

An updated review of bird diversity in Central Altai highlands

Sergei V. Vazhov¹, Alex V. Matsyura², Viktor M. Vazhov¹

1 *Shukshin Altai State University for Humanities and Pedagogy, 53 Korolenko St., Biysk, 659333*

2 *Altai State University, 61 Lenina St., Barnaul, 656049, Russia*

Corresponding author: Alex V. Matsyura (amatsyura@gmail.com)

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Abstract

The Katun and North Chuya ridges are the highest and most popular mountain ranges in the Altai Republic. The Katun ridge is 150 km long and includes 386 glaciers; its highest mountain is 4509 m. The mountain ranges received the status of World Heritage Sites in 1998. The deepening tourist and recreational development of the Katun and North Chuya ridges is accompanied by a change in bird numbers and species diversity; therefore, constant monitoring is needed to support the bird species database. The purpose of our research was to supplement the modern information on the fauna and bird population of the highlands of central Altai within the Katun and North Chuya ridges. We conducted field observations during 2010–2022 in Central Altai on hiking routes along the Katun and North Chuya ridges with a total length of 1015.4 km to the highest elevation of 3400 m. The bird diversity of the Katun and North Chuya ridges is represented by 53 species from 11 orders and 21 families. We also registered 21 rare and endangered species, among them the extremely rare species are: great cormorant, ruddy shelduck, and Eurasian goshawk; very rare species are: black kite, upland buzzard, common buzzard, booted eagle, golden eagle, white-tailed eagle, bearded vulture, common kestrel, red grouse, demoiselle crane, common cuckoo, scops owl, pygmy owl, nightjar, black woodpecker, Richard's pipit, grey wagtail, red-billed chough, raven, greenish warbler, white-winged redstart, common rosefinch, and common crossbill; rare species are: sparrowhawk, red-necked phalarope, water pipit, fieldfare, long-tailed tit, marsh tit, great tit, and Brandt's mountain finch; and the common species are: spotted nutcracker, common chiffchaff, and willow tit.

Keywords

Avifauna, population, rare species, Central Altai, Katun ridge, North Chuya ridge

Introduction

The Katun and North Chuya ridges are located in the central Altai. These are the highest, most severe, and very popular mountain ranges among domestic and foreign tourists of the Altai Republic (Fig. 1). The Katun ridge is 150 km long and 60 km wide, with the highest elevation of 4509 m (Mount Belukha) (Katun ridge... 2023), while for the North Chuya ridge these figures are, respectively: 120 km, 50 km, and 4173 m (Maashei-Bashi mountain, Severo-Chuisky...). The relief is mid-mountain and high-mountain, in the central part, alpine with a predominant form of glacial and permafrost. The forest boundary is located at the elevation 2000-2200 ms. Tree massifs are mainly represented by Siberian larch (*Larix sibirica*) and Siberian stone pine (*Pinus sibirica*) with the inclusion of other species and various shrubs. Above the forest boundary, subalpine, alpine, mountain-tundra, and nival landscapes prevail, as well as thickets of small shrubs, mainly dwarf birch (*Betula nana*), gray willow (*Salix glauca*), blue honeysuckle (*Lonicera altaica*), cliffs, rocky screes, kurums, moraines, snowfields, and glaciers.



Figure 1. On the route along the Ak-Kem Pass. September 2015. Photo by S.V. Vazhov and A.V. Makarov.

On the slopes of the Katun Ridge there are 386 glaciers (Katun ridge... 2023), one of which (Gebler glacier) is the source of the Katun River, which is popular among water tourists in Russia and abroad. The range system also includes the largest rivers Kuragan and Ak-Kem, and lakes Akkems koye, Kucherlinskoye, Multinskoye, Doroshkol, Taymene, Kuiguk, Akchan, Kyrgyz, and Alla-Askыр. There are 216 glaciers on the North Chuya ridge (Atlas1991). The rivers Shavla, Karagem, Yungur, Kamryu, Djelo, and Aktru start here. The most significant lakes are Upper and Lower Shavlinsky, Karakol, Dzhangyskol, Kamryu, Abyl-Oyuk, and Karakabak. The unique and inimitable natural features of the mountain landscapes predetermined the establishment of the Katun Ridge in 1991 of the Katun Nature Reserve (Fig. 2) on the territory adjacent to Kazakhstan with an area of 150 thousand hectares, and in 1997, the first natural park in the Altai Republic, "Belukha" (Fig. 3) with an area of 132.5 thousand hectares. Both of these specially protected natural territories (SPNTs) of the Altai Republic received the status of UNESCO World Heritage Sites in 1998 (Katun ridge... 2023).



Figure 2. Location of the Katun Nature Reserve (http://www.sayanring.com/glossary/katunsky_reserve_eng/).

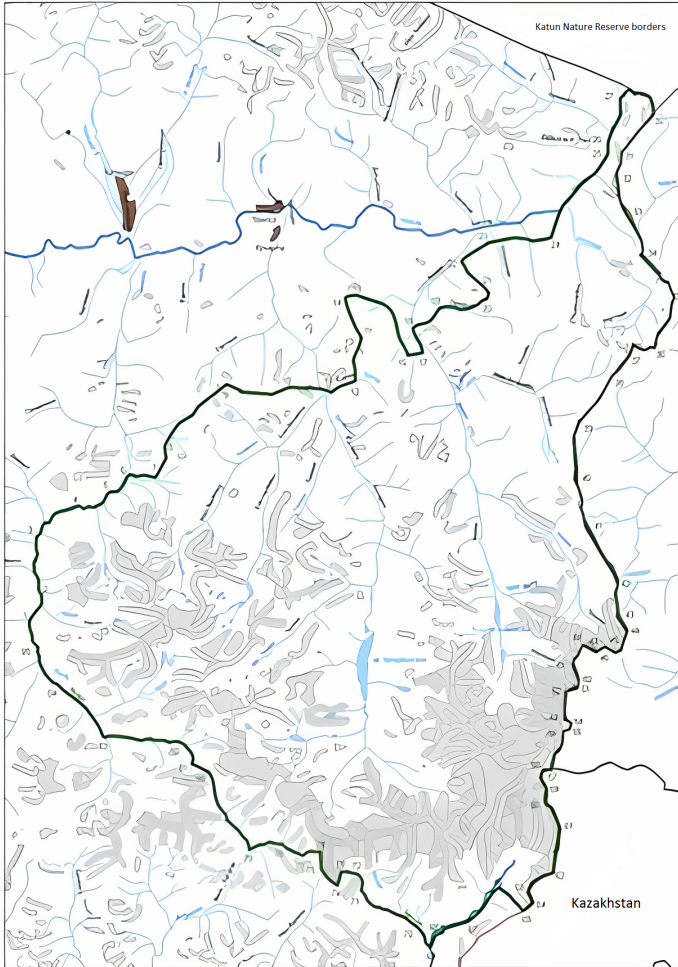


Figure 3. Boundaries of Belukha Park (Belukha Park).

Picturesque mountain landscapes, preserved wildlife, swift rivers, glaciers, passes of all categories of complexity, lakes with clear water attract many tourists and travelers from all over the world to the Katun and North Chuya ridges. Mount Belukha, the highest point of Siberia and one of the largest mountain peaks in Russia, is especially famous internationally.

Popular hiking, horseback riding and mixed tourist routes from Tyungur village to the foot of Belukha of various lengths are laid along the Katun Ridge and the Belukha Nature Park, the participants of which, often unorganized and unprepared for appropriate behavior in the wilderness, create a serious disturbance factor. The most famous tourist routes on the North Chuya ridge are laid from Chibit village to the Shavlinskies lakes and along the Aktru River. The studies conducted confirm the high value of PA as a habitat for birds, especially rare birds, and also contribute

to the reproduction and conservation of the avifauna complex as a whole (Vazhov 2015).

The composition of the Katun Reserve is represented by 155 species of 17 orders belonging to 40 families (Fauna 2023). In the Belukha Nature Park, 117 bird species from 10 orders including 27 families are assumed to be present (Nagibina 2005). However, the modern avifauna of the Katun and North Chuya Ridges is not adequately studied. Furthermore, the latest edition of the Republican Red Data Book (The Red Data 2017) significantly limits the information on many rare species of the Central Altai.

The deepening tourist and recreational development of the Katun and North Chuya Ridges is accompanied by changes in avifauna and bird populations. Consequently, more research is needed to replenish the database on different species of birds. Protection of rare species should be combined with the inevitability of punishment not only for poachers, but also for nature users, including recreationists involved in destructive ecological activities (Vazhov et al. 2022; Vazhov et al. 2023). Therefore, the objective of our research is to supplement current information on the fauna and bird populations of the highlands of the central Altai Mountains within the Katun and North Chuya Ridges.

Materials and methods

In 2010–2022, work was carried out in the highlands of the Central Altai on hiking routes along the Katun and North-Chuya ridges with a total length of 1015.4 km to the highest mark of 3400 m (Druzhba pass, 1B).

In 2010, studies were carried out on a circular route: Chibit village – Chuya River – Oroï River – Oroy Pass – Shabaga River (Eshtykol) – Shavla River – Nizhnaya Shavlinskoye lake – Nizhneshavlinskiy Pass – Maashei River – Maasheiskoye lake – Maashei River – Chuya River (radial) – Maashei (Mazhoy) River – Oroy Pass – Oroï River – Chuya River – Chibit village from 7 to 17 August, the route length was 98 km, the total surveyed area was approximately 29 km² (Fig. 4).

In 2012 two routes were passed. The first one: village. Multa – Lower Multinskoye lake – Kuiguk River – Kuiguk lake – Kuiguk Pass – Akchan River – watershed between Akchan and Kyrgyz river basins – Kyrgyz lake – Kyrgyz River – Kuragan River – Ioldo River – Northern Ioldo River – Ioldo Pass – Western Ioldo – Ayry Pass – Ioldoaira glacier – Doroshkol lake – Ioldoaira River – Koniaira River – Kucherlinskoe lake – watershed between Akkk and Kyrgyz river basins – Kucherlinskoe River. Kucherlinskoe – watershed between the Akkem and Kucherla river basins, Tekelyushka river – Karatyurek pass (radial) – watershed between the Akkem and Kucherla river basins – Kuilyu River, Kucherla River – Kucherla settlement, Tyungur village from 04 to 15 June, the route length was 136 km, the total surveyed area was approximately 41 km² (Fig. 5).



Figure 4. Scheme of the route along the North-Chuysky Ridge in 2010.

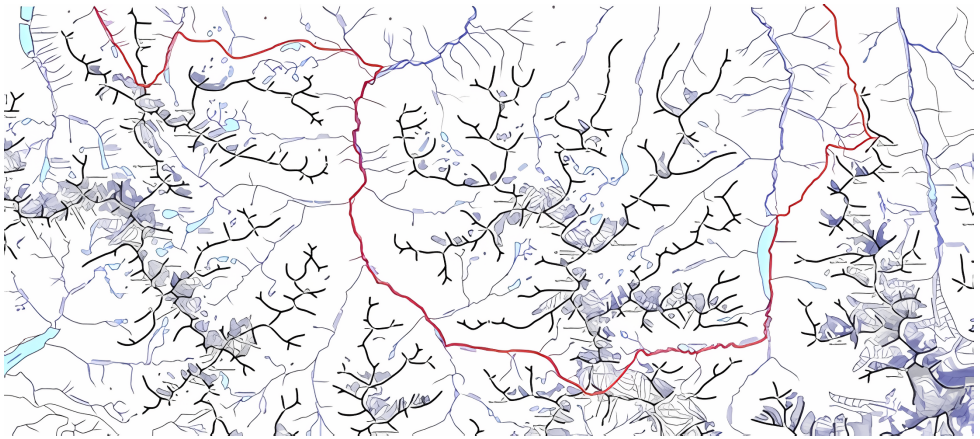
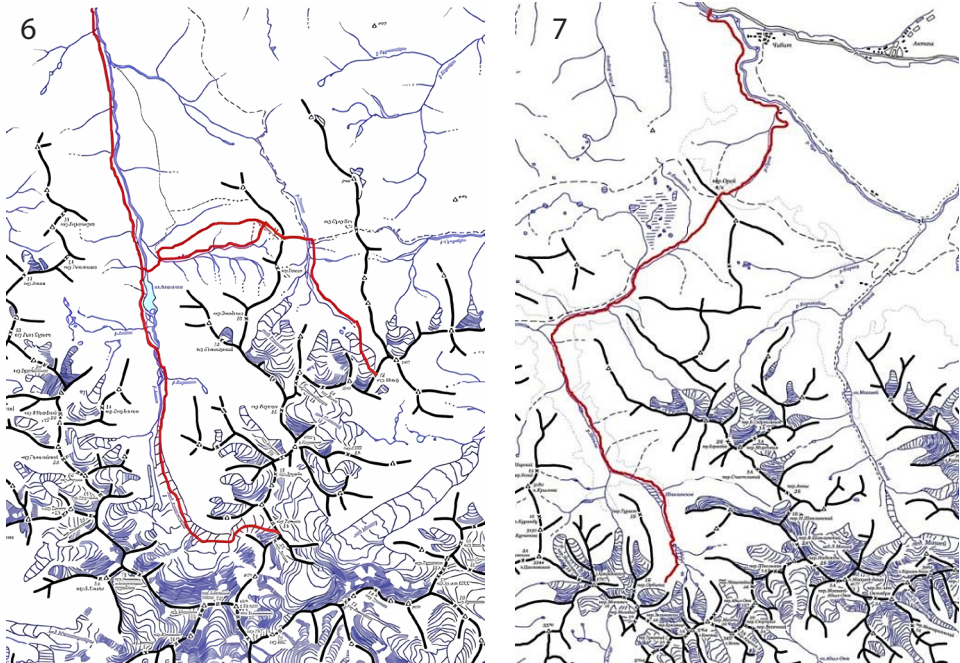


Figure 5. Scheme of the first route along the Katun ridge in 2012.

The second route: Tungur village – settlement. Kucherla – Kuzuyak Pass – Akkem River – Akkemskeye Lake – Yarlyu River – Yarlyu-Boch Pass – Tekelu River – Mensu Pass (radial) – Tekelu River – Yarlyu-Boch Pass – Yarlyu River – Akkemskeye Lake – Tomsk. Akkem – Akkemsy (Rodzevich) Glacier – Tomsk campsites – Tomsk Students Peak (radial) – Akkemsy (Rodzevich) Glacier – Akkem River

– Akkems koye Lake from July 02 to 12, the route length was 93 km, the total area covered was approximately 28 km² (Fig. 6).

In 2013 the following works were carried out on the route: Chibit village – Chuya River – Oroï River – Oroïsky Pass – Shabaga River (Eshtykol) – Shavla River – Lower Shavlinskoye lake – Upper Shavlinskoye lake – glacier under Orbita Pass – Upper Shavlinskoye – Lower Shavlinskoye Lake – Shavla River – Shabaga River (Eshtykol) – Oroïsky Pass – Oroï River – Chuya River – Chibit village from 9 to July 15. The route length was 94.4 km, and the total surveyed area was about 28 km² (Fig. 7).

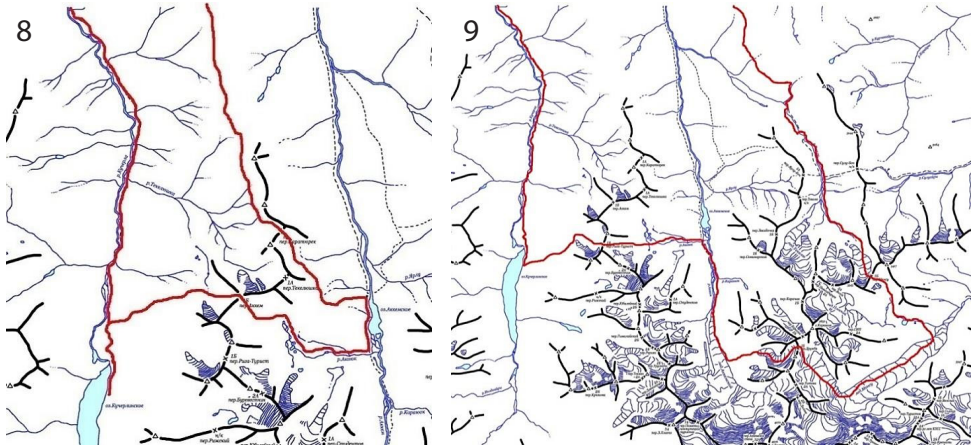


Figures 6–7. 6. Scheme of the second route along the Katun Ridge in 2012. 7. Scheme of the route along the North Chui Ridge in 2013.

In 2015, studies were carried out on the circular route from Tyungur village to the Kucherla settlement to the Kucherla river to Kuilyu river, the watershed between the basin. Tyungur – Kucherla settlement – Kucherla River – Kuilyu River – watershed between the Akkem and Kucherla river basins – Karatyurek Pass – Akkem Lake – Akoyuk River – Akkem Pass – Kucherla Lake – Kucherla River – Kucherla Settlement – Tyungur from 06 to 15 September, the route size was 94 km, the total surveyed area was approximately 28 km² (Fig. 8).

In 2017, field work was carried out on the circular route from Tyungur village – Kucherla settlement – Kuzuyak Pass Tyungur – Kucherla settlement – Kuzuyak pass – Akkem river – Oroktói river – Oroktói trail – Aktashka lake – Tekelyu river – Mensu glacier pass – Mensu (Sapozhnikov) – Druzhba pass – Akkemy sky glacier

(Rodzevicha). Druzhba – Akkemy Glacier (Rodzevicha) – Akkem River – Akkenskoye Lake – Akoyuk River – Riga-Turist Pass – Kucherlinskoye Lake – Kucherla River – Kucherla Settlement – Tyungur village from August 16 to September 01, the route length reached 128 km, the total surveyed area - about 38 km² (Fig. 9).

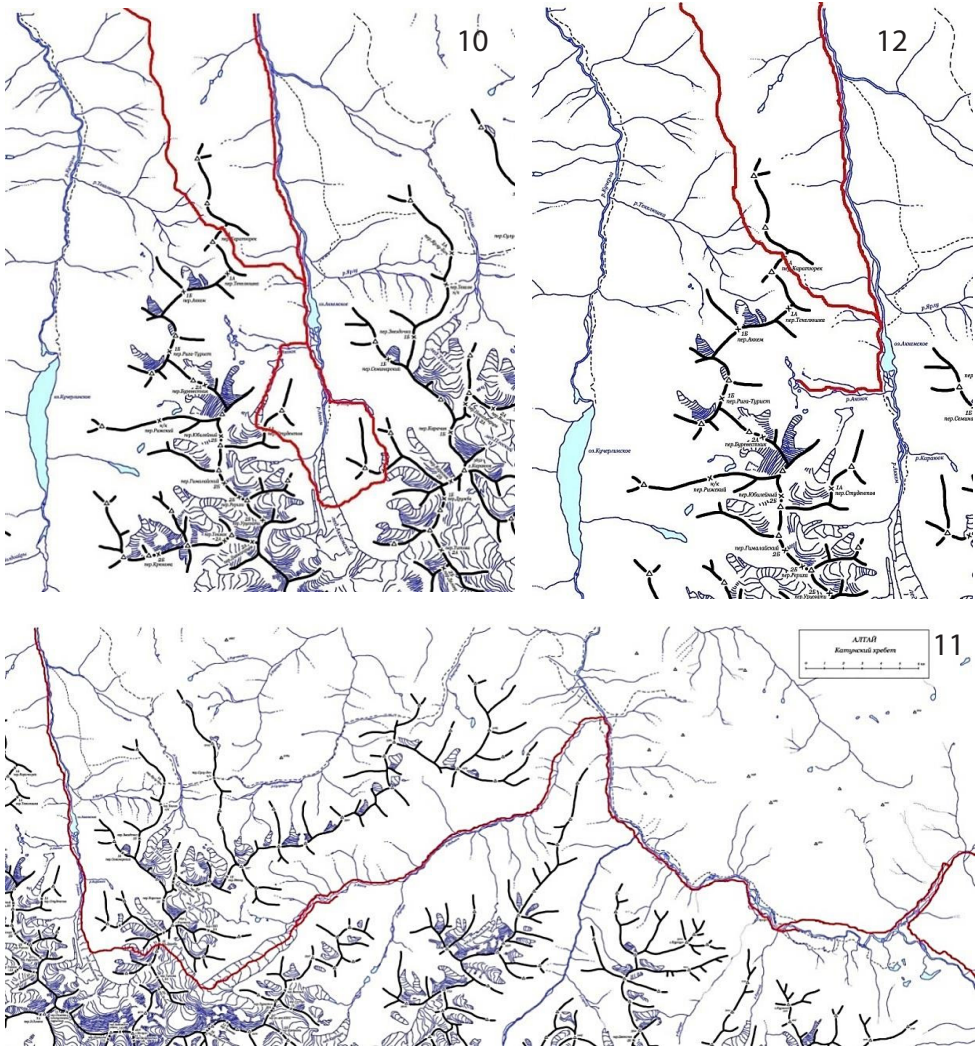


Figures 8–9. 8. Scheme of the route along the Katun Ridge in 2015. 9. Scheme of the route along the Katun Ridge in 2017.

In 2018, studies were conducted along the circular route: Tyungur village – Kucherla settlement – Kuzuyak pass – Akkem river – Akkenskoye lake – Karaoyuk river – Dukhov lake – Nadezhda pass – Akkemy (Rodzevicha) glacier – Karatyurek pass – watershed between the basins. Students – Akkenskoe River – Akkenskoe Lake – Karatyurek Pass – watershed between the Akkem and Kucherla river basins – Kuilyu River – Kucherla River – Kucherla settlement – Tyungur village from 01 to 16 August, the route length was 95 km and the total surveyed area was about 29 km² (Fig. 10).

In 2019, work was carried out on the route: Tyungur village – Kucherla settlement – Kuzuyak pass – Akkem river – Akkem lake – Akkemy glacier (Rodzevicha) – Druzhba pass – Mensu glacier (Sapozhnikov) – Mensu river (Iedigem) – Ardigem river. Druzhba – Mensu Glacier (Sapozhnikova) – Mensu River (Iedigem) – Argut River – Karagem River (up to the ford and back) – Argut River – Dzhazator River – Dzhazator village – Dzhazator village from 02 to 21 August, the route size reached 187 km, the total area covered about 56 km² (Fig. 11).

In 2022, observations were made along the circular route: Tyungur village – Kucherla settlement – Kucherla River – Kuilyu River – watershed between the Akkem and Kucherla river basins – Karatyurek Per. Akoyuk – Akkenskoye Lake – Akkem River – Kuzuyak Pass – Kucherla Settlement – Tyungur village from 06 to 15 August, the route length was 90 km and the total surveyed area was about 27 km² (Fig. 12).



Figures 10–12. 10. Scheme of the route along the Katun Ridge in 2018. 11. Schematic of the route along the Katun and North-Chuysky ridges in 2019. 12. Scheme of the Katun Ridge Route in 2022.

Incomplete territorial coverage is largely compensated for by nine bird observations over a 13-year period, conducted during the summer-autumn seasons (the earliest, from 04 to 15 June 2012, the latest, from 06 to 15 September 2015). Such research methods as counting birds on an unrestricted strip with subsequent statistical processing of data (Bibby et al. 1998; Ravkin and Livanov 2008; Karyakin 2004), as well as abstraction, analysis and synthesis of information were used. The birds were observed with binoculars with Canon 8×25 IS and Yukon 8×40. According to the methodology, all representatives of the avifauna encountered along the routes

were recorded. Radial walks were made to count birds on the surveyed territory of the ridge. Field materials collected during the expedition (field diaries, photographic materials, GPS information), as well as available literature and information resources were analyzed. For each bird the distance from the observer to the bird at the first moment of its registration (detection range) was determined. To calculate the density for each species, the average detection range was calculated from the set of registrations. The abundance of species was estimated on the basis of their densities obtained during the survey. A point scale of abundance was used to describe species (Kuzyakin 1962).

When a nesting site was found, its geographic coordinates were recorded using a personal satellite navigator and entered into the ArcView GIS geoinformation program electronic database, where further desktop processing of spatial data was performed. By nesting areas, we mean areas where nests were found or where adult birds in pairs, unbrooded broods, mating adult males, or solitary adult birds showing disturbance to humans or other predators were observed during the breeding season.

Bird systematic is given in accordance with relevant reference books and field guides (Stepanyan 1990; Ryabitsev 2001; Koblik et al. 2006; Ryabitsev 2014a; Ryabitsev 2014b).

Result

The main type of bird habitat in the highlands of the Central Altai is the cedar larch taiga, rocks, rocky screes, mountain tundra, open forest areas with extensive glades, water and water-wetland areas with wooded banks of watercourses and reservoirs. We summarize the data on rare bird species (Table 1).

Table 1. Rare and threatened bird species

Species	Red Data Book category	
	Russian Federation (2021)	Altai Republic (2017)
<i>Phalacrocorax carbo sinensis</i> (Blumenbach, 1798)	not evaluated	critically endangered
<i>Pandion haliaetus haliaetus</i> (Linnaeus, 1758)	critically endangered	critically endangered
<i>Circus macrourus</i> (S.G. Gmelin, 1771)	critically endangered	endangered
<i>Buteo hemilasius</i> (Temminck et Schlegel, 1844)	not evaluated	critically endangered
<i>Hieraaetus pennatus milvodes</i> (Jerdon, 1839)	not evaluated	extinct
<i>Aquila nipalensis nipalensis</i> (Hodgson, 1833)	endangered	critically endangered

Species	Red Data Book category	
	Russian Federation (2021)	Altai Republic (2017)
<i>Aquila clanga</i> (Pallas, 1811)	endangered	endangered
<i>Aquila heliaca</i> (Savigny, 1809)	endangered	endangered
<i>Aquila chrysaetos chrysaetos</i> (Linnaeus, 1758)	critically endangered	endangered
<i>Haliaeetus albicilla</i> (Linnaeus, 1758)	low risk	extinct
<i>Aegypius monachus</i> (Linnaeus, 1766)	endangered	critically endangered
<i>Gypaetus barbatus hemachalanus</i> (Hutton, 1838)	critically endangered	extinct
<i>Falco cherrug milvipes</i> (Jerdon, 1871)	extinct	extinct
<i>Falco peregrinus</i> (Tunstall, 1771)	critically endangered	extinct
<i>Lagopus lagopus major</i> (Lorenz, 1904)	endangered	not evaluated
<i>Tetraogallus altaicus</i> (Gebler, 1836)	not evaluated	critically endangered
<i>Anthropoides virgo</i> (Linnaeus, 1758)	endangered	low risk
<i>Gallinago solitaria</i> (Hodgson, 1831)	not evaluated	low risk
<i>Bubo bubo</i> (Linnaeus, 1758)	critically endangered	endangered
<i>Glaucidium passerinum</i> (Linnaeus, 1758)	not evaluated	vulnerable, data deficient
<i>Carpodacus rubicilla</i> (Güldenstädt, 1775)	not evaluated	vulnerable, data deficient

Pelicaniformes

Phalacrocoracidae

1. Great Cormorant (*Phalacrocorax carbo sinensis* (Blumenbach, 1798)). A rare species in the Altai Republic (The Red Data Book ...2017). Two sightings in August 1997 at Sredniye Multinskoye Lake and on August 9, two birds were observed in the upper reaches of the Katun River (Nagibina 2006). We recorded an individual on August 14, 2019 on the Argut tributary of the river. Kurkure. The density was 0.02 individuals/km². According to our data, an extremely rare species.

Anseriformes

Anatidae

2. Ruddy shelduck (*Tadorna ferruginea* (Pallas, 1764)). It is supposed to nest in the Belukha Park (Nagibina 2005). We observed a swimming bird at Akkem Lake

on August 05, 2019. The density was 0.02 individuals/km². The average density was 0.0001 individuals/km². According to our data, an extremely rare species.

Falconiformes

Pandionidae

3. Osprey (*Pandion haliaetus haliaetus* (Linnaeus, 1758)). Rare species (The Red Data Book... 2017, 2021). Observed ospreys are most likely migratory, wandering, or flying solitary birds (Vazhov, Matsyura 2020). The birds are occasionally seen on lakes in the Katun Reserve, where in 2000 individuals were recorded on May 29 and June 15 in the Multa River basin (Nagibina, 2006). In general, numbers are declining in southern Siberia (Mitrofanov, 2016). We did not find this bird in the study area.

Accipitridae

4. The black kite (*Milvus migrans* (Boddaert, 1783)) is one of the most widespread raptors on Earth (Literak Ivan et al. 2022). Through food chains, it is able to accumulate antibiotic-resistant bacteria of human infectious diseases in its body and spread them during migrations (Hassan Tarabai et al. 2019). During the breeding season in southwestern Siberia, kites occupy mostly natural or semi-natural habitats for an average of 106 days, with an average nesting habitat size of 3,554 km² (Literak Ivan et al. 2022). On 3 August 2018 in the lower reaches of the Akkem River, on 4 August 04, 2019 a kite was observed there, on 5 August 05, 2019 at Akkem Lake, on 13 August 13 this year – on the Argut River near the settlement of the same name and on a tributary of the Argut, the Kurkure River, on 12 August 2022 a kite hunted pika in the tundra at the descent from Karatyurek Pass to the Ak-Kem valley. The average density was 0.01 individuals/km². According to our data, the black kite is a very rare species in the study area.
5. Hen harrier (*Circus cyaneus cyaneus* (Linnaeus, 1766)). This species was previously recorded in the Belukha Park, where it may nest (Nagibina 2005). We did not find this species in the study area.
6. Pallid harrier (*Circus macrourus* (S.G. Gmelin, 1771)). Rare, with decreasing numbers and range (The Red Data Book... 2017, 2021). Sighting records have been recorded in the Katun Reserve (Fauna 2023). The species has not been recorded in the study area.
7. Eurasian goshawk (*Accipiter gentilis* (Linnaeus, 1758)). Nests in Belukha Park (Nagibina 2005). Inhabits unevenly different forest types (Kuchin 2004; Vazhov et al. 2022). In the taiga on the upper Tekelyushka River, we saw a disturbed bird on June 13, 2012. An adult was seen near the upper bridge near the village of Tyungur on September 07, 2015. Density was 0.02-0.04 individuals/km². According to our data, it is an extremely rare species.

8. Sparrowhawk (*Accipiter nisus* (Linnaeus, 1758)). We observed it attacking a black kite on 08 August 2010 in the Chuya River valley near Chibit village, and on 15 August we found a brood near the Maashey estuary. In 2019 this species was seen in flight in the middle reaches of the Iedigem River on August 11, and the next day a sparrowhawk was seen hunting at dusk after sunset. The density was 0.10-0.02 individuals/km². According to our data, it is a rare species.
9. Rough-legged Buzzard (*Buteo lagopus* (Pontoppidan, 1763)). A rare visiting species, wintering in the Belukha Park (Nagibina 2005). This species was not found in the study area.
10. Upland buzzard (*Buteo hemilasius* (Temminck et Schlegel, 1844)). A rare low-abundance Central Asian species (The Red Data Book... 2017, Garms 2020). This raptor is supposed to fly up to 2800 m, possibly nesting in Belukha Park (Nagibina 2005). Nesting in Katun Reserve, a clutch nest was found on June 01, 2000 in the forest along the Multa River; another nest was found on July 15 near the Poberezhnaya River (Nagibina 2006). We recorded it only once - on August 12, 2010 in the valley of a tributary of Nizhneshavlinsky Lake. The density was 0.03 individuals/km². According to our data, it is a very rare species.
11. Common buzzard (*Buteo buteo* (Linnaeus, 1758)). In the Katun valley near the mouth of the Ak-Kem River, a pair of buzzards was recorded in June and July 2018 (Rakin 2018). It nests in Belukha Park (Nagibina 2005). We observed a flying buzzard near Maasheyskoye Lake on August 14, 2010. We saw this bird along the Kuiguk River near the upper boundary of the forest on 10 05 June 2012, and on July 2013 we observed a pair of buzzards in the upper reaches of the Oroi River. Several individuals were observed in flight in 2015 on 07 and 14 September: a pair near the upper bridge near the Tyungur village and a bird near the seventh tributary of the Kuilyu River. A single Buzzard was observed near the ford across the Maly Araskan near the upper forest border on August 20, 2017. In 2019 this bird was recorded on 05 August twice near Akkem Lake and once on 11 August near the Iedigem River. The density was 0.02-0.11 individuals/km². According to our data, this species is very rare.
12. Booted eagle (*Hieraetus pennatus milvodes* (Jerdon, 1839)). In the Altai Republic it is threatened with extinction under natural conditions (The Red Data Book... 2017). In 2018, a bird was seen in June and July at the mouth of the Ak-Kem River, another bird was recorded near the district center of Ust-Koksa, and another in the village itself in mid-June. In this regard, the nesting of this eagle near Ust-Koksa is assumed (Rakin 2018). In Belukha Park, the bird is registered as a visiting species (Nagibina 2005). In the Chuya River near Chibit village on 8 August 08, 2010 we observed a mating pair of dark morph (Fig. 13), and on 9 July 2013 a bird of similar morph was recorded there. On the outskirts of the Tyungur, a pair of birds of the same morph was observed on 9 July 9, 2013. On 11 July 2012, a booted eagle of the same dark morph was seen on the outskirts of Tyungur village. The density was 0.04-0.07 individuals/km². According to our data, it is a very rare species.



Figure 13. Booted eagles. August 08, 2010. Chuya River valley near Chibit village. Photo by S.V. Vazhov.

13. Steppe Eagle (*Aquila nipalensis nipalensis* (Hodgson, 1833)). A rare, low abundance species (The Red Data Book... 2017, 2021). The eagle was recorded at the mouth of the Ak-Kem River. In the Belukha Park, it was registered as a visiting species (Nagibina 2005). We did not observe this species in the study area.
14. Greater Spotted Eagle (*Aquila clanga* (Pallas, 1811)). Rare, with decreasing numbers and mosaic range (The Red Data Book... 2017, 2021). Up to five pairs can nest in forested swamp landscapes in the western part of the Altai Mountains. In total, in the Altai Republic, this figure does not exceed 20 pairs (Karyakin, Nikolenko 2015). There are data on single records in the mountain provinces of Altai (Vazhov et al. 2022), in the Katun Reserve (Fauna 2023). We did not encounter it in the study area.
15. Eastern imperial eagle (*Aquila heliaca* (Savigny, 1809)). A rare species with clearly declining numbers and habitat (The Red Data Book... 2017, 2021). This eagle is supposed to be found in the Belukha Park (Nagibina 2005). It was observed near the Ust-Koksa village on April 17 and July 20, 2000, and an earlier encounter of the eagle was recorded the following year on April 10. A pair of birds was seen in the vicinity of the village of Cendek on 23 September 2004 (Nagibina 2006). In summer 2018, four eagle nests were found near the mouth of the Ak-Kem River, three of which were with chicks, and nine adult birds were recorded here, suggesting the existence of two more nesting sites. In this year, the burial

site was also recorded near the tract (Rakin 2018). We did not find this species in the study area.

16. Golden eagle (*Aquila chrysaetos chrysaetos* (Linnaeus, 1758)). A rare species with clearly declining numbers and habitat (The Red Data Book... 2017, 2021). Golden Eagle sightings are known in the area of the watershed between the Kucherla and Ak-Kem rivers (Nagibina 2005). Single and pair birds were recorded in February and April 1998 in the vicinity of Ust-Koksa and Bashtal villages, on July 16, 2001 – in the upper reaches of the Kuragan River, in 2003 – on July 25 – along the Tyurgen River, on August 01 – near Lake Taimenye, on August 13 – in the northern direction from the same lake, in July 2004 – near Multa village, in August of this year – in the upper reaches of the Tekelyu River, repeatedly – in the upper reaches of the Akchan River (Nagibina 2006). An interesting fact was the accumulation of up to 10 golden eagles in early May 2004 in the Katun valley 22 km below the village of Tyungur at the site of mass grazing and mass lamb mortality (Nagibina 2006). In 2018, a golden eagle was observed at the mouth of Uzun-Karasu (Rakin 2018). It nests in Belukha Park and Katun Reserve, presumably in the Bertkem River basin (Nagibina, 2005), as well as many other places in Altai (Irisova, 2017a). Near Akkem Lake on July 06, 2012, we observed a pair of golden eagles chasing away a warthog. The territorial behavior of the birds suggests that their breeding area is located here. In 2017 we observed a flying golden eagle on August 22 near the Tekelyu River; in 2019 on August 13 in the morning an adult golden eagle followed in flight up the valley of the Argut River; on August 20 of the same year, we also observed a flying bird in the direction of the Argut before ascending to the pass near Kyzyl-Argut. Density was 0.03-0.07 individuals/km². According to our data, it is a very rare species.
17. White-tailed eagle (*Haliaeetus albicilla albicilla* (Linnaeus, 1758)). A species at risk of extinction in the wild (The Red Data Book... 2017, 2021). Discriminant analysis showed that the spatial niche of the white-tailed eagle in the habitat is almost contiguous with the burial niche and clearly separated from the niches of other species. Judging by distances between nearest neighbors, intraspecific competition seems to be much more important in the selection of habitats used for nesting than interspecific competition (Vazhov 2013). We observed two eagles on September 12, 2015 at the mouth of an unnamed creek near the headwaters of the Kucherla River. The density was 0.07 individuals/km². According to our data, a very rare species.
18. Cinereous vulture (*Aegypius monachus* (Linnaeus, 1766) – a rare, small species (The Red Data Book... 2017, 2021). Systematically observed in Belukha Park, nesting is assumed (Nagibina 2005); it prefers to build nests on rocky ridges of watershed ridges (Irisova 2017c). We have information on the sporadic visit the Katun Reserve. In November-February 1999-2000, 3 scavengers were recorded near Ogniovka village; in early May 2001, five vultures fed on a fallen horse near Maralovodka village; in spring 2004, birds hovered over cowsheds

and pastures of small ruminants; in May 2004, vultures were recorded below the Tyungur village. In May 2004 vultures were recorded below Tyungur village and in the vicinity of Tereкта village. On 18 August 2004, a single individual was observed near Kucherlinsky Lake (Nagibina, 2006). We did not find any vultures in the study area.

19. Bearded vulture (*Gypaetus barbatus hemachalanus* (Hutton, 1838). A species at risk of extinction in the wild (The Red Data Book... 2017, 2021). A sedentary bird (Irisova 2017b). Solitary vultures were regularly observed on 17-18 July 2006 above the Tara River in the Yelan tract. Tara in the Yelangash tract, as well as over the lakes Dzhankol and Karakol. Two birds circled rocks in the upper reaches of the Akbul River on 13 July 2006, and a pair was observed flying over Karov Lake and glaciers for 2 days (Grebenshchikov 2010). A bird was observed along the Argut River, near the mouth of the Cairo River in the Belukha Park (Nagibina 2005). The vulture has been recorded in the Katun Reserve (Fauna 2023). On 06 July 2012, we observed a vulture chased by a pair of golden eagles near Akkem Lake. The species was also observed in flight on 13 August 2018 against the backdrop of Mount Boris on the approach to the Student Pass. The density was 0.03-0.04 individuals/km². According to our data, it is a very rare species.

Falconidae

20. Saker falcon (*Falco cherrug milvipes* (Jerdon, 1871) is a rare species with clearly declining numbers and habitat (The Red Data Book... 2017, 2021). The bird was observed near the Belukha massif, in the vicinity of Akkem Lake, in the upper reaches and along the watershed of the Yarluk and Tekelyu rivers. In April 1998 and May 1999, repeated sightings of the falcon were recorded near the village of Ust-Koksa. On 25 August 2001, three falcons hunted the Greater Merganser near the mouth of the Biryuksa River, and in mid-September 2004, the bird was observed near the Middle Multinsky Lake (Nagibina 2006; The Red Data Book... 2017). There are data on falcon nesting in the Belukha Park and Katun Reserve (Nagibina 2005). We did not find the saker falcon in the study area.
21. The peregrine falcon (*Falco peregrinus* (Tunstall, 1771) is a very rare species; its sightings in the vicinity of Akkemskeye Lake (The Red Data Book... 2017, 2021). In 2018, two falcons were seen in June and July near the mouth of the Ak-Kem River (Rakin 2018). It nests in Belukha Park (Nagibina 2005). We have not found this species in the study area.
22. Merlin (*Falco columbarius pallidus* (Sushkin, 1900). This bird may nest in Belukha Park (Nagibina 2005). We did not observe this species in the study area.
23. Common kestrel (*Falco tinnunculus* (Linnaeus, 1758). In summer 2018, more than 10 individuals were observed near the mouth of the Ak-Kem River (Rakin 2018). It nests in Belukha Park (Nagibina 2005). We observed a pair of kestrels on 10 July 2013 at the Oroi Pass, in 2015 on 11 September, when climbing to the

Ak-Kem Pass, and on 14 September this bird was observed during hunting near the seventh tributary of the Kuilyu River. A female kestrel was also seen hunting at Karatyurek Pass on August 15, 2018. The density was 0.03-0.07 individuals/km². According to our data, it is a very rare species.

Galliformes

Phasianidae

24. The red grouse (*Lagopus lagopus major* (Lorenz, 1904) is a declining species (The Red Data Book... 2021). The Willow Grouse inhabits the Belukha Park year-round (Nagibina 2005). It nests in the Katun Reserve (Fauna 2023). We recorded a single bird on June 13, 2012 in a subalpine sparse forest with birch. Birds were observed in the watershed between the Yarlu and Tekelyu river basins on 5 July the same year. In 2015, 8 birds were seen in the tundra on September 09. The density was 0.02-0.29 individuals/km². According to our data, a very rare species.
25. Altai snowcock (*Tetraogallus altaicus* (Gebler, 1836). In the Altai Republic it is a rare and rare species (The Red Data Book... 2017). Year-round inhabits the Belukha Park at an altitude of more than 2000 m, occurs in the upper reaches of the Kucherla River, near Doroshkol Lake, and in the upper reaches of the Yarlu, Tekelyu, and Ak-Kem Rivers (Nagibina 2005). Nests in Katun Reserve (Fauna 2023). We have not detected this species in the study area.

Gruiformes

Gruidae

26. Demoiselle crane (*Anthropoides virgo* (Linnaeus, 1758). A recovering and re-covering species (The Red Data Book... 2017, 2021). We found feeding cranes on the evening of 13 August 2019, on a tributary of Coeur Cure. The density was 0.09 individuals/km². According to our data, this species is very rare.

Charadriiformes

Scolopacidae

27. Round-necked phalarope (*Phalaropus lobatus* (Linnaeus, 1758). A group of 3 phalaropes was observed on August 13, 2022 at one of the water bodies of the Ak-Oyuk River valley (Fig. 14). The density was 0.11 individuals/km². According to our data, it is a rare species.
28. Solitary snipe (*Gallinago solitaria* (Hodgson, 1831) is a species that has recovered in the Altai Republic (The Red Data Book... 2017). It inhabits the alpine

zone of high mountains near water sources, has been observed in the vicinity of Akkem Lake, in the upper reaches of the Yarlu and Tekelyu rivers, and nests in the Belukha Park and Katun Reserve (Nagibina 2005). We observed mocking of snipes at Akkem Lake in July 2012, but their number could not be determined.

Cuculiformes

Cuculidae

29. Common cuckoo (*Cuculus canorus* (Linnaeus, 1758)). In the forest on the left bank of Akkem Lake, we observed a cuckoo on 06 July 2012. The density was 0.04 individuals/km². According to our data, it is a very rare species.



Figure 14. Round-necked phalaropes in a lake in the Ak-Oyuk River valley. August 13, 2022. Photo by S.V. Vazhov.

Strigiformes

Strigidae

30. Eurasian eagle-owl (*Bubo bubo* (Linnaeus, 1758)) is a very rare species with constantly decreasing numbers (The Red Data Book... 2017, 2021). By nature of stay, it is included in the group of nesting and wintering birds in nesting areas (Vazhov et al. 2016). It is found year-round in the Belukha Park (Nagibina 2005). In 2003, the bird was recorded on April 21 and November 28 at the mouth of the Kyrgyz River, on August 6 near the cordon at the mouth of the Kazinikha River, and on October 27 in the Shchyoki tract (Nagibina 2006). Nesting in Katun Reserve (Fauna 2023). This species was not recorded in the study area.
31. Eurasian scops owl (*Otus scops* (Linnaeus, 1758)). We managed to identify a mating bird by voice only once - at night from August 07 to 08, 2010 opposite

the Chibit village. The density was 0.03 individuals/km². According to our data, it is a very rare species.

32. Eurasian pigmy-owl (*Glaucidium passerinum* (Linnaeus, 1758) in the Altai Republic is an insufficiently studied species, the number and status of which are alarming (The Red Data Book... 2017). By the nature of the stay, it is a representative of the group of nesting and wintering at nesting sites (Vazhov, Bakhtin, Vazhov). In 2012, on 12 June, we heard a disturbed bird near the Kucherla campground. We also identified it by voice several times on 20 August 2017 in the upper reaches of the Oroktoi River. In 2019, an individual was recorded on 04 August in the lower reaches of the Akkem River, and on 05 August the bird was heard near the mouth of the Ak-Oyuk River. Density was 0.02-0.08 individuals/km². The average density was 0.02 individuals/km². According to our data, it is a very rare species.

Caprimulgiformes

Caprimulgidae

33. European nightjar (*Caprimulgus europaeus* (Linnaeus, 1758). We recorded a moulting nightjar by voice on the left bank of the Chuya River opposite Chibit village at night from August 07 to 08, 2010. The density was 0.03 individuals/km². According to our data, it is a very rare species.

Piciformes

Picidae

34. Black woodpecker (*Dryocopus martius* (Linnaeus, 1758). It inhabits Belukha Park year-round (Nagibina 2005). In the mixed forest of the lower reaches of the Akkem River, we observed the birds on 3 July 2012 and on July 11, 2013 we saw it near the mouth of the Shabagi River. This bird was observed on August 21, 2017 in the forest of the Kara-Aira River valley. The density was 0.03-0.04 individuals/km². According to our data, it is a very rare species.

Passeriformes

Motacillidae

35. Richard's pipit (*Anthus richardi centralasiae* (Kistiakovsky, 1928). We observed several individuals on the Kur-Kure tributary from August 13-14, 2019. The density was 0.09 individuals/km². According to our data, a very rare species.
36. Water pipit (*Anthus spinoletta blakistoni* (Swinhoe, 1863). Nests in Belukha Park (Nagibina 2005). On the descent from Kara-Tyurek on September 10, 2015, we

saw several birds. The density was 0.18 individuals/km². According to our data, a rare species.

37. Grey wagtail (*Motacilla cinerea* (Tunstall, 1771). Nests in Belukha Park (Nagibina 2005). We observed wagtails on the Kur-Kure tributary from August 13 to 14, 2019. The density amounted to 0.09 individuals/km². According to our data, a very rare species.

Laniidae

38. Great grey shrike (*Lanius excubitor mollis* (Eversmann, 1853) presumably winters in the Belukha Park (Nagibina 2005). We did not observe such species in the study area.

Corvidae

39. Spotted nutcracker (*Nucifraga caryocatactes macrorhynchos* (C.L. Brehm, 1823). In Belukha Park, it inhabits all the year round (Nagibina 2005). In the lower reaches of the Akkem River in a mixed forest, we observed several birds on 03 July 2012. In July 2013, these birds were regularly recorded in the Shabaga River valley and the upper reaches of the Shavla River. In the taiga of the upper reaches of the Kuilyu River. Pintails were seen in the taiga of the upper Kuylyu River on September 08, 2015. Numerous individuals were observed in 2017, including: 19 August in the taiga along the Oroktoi River; August 20 at the upper limit of the forest on the Maly Araskan River; August 21 in the forest at the headwaters of the Tekelyu River, in the valley of the Kara-Aira River; on the Sary-Bel Plateau; and in the headwaters of the Aktash River. Additionally, pine geese were recorded on August 19, 2019 in the lower reaches of the Karagem River. In 2022, birds were recorded on August 09 and 14 in the lower and middle reaches of the Akkem River. The average density was about 1 individual/km². According to our data, it is a common species.
40. Red-billed chough (*Pyrrhonorax pyrrhonorax brachypus* (Swinhoe, 1871). This bird is observed in Belukha Park all year round (Nagibina, 2005). We observed the brachypus in flight on 29 August 2017 over the Riga-Turist Pass. The density was 0.03 individuals/km². According to our data, it is a very rare species.
41. Common raven (*Corvus corax* (Linnaeus, 1758). It inhabits the Belukha Park throughout the year (Nagibina 2005). In 2012, on June 13, we saw raven fledglings in the taiga at the headwaters of the Tekelyushka River. The presence of this bird on the Akkemy Glacier near Tomsk campgrounds on July 8, 2012, was determined by its voice. We also heard bird calls in the upper part of the Delone Pass on July 09 this year, and on July 10, 2013 a pair of birds was observed on the Oroisky Pass. A bird was seen in 2015 on 10 September on the descent from the Kara-Turek Pass. In 2017, a bird was observed on August 20 at the upper limit of the forest near the ford across the Maly Araskan, on August

21 in the taiga of the Kara-Aira valley near the Aktash River watershed, on August 28 in the Seven Lakes valley and on August 29 above the Kara-Tyurek Pass. A pair of mocking birds was heard on August 15, 2018 at the same pass. In 2022, a solitary raven was observed flying permanently near the rocks of Kara-Tyurek on 11 August, and several more individuals were observed on 14 August. Density was 0.04-0.10 individuals/km². The average density was 0.05 individuals/km². According to our data, this species is very rare.

Sylviidae

42. Siberian chiffchaff (*Phylloscopus collybita tristis* (Blyth, 1843)). We observed five warblers in the lower reaches of the Ak-Kem River in mixed forest on 03 July 2012. The density was 0.18 individuals/km². According to our data, it is a rare species.
43. Greenish warbler (*Phylloscopus trochiloides* (Sundevall, 1837)). Presumably nests in the Belukha Park (Nagibina 2005). We identified three individuals by voice in the lower reaches of the Akkem River on the morning of 4 August, 2019. The density was 0.05 individuals/km². According to our data, a very rare species.

Muscicapidae

44. White-winged redstart (*Phoenicurus erythrogaster* (Güldenstädt, 1775)). Nests in Belukha Park (Nagibina 2005). We observed an individual on 10 September 2015 on the descent from Kara-Tyurek, and 5 birds were seen on August 07, 2019. The density was 0.04-0.09 individuals/km². The average density was 0.02 individuals/km². According to our data, a very rare species.

Turdidae

45. Fieldfare (*Turdus pilaris* (Linnaeus, 1758)). Presumably nests in Belukha Park (Nagibina 2005). We saw 4 birds on September 08, 2015 in the taiga near the mountains along the Kuilyu River. The density was 0.14 individuals/km². According to our data, it is a rare species.

Aegithalidae

46. Long-tailed tit (*Aegithalos caudatus* (Linnaeus, 1758)). It inhabits Belukha Park year-round (Nagibina 2005). We observed these birds from 06 to 07 September 2015 near Katanda; on 19 August 2017 we saw these birds in the taiga while ascending the Oroktoi River; on 04 August 2019 we heard species voices in the morning in the middle reaches of the Akkem River. The average density was about 0.8 individuals/km². According to our data, a rare species.

Paridae

47. Marsh tit (*Parus palustris* (Linnaeus, 1758)). It is recorded in Belukha Park throughout the season (Nagibina, 2005). In the vicinity of Katanda we recorded 11 birds on the night of September 06-07, 2015. The density was 0.39 individuals/km². According to our data, it is a rare species.
48. Willow tit (*Parus montanus baicalensis* (Swinhoe, 1871)). We observed in the forest on the left bank of Akkem Lake on July 06, 2012. In July 2013 these birds were observed in the valleys of the Oroï and in Shabaga rivers and the upper reaches of the Shavla River. The birds were seen on August 19, 2017 in the taiga along the Oroktoy, and the voices of these birds were heard in the morning on August 4, 2019. In 2022, a few individuals were recorded on the night of August 14 on the Kuilyu River. The average density was about 1 individual/km². According to our data, it is a common species.
49. Great tit (*Parus major* (Linnaeus, 1758)). We saw the Great Tits on 9 August 2022 on 14 the Kuilyu River, and on August we observed them in the upper reaches of the Akkem River. In July 2013 they were recorded in the valleys of the Oroï and Shabaga rivers. The average density was 0.78 individuals/km². According to our data, it is a rare species.

Fringillidae

50. Brandt's mountain finch (*Leucosticte brandti* (Bonaparte, 1850)). In 2017, we recorded these birds on August 23 and 24 in ruffed tundra in the upper Tekelyu River. We also saw finches on 07 August 2019 on the moraine of the Akkem glacier. The average density was 0.3 individuals/km². According to our data, it is a rare species.
51. Common rosefinch (*Carpodacus erythrinus* (Pallas, 1770)). Nests in Belukha Park (Nagibina 2005). In 2012, we recorded several birds on 03 July in the mixed forest of the lower reaches of the Akkem River, and on 06 July we saw singing birds in the forest on the left bank of Akkem Lake. We identified species by voice on the morning of August 04, 2019 at Kuzuyak Pass. The density was 0.02-0.29 individuals/km². The average density was 0.03 individuals/km². According to our data, a very rare species.
52. Great rosefinch (*Carpodacus rubicilla* (Güldenstädt, 1775)) is a poorly studied species in the Altai Republic (The Red Data Book... 2017). In breeding time, the lentic was observed on alpine meadows in places where large rocks emerge at an altitude of 2000-2500 meters. It inhabits Belukha Park year-round (Nagibina 2005). In the first half of July 2004, Lentic was observed on a cordon near Srednye Multinsky Lake, on the left bank of which nesting is expected. A pair of birds was feeding on honeysuckle near the Perechnaya River (Nagibina 2005). Nesting in Katun Reserve (Fauna 2023). This species has not been recorded in the study area.

53. Red crossbill (*Loxia curvirostra altaiensis* (Sushkin, 1925)). It inhabits Belukha Park year-round (Nagibina 2005). We observed the birds on August 19, 2017 in the taiga along the Oroktoy River and the next day on the upper forest border. We also observed a single bird on 03 August 2019 at Kuzuyak Pass. The density was 0.09 - 0.26 individuals/km². The average density was 0.05 individuals/km². According to our data, a very rare species.

Conclusion

The avifauna of the Katun and North Chuya ridges of the central Altai is represented by 53 species of 11 orders and 21 families. We registered 21 rare and endangered species, among them the extremely rare species are: great cormorant, ruddy shelduck and Eurasian goshawk; very rare species are: black kite, upland buzzard, common buzzard, booted eagle, golden eagle, white-tailed eagle, bearded vulture, common kestrel, red grouse, demoiselle crane, common cuckoo, scops owl, pygmy owl, nightjar, black woodpecker, Richard's pipit, grey wagtail, red-billed chough, raven, greenish warbler, white-winged redstart, common rosefinch, and common crossbill; rare species are: sparrowhawk, red-necked phalarope, water pipit, fieldfare, long-tailed tit, marsh tit, great tit, and Brandt's mountain finch; and the common species are: spotted nutcracker, common chiffchaff, and willow tit.

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