

Raptor inventory of the Karatau State Nature Reserve, southern Kazakhstan

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Raptor populations in Central Asia benefit from the abundance of small mammals in extensive steppe regions, but most raptor populations are poorly known and many may be threatened. A potentially diverse raptor population exists in the transition zone between the Tien-Shan mountain range and the vast steppe plains in southern Kazakhstan. The Karatau state nature reserve in south-central Kazakhstan is part of a World Heritage Area (Western Tien-Shan) inscribed in 2016, and partly overlaps with the 'Kenshektau Mountains' (KZ070) IBA in the east. The Kenshektau mountains IBA was designated in 2007 based on its breeding population of Eurasian Griffon Vultures *Gyps fulvus* and a diverse array of large raptors and scavengers. However, no comprehensive raptor survey has been carried out in the Karatau reserve. In April and May 2017 we conducted an intensive survey of the Karatau SNR to estimate the size of breeding raptor populations. We surveyed c30 000 ha of mountainous terrain (~50% of the reserve), and inspected cliffs and rocky hillsides for nesting eagles, vultures and falcons. We observed up to 45 Eurasian Griffon Vultures at a single roost site, and found two nests of Eurasian Griffon, three nests of Black *Aegypius monachus* and one nest of the Endangered Egyptian *Neophron percnopterus* Vulture. Overall the majority of observed vultures appeared to be non-breeding individuals, and the number of breeding pairs of vultures was estimated to be 10–20 for Eurasian Griffon, 10–15 for Black and 2–4 for Egyptian Vulture. Besides vultures, kestrels (*Falco tinnunculus* and *F. naumanni*) and Golden Eagles *Aquila chrysaetos* were common, but we did not observe any other large falcons or eagles. We noted all other bird species recorded and provide appendix 1, an annotated species list of all 87 bird species observed.

INTRODUCTION

The vast steppe regions of Central (Middle) Asia are inhabited by many small mammals that provide food for large raptors, and grazing livestock provide carcasses for avian scavengers (Barashkova *et al* 2013, Kamp *et al* 2009, Kamp *et al* 2015). Raptor populations in Central Asia are poorly known and many may be threatened, however very little knowledge exists on most populations (Barashkova *et al* 2009, Katzner 2003, Katzner *et al* 2005, Katzner *et al* 2006). Areas where steep topography provides suitable nesting places for cliff-nesting raptors and scavengers, adjacent to steppe regions that harbour both natural and anthropogenic food sources, are potentially important areas for high raptor diversity and abundance.

The Karatau mountain range (Plate 1) is a small extension of the western Tien-Shan mountains that extends north into the steppe areas of south-central Kazakhstan and forms a natural boundary between the fertile Syr Darya river valley and the dry lowlands to the north of the range. The mountains are a rocky massif of marble and limestone and are a conspicuous feature in the expanse of adjoining lowland which is the southwestern edge of the Moynkum desert. The northeastern part of the mountain range includes sheer rock faces or tapering pyramids rising to several hundred metres that were formed by tectonic processes. The highly varied and rugged relief creates abundant opportunities for the safe nesting of many bird species.

Part of the Karatau mountains were declared as a state nature reserve (zapovednik) in 1995 to protect an endemic local subspecies of the mountain sheep, the Karatau Argali (*Ovis ammon nigrimontana*). The area is also important for several bird species, and the northern part of the reserve was designated an Important Bird Area (IBA) in 2007 (Sklyarenko *et al* 2008) based on its medium-sized breeding population of Eurasian Griffon Vultures *Gyps fulvus* and a diverse array of large raptors and scavengers of global or national conservation concern (Cinereous Vulture *Aegypius monachus*, Bearded Vulture *Gypaetus barbatus*, Egyptian Vulture *Neophron percnopterus*, Golden Eagle *Aquila chrysaetos*,



Plate 1. Typical scenery in the Karatau mountains north of the Baldysu river valley, Karatau SNR, Kazakhstan, May 2017. © Steffen Oppel

Short-toed Snake Eagle *Circaetus gallicus* and Eagle Owl *Bubo bubo*). However, since the designation of the IBA (Plate 2) no dedicated surveys have been conducted in the area, and the size and conservation status of the raptor populations in the Karatau mountains were unknown.

Here we describe the results of a survey conducted in spring 2017 that allowed us to conservatively extrapolate breeding population sizes of diurnal raptor species in the Karatau SNR. We explored the Karatau mountains for one month and scanned cliff faces and rocky scree slopes where large raptors might be nesting, and extrapolated total population sizes based on our observations and the proportion of the mountain area that was surveyed.

METHODS

Study area

The Karatau mountain range is situated in south-central Kazakhstan (42° 53' 20" N, 69° 58' 50" E). The mountains are from 500–2200 m above sea level and are characterised by a highly continental and dry climate, with very cold winters and extremely hot summers. The local name, meaning 'Black mountains' reflects the dark colouration of the underlying bedrock and many scree slopes at higher elevation. The vegetation is predominantly xerophyte associations of grasses and dwarf plants, and vegetation is increasingly sparse and fragmented at higher elevations, on very steep cliffs, or on soft substrate where erosion and geomorphological processes lead to frequent disturbances of the substrate. Snow depth and soil moisture lead to differences in vegetation between northerly and south-facing slopes, with often dense growth of hardy bushes and impenetrable woody thickets on northerly slopes and in valleys and river gorges. While many small streams



Plate 2. The Kenshektau IBA is characterised by several rock formations that offer safe roosting and nesting opportunities for raptors, Karatau SNR, Kazakhstan, May 2017. © Steffen Oppel

dry out during the summer, forming some harsh arid rocky gorges, there are several larger rivers that have running water year round and form important vegetation communities that affect the diversity of the avifauna (Plate 3).

The Karatau SNR encompasses 34 300 ha of strict nature reserve without public access, surrounded by a 17 492 ha buffer zone. The key threat used to be hunting, but the reserve is currently well managed and only small-scale illegal grazing poses a minor threat to the reserve's biodiversity. The Kenshektau IBA covers 10 915 ha, of which 3010 ha fall within the Karatau SNR (Figure 1).

Raptor surveys

We conducted surveys in the Karatau mountain range 25 April–17 May 2017. The surveys did not follow a structured sampling design to yield robust density estimates, but aimed to cover a relatively large proportion of the reserve (Figure 1) while inspecting suitable nesting habitat very closely to find nests of globally threatened raptor species. Our survey routes generally followed river valleys or mountain ridges where adjacent slopes offered suitable nesting areas for cliff-nesting species and where good vantage points were available to scan mountain slopes, cliffs, and the skies above for any raptors. Surveys were conducted 7.30–18.00 h every day, when solar radiation was sufficient for soaring raptors to fly. We walked at a slow to moderate pace during all surveys, covering no more than 2–3 km/h, and stopped frequently to scan suitable cliffs and scree slopes for signs of nesting raptors. Because safe access and survey conditions could not be guaranteed in northwestern parts of the reserve, no surveys could be conducted in this area (Figure 1).

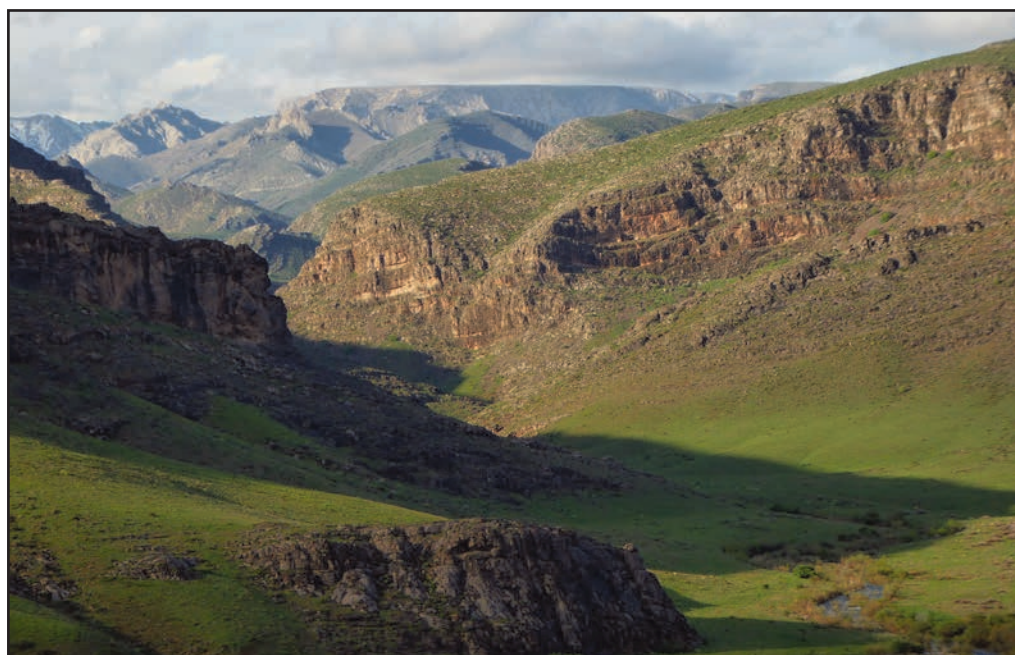


Plate 3. The Khantagi river valley in the southern buffer zone of the Karatau SNR, Kazakhstan, May 2017. © Steffen Oppel



Figure 1. Map of the Karatau state nature reserve and Kenshektau IBA, in southern Kazakhstan. Black lines indicate the routes along which raptor surveys were carried out in April and May 2017.

Extrapolation of raptor breeding population sizes

Our surveys did not follow a systematic protocol that would allow robust estimates of density due to our imperfect detection of birds and incomplete coverage of the entire reserve area. The key limitations of our observation data are that (1) in most cases the breeding status and breeding location of the observed individuals was unknown; (2) for wide-ranging species it was impossible to discern whether individuals counted in different localities were the same or different individuals; (3) our coverage of the reserve area was <50% for all species; and (4) the relative suitability of the areas surveyed and those not surveyed is unlikely to be the same as we focussed our surveys on suitable cliff areas. Hence, the population estimates should be considered as coarse extrapolations.

To avoid overestimating the raptor populations we only considered observations indicative of a territorial or nesting pair. We then summed the number of spatially-distinct territorial pairs that were observed, and estimated for each species the proportion of the reserve that was surveyed. This proportion varied between species, because smaller species such as kestrels were less likely to be detected from larger distances, and the proportion of the reserve that was effectively surveyed for smaller species was therefore less than for larger species. Together with local rangers we discussed our observations and extrapolations and provide the minimum and maximum number of breeding pairs that appeared plausible from our observations. We caution that these ranges are not based on a robust statistical estimation, and that actual breeding populations may be higher or lower for different species.

RESULTS

We observed a total of 14 diurnal raptor species, and a further 73 landbird species (Appendix 1). The most common raptor species were Lesser *Falco naumanni* and Common Kestrel *F. tinnunculus*, Eurasian Griffon Vulture and Cinereous Vulture (Table 1). However, the majority of vultures did not appear to be nesting, but congregated at communal roost sites in the southwest and northeastern parts of the reserve. A towering pinnacle in a side valley near the Baldysu river valley was occupied by 47 Eurasian Griffons (including one nest), 1 Egyptian Vulture, 1 Bearded Vulture, and 2 Cinereous Vultures on 3 May 2017. Repeated observations at this roosting site revealed substantial variation in the number of vultures both during the day (virtually none before 15.00 h, most birds arriving after 16.30 h), but also between days, with evening roost counts ranging from 0 (14 May) to 47 (3 May). The majority of the roosting birds appeared to be immature birds, and the number of breeding adult birds was relatively small. However, this cliff face supported one Eurasian Griffon nest (adult bird incubating 14 May), a Common Raven *Corvus corax* nest (with two large chicks), and an Egyptian Vulture nest (adult bird incubating 14 May).

Similar towering pinnacles (Plate 4) that extended along a single fault line in the northeastern part of the reserve were characterised by numerous ledges and small caves with extensive white faecal markings, but none contained nesting vultures in the visible southerly facing cliffs. Instead, roost aggregations from 4–15 birds were observed to gather in the late afternoon, and depart from roosting cliffs in the morning, with one detailed observation (on 4 May) revealing that by 11.30 h all vultures had left the roost site. Most vultures appeared to arrive at roosting cliffs from the northeast where large numbers of vultures were seen soaring over adjacent farms and livestock aggregations in the steppe on 10 May during an excursion in the eastern buffer zone. More vulture nests may have existed on cliff faces that were facing towards inaccessible terrain to the north and east and were therefore not visible to us.

Table 1. Observed number of individuals summed over the surveyed parts of the reserve and extrapolated total breeding population estimate for raptor species in Karatau state nature reserve based on our surveys in April and May 2017.

Species		number of individuals observed	area of reserve surveyed (%)	total breeding population (pairs)
Peregrine Falcon	<i>Falco peregrinus</i>	0	35	0
Barbary Falcon	<i>Falco pelegrinoides</i>	0	35	0
Saker Falcon	<i>Falco cherrug</i>	1	35	1–3
Lesser Kestrel	<i>Falco naumanni</i>	31	30	50–75
Common Kestrel	<i>Falco tinnunculus</i>	15	30	20–25
Bearded Vulture	<i>Gypaetus barbatus</i>	1 (juv)	40	0–2
Egyptian Vulture	<i>Neophron percnopterus</i>	7 (1 nest)	40	2–4
Himalayan Griffon	<i>Gyps himalayensis</i>	11	40	0–2 (?)
Eurasian Griffon	<i>Gyps fulvus</i>	75 (2 nests)	40	10–20
Cinereous Vulture	<i>Aegypius monachus</i>	26 (3 nests)	40	10–15
Black Kite	<i>Milvus migrans</i>	1	35	?
Shikra	<i>Accipiter badius</i>	0	30	0
Eurasian Sparrowhawk	<i>Accipiter nisus</i>	12	30	5–10
Long-legged Buzzard	<i>Buteo rufinus</i>	13	40	0–5
Golden Eagle	<i>Aquila chrysaetos</i>	13	40	5–10
Eastern Imperial Eagle	<i>Aquila heliaca</i>	0	40	0
Short-toed Snake Eagle	<i>Circaetus gallicus</i>	0	40	0



Plate 4. Towering rock pinnacle in the Karatau SNR, Kazakhstan, where more than 30 Eurasian Griffons *Gyps fulvus* were regularly roosting in May 2017. © Steffen Oppel

We found three Cinereous Vulture nests on the ground in scree slopes above 1200 m elevation asl. Due to the extensive number of scree slopes across the entire reserve, it is very likely that other nests existed that we did not discover.

Golden Eagles were the only frequently seen eagle species, with two pairs observed with territorial display. Apart from one Booted Eagle *Aquila pennata*, that was observed south of the reserve, no other eagles were observed. We observed only one Saker Falcon *Falco cherrug*, that flew past the vulture roosting cliff, but no other large falcons.

Very few large raptors were observed along the plateaus and valley of the Biresik river, but a Cinereous Vulture nest and an adult Egyptian Vulture performing territorial display and defending a territory against ravens were observed 13 May in the upper reaches of the Khantagi river drainage.

DISCUSSION

Our survey provides a useful update that emphasizes the importance of the Karatau SNR for local vulture populations. However, we found generally fewer nesting birds than described in the IBA designation (Sklyarenko *et al* 2008), and it is possible that past population sizes may have been overestimated due to the presence of a large number of roosting birds. Because our surveys did not cover the entire IBA, which extends outside the Karatau SNR (Figure 1), we are not able to compare our results to the previous IBA assessment, but given that we surveyed the most suitable habitats it seems highly unlikely that the unsurveyed part of the IBA would harbour more raptors than the areas we surveyed.

The absence of large eagles other than Golden Eagles was striking. While Eastern Imperial Eagles *Aquila heliaca* prefer nesting in trees in lowland steppe regions (Demerdzhiev *et al* 2011, Karyakin *et al* 2011, Katzner *et al* 2006) and therefore do not occur in the Karatau mountains, we also observed no Short-toed Snake Eagles although the species generally occurs in low numbers in the area (S Sklyarenko pers comm). Short-toed Snake Eagles are long-distance migrants (Mellone *et al* 2011, Vidal-Mateo *et al* 2016), and may therefore not have returned to the Karatau mountains prior to our surveys. However, in other parts of their range Short-toed Snake Eagles return in March or April (Mellone *et al* 2012, Panuccio *et al* 2012), and we therefore consider it unlikely that the lack of any observations of Short-toed Snake Eagles was due to late arrival from spring migration.

The Karatau SNR is a strictly protected reserve without any human use or disturbance. Visitors and hunters are not allowed inside the reserve, and no livestock grazing is permitted. Rangers patrol the reserve from several ranger stations situated around the perimeter of the reserve, and we did not observe any major transgressions or threats inside the reserve. We observed only two small groups of cattle and horses, and rangers confirmed that small-scale illegal grazing occurs occasionally because the penalties for livestock owners are an insufficient deterrent. Nonetheless, the reserve is a very safe area for nesting birds, and it is unlikely that, if there have been any declines in population size of raptors, these declines are due to threats that exist within the reserve.

Our observations of roosting vultures indicated that birds that breed and roost within the reserve likely depend on food resources acquired in surrounding areas where many livestock herds exist. Changes in farming structures following the collapse of the Soviet Union have led to an extension of steppe habitats and this may have benefitted some species, but detrimentally affected breeding habitat for others (Kamp *et al* 2016, Kamp *et al* 2011, Wesche *et al* 2016). Because the scavenger populations that we observed were similar to previous surveys and as large as expected, we consider it unlikely that large changes in livestock farming practices have altered food availability for the observed vulture species.

In summary, we conclude that the Karatau mountains still host valuable raptor populations, but further monitoring and research may be warranted to investigate the apparent absence of eagles and large falcons from the region.

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Appendix 1. Annotated avian species list for the Karatau SNR. We provide a summary for all species observed during the surveys in April and May 2017. All data have been submitted to eBird, where details of observation dates, times, and locations can be obtained.

Chukar *Alectoris chukar*. Very common species observed virtually everywhere in the reserve.

Grey Partridge *Perdix perdix*. Relatively rare, only 4–6 birds observed in moist valleys near Baldysu ranger station.

Common Quail *Coturnix coturnix*. Relatively rare, only 1 bird seen on a rocky ridge at 1400 m asl on 9 May, and other individuals heard at night in moist valleys near Baldysu ranger station.

Mallard *Anas platyrhynchos*. Rare, only observed in larger river valleys with 2 individuals in Khantagi and 2 in the Baldysu river valley; one nest found 1 km from Baldysu ranger station.

Black Stork *Ciconia nigra*. Relatively rare, only three individuals observed near Bayaldyr (25 April) and Khantagi (29 April) ranger stations and in the west branch of the Biresik river (16 May).

Saker Falcon *Falco cherrug*. Rare, only one individual observed, near Baldysu ranger station on 10 May; no other large falcons seen in reserve; one cave with white faecal markings typical of Saker Falcon seen in upper reaches of Baldysu river; allegedly the ranger at Baldysu regularly observes the species and believes it to breed in the area.

Lesser Kestrel *Falco naumanni*. Common species, but more frequently observed in eastern parts of the reserve than in the western part. Most cliff faces had an attending kestrel, but identification was sometimes difficult; however, Lesser Kestrel appeared to be more common than Common Kestrel overall.

Common Kestrel *Falco tinnunculus*. Uncommon species mostly observed around cliff faces in the western part of the reserve, but also possibly in the higher mountain areas. Overall less common than Lesser Kestrel.

European Honey Buzzard *Pernis apivorus*. Only one individual observed, possibly on migration, above Baldysu ranger station on 11 May 2017.

Bearded Vulture *Gypaetus barbatus*. Only one juvenile bird observed, 3 May 2017 at the main vulture roost near Baldysu ranger station; species may breed in some years in the reserve.

Egyptian Vulture *Neophron percnopterus*. Relatively rare species only observed around Baldysu and Khantagi ranger stations; one active nest found on main vulture cliff near Baldysu ranger station, another adult bird observed with territorial display and attacking ravens c3 km further west in a side valley (potentially a further nesting pair); adult bird observed near Khantagi ranger station on two occasions, and several individuals observed in transition zone between reserve and adjacent steppe in both Khantagi and Baldysu drainages.

Himalayan Griffon *Gyps himalayensis*. Rare, only 11 birds (possibly same individuals on subsequent days) firmly identified due to very white underwing coverts; possibly more birds were considered to be Eurasian Griffon because immature plumages not safely distinguishable in the field.

Eurasian Griffon *Gyps fulvus*. Fairly common but localized species that nests in towering rock pinnacles both in the Bayaldyr and the Baldysu river valleys. Much more common in the east, where a fault line of very tall cliff faces forms a chain of roosting cliffs with up to 45 individuals roosting; most birds observed on cliffs appeared to be immatures/non-breeders, and only 2 nests were found. Overall population therefore dominated by non-breeding individuals.

Black (Cinereous) Vulture *Aegypius monachus*. Uncommon but broadly distributed species without aggregations like Griffons, but pairs and groups of up to 4 individuals regularly observed throughout the reserve. Three active nests found near bushes on scree slopes above 1300 m asl, though extremely difficult to see and therefore likely overlooked in many places.

Black Kite *Milvus migrans*. Only one individual observed, on 16 May 2017 above west branch of Biresik river, possibly on migration.

- Eurasian Sparrowhawk *Accipiter nisus*. Uncommon species observed across the reserve, numbers possibly limited by amount of arboreal vegetation suitable for nesting and hunting.
- Long-legged Buzzard *Buteo rufinus*. Uncommon species observed across the reserve, but mostly without territorial or nesting displays; only one territorial display observed on 8 May in northern part of reserve on east buttress of the highest mountains.
- Golden Eagle *Aquila chrysaetos*. Uncommon species broadly distributed across higher elevations of the reserve; territorial display observed in northeastern part near highest mountains, and presumably also common and widespread in the parts of the reserve that we could not access.
- Booted Eagle *Aquila pennata*. Only one individual observed (2 May) outside of reserve above Khantagi ranger station.
- Little Ringed Plover *Charadrius dubius*. Not seen inside reserve, but uncommon breeder in broader river valleys outside reserve and associated with shingle beds and short grassy vegetation.
- Green Sandpiper *Tringa ochropus*. Two individuals observed on 4 and 6 May at pond of Baldysu ranger station; presumably on migration.
- Common Sandpiper *Actitis hypoleucos*. Fairly common species in broader river valleys along Khantagi, Biresik and Bayaldyr rivers where broad shingle islands were available.
- Common Tern *Sterna hirundo*. Two individuals observed on two separate occasions (30 April and 1 May) in Khantagi river valley between ranger station and Khan's Throne.
- Rock Dove/Feral Pigeon *Columba livia*. Uncommon species along higher cliffs in reserve, but also feral individuals around ranger stations and farms in buffer zone. One individual killed by station cat on 15 May at Baldysu ranger station.
- Oriental Turtle Dove *Streptopelia orientalis*. Rare, only one individual observed in poplar trees at Baldysu ranger station, and two individuals on 16 May by west branch of Biresik river.
- Laughing Dove *Streptopelia senegalensis*. Not observed in reserve, but several individuals observed along roadside on way to and from Khantagi and Biresik ranger stations.
- Common Cuckoo *Cuculus canorus*. Very common and vocal, heard throughout the reserve and frequently heard and seen on unvegetated mountain ridges, with many individuals observed above 1200 m asl; female bubble calls and other interactions suggested that not all individuals were migrants.
- Eurasian Scops Owl *Otus scops*. Common bird heard at every campsite throughout the reserve.
- European Nightjar *Caprimulgus europaeus*. Uncommon, first heard after 4 May from Baldysu ranger station and also heard at campsite at 1200 m asl where large expanses of scree and open gravel were present, which appeared to be the habitat where birds were foraging.
- Common Swift *Apus apus*. Common and widespread, observed over most mountaintops on suitably sunny days.
- Alpine Swift *Tachymarptis melba*. Abundant and widespread, observed over most mountaintops on suitably sunny days.
- European Bee-eater *Merops apiaster*. Twice heard flying high over ridges above Baldysu and Biresik river valleys, but only seen outside reserve on power lines of villages bordering the steppe zone.
- Hoopoe *Upupa epops*. Relatively rare, but observed in all major river valleys with single individuals; not recorded singing except one individual on 15/16 May at Biresik ranger station.
- Turkestan Shrike *Lanius phoenicuroides*. Rare, only two individuals observed on 5 May in Baldysu river valley and on pass between Baldysu and Khantagi drainages.
- Lesser Grey Shrike *Lanius minor*. Uncommon, only observed after 9 May with one individual around Baldysu ranger station; 8 birds seen along 1 km stretch of Biresik river valley with two nests in poplar trees near Biresik ranger station on 16/17 May; arriving in late April/early May and hence not recorded previously.
- Magpie *Pica pica*. Uncommon, mostly in lower river valleys, but observed across the reserve even far away from human structures.

Common Raven *Corvus corax*. Uncommon, but at least two nesting pairs observed (one nest with two large chicks near Baldysu ranger station on 4 May); some individuals closely observed and positively identified as Common Raven, no Brown-necked Ravens *Corvus ruficollis* positively identified but may have been present in western part of reserve.

Indian Oriole *Oriolus kundoo*. Relatively rare, but possibly seasonal arrival of birds prevented observations before 10 May. First seen at Baldysu ranger station; heard near Biresik ranger station and in riparian arboreal vegetation along Biresik river west branch.

Turkestan Tit *Parus major turkestanicus*. Three individuals observed in side-valley of Bayaldyr river.

White-crowned Penduline Tit *Remiz coronatus*. Uncommon, restricted to river valleys with arboreal vegetation overhanging the water, observed in three localities along Baldysu and Biresik river valleys.

Sand Martin *Riparia riparia* or Pale Martin *Riparia diluta*. Relatively rare, observed on only two occasions (11 and 12 May) flying over mountains; no territorial or nesting behaviour observed inside reserve.

Eurasian Crag Martin *Ptyonoprogne rupestris*. Fairly common, frequently observed around tall rocky cliffs and mountaintops across the reserve.

Barn Swallow *Hirundo rustica*. Uncommon, mostly observed in large river valleys and around farms and ranger stations in buffer zone rather than inside the reserve.

Red-rumped Swallow *Cecropis daurica*. Uncommon, most frequently seen around Khantagi outside the actual reserve, but also seen in Biresik river valley.

House Martin *Delichon urbica*. Relatively rare, mass migration (~100s of individuals) observed on 16 May above Biresik river, but seen only on one occasion outside reserve before that.

Calandra Lark *Melanocorypha calandra*. Not observed inside the reserve, but abundant in adjacent steppe plains and along access roads to ranger stations.

Bimaculated Lark *Melanocorypha bimaculata*. Relatively rare, only observed on flat stony plateaus between Khantagi and Biresik river valleys; also fairly common outside reserve in flat steppe areas.

Skylark *Alauda arvensis*. Only one individual observed on 12 May on a stony plateau between Khantagi and Biresik river valleys.

Grasshopper Warbler *Locustella naevia*. Fairly commonly heard across main river valleys, but never certainly identified. One streaky individual seen in low scrub at base of highest mountains on 8 May, one plain individual with rufous rounded tail observed in dry scrub east of Khantagi outside the reserve; possibly more than one species of *Locustella* present; typical song was slower and more rattling, slightly drier and more metallic sounding than typical Common Grasshopper Warblers of Europe.

Upcher's Warbler *Hippolais languida*. Uncommon, but widespread in valleys with bushy vegetation. Identification based on song and three individuals observed in west branch of Biresik river 16 and 17 May, which appeared large-headed and with white tail sides and a noticeable colour difference between back and wings, and a pale panel on folded wing.

Willow Warbler *Phylloscopus trochilus*. Only one individual seen, and a few more individuals heard singing 16 and 17 May in west branch of Biresik river.

Chiffchaff *Phylloscopus collybita*. Uncommon, but possibly confused with other leaf warbler species. Several unmarked leaf warblers with dark legs observed in bushes in river valleys in Khantagi and Bayaldyr river valleys.

Hume's Leaf Warbler *Phylloscopus humei*. Relatively rare. Observed in Bayaldyr and Khantagi river valleys 26 and 28 April and 2 May.

Greenish Warbler *Phylloscopus trochiloides*. One individual observed at Camp 1 on 27 April.

Hume's Whitethroat *Sylvia althaea*. Common, the most common warbler in both valleys and along hillsides with dry scrub throughout the reserve.

Common Whitethroat *Sylvia communis*. Rare, only a few individuals observed before 10 May in scrubby vegetation in river valleys.

Eastern Rock Nuthatch *Sitta tephronata*. Common, on most suitable rock faces throughout the reserve, especially numerous in narrow-sided canyons.

Common Myna *Acridotheres tristis*. Localised, only around human structures in main river valleys, mostly ranger stations and nearby farms adjacent to the reserve.

Rosy Starling *Pastor roseus*. Abundant migrant, seen in large flocks of up to 300 birds. Migration started in early May and was observed in Baldysu river valley, where >1000 birds passed through in <30 min on 6 May. Most migrants appeared to be flying in a northwesterly direction.

Common Rock Thrush *Monticola saxatilis*. Common bird on exposed rocky mountain ridges, seen throughout the reserve.

Blackbird *Turdus merula*. Relatively rare, only few individuals observed in river valleys with arboreal vegetation.

Mistle Thrush *Turdus viscivorus*. Relatively rare, possibly migrants observed across meadows and open areas in river valleys in the west of the reserve and around highest mountains.

White-throated Robin *Irania gutturalis*. Uncommon and localised in scrubby river canyons, only observed in Biresik and Baldysu river valley canyons, but return from migration in late April and May precluded earlier sightings.

Bluethroat *Luscinia svecica*. One female observed on a mountain ridge resting in a single shrub 13 May (likely a migrant).

Common Redstart *Phoenicurus phoenicurus*. Relatively rare, only observed in riparian vegetation along river valleys, representing birds on migration.

Black Redstart *Phoenicurus ochruros*. Relatively rare, only two individuals observed in Bayaldyr and Khantagi river valleys.

Siberian Stonechat *Saxicola maura*. Uncommon, but almost always occurring in small groups of 4–8 individuals in open grassy areas with taller herbs and scattered shrubs throughout the reserve.

Northern Wheatear *Oenanthe oenanthe*. Relatively rare, five individuals observed at higher elevations on rocky slopes or ridges throughout the reserve.

Isabelline Wheatear *Oenanthe isabellina*. Rare, only one individual observed in short grassy areas in upper reaches of Baldysu river valley 5 May.

Pied Wheatear *Oenanthe pleschanka*. Common and widespread bird observed throughout the reserve in all open habitats from river valleys to mountain ridges; one nest with 4 eggs found in a shady ravine at 1150 m asl near campsite 13 May. Females potentially mistaken with female Variable Wheatears.

Spotted Flycatcher *Muscicapa striata*. Relatively rare, mostly in riparian vegetation along flowing streams, more common in Biresik river valley than elsewhere, although this may have been a seasonal effect.

Pied Flycatcher *Ficedula hypoleuca*. Only one female-type observed, in a narrow canyon near Khantagi ranger station outside the reserve.

Indian Sparrow *Passer indicus*. Localised, only around human structures in main river valleys, mostly ranger stations and nearby farms adjacent to the reserve.

House Sparrow *Passer domesticus*. Localised, only around Bayaldyr ranger station in buffer zone of reserve. Females possibly confused with Indian Sparrow females.

Rock Sparrow *Petronia petronia*. Rare, only observed on two occasions in narrow rocky canyons near Khantagi and Biresik ranger stations. The species was very difficult to see on extensive rock faces, and may have been overlooked elsewhere.

Masked Wagtail *Motacilla alba personata*. Localised, in broad river valleys of Khantagi and Biresik rivers, mainly near human structures in buffer zone outside of reserve.

Yellow Wagtail *Motacilla flava*. Relatively rare migrant, only two individuals observed on ground at Baldysu ranger station, but several more heard migrating through mountain passes; one exceptional flock of 45 individuals passing over main Karatau ridge on 9 May.

Grey Wagtail *Motacilla cinerea*. Relatively rare resident in small valleys and canyons with running water throughout the reserve.

Tawny Pipit *Anthus campestris*. Only one individual observed on broad stony plateau between upper branches of Khantagi river valley.

Tree Pipit *Anthus trivialis*. Relatively rare and sporadic; observed in single bushes or shrubbery of valleys and open hillsides across the reserve, most likely birds on migration.

Eastern Goldfinch *Carduelis carduelis parapanisi*. Uncommon, but broadly distributed across open river valleys throughout reserve, mainly at lower elevations.

Common Rosefinch *Carpodacus erythrinus*. Rare, only one group of 3–4 individuals observed roosting in trees around Baldysu ranger station, and one female observed 17 May in Biresik river valley.

Rock Bunting *Emberiza cia*. Uncommon but broadly distributed in rocky areas across many mountain ranges throughout the reserve.

Corn Bunting *Emberiza calandra*. Relatively rare and localised around human structures and in broad river valleys of Baldysu and Biresik rivers, more common outside reserve in pastoral landscape.

Grey-necked Bunting *Emberiza buchanani*. Uncommon and mostly arriving in early May, regularly observed on rocky hillsides at higher elevations throughout the reserve.

Ortolan Bunting *Emberiza hortulana*. Only observed on 30 April in side canyon of Khantagi river outside the reserve, when several individuals were bathing in a shady canyon.

Red-headed Bunting *Emberiza bruniceps*. Common to abundant, but only recorded from 30 April onwards with increasing abundance; regular at high densities in river valleys and along vegetated hillsides throughout the reserve.