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Article

The fauna and summer bird population of the Karagai Biosphere Reserve (Chelyabinsk Oblast)

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Abstract. Based on the results of ornithological studies, conducted in the Karagai Biosphere Reserve in 2008–2022, a list of bird species has been compiled. It consists of 134 (including 118 breeding or, probably, breeding) species. In 2006, chaffinch and tree pipit dominated in number in forest biotopes. The group of subdominants included willow tit, common chiffchaff, great tit and pied flycatcher. In 2018, most numerous chaffinch and tree pipit slightly outnumbered great tit, common redstart, common chiffchaff, and great spotted woodpecker. In ecological groups, dendrophiles prevailed (63% of all species). The share of limnophiles made up 17%, campophiles and sclerophiles – 10% each. Characteristic of the taiga complex breeding (or expected to nest), species, i.e. hazel grouse, deaf cuckoo, long-tailed and great grey owls, bramble finch, common crossbill, and common bullfinch were encountered.

Keywords: avifauna, nesting, dominant, ecological group, faunistic complex, Red Data Book

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Научная статья

Фауна и летнее население птиц Карагайского природного биологического заказника (Челябинская область)

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Аннотация. По итогам орнитологических исследований, проводившихся на территории Карагайского природного биологического заказника в период 2008–2022 гг., составлен список видов птиц. В него вошло 134 вида, 118 из которых гнездятся или гнездование их предполагается. Доминантами по численности в 2006 г. в лесных биотопах были зяблик и лесной конёк. В группу субдоминантов входили пухляк, пеночка-теньковка, большая синица и мухоловка-пеструшка. В 2018 г. наиболее многочисленными оказались зяблик и лесной конёк. Несколько уступали им большая синица, обыкновенная горихвостка, пеночка-теньковка и большой пестрый дятел. Среди экологических группировок в заказнике преобладали дендрофилы (63% от всех видов). Доля лимнофилов составила 17%, кампофилов и склерофилов – по 10%. Обнаружены на гнездовании (или оно предполагается) такие характерные для таежного комплекса виды, как рябчик, глухая кукушка, длиннохвостая и бородатая неясыти, юрок, клёст-еловик, обыкновенный снегирь.

Ключевые слова: авифауна, гнездование, доминант, экологическая группировка, фаунистический комплекс, Красная книга

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Introduction

In contrast to unprotected, the protected federal and regional areas are subject to much less anthropogenic impact. They serve as the refugia for many rare, vulnerable and still common species of various systematic groups. However, large-scale logging, intensive agriculture, capital structures' construction, changes in the boundaries resulting in loss of the most ecologically valuable areas, as well as other activities which entail degradation of ecosystems, depletion of biodiversity and reduction in the number of many species of the flora, fauna and mycobiota are implemented in many protected areas (especially of a regional importance) despite the existing environmental legislation and relevant provisions for economic activity.

The aim of our research was to study the fauna and summer population of birds of one of the regional protected areas in Chelyabinsk Oblast – the Karagai Biosphere Reserve.

Materials and methods

Geographical and ecological characteristics of environmental conditions of the surveyed territory

In 1969, by the decision of the Executive Committee of the Chelyabinsk Regional Council of the People's Deputies dated 21.01.1969 No. 29, the Karagai island pine forest (8 thous. ha) located in the north of the Verkhneuralsky region at Karagaysky settlement was declared a Natural Monument¹. This decision was made due to the recognized importance of its habitat-forming and recreational value. In 1981, the Karagai State Hunting Reserve was organized by the order of the Executive Committee of the Chelyabinsk Regional Council of the People's Deputies dated 05.03.1981 No. 288-r on the area of 16 thousand hectares to preserve ungulates, forest birds, hares and other species².

In May 2008, by the Decree of the Government of Chelyabinsk Oblast, the reserve was renamed into the Karagai Biosphere Reserve of Chelyabinsk Oblast. According to the Reserve Regulation³, the purpose of its establishment is the preservation, reproduction and restoration of living and non-living nature resources, including rare and endangered wildlife species. The reserve is situated in the Verkhneuralsky and Uysky regions of Chelyabinsk Oblast near the settlement of Karagaysky (Fig. 1). Its total area is 18428.55 ha; the Verkhneuralsky and Uysky regions occupy 14070.88 and 4357.67 ha, respectively.

¹ Decision of the Executive Committee of the Chelyabinsk Regional Council of the People's Deputies dated 21.01.1969 No. 29 "On nature monuments protection in Chelyabinsk Oblast".

² Order of the Executive Committee of the Chelyabinsk Regional Council of the People's Deputies dated 05.03.1981 No. 288-r "On the Karagai State Hunting Reserve".

³ Decree of the Government of Chelyabinsk Oblast "On the Karagai Biosphere Reserve".

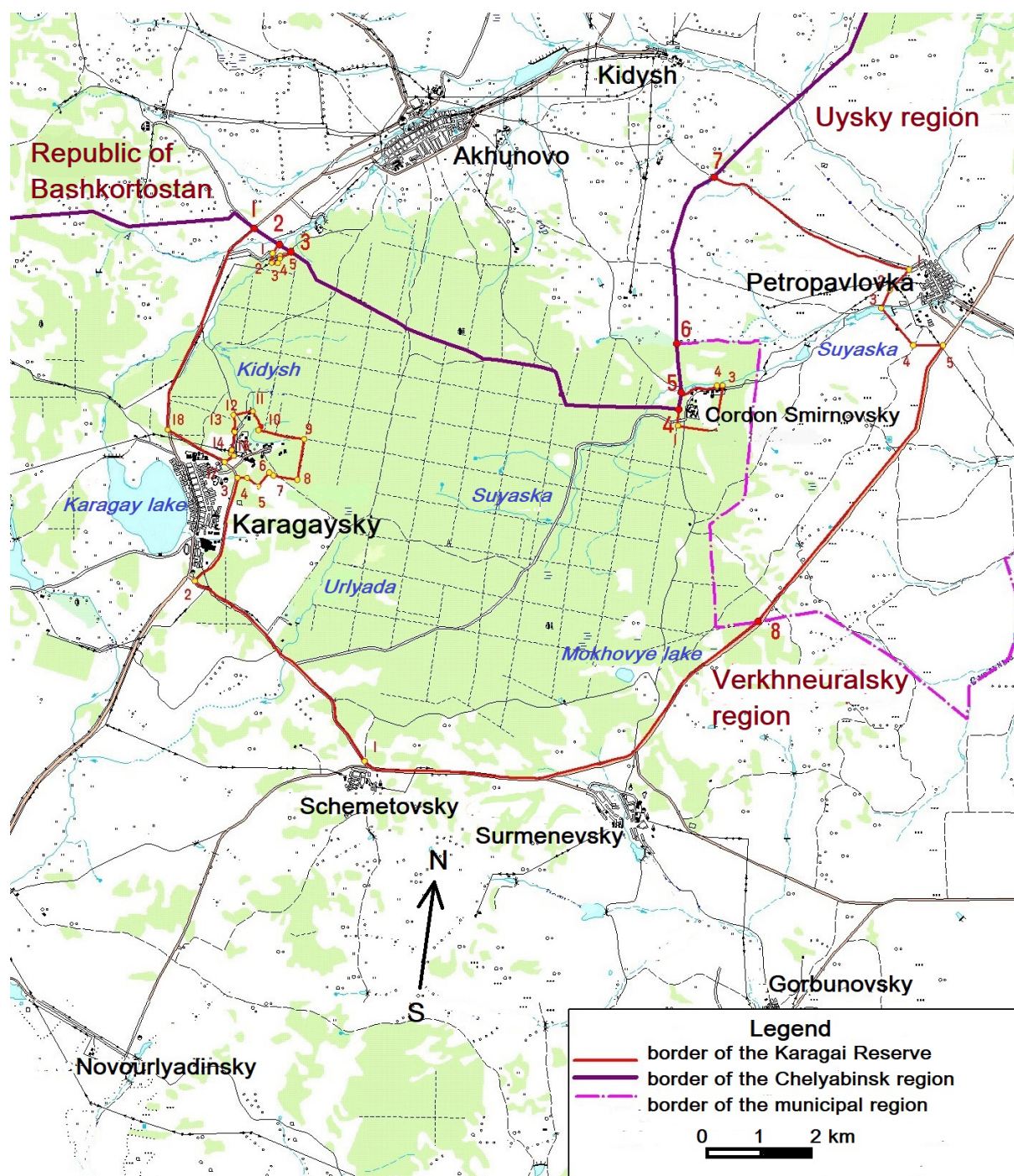


Fig. 1. Location of the Karagai Biosphere Reserve.

In terms of physical-geographical zoning, the territory of the Karagai Reserve and the Karagai Forest is located in the forest-steppe zone of the Ural Mountains, in the subzone of the southern forest-steppe of the westernmost part of the Trans-Ural peneplain at the foot of the easternmost ridges of the Ural Mountains (Andreeva and Markova, 2002; Kolesnikov, 1961).

The relief of the reserve is rocky and hilly, weakly dissected. About half of its territory is occupied by the Karagai Forest – an island pine forest, typical of the forest-steppe of the Trans-Ural peneplain associated with an extensive granite intrusion elevated above the surrounding hilly foothill plain (Fig. 2).

The highest point of the study territory (635 m a.s.l.) is recorded in the Karagai Forest massif at the northern boundary of the reserve with the Republic of Bashkortostan. The river network of the Karagai Reserve and Karagai Forest area is represented by the Suyaska River (Tobol basin), inflowing the Kidysh River (Andreeva and Markova, 2002). The Suyaska is a shallow river having small tributaries. The upper reaches of the Urlyada River (Ural basin) are also referred to the reserve and forest territory. In the reserve (outside the forest), there is a small and completely overgrown lake Mokhovoye.

According to the scheme of geobotanical zoning of the European part of the former USSR (Gribova et al., 1980; Lavrenko and Isachenko, 1976), the territory of the Karagai Biosphere Reserve and the Karagai Forest is a part of the West Siberian forest-steppe province of the Eurasian Steppe Region with a vegetation cover mostly represented by pine forests with an admixture of silver birch, aspen, and Siberian larch. The most common are herbal (cereal-forb, bracken-forb, etc.) and herbal-green moss pine forests. In places, there are pine forests with lingonberries and white moss, while in the driest areas of their central part - steppe rocky pine forests and low-grass thin forests with an extremely depleted grass layer and well-developed moss-lichen cover with inclusion of species of the genus *Cladina*. Very rarely and in small areas, there are grass-swampy openings amongst pine forests and lowland bogs (near Lake Mokhovoye). On the periphery of the reserve, the communities of the secondary birch forests, steppe meadows, meadows, true sod grass-forb and petrophytic steppes are widespread. Meadow steppe and steppe meadow communities are located on the outskirts of the reserve territory (Fig. 3). Their herb cover is formed by a mixture of sod grasses and steppe forbs. Feather grass-forb



Fig. 2. Western part of the Karagai Biosphere Reserve.



Fig. 3. Steppe northeastern part of the Karagai Biosphere Reserve.

and fescue-forb steppes predominate. Here, feather grass *Stipa pennata* L., hairy feather grass *Stipa capillata* L., fescue *Festuca valesiaca* Gaudin s.l. act as coenosis-forming plants. Marsh and semi-aquatic vegetation of the reserve is represented by Lake Mokhovoye, which is totally covered predominantly by such species as broadleaf cattail *Typha latifolia* L., small bur-reed *Sparganium minimum* Wallr., swamp chickweed *Stachys palustris* L., marsh ash grass *Tephroseris palustris* (L.) Reichenb., bladder sedge *Carex vesicaria* L., two-row sedge *Carex disticha* Huds., marsh cinquefoil *Comarum palustre* L., celery-leaf buttercup *Ranunculus sceleratus* L., etc.

Weed vegetation consisting of typical for this zone ruderal species is widespread near the populated areas and along roads. Note that some sites of agrophytocenoses do exist on the reserve territory as well.

In terms of boreal higher plant species diversity, the Karagai Forest surpasses all the island pine forests of the Trans-Ural forest-steppe (Belkovsky et al., 2008).

All forests in the reserve belong to group 1, where solely forest thinning and sanitary felling are allowed. However, during the reserve inspection (2018), we have revealed the following violations:

- the technique used significantly damages soil cover and almost completely destroys herb vegetation;
- the dragging of trunks and their transportation result in deep ruts;
- more than 5% (allowed by the standards) of the damaged trees cease their growth;
- the trees for felling are selected unevenly; in places, stands' density drops to 0.3 or less;
- the logging residues are not promptly removed and stored (in most cases) with violation of fire safety regulations;
- the selection of trees for felling, allegedly based on sanitary considerations, is often hardly subject to control;
- the high-value commercial timber is first cut down (Vlasova et al., 2019).

Research volume and methodology

The main ornithological studies in the Karagai Reserve were carried out on July 11–13, 2006, June 24 – July 2 and August 7–8, 2018, and July 10–28, 2022. Short visits to the reserve (mainly to its steppe eastern part) were made almost annually from 2007 to 2020. In addition, one of the authors (D.A. Yasko), who worked in the reserve (2008–2014) as a state inspector, conducted the faunistic observations, primarily of non-passerine birds (mostly daytime predators and owls). Only in 2006, based on the method of Yu.S. Ravkin (1967), we performed quantitative route counts of birds in forest biotopes without limiting the counting band. In 2018 and 2022, birds were visually counted on the unfixed walking routes through the use of binoculars, by their voices, nests, remains and without recording the distance from an observer to surveyed birds. Species with shares of 10% or higher of the total population, were considered dominant (Kuzyakin, 1962), while from 5 to 9% – subdominants. For bird grouping by relative abundance, the modified scale of V.P. Belik was applied (2000):

- very rare – encountered less than 5 times during all years of our investigations;
- rare – encountered 1–2 times per season;
- uncommon – encountered 3–5 times per season;
- few – encountered regularly, but not daily;
- common – encountered 1–10 times per day;
- numerous – encountered more than 10 times per day.

When distributing birds by ecological groups, we followed the birds' classification by V.P. Belik (2000).

Reliable confirmation of nesting was made in accordance with the criteria of the EBCC Atlas of European Breeding Birds (The EBCC Atlas..., 1997). Breeding was considered *proven* if nests, eggs, broods and birds with food for their chicks were observed and *expected* (probable) when birds demonstrated the elements of breeding behavior (cooing, singing or vocalizing, mating, restlessness at nests), and if they were encountered during the breeding period at the permanent nesting sites under suitable breeding conditions. Listing and names of species are given according to E.A. Koblik et al. (2006).

Table. 1. Species composition of birds of the Karagaysky reserve. The residency status: ne – nesting; ne? – probably nesting; mig – transient species; vag – vagrant; nom – nomadic; win – wintering; vis – visitor during nesting period; sum – summering. Abundance: num – numerous; com – common; few – few; un – uncommon; rare – rare; vr – very rare. Ecological grouping: lim – limnophile; dendr – dendrophile; camp – campophile; scler – sclerophile.

Species	Presence	Abundance	Ecological grouping
The order Podicipediformes			
<i>Podiceps auritus</i> (L., 1758)	ne?	rare	lim
The order Ciconiiformes			
<i>Ardea cinerea</i> L., 1758	vis	com	lim
The order Anseriformes			
<i>Tadorna ferruginea</i> (Pallas, 1764)	ne	com	lim
<i>Tadorna tadorna</i> (L., 1758)	sum	un	lim
<i>Anas platyrhynchos</i> (L., 1758)	ne	com	lim
<i>Anas crecca</i> (L., 1758)	mig	few	lim
<i>Anas strepera</i> L., 1758	ne	un	lim
<i>Anas querquedula</i> L., 1758	ne	un	lim

Species	Presence	Abundance	Ecological grouping
The order Falconiformes			
<i>Pernis apivorus</i> (L., 1758)	ne?	un	dendr
<i>Milvus migrans</i> (Boddaert, 1783)	ne	com	dendr
<i>Circus cyaneus</i> (L., 1766)	ne?	un	camp
<i>Circus macrourus</i> (S.G. Gmelin, 1771)	ne?	un	camp
<i>Circus pygargus</i> (L., 1758)	ne	few	camp
<i>Circus aeruginosus</i> (L., 1758)	ne?	un	lim
<i>Accipiter gentilis</i> (L., 1758)	ne	com	dendr
<i>Accipiter nisus</i> (L., 1758)	ne	com	dendr
<i>Buteo buteo</i> (L., 1758)	ne	com	dendr
<i>Aquila nipalensis</i> Hodgson, 1833	vag	rare	camp
<i>Aquila heliaca</i> Savigny, 1809	ne	com	dendr
<i>Aquila chrysaetos</i> (L., 1758)	nom	rare	dendr
<i>Haliaeetus albicilla</i> (L., 1758)	vis	few	dendr
<i>Falco cherrug</i> J.E.Gray	mig	vr	scler?
<i>Falco peregrinus</i> Tunstall, 1771	ne	few	scler?
<i>Falco subbuteo</i> L., 1758	ne	few	dendr
<i>Falco columbarius aesalon</i> Tunstall, 1771	mig	rare	dendr
<i>Falco vespertinus</i> L., 1766	mig	rare	dendr
<i>Falco tinnunculus</i> L., 1758	ne	com	scler
The order Galliformes			
<i>Lagopus lagopus major</i> (Lorenz, 1904)	ne?	rare	camp?
<i>Lyrurus tetrix</i> (L., 1758)	ne	com	dendr
<i>Tetrao urogallus</i> L., 1758	ne	com	dendr
<i>Tetrastes bonasia</i> (L., 1758)	ne	rare	dendr
<i>Perdix perdix</i> (L., 1758)	ne	few	dendr?
<i>Coturnix coturnix</i> (L., 1758)	ne	com	camp

Species	Presence	Abundance	Ecological grouping
The order Gruiformes			
<i>Grus grus</i> L., 1758	ne	few	lim
<i>Anthropoides virgo</i> (L., 1758)	ne	few	camp
<i>Rallus aquaticus</i> L., 1758	ne?	un	lim
<i>Porzana porzana</i> (L., 1766)	ne	few	lim
<i>Crex crex</i> (L., 1758)	ne	few	camp
<i>Fulica atra</i> L., 1758	ne	un	lim
The order Charadriiformes			
<i>Vanellus vanellus</i> (L., 1758)	ne	few	lim
<i>Tringa ochropus</i> L., 1758	ne?	few	lim
<i>Actitis hypoleucos</i> (L., 1758)	ne?	few	lim
<i>Gallinago gallinago</i> (L., 1758)	ne?	few	lim
<i>Scolopax rusticola</i> L., 1758	ne	com	lim
<i>Larus ichthyaetus</i> Pallas, 1773	vis	rare	lim
<i>Larus barabensis</i> H Johansen, 1960	vis	few	lim
<i>Larus canus</i> L., 1758	ne?	un	lim
The order Columbiformes			
<i>Columba palumbus</i> L., 1758	ne	com	dendr
<i>Columba oenas</i> L., 1758	ne?	un	dendr
<i>Columba livia</i> J.F. Gmelin, 1789	ne	un	scler
<i>Streptopelia turtur</i> (L., 1758)	ne?	rare	dendr
<i>Streptopelia orientalis</i> (Latham, 1790)	ne	com	dendr
The order Cuculiformes			
<i>Cuculus canorus</i> L., 1758	ne	com	dendr
<i>Cuculus (saturatus) optatus</i> Gould, 1845	ne?	few	dendr
The order Strigiformes			
<i>Nyctea scandiaca</i> (L., 1758)	win	few	camp
<i>Bubo bubo</i> (L., 1758)	ne?	rare	scler

Species	Presence	Abundance	Ecological grouping
<i>Asio otus</i> (L., 1758)	ne	com	dendr
<i>Asio flammeus</i> (Pontoppidan, 1763)	ne	com	camp
<i>Otus scops</i> (L., 1758)	ne	rare	dendr
<i>Athene noctua</i> (Scopoli, 1769)	ne?	rare	scler
<i>Surnia ulula</i> (L., 1758)	nom	rare	dendr
<i>Strix uralensis</i> Pallas, 1771	ne	com	dendr
<i>Strix nebulosa</i> Forster, 1772	ne	few	dendr
The order Caprimulgiformes			
<i>Caprimulgus europaeus</i> L., 1758	ne	com	dendr
The order Apodiformes			
<i>Apus apus</i> (L., 1758)	ne	com	scler
The order Piciformes			
<i>Jynx torquilla</i> L., 1758	ne	few	dendr
<i>Picus canus</i> J.F. Gmelin, 1788	nom	un	dendr
<i>Dryocopus martius</i> (L., 1758)	ne	com	dendr
<i>Dendrocopos major</i> (L., 1758)	ne	com	dendr
<i>Dendrocopos leucotos</i> Bechstein, 1803)	ne	un	dendr
<i>Dendrocopos minor</i> (L., 1758)	ne	rare	dendr
The order Passeriformes			
<i>Riparia riparia</i> (L., 1758)	ne	few	scler
<i>Hirundo rustica</i> L., 1758	ne	com	scler
<i>Alauda arvensis</i> L., 1758	ne	com	camp
<i>Anthus trivialis</i> (L., 1758)	ne	num	dendr
<i>Motacilla flava</i> L., 1758	ne?	un	camp
<i>Motacilla alba</i> L., 1758	ne	com	lim
<i>Lanius collurio</i> L., 1758	ne	com	dendr
<i>Oriolus oriolus</i> (L., 1758)	ne	com	dendr
<i>Garrulus glandarius</i> (L., 1758)	ne?	un	dendr

Species	Presence	Abundance	Ecological grouping
<i>Pica pica</i> (L., 1758)	ne	com	dendr
<i>Corvus frugilegus</i> L., 1758	ne	un	dendr
<i>Corvus (corone) cornix</i> L., 1758	ne	few	dendr
<i>Corvus corax</i> L., 1758	ne	com	dendr
<i>Bombycilla garrulus</i> (L., 1758)	nom	com	dendr
<i>Locustella fluviatilis</i> (Wolf, 1810)	ne?	un	lim
<i>Locustella naevia</i> (Boddaert, 1783)	ne?	few	lim
<i>Acrocephalus dumetorum</i> Blyth, 1849	ne	com	dendr
<i>Hippolais icterina</i> (Vieillot, 1817)	ne	few	dendr
<i>Hippolais caligata</i> (M.N.K. Lichtenstein, 1823)	ne	few	dendr
<i>Sylvia atricapilla</i> (L., 1758)	ne?	rare	dendr
<i>Sylvia borin</i> (Boddaert, 1783)	ne	com	dendr
<i>Sylvia communis</i> Latham, 1787	ne	com	dendr
<i>Sylvia curruca</i> (L., 1758)	ne	com	dendr
<i>Phylloscopus trochilus</i> (L., 1758)	ne?	un	dendr
<i>Phylloscopus collybita</i> (Vieillot, 1817)	ne	num	dendr
<i>Phylloscopus trochiloides</i> (Sundevall, 1837)	ne	few	dendr
<i>Ficedula hypoleuca</i> (Pallas, 1764)	ne	com	dendr
<i>Muscicapa striata</i> (Pallas, 1764)	ne	com	dendr
<i>Saxicola rubetra</i> (L., 1758)	ne	com	camp
<i>Saxicola torquata</i> (L., 1766)	ne	few	camp
<i>Oenanthe oenanthe</i> (L., 1758)	ne	com	scler
<i>Phoenicurus phoenicurus</i> (L., 1758)	ne	com	dendr
<i>Phoenicurus ochruros gibraltariensis</i> (S.G. Gmelin, 1774)	ne (on the outskirts)	un	scler
<i>Erithacus rubecula</i> (L., 1758)	ne	com	dendr
<i>Luscinia luscinia</i> (L., 1758)	ne?	rare	dendr
<i>Luscinia svecica</i> (L., 1758)	ne?	com	lim?
<i>Turdus pilaris</i> L., 1758	ne	com	dendr

Species	Presence	Abundance	Ecological grouping
<i>Turdus merula</i> L., 1758	ne?	un	dendr
<i>Turdus iliacus</i> L., 1758	ne	com	dendr
<i>Turdus philomelos</i> C.L. Brehm, 1831	ne	com	dendr
<i>Turdus viscivorus</i> L., 1758	ne	com	dendr
<i>Aegithalos caudatus</i> L., 1758	ne	com	dendr
<i>Remiz pendulinus</i> L., 1758	ne	un	lim?
<i>Parus montanus</i> Baldenstein, 1827	ne	com	dendr
<i>Parus ater</i> L., 1758	ne	com	dendr
<i>Parus caeruleus</i> L., 1758	ne	few	dendr
<i>Parus cyanus</i> Pallas, 1770	ne?	rare	dendr
<i>Parus major</i> L., 1758	ne	com	dendr
<i>Sitta europaea</i> L., 1758	ne	com	dendr
<i>Passer domesticus</i> (L., 1758)	ne (on the outskirts)	com	scler
<i>Passer montanus</i> L., 1758	ne	com	scler
<i>Fringilla coelebs</i> L., 1758	ne	num	dendr
<i>Fringilla montifringilla</i> L., 1758	ne?	rare	dendr
<i>Chloris chloris</i> (L., 1758)	ne	com	dendr
<i>Spinus spinus</i> (L., 1758)	ne	com	dendr
<i>Carduelis carduelis</i> (L., 1758)	ne	com	dendr
<i>Acanthis cannabina</i> (L., 1758)	ne? (on the outskirts)	few	dendr
<i>Carpodacus erythrinus</i> (Pallas, 1770)	ne	com	dendr
<i>Uragus sibiricus</i> (Pallas, 1773)	nom	few	dendr
<i>Loxia curvirostra</i> Borkhausen, 1793	ne?	few	dendr
<i>Pyrrhula pyrrhula</i> (L., 1758)	ne?	few	dendr
<i>Emberiza citrinella</i> L., 1758	ne	com	dendr
<i>Emberiza hortulana</i> L., 1758	ne	com	dendr
Number of species		134	

Results and discussion

Table 1 presents the compiled (for the whole study period) species list of the avifauna of the Karagai Reserve and its immediate vicinity with indication of the peculiarities of birds' stay and occurrence. Photographs of some species are given in Appendix.

In 2006–2022, 134 bird species belonging to 14 orders and 34 families were identified in the Karagai Reserve. Of these, 118 were reliably or presumably nesting, 4 were encountered during migration and 6 – during wintering and seasonal migrations, 1 was a vagrant, 1 – a fly-by, 4 – reserve's visitors from the neighboring territories during the breeding season.

According to the results of bird counts carried out in forest biocenoses of the reserve during the nesting period of 2006, Chaffinch was the absolute dominant in terms of number; its contribution to the total population reached 33%. The group of dominants also included Tree Pipit (11%). Willow Tit (8%), Common Chiffchaff (6%), Great Tit and European Pied Flycatcher (5% each) were subdominants.

At the midst of the nesting period of 2018, Chaffinch (21% of all species encountered on the routes) and Tree Pipit (14%) were most abundant. Great Tit (7%), Common Redstart (6%), Common Chiffchaff and Great Spotted Woodpecker (5% each) had a significant share in the forest population as well.

Analysis of the breeding avifauna of the reserve suggests that the overwhelming majority of species (63%) is expectedly represented by dendrophiles (Fig. 4). Their obvious predominance over other ecological groups is explained, on the one hand, by the large area of forest biocenoses in the reserve, and on the other – by the complex tiered structure of tree and shrub biotopes providing birds with the greatest variety of feeding and protective conditions. In spite of a small area occupied by water bodies, the limnophile group is also quite impressive – 17%. Similar to the Don Steppe region, limnophilic group abundance is probably related with its main habitats preserved virtually unchanged in Pleistocene (Belik, 2000). Campophiles and sclerophiles make up 10% each. The campophilic group is insignificant because of adaptation of a relatively small number of species to herb communities distinguished by a simplified tiered structure dominated in open landscapes. Such landscapes occupy almost a third of the reserve's area and do not provide a proper protection to birds. In addition, these are communities greatly disturbed by man. Currently, they have turned into heavily overrun-by-cattle pastures and fields of grain crops. In meadow steppes and steppe meadows of the eastern part of the reserve, Eurasian Skylark

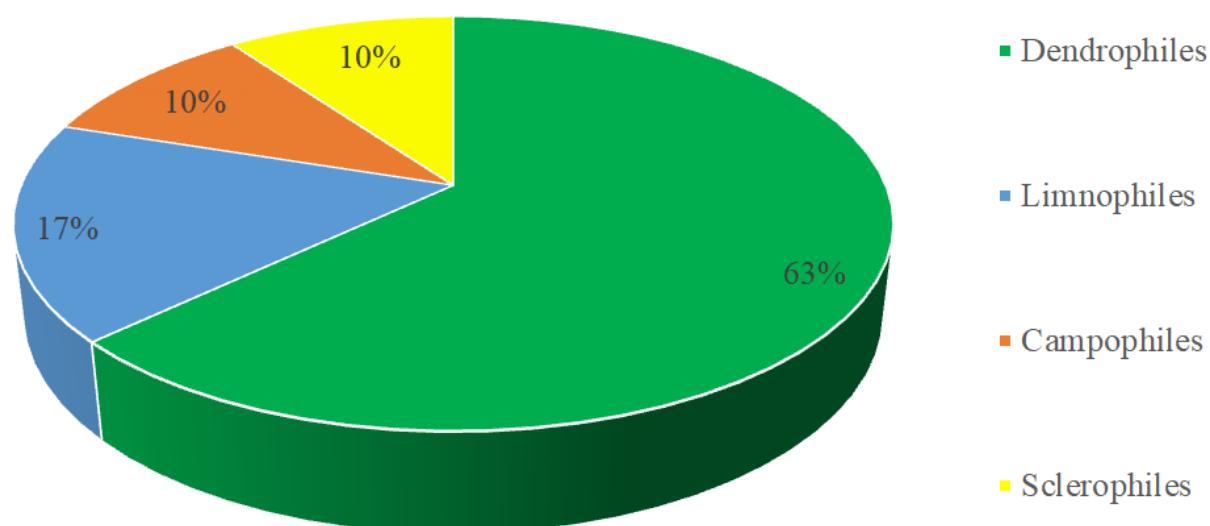


Fig. 4. Ecological structure of the breeding fauna of the Karagai Biosphere Reserve.

is the absolute dominant in terms of number. Other campophilic species (Northern Hawk, Montagu's and Pallid Harriers, Common Quail, Demoiselle Crane, Corncrake, Whinchat and Common Stonechat) of steppe-meadow biotopes are few in number. Sclerophiles, inhabiting erosional outcrops of rocks or their analogues as nesting sites, represent a small group due to such a specificity (cliffs, coastal cliffs, ravines, ma-made structures). Among the representatives of this group are Peregrine Falcon, Common Kestrel, Eurasian Eagle-owl, Common Swift, Northern Wheatear, etc.

Below we give the information on the most interesting bird species found in the Karagai Reserve for all years of our investigation: rare (both listed in the Red Data Books of the Russian Federation (Krasnaya kniga..., 2021) and Chelyabinsk Oblast (Krasnaya kniga..., 2017) and not listed but in need of protection) discovered at the area boundary or in an unusual natural zone.

Birds of the Karagai Biosphere Reserve that deserve special attention

Slavonian Grebe. Listed in the Red Data Book of the Russian Federation (category II – a species declining in number and distribution). In Chelyabinsk Oblast, its population has decreased threefold over the past 15–20 years (Tarasov, 2017).

On August 8, 2018, a young bird was noted on a small pond in the steppe eastern part of the reserve (Gashek et al., 2019). Perhaps a few species are nesting in the reserve or its environs.

Ruddy Shelduck. Listed in the Red Data Book of Chelyabinsk Oblast (category III – rare species).

On June 27, 2018, we observed a pair of birds showing a great anxiety on a small pond in the steppe eastern part of the reserve and on July 12, 2022 – a pair with three fledglings (Gashek et al., 2019). Every year one pair of ducks nests in the reserve.

European Honey-buzzard. Listed in the Red Data Book of Chelyabinsk Oblast (category III – rare species).

In 2022, few adult birds of a dark morph were repeatedly seen in flight in the reserve (Fig. S3). We assume nesting of 1–2 pairs.

Pallid Harrier. Listed in the Red Data Books of the Russian Federation (category III – rare species) and Chelyabinsk Oblast (category V – recovering species).

A male in flight was noted on June 13, 2006 over the meadows along the Suyaska River. In favorable (rich in “mouse”) years, breeding of one or several pairs is probable in the steppe eastern part of the reserve.

Montagu's Harrier. Listed in the Red Data Book of Chelyabinsk Oblast (category III – rare species).

A single male flying over the meadows along the Suyaska River was recorded on June 13, 2006. During the study period (2022), solitary adult birds of both sexes, as well as pairs were regularly seen hunting in steppe-meadow sites in the east and northeast of the reserve; On July 26, two playing fledglings were noted. We assume that at least two pairs of this species nest in the reserve.

Northern Goshawk. Listed in Appendix 3 of the Red Data Book of Chelyabinsk Oblast as a species, the state of which in the natural environment requires special attention.

A built-on-old-birch nest with downy chicks (two were visible from the ground) was detected on June 27, 2018 in mature pine stands in the southeastern part of the reserve (Gashek et al., 2019). A bird, hunting for young Eurasian Hobbies, was observed on August 8, 2018 in an aspen-birch grove near the village of Petrovpavlovka (the same place). In 2022, a Northern Goshawk nesting site was in the old pine forest of the northeastern part of the reserve, where on June 15, we discovered an extremely alarmed adult bird staying next to a couple of abandoned their nest fledglings. Here, we also found hare's (*Lepus* sp.) leftovers. Along with a resident nest, there were 4 more old (differently preserved) nests in old larches nearby.

Steppe Eagle. Listed in the Red Data Books of the Russian Federation (category II – a species declining in number and/or distribution) and Chelyabinsk Oblast (category II – a species declining in number). Rare flights of single individuals were recorded in Chelyabinsk Oblast (Korovin, 1997; Ryabitshev et al., 2006; Zakharov and Brusyanin, 2012, 2014).

On June 28, 2018, the one-year old bird, probably, was observed circling in the sky over Lake Mokhovoye (Gashek et al., 2019). Solitary birds were occasionally encountered in the reserve during their autumn migration.

Eastern Imperial Eagle. Listed in the Red Data Books of the Russian Federation (category II – a species declining in number and/or distribution) and Chelyabinsk Oblast (category III – rare species). Quite a large number of breeding species was marked in the Verkhneuralsky and Uysky regions (Gashek and Zakharov, 2010; Zakharov, 2013; Zakharov et al., 2018).

A pair of Eastern Imperial Eagle was nesting in the steppe northeastern part of the reserve, in different years alternately occupying the nests located amongst the hilly steppe in the vicinity of Petrovpavlovka village at a distance of about 2 km from each other, on a birch and a pine (Gashek et al., 2019; Zakharov et al., 2018). In 2018, a pair hatched two chicks (Fig. S5) (Gashek et al., 2019). In early May 2021, we observed a hatching eggs female bird. In July 2022, adult Eastern Imperial Eagles were repeatedly seen on the nesting territory and around, but both nests were empty. Obviously, birds were disturbed by people at the beginning of the incubation period.

Golden Eagle. Listed in the Red Data Books of the Russian Federation and Chelyabinsk Oblast (category III – rare species).

Few adult and young birds are periodically found (until January) in the reserve and its environs during the post-breeding migrations.

White-tailed Sea-eagle. Listed in the Red Data Books of the Russian Federation (category V – restored and recovering species) and Chelyabinsk Oblast (category III – rare species).

From time to time, adult and young eagles are encountered in the reserve in summer (flights from surrounding areas) and during migration.

Saker Falcon. Listed in the Red Data Books of the Russian Federation and Chelyabinsk Oblast (category I – endangered species).

Single birds are occasionally observed during migration.

Peregrine Falcon. Listed in the Red Data Books of the Russian Federation and Chelyabinsk Oblast (category III – rare species).

Yearly nesting of a pair on rocky outcrops in the central part of the reserve has been registered since 2008 (Gashek et al., 2019).

Red-footed Falcon. Listed in the Red Data Book of the Russian Federation (category III – rare species).

Single birds are occasionally encountered during migration.

Willow Grouse. Listed in the Red Data Book of the Russian Federation (category II – a species decreasing in number and/or distribution) and Chelyabinsk Oblast (as *Lagopus lagopus* sp.) (category III – rare species).

1–2 pairs are occasionally encountered, usually in autumn, in the steppe areas of the reserve.

Black-billed Capercaillie. In the Southern Urals, it is found in pine stands from the northern boundary of the region up to the southern forest edge. Its southernmost spread in Chelyabinsk Oblast involves the Karagai and Sanarsky pine forests (Zakharov, 2006).

In the Karagai Reserve, we detected Black-billed Capercaillie during all periods of our research. Adult birds and broods were regularly recorded in old pine forests.

Hazel Grouse. Spread in the forested areas of the Southern Urals. In foothills, it is discovered in pine-birch forests and riverine grooves. In the mountains of the Southern Urals, this species is more common in spruce-birch and spruce-fir forests. It also inhabits pine-birch forests, riverine urames, including spruce-birch and spruce-fir forests. With berry harvest, this bird is noted in pine forests (Zakharov, 2006).

R.L. Potapov (1990) classifies Hazel Grouse as a species with a greatly varying number and as the most sedentary of all black grouses.

This species was recorded only in 2006, when we scared two birds during bird counts (July 11, 12) in the central part of the reserve along the Suyaska River. Today, the Karagai Reserve is the southernmost point of Hazel Grouse distribution in Chelyabinsk Oblast (Belkovsky et al., 2008). Perhaps, because of the southern range limit and suboptimal conditions (lack of food stations in winter (grooves)), the species has completely disappeared with the onset of unfavorable environmental conditions (low-snow winters, dense snow cover in frosty winters, epizootics, etc.).

Demoiselle Crane. Listed in the Red Data Books of the Russian Federation (category II – a species declining in number and distribution) and Chelyabinsk Oblast (category III – a rare species).

A pair of circling in the sky birds was seen on July 11, 2022 in the northeastern part of the reserve and on July 25 – on a small pond, i.e. a watering place on a heavily trampled pasture in the steppe eastern part. A pair of Demoiselle Cranes is breeding in this place every year.

Stock Dove. Listed in the Red Data Books of most regions of the European part of the Russian Federation (categories II–V), in Appendix 2 of the Red Data Book of Sverdlovsk Oblast (Krasnaya Khiga..., 2018) as a species that requires special protection. According to our data, Stock Dove is rare in Chelyabinsk Oblast and needs to be included in Appendix 3 of the regional Red Data Book (Gashek and Krasutsky, 2021). In the Karagai Nature Reserve, we recorded a single bird on July 12, 2006. Later this species was not encountered. Nesting of few pairs is probable.

European Turtle-dove. Listed in the Red Data Books of the Russian Federation (category II – a species declining in number and/or distribution) and Chelyabinsk Oblast (a species declining in number). We discovered the only bird in the reserve on July 12, 2006. Later this species was not recorded.

Oriental Cuckoo. The species inhabits mainly coniferous stands of the Southern Urals (Zakharov, 2006). A.M. Sudilovskaya (1952) associates the finds of Oriental Cuckoo in places where it was previously not encountered not with its range expansion, but with more profound studies of the country's avifauna. Nevertheless, its detection in the southern forest-steppe of the Trans-Urals is quite rare. The Yetkulsky pine forest, in the vicinity of Priozerny and Groznetsky villages of the Yetkulsky region, in the southern part of the Sanarsky pine forest (at Stepnoye village, the Troitsky region), as well as at the southern boundary of the Dzhabyk-Karagaysky pine forest (near Sistema village, the Kartalinsky region) are the southernmost points of deaf cuckoo discovery in the Southern Trans-Urals (Gashek, 2016; Tarasov et al., 2014).

In the Karagai Reserve, the Oriental Cuckoo's call was repeatedly heard near the field camp at Lake Mokhovoye (2018) and in the northeastern part of the lake (2022). This is the southernmost (probable) nesting site of the species in the region.

Eurasian Eagle-owl. Listed in the Red Data Books of the Russian Federation and Chelyabinsk Oblast (category III – rare species). On the territory of the Karagai Reserve, one could hear Eurasian Eagle-owl's vocalizations almost every year in spring. The presence of suitable biotopes and regular hooting during the nesting period give reason to assume breeding of this species.

Common Scops-owl. In the south of the Urals, the Cis-Urals and Western Siberia, it is generally a rare and extremely unevenly distributed species (Ryabitsev, 2008).

In 2015, we found a fledgling in the Karagai Reserve. A hooting Common Scops-owl was noted on August 6, 2018 in an aspen-birch grove in the eastern part of the reserve.

Little Owl. Listed in the Red Data Book of Chelyabinsk Oblast (category III – rare species). It is rare, in places, common for the steppe south of the Urals, the Cis-Urals and Western Siberia (Ryabitsev, 2008). There is evidence of its recent spread to the east (Tarasov, 2011). In 2018 or 2019, a vocalizing bird was observed near the abandoned Mokhovsky cordon in the central part of the reserve. Nesting is probable.

Northern Hawk Owl. Listed in the Red Data Book of Chelyabinsk Oblast (category III – rare species). Sedentary or nomadic bird, most typical of the northern taiga (Ryabitsev, 2008). In Chelyabinsk Oblast, it is most often recorded during autumn-winter migrations (Krasnaya..., 2017). In the nesting period, it is occasionally encountered in spruce-fir forests (Zakharov, 2006). In the spring of 1983, mating birds were observed in the Ilmen Reserve that indirectly suggests probable breeding of this species (the same place).

In the Karagai Reserve, single individuals are rarely noted during autumn-winter migrations; last time they were seen in November 2006 or 2007.

Ural Owl. In the Southern Urals, it is a nesting sedentary and nomadic species spread from the north the region to its steppe areas (Zakharov, 2006).

Twice (July 24 and 26, 2022) we encountered single adult birds in different sites of the old pine forest in the northeast of the reserve. Previously, we repeatedly detected nests and birds (in mesoptile), which had abandoned their nests. In the reserve, the population of this species may consist of 1–2 nesting pairs.

Great Grey Owl. Listed in the Red Data Book of Chelyabinsk Oblast (2017). Category V (a recovering species).

One of the authors repeatedly found resident nests in the reserve. The population may consist of 1–2 breeding pairs.

White-backed Woodpecker. Listed in the Red Data Books of a number of regions of the European part of Russia (categories III, V). In Chelyabinsk Oblast, the number of White-backed Woodpeckers has decreased over the past decade (Gashek et al., 2022).

In the Karagai Reserve (2006, 2018), we encountered only few representatives of this species. On July 22, 24 and 25 of 2022, two young birds and an adult were noted in the northeastern part of the reserve.

Blackcap. This European species is relatively common in the mountain (western) regions of Chelyabinsk Oblast and rare in the forest-steppe Trans-Urals (Zakharov, 2006).

Blackcap was encountered in the reserve only once (July 12, 2022): a singing male was seen in a wet (near-floodplain) forest in the central part of the protected area. Nesting is probable.

Black Redstart. A species actively spreads in the northeast. In recent years, increasing cases of its nesting in the Urals, the Cis-Urals and Western Siberia have been recorded (Gashek and Zakharov, 2020; Ryabitsev, 2008).

In 2022, a breeding pair of birds was discovered in an inactive children's camp at the northeastern boundary of the reserve. The nest was built in a metal vent pipe under the roof of the one-story house (Fig. S10). On July 10, it contained three blind chicks of 4–5 day old. Judging by late dates and a small number of chicks, this was probably the second breeding cycle of the pair. All three fledglings (Fig. S11) successfully left the nest on July 21 and were staying (until the end of our survey: July 28) on the nesting territory (on buildings), where they continued to be fed by their parents (Fig. S9). Nesting of several more pairs of Black Redstarts is possible on the territory of numerous tourist bases and the "Karagaisky Bor" sanatorium situated at the northeastern and western parts of the reserve.

Eurasian Blackbird. On the territory of the Southern Urals, the species is rare in dark coniferous-broad-leaved forests and is more common in broad-leaved forests. In the east, it is distributed as far as the Ilmen Reserve (Zakharov, 2006).

Two single males were noted on July 14 and 24, 2022 in wet floodplain forests near the Suyaska River in the northeastern part of the reserve. Nesting is probable.

Brambling. The species is common in pine-birch, pine and birch forests of the eastern foothills of the Southern Urals. In the mountains, it inhabits spruce-birch and fir-spruce biotopes. Bramble finch is found in the overgrown clearings and spruce thin forests of the subalpine belt. In the Trans-Ural forest-steppe, it is encountered mainly when migrating and extremely rarely – during the nesting period. Apparently, in some years it can breed in groves. In June 1994, a nest with an incubating female was found in a large birch grove nearby Chelyabinsk (Tomino village) (Zakharov, 2006).

On June 25 and July 1, 2018, in a mixed forest in the reserve south, a singing male was observed twice, that clearly suggests breeding of this species. To date, the Karagai Reserve is the southernmost point of possible nesting of this species in Chelyabinsk Oblast.

Red Crossbill. In forested areas of the Southern Urals, the species is relatively common in pine and pine-birch forests. In dark coniferous habitats, it is found in fir-spruce and spruce-birch stands, while in the mountainous areas – in spruce sparse forests of the subalpine belt, in overgrown clearings and spruce groves of the mountain tundra. During the breeding season, it was found only in the island pine forests of the Trans-Ural forest-steppe (Zakharov, 2006).

In 2006, Red Crossbill was recorded in the reserve by voices of flying birds. In 2018, flocks of 5–8 individuals were repeatedly observed flying in the central and southern parts of the reserve. In 2022, flocks of crossbills were regularly encountered in the central and northeastern parts of the reserve. In addition, a brood was seen several times in the larch forest at the northeastern boundary of the protected area. For instance, on July 15, a male was singing next to the brood. On July 19 and 24, adult birds were feeding several young ones in larch crowns and restlessly scared away squirrels *Sciurus vulgaris* (L., 1758) scurrying around the brood. Obviously, on top of a tree crown, birds had built their nest made of thin larch branches since the brood was staying next to it at least for a week. This was the southernmost location of the supposed nesting of Red Crossbills in Chelyabinsk Oblast.

Conclusion

Over the entire study period in the Karagai Biosphere Reserve, 134 bird (including 118 breeding or probably nesting) species were identified. From bird counts implemented during the nesting period of 2006 it follows that the dominants in forest biocenoses were Chaffinch and Tree Pipit (33 and 11% of the total population, respectively), while subdominants – Willow Tit (8%), Common Chiffchaff (6%), Great Tit and European Pied Flycatcher (5% each). In 2018, most numerous Chaffinch (21% of all species encountered on the routes) and Tree Pipit (14%) slightly outnumbered Great Tit (7%), Common Redstart (6%), Common Chiffchaff, and Great Spotted Woodpecker (5% each).

The majority of breeding species (63%) was represented by dendrophiles. The limnophile group included 17% of all species. Campophiles and sclerophiles made up 10% each.

The diversity of environmental conditions, the combination of forest biotopes with open landscapes occupied by steppe-meadow communities, the reserve's location at the boundary of the southern forest-steppe and steppe, the proximity of eastern ridges of the Ural mountain country determine the presence of species of various faunal complexes in its avifauna (V.P. Belik (2000, 2006)). Here, in addition to species of the forest-steppe faunal complex (Eastern Imperial Eagle, Grey Partridge, Common Wood-pigeon, European Turtle-dove, Eurasian Nightjar, Tree Pipit, Red-backed Shrike, Hooded Crow, European Greenfinch, European Goldfinch, Eurasian Linnet, Yellowhammer and Ortolan Bunting), we note reliable (or probable) nesting of the representatives of the northern taiga (Green Sandpiper, Great Grey Owl, Brambling) and mountain taiga (Hazel Grouse, Oriental Cuckoo, Ural Owl, Black Woodpecker, Willow Tit, Coal Tit, Eurasian Siskin, Red Crossbill, Common Bullfinch), desert-steppe (Pallid Harrier, Demoiselle Crane, Eurasian Skylark, Booted Warbler), desert-mountain (Little Owl) faunal complexes and those from the intra-zonal estuary complex closely related to water bodies of the desert-steppe belt (Ruddy Shelduck, Water Rail).

The Karagai Biosphere Reserve is one of the southern outposts in Chelyabinsk Oblast for nesting (or expected breeding) of Hazel Grouse, Oriental Cuckoo, Ural and Great Grey Owls, Brambling, Red Crossbill, and Common Bullfinch. Its importance for conservation of such rare species listed in the Red Data Books of the Russian Federation and Chelyabinsk Oblast as Ruddy Shelduck, European Honey-buzzard, Pallid and Montagu's Harrier, Eastern Imperial Eagle, Peregrine Falcon, Demoiselle Crane, Eurasian Eagle-owl, Little Owl, Great Grey Owl is undeniable. However, logging in the reserve carried out with violation of the federal/regional environmental legislation and contradicting the regulation documents on economic regime of the reserve use brings to deterioration of habitats, primarily of forest rare and common species. In addition, the hydrological regime of small rivers changes that in turn entails the transformation of coastal habitats and brings to disappearance of some birds (Western Marsh Harrier, Green Sandpiper, Common Snipe, Hazel Grouse, etc.) or reduction of their number. In our opinion, the preservation of mature, old larch and pine stands in the reserve is of paramount importance since they provide optimal conditions for successful reproduction of many species..

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APPENDIX. Photographs of some bird species of the Karagai Biosphere Reserve.



Fig. S1. A downy Mallard chick, 2023. All photos are made by V.A. Gashek.



Fig. S2. A Ruddy Duck chick, 2023

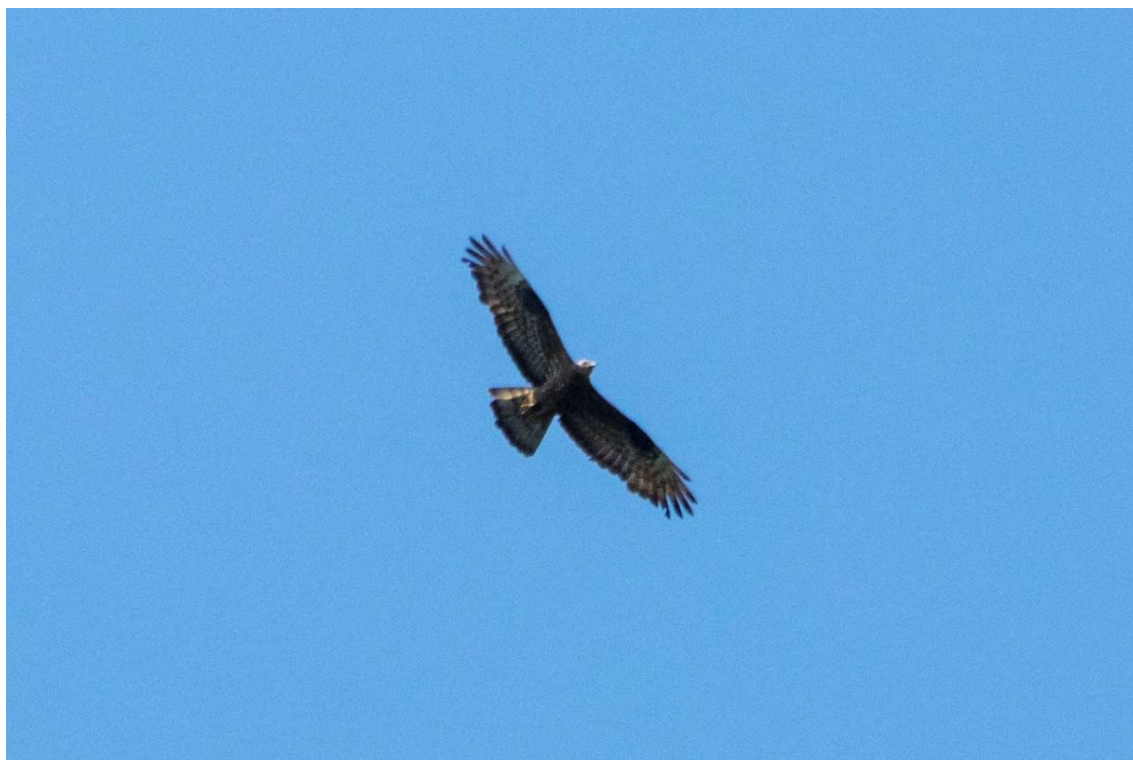


Fig. S3. A Common Wasp Eater, 2023.



Fig. S4. A fledgling of Sparrow Hawk, 2023.



Fig. S5. Nestling chicks of Imperial Eagle, 2018.



Fig. S6. A Hobby Falcon, 2023.



Fig. S7. A Common Crane, 2018.



Fig. S8. A female of Common Nightjar, 2023.

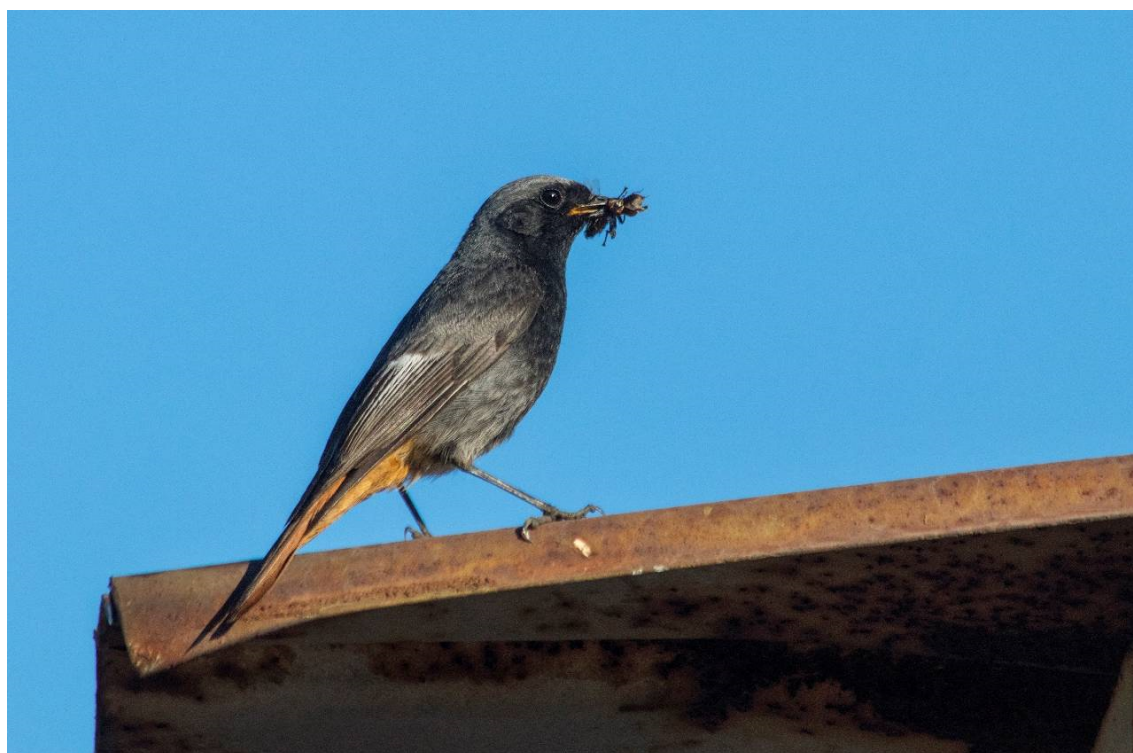


Fig. S9. A male of Black Redstart with food next to its nest, 2023.



Fig. S10. Nestling chicks of Black Redstart, 2023.



Fig. S11. A fledgling of Black Redstart, 2023.



Fig. S12. A male of Ortolan Bunting, 2018.