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Community composition and population dynamics of vertebrates in the State National Nature Park "Burabay"

The article presents the analysis results of vertebrate community composition in the State National Natural Park "Burabay" and its population dynamics for 2016–2020, as a basic component of the ecological network of specially protected natural areas, ensuring the conservation and restoration of biological diversity, both typical and unique landscapes. The route method of animal registration on the trial plot was applied to study and estimate the number of ungulates, carnivores, rodents, and guans. The animal life forms were classified according to the morphology of A.N. Formazov. The typical nature of the species composition of the park is confirmed by the presence of characteristic communities inherent in the steppe zone. The uniqueness of the species composition of vertebrates lies in the presence of species characteristic to the forest ecosystem; boreal relic animals; species of animals listed in the Red Book of Kazakhstan and species diversity.

Keywords: park, steppe, vertebrates, animals, typicality, uniqueness, types, dynamics.

Introduction

The fauna is an integral part of the biosphere and basic component of ecological network of protected natural areas, which ensures the preservation and restoration of biological diversity, both typical and unique landscapes [1]. Due to the violation of the integrity of their habitat, illegal fishing (poaching), unintentional destruction, and environmental pollution, there is a significant depletion in the numbers of animals and its diversity [2].

To protect wildlife several legislative frameworks have been created in Kazakhstan. The International Convention on Biodiversity was ratified [3], "Ecological Code" [4], "On Protection, Reproduction and Use of Animal World" [5], "On Specially Protected Natural Areas" [6] have been adopted.

In accordance with the Ecological Code of the Republic of Kazakhstan, one of the principles of saving biodiversity is the ecosystem approach in the environmental control [4]. In this regard, it is important to observe the landscape-geographical principle of the reserve territory, since each zone has its own species diversity. Kazakhstan occupies a special place in the biosphere in terms of its natural wealth and diversity.

The National report on the state of the environment [7] provides data on the species composition of the fauna and the list of threatened and endangered animal species is in the Red Book of Kazakhstan [8, 9]. The characteristics of the latitudinal-zonal types of the steppes of Kazakhstan are described by T.I. Isachenko and E.I. Rachkovskaya [10]. The steppe zone is divided into five latitudinal-zonal (subzonal) types [11]. There are four climatic zones on the territory of Northern Kazakhstan: forest-steppe, steppe, dry steppe, and semi-desert [10]. The fauna of the steppe zone is described in the work of S.A. Bulanova and S.K. Gorelova [12].

The State National Natural Park "Burabay" (hereinafter — SNNP "Burabay") is located in the north of the Kazakh Hummocks, belongs to the steppe zone, which is one of the richest and most interesting regions in terms of biological diversity.

The study aims to analyze the community composition of vertebrates in SNNP "Burabay" and to examine its dynamics for 2016–2020.

Scientific novelty and significance. The article describes typical and unique species of vertebrates and their dynamics in the park for 2016–2020. The comparative assessment of the vertebrate abundance in the studied area and the steppe zone of Kazakhstan, Russia, and other countries of the Eurasian continent are given.

Experimental

The study object is the SNNP "Burabay"; the study subject is the community composition and population dynamics of vertebrates in the SNNP "Burabay".

The territory of the national park "Burabay" is divided into four functional zones: protected area — 14,052 ha (10.8 %); ecological stabilization zone — 43,221 ha (33.5 %); tourist and recreational activities zone — 11,280 ha (8.7 %); limited economic activity zone — 60,746 ha (47 %). There are 10 forestry districts on the park territory.

SNNP "Burabay" occupies a mountain-forest area located in Kokshetau Upland. The territory relief is varied: most of it is occupied by steppes, hummocks, flat, slightly dissected, and river valleys, mountains covered with forests. The hight of the Kokshetau range is 887 m [13].

There are many picturesque lakes in the park — Burabay, Shchuchye, Kotyrkol, Bolshoye and Maloye Chebachye, etc. Most of the lakes are fresh, some are brackish. There is an extensive network of rivers and streams (Sarybulak, Gromovaya, Kolchakty, Kilchakty, Imanaysky brook etc.).

The soils are represented by ordinary chernozem, southern chernozem, gray forest soils, meadow chernozems; meadow chernozem, meadow bog and boggy soils, solonetzes, malts, salt marshes, burozems and soddy brown earth and fragmentary soils [14].

The land cover of SNNP "Burabay" includes the following types of vegetation: forest, shrub, meadow, steppe, boggy, as well as water, saline-solonetzic communities.

To analyze the vertebrate communities, we have used the results of our field observations for 2019–2020, also the Nature Chronicle of the SNNP "Burabay" for 2016–2018 [15].

The study of the species composition and their abundance was carried out by the following methods: 1) the route method and registration of animals on trial sites — for the entire species composition of animals; 2) running — for ungulates, carnivores, rodents, and chickens; 3) in places of winter accumulation — for ungulates and chickens; 4) registration of nesting sites for birds; 5) visually in the mountains — for ungulates, carnivores, rodents, and chickens; 6) photography. The life forms of animals were classified according to the morphology of A.N. Formazov.

Results and Discussion

The fauna of SNNP "Burabay" is represented by 621 species belonging to 31 orders, including 13 — fishes, 3 — amphibians, 7 — reptiles, 191 — birds, and 47 — mammals. Now 14 species of animals are listed in the Red Book of Kazakhstan. 4 types of birds are rare and endangered extinction: crane *(Grus grus),* golden eagle *(Aquila),* white-tailed eagle *(Haliaeetus alibicilla),* black-headed gull *(Lams ichthyaetus)* and 1 species of mammal pine marten *(Martes martes)* live in the park, 8 representatives are listed in the International List of Conservation of Nature (ILCN).

Table 1 demonstrates the vertebrate community composition by classes, orders, families, and their ratios. The typicality of the vertebrate species composition lies in the presence of typical animals for the steppe zone of Northern Kazakhstan. However, they are distinguished by an abundance of species composition, which are expressed in a significant ratio of families, genera, and species.

From the class of birds — passeriformes, mammals — rodents, fish — cyprinids predominate. The highest ratio of family, genus and species was found in the Anseriformes (1:11:22) and Accipitridae (1:7:16).

The uniqueness of the vertebrates is in the presence of species characteristic to the forest ecosystem; boreal relic animals; species of animals listed in the Red Book of Kazakhstan and species diversity. The fauna of pine forests is richer than the surrounding steppes. The uniqueness of the vertebrates in the territory of the SNNP "Burabay" is a mixture of forest, steppe and mountain elements, as well as European and Siberian animal species.

The indigenous species are elk (*Alcesalces* (L.), Siberian Roe Deer (*Capreolus pygargus* (Pallas), brown hare (*Lepus europaeus* (P), badger (*Meles meles* (L.), steppe polecat (*M. Eversmanni Lesson*), stoat (*M. erminea* (L.), weasel (*Mustela nivalis* (L.), pine marten (*Martes martes* (L.), fox (*V. vulpes* (L.), wolf (*Canis lupus* (L.), lynx (*Lynx lynx* (L.); from birds — black grouse (*Lyrurus tetrix* (L.), willow grouse (*Lagopus lagopus* (L.), gray partridge (*Perdix perdix* (L.), quail (*Coturnix coturnix* (L.) and many others.

These typical animal species of of the Siberian taiga live next to the inhabitants of the southern steppes such as corsac (*Vulpes corsac* (L.), little souslik (*S. pygmaeus* (P), brown hare (*Lepus europaeus* (P), steppe polecat (*M. Eversmanni Lesson*), but are extremely rare.

The muskrat (*Ondatra zibethicus* L.) lives in rivers, lakes and wetlands.

Table 1

The ratio of the main taxonomic groups of animals on the territory of SNNP "Burabay"

Orders	Families		Genus		Species		Relation — families; genus; species
	A	B	A	B	A	B	
Avifauna (Aves)							
Total	**45**	**100**	**105**	**100**	**191**	**100**	**1:2,3:4,2**
Passeriformes	21	46,8	36	34,4	69	36,1	1:1,7:3,2
Piciformes	1	2,2	3	2,9	5	2,6	1:3:5
Bucerotiformes	1	2,2	1	0,9	1	0,6	1:1:1
Coraciiformes	2	4,5	2	1,9	2	1,0	1:2:2
Apodiformes	1	2,2	1	0,9	1	0,6	1:1:1
Caprimulgiformes	1	2,2	1	0,9	1	0,6	1:1:1
Strigiformes	1	2,2	5	4,8	7	3,7	1:5:7
Cuculiformes	1	2,2	1	0,9	1	0,6	1:1:1
Columbiformes	1	2,2	3	2,8	4	2,0	1:3:4
Charadriiformes	5	11,2	19	18,2	38	19,9	1:3,8:7,6
Otidiformes	1	2,2	1	0,9	1	0,6	1:1:1
Gruiformes	2	4,5	5	4,8	6	3,1	1:2,5:3
Galliformes	1	2,2	4	3,8	4	2,0	1:4:4
Falconiformes	1	2,2	1	0,9	6	3,1	1:1:6
Accipitriformes	1	2,2	7	6,8	16	8,4	1:7:16
Anseriformes	1	2,2	11	10,5	22	11,5	1:11:22
Pelecaniformes	1	2,2	2	1,9	2	1,0	1:2:2
Suliformes	1	2,2	1	0,9	1	0,6	1:1:1
Podicipediformes	1	2,2	1	0,9	4	2,0	1:1:4
Mammalia							
Total	**13**	**100**	**26**	**100**	**47**	**100**	**1:2:3,6**
Lagomorpha	1	7,7	1	3,8	2	4,3	1:1:2
Rodentia	4	30,8	10	38,5	19	40,4	1:2,5:4,8
Artiodactyla	2	15,4	4	15,4	4	8,5	1:2:2
Carnivora	3	23,0	5	19,2	10	21,3	1:1,7:3,3
Chiroptera	1	7,7	2	7,7	5	10,6	1:2:5
Insectivora	2	15,4	4	15,4	7	14,9	1:2:3,5
Reptilia							
Total	**3**	**100**	**3**	**100**	**7**	**100**	**1:1:2,3**
Lepidosus	3	100	3	100	7	100	1:1:2,3
Amphibia							
Total	**2**	**100**	**2**	**100**	**3**	**100**	**1:2:1,5**
Dimock	2	100	2	100	3	100	1:2:1,5
Osteichthyes							
Total	**4**	**100**	**11**	**100**	**13**	**100**	**1:2,7:3,3**
Perciformes	1	25	2	18,2	2	15,4	1:2:2
Salmaniformes	1	25	1	9,1	2	15,4	1:1:2
Cypriniformes	1	25	7	63,6	8	61,5	1:7:8
Ecosiformes	1	25	1	9,1	1	7,7	1:1:1

Note: A — the absolute quantity of species in the group; B — the percentage of the total quantity of species.

Ornithological analysis shows that the territory is mainly inhabited by forest-steppe avifauna of European origin. The avifauna is represented mainly by European species with a small proportion of Siberian forms, such as eastern turtledove (*Streptopelia orientalis*), spotted flycatcher (*Muscicapa Striata*), chiffchaff (*Phylloscopus collybitus*), pine bunting (*Emberiza leucocephala*). Species characteristic to taiga like western capercaillie (*Tetrao urogallus*), black woodpecker (*Dryocopus martius*), willow tit (*Parus montanus*), bullfinch (*Pyrrhula pyrrhula*) live here.

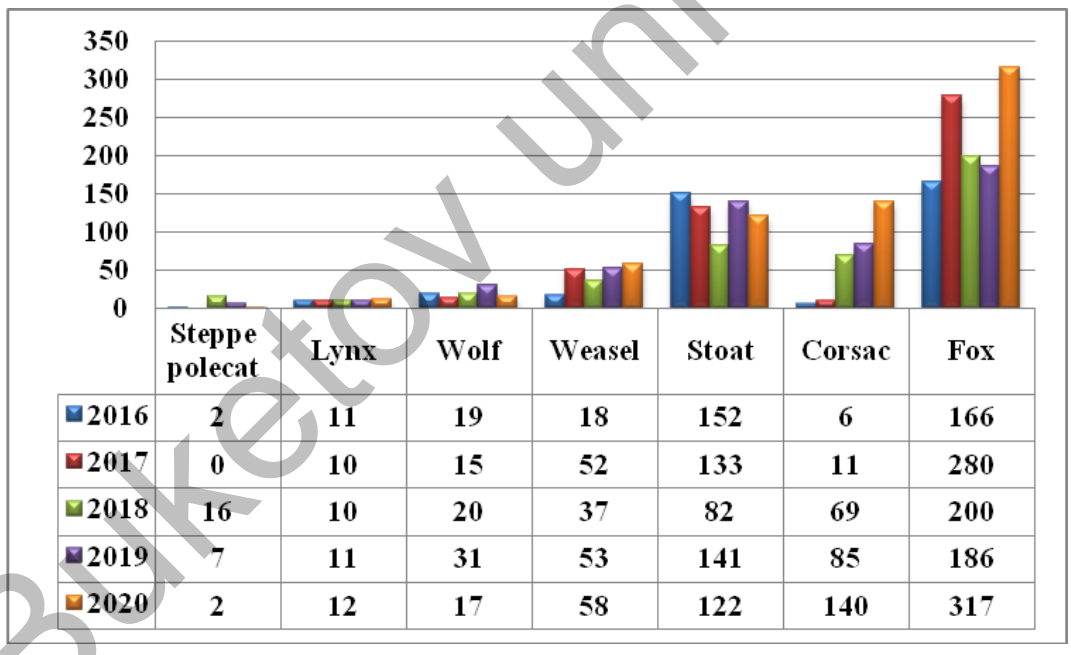
To enrich the species diversity of the fauna in the lands of Burabay, from 1938 to 1972, 8 species of mammals and 1 species of birds were introduced and acclimatized, including commercial species (Table 2). Observations have shown their good acclimatization, at present their numbers are high.

Table 2

List of introduced animal species in SNNP "Burabay"

Species	Import year	Region	Number of individuals
Red squirrel (*Sciurus vulgaris L.*)	1938	Zerenda	362
The muskrat (*Ondatra zibethicus L.*)	1962	Lake Chagaly, Kokchetav region	389
Argali (*Ovis ammon*)	1961–1964, 1969	Kyrgyzstan	47
Maral (*Cervus elaphus)*	1960	Eastern Kazakhstan	6
Ascanian deer	1963–1966	Azov-Sivash farm	58
	1984	Askania-Nova, Ukraine	2
Siberian ibex (*Capra sibirica*)	1963–1964	Kyrgyzstan	27
Brown bear (*Ursus arctos*)	1964	Kyrgyzstan	10
Wild boar (*Sus scrofa*)	1972	Balkhash	24
Western capercaillie (*Tetrao urogallus*)	1965–1968	Kirov region RSFSR	129

It should be noted that the number of mammals in the park for 2016–2020 have generally increased, for example, the number of weasel *(Mustela nivalis (L.))*, corsac *(Vulpes corsac (L.))*, common fox *(V. vulpes (L.))* (Figure 1). The number of Baibak (*Marmota bobac*) in comparison with 2016 has increased from 6318 heads to 8415 heads in 2020.

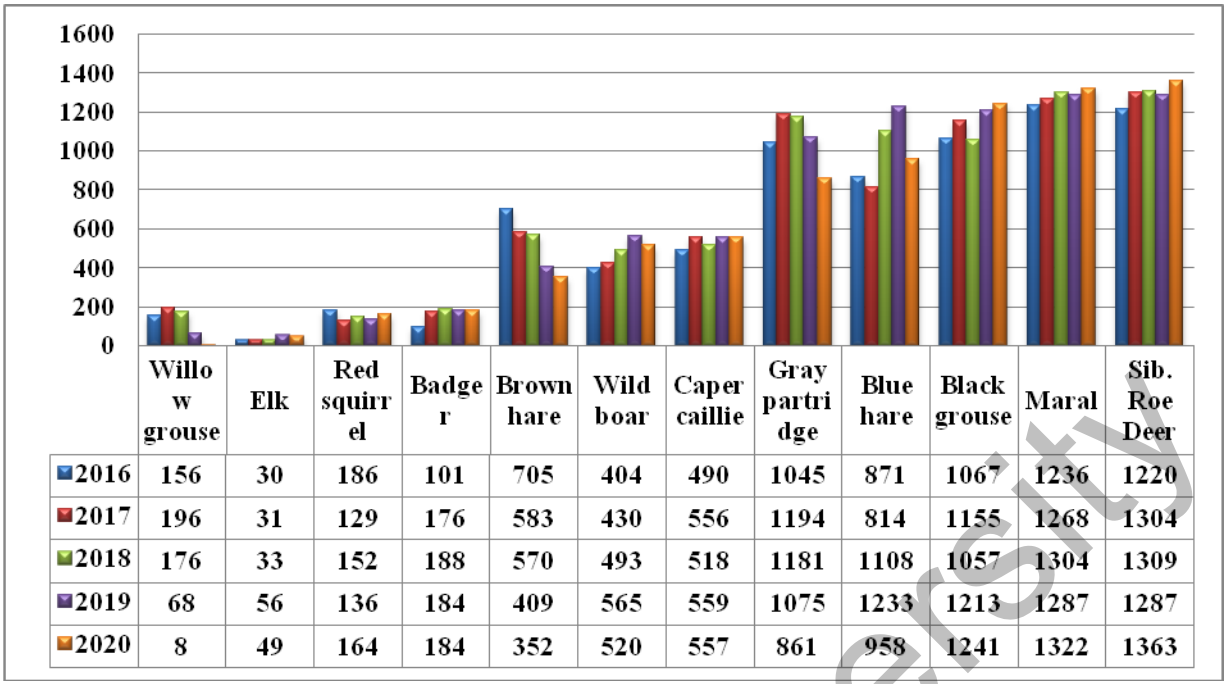


	Steppe polecat	Lynx	Wolf	Weasel	Stoat	Corsac	Fox
2016	2	11	19	18	152	6	166
2017	0	10	15	52	133	11	280
2018	16	10	20	37	82	69	200
2019	7	11	31	53	141	85	186
2020	2	12	17	58	122	140	317

Figure 1. Population dynamics of mammals in SNNP "Burabay" for 2016–2020

From 2016 to 2020 the population of herbivorous has been also increased, including elk (*Alcesalces (L.))*, badger *(Meles meles (L.))*, wild boar (*Sus scrofa*), western capercaillie (*Tetrao urogallus*), brown hare (*Lepus europaeus (P))*, black grouse (*Lyrurus tetrix (L.))*, Maral (*Cervus elaphus)* and Siberian Roe Deer (*Capreolus pygargus (P)* (Figure 2).

Inhabiting vertebrates in the SNNP "Burabay" differ in life forms; they occupy almost all ecological niches in accordance with their habitat. According to analyses of terrestrial-aquatic vertebrates predominate, terrestrial-arboreal and arboreal ones are often found; meet aerial and aquatics; there are also terrestrial-underground and underground life forms (Figure 3).



	Willow grouse	Elk	Red squirrel	Badger	Brown hare	Wild boar	Caper caillie	Gray partridge	Blue hare	Black grouse	Maral	Sib. Roe Deer
2016	156	30	186	101	705	404	490	1045	871	1067	1236	1220
2017	196	31	129	176	583	430	556	1194	814	1155	1268	1304
2018	176	33	152	188	570	493	518	1181	1108	1057	1304	1309
2019	68	56	136	184	409	565	559	1075	1233	1213	1287	1287
2020	8	49	164	184	352	520	557	861	958	1241	1322	1363

Figure 2. Population dynamics of herbivorous animals in SNNP “Burabay” for 2016–2020

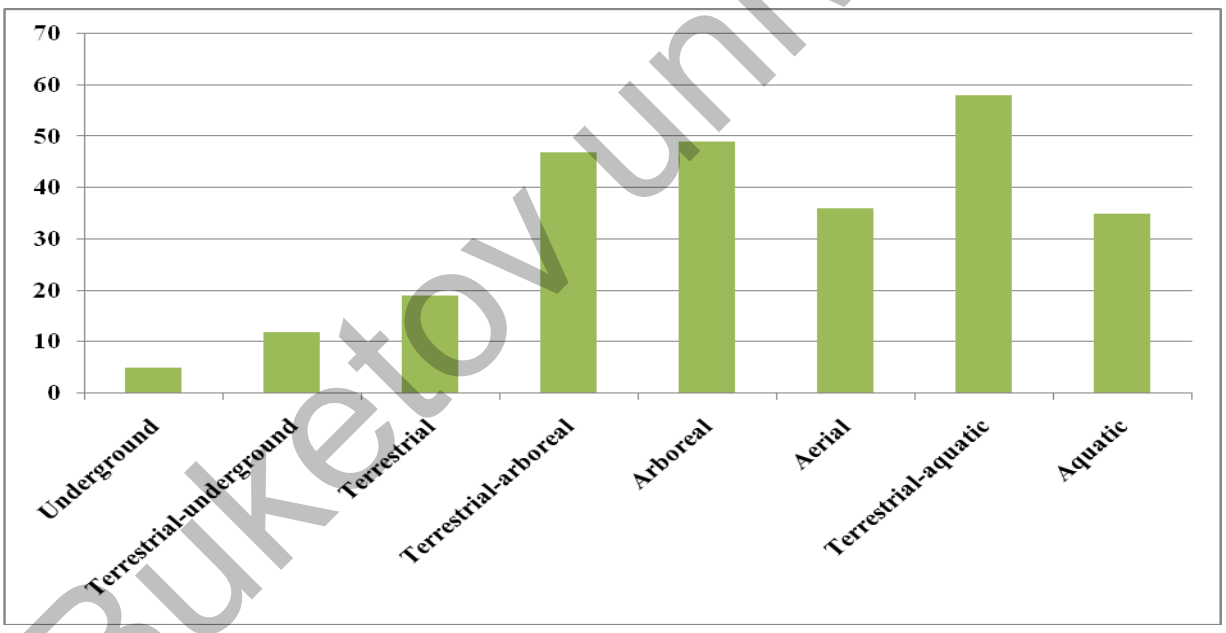


Figure 3. Distribution of animals by life forms on the territory of SNNP “Burabay”

Conclusions

Studies of the animal world have shown that the fauna of the SNNP “Burabay” includes 621 species belonging to 31 orders, including 13 species and subspecies of fish, 3 amphibian species, 7 reptile species, 191 bird species and 47 types of mammals, mainly characteristic to the steppe zone of the Northern Kazakhstan.

The uniqueness of the animal world is in the presence of forest ecosystem, an abundance of species composition, boreal relic animals, unique animal species included in the Red Book of the Republic of Kazakhstan. Vertebrate animals of the national park differ from the fauna of the steppe zone by the abundance of species composition and the high ratio of families, genera and species. From the class of birds, passeriformes predominate, which are represented by 21 families (46.8 %), 36 genera (34.4 %) and

69 species (36.1 %). From the class of mammals — rodentia (30.8 %), which are represented by families (30.8 %), 10 genera (38.5 %) and 19 species (40.4 %). From the class of fish cypriniformes, which is represented by 1 family (25 %), 7 genera (63.6 %) and 8 species (61.5 %). The ratio of family, genus and species was 1:7:8. The highest ratio was found in the orders Anseriformes (1:11:22) and Accipitriformes (1:7:16).

Vertebrate animals of SNNP "Burabay" differ in life forms: the priority are terrestrial-aquatic, arboreal and terrestrial-arboreal, inhabited by 154 species; 71 species inhabit the aerial and aquatic environment; in terrestrial, terrestrial-underground and underground environment 36 species.

Conflict of interest

All authors are familiar with the text of the article and declare that they have no conflict interests.

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«Бурабай» Мемлекеттік ұлттық табиғи саябағындағы омыртқалы жануарлардың қауымдастық құрамы мен популяциясының динамикасы

Мақалада «Бурабай» Мемлекеттік ұлттық табиғи паркіндегі омыртқалы жануарлардың түрлік құрамы мен оның 2016–2020 жылдардағы динамикасына жүргізілген талдау нәтижелері келтірілген, яғни ерекше қорғалатын табиғи аумақтардың экологиялық желісінің базалық құрамдас бөлігі ретінде, табиғатты сақтау мен қалпына келтіруді қамтамасыз ететін биологиялық әртүрлілік, типтік және бірегей ландшафттар. Омыртқалы жануарларды зерттеу сынақ алаңдарында жануарларды есепке ала отырып, маршруттық әдіспен жүргізілді. Тұяқты жануарларды, жыртқыштарды, кеміргіштерді және тауықтарды есепке алу үшін қоршау, айдау әдісі, сонымен қатар фототүсірілім қолданылған. А.Н. Формазовтың морфологиясы бойынша жануарлардың тіршілік формалары топтастырылған. Саябақтың түрлік құрамының типтік сипаты далалық аймаққа тән сипатты қауымдастықтардың болуымен расталады. Омыртқалы жануарлардың түрлік құрамының бірегейлігі мынада: орман экожүйесіне тән түрлердің болуы; бореалдық реликті жануарлар; Қазақстанның Қызыл кітабына енген жануарлар түрлері және түрлердің әртүрлілігі.

Кілт сөздер: саябақ, дала, омыртқалылар, жануарлар, типтік, бірегейлік, түрлері, динамикасы.

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Состав сообществ и динамика численности позвоночных животных в Государственном национальном природном парке «Бурабай»

В статье приведены результаты анализа видового состава позвоночных животных Государственного национального природного парка «Бурабай» и его динамики за 2016–2020 гг., как базового компонента экологической сети особо охраняемых природных территорий, обеспечивающего сохранение и восстановление биологического разнообразия, как типичных, так и уникальных ландшафтов. Изучение позвоночных животных проводилось маршрутным методом, учетом животных на пробных площадках. Для учета копытных, хищных, грызунов и куриных окладной использовались прогонный метод, а также фотосъемки. Жизненные формы животных группировались по морфологии А.Н. Формазова. Типичность видового состава парка подтверждена присутствием характерных сообществ, присущих степной зоне. Уникальность видового состава позвоночных животных заключается в наличии видов, характерных для лесной экосистемы; бореальных реликтовых животных; видов животных, занесенных в Красную книгу Казахстана; и видовым многообразием.

Ключевые слова: парк, степь, позвоночные, животные, типичность, уникальность, виды, динамика.

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