomous republic was created in 1969 by the initiative and care of our National leader. The purpose of creating this reserve, Ordubad State Nature Reserve, which covers 40 thousand hectares (in Julfa, Ordubad regions), was to protect and increase the number of mouflons and bezoar mountain goats, whose numbers decreased sharply at that time. "Arazboyu" (area - 9118 ha) and "Arpachay" (area - 68 thousand 911ha) State Nature Reserves were established by the decrees of the Speaker of the Supreme Assembly of the Nakhchivan Autonomous Republic dated September 23, 2005 and June 22, 2009.

By the Decree No. 212-01/S of the Chairman of the Supreme Assembly of the Nakhchivan Autonomous Republic, dated September 23, 2005, the "Arazboyu" State Nature Reserve with an area of 9118 ha was established in the administrative territories of Sadarak, Sharur, Kangarli, Babek, Julfa and Ordubad districts of the Nakhchivan Autonomous Republic.

CONCLUSION

The conducted research allows the following conclusions to be drawn from the main defended propositions of the dissertation:

1. As a result of the conducted research, it was determined that currently the wetland birds of the autonomous republic are represented by 8 groups, 17 families, 56 genera and 86 species. During the research period, *Elanus caeruleus* Desfontaines, 1789, belonging to the genus Elanus from the Falconiformes group - Gray-winged black-winged warbler; *Vanellus spinosus* Linn., 1758, belonging to the genus Vanellus from the group of sardines, is a spiny sardine; *Rissa tridactya* Stephens, 1826 belonging to the genus Rissa - the three-toed gull was identified by us for the first time and included in the fauna of Azerbaijan. [1, 2, 6, 9, 10, 11, 12, 17, 19].
2. Looking at the seasonal nature of the species in the area, there are 19 (22.1%) wintering migrants, 26 (30.23%) sedentary nesters, 7 (8.14%) coming to winter, and 20 (23.26%) nesting migrants. , there were 14 (16.27%) species during the migration period. According to the relative numbers of the studied species: 12 are Rare, 7 are Rare and 67 are Common species. [15].
3. The proximity of the Araz, Uzunoba, and Sadarak checkpoints, the highest total density of birds on the banks of the Shirarch, Arpachay rivers, as well as other lakes and rivers, are favorable conditions for the nesting of species belonging to the Charadriiformes and Anseriformes groups. Dastgol, Bilav reservoir, etc. The lowest species diversity and population density of wetland birds were recorded here because high mountain lakes with bare shores and lack of vegetation in the upper reaches of watersheds lacked suitable nesting conditions. [13, 14, 15].
4. Among the wetland birds common in the area, the most nesting species belong to the families Anatidae, Ardeidae, Rallidae, Charadriidae and Scolopacidae. After the end of the spring migration, the species diversity and the total number of birds decreased. During the autumn migration, the density of the bird population increases significantly due to the nesting species in the area, and the species diversity decreases, as many migratory birds move south due to a sharp drop in temperature

in autumn. [2, 3, 4].

5. Harsh continental climatic conditions, as well as disruption of the nesting regime, which occurs especially often in the coastal zone of lakes as a result of human activity, as well as the increase in the activity of predators here, are among the main factors affecting the hatching and development of chicks. In general, 6.3% of the laid eggs were defective, and 17% were eggs with dead embryos. Pasture areas located near the lakes and intensive livestock grazing there lead to the fact that the eggs of ducks nesting on the ground were destroyed during the laying and hatching period. For species nesting only in water, overall mortality rates varied slightly from year to year (5-7%). An intermediate position nest was occupied by a group of diving ducks, both in water and on land, which had a chick mortality rate of 32-33%. [2, 16,18].
6. 3280 birds were counted per 100 hectares of nesting area in Sututars. Such a high density indicator is observed only in the sututars near the Araz, Gümüşlü, Uzunoba, Sadarak checkpoints. Calculations showed that in these nesting areas Anas platyrhynochos Linn., 1758 - the share of mallard - 54.4%, Anas crecca Linn., 1758 - the share of Fitji duck - 24.5%, the remaining ducks (grey, weasel, etc.) and Fulica atra Linn., 1758 - and the share of kashgaldag is 21.1% [.
7. Among the wetland birds of the area, the main part of the prey species is the mallard, the teal duck and the grebe, which makes up 79% (of the total number of individuals). The calculation of total biomass using respect data gave the following results. If we consider that the average weight of geese is 3.1 kg, and the average weight of river ducks, diving ducks and mallards is 0.8 kg, the total biomass of geese is 46,515 kg (on average 46,515 t), that of ducks is 44,827.2 kg, and that of mallards is 38,810.4 kg (on average, the two together were 83,637 t.). The total biomass of waterfowl intended for hunting was about 130 tons on average [3, 9].
8. According to the relation of species to conventions and agreements: 67 Ramsar-Bern-Bonn-AEWA; 13 Ramsar-Berin; 3 Ramsar-Bern-Bonn; one Bern-Bonn, one Bern-Bonn-AEWA and one type included in the convention and agreement. 16 wetland species distributed in

the area are included in the high criteria of IUCN and the "Red Book" of Azerbaijan compiled in 2023 [15].

PRACTICAL SUGGESTIONS

1. Exploitation of wetlands requires a comprehensive approach that takes into account the interests of all areas of economic activity, including hunting. The set of measures to increase the productivity of populations should include the following biotechnical measures: organization of new micro-reserves, improvement of the quality of census results in the areas, determination of the number of wild animals for the area.
2. Control of high water levels in reservoirs, restriction of cattle grazing near nesting sites, change of timing of grazing of agricultural animals and start of grass cutting.
3. Expansion of scientific-research works on the condition of individual populations of waterfowl in the conditions of the autonomous republic;
4. Identifying the sources of water pollution and not plowing the banks up to the water line for various agricultural crops. Aerial spraying of agricultural plants with chemicals should be prohibited.
5. Installation of artificial nests. These methods will allow to multiply the productivity of waterfowl populations.

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