Bash 500MW Wind Farm
Republic of Uzbekistan

Environmental and Social Impact Assessment

Volume 4 – Appendices: Part B

Prepared for:

September 2022

DOCUMENT INFORMATION

PROJECT NAME	Bash 500MW Wind Farm
5CS PROJECT NUMBER	1305/001/100
DOCUMENT TITLE	Environmental and Social Impact Assessment Volume 4 – Appendices: Part B
CLIENT	ACWA Power
5CS PROJECT MANAGER	Eva Muthoni Oberholzer
5CS PROJECT DIRECTOR	Ken Wade

DOCUMENT CONTROL

VERSION	VERSION DATE	DESCRIPTION	AUTHOR	REVIEWER	APPROVER
1	11/01/2022	ESIA – Volume 4 Terrestrial Ecology (WF & OHTL)	EMO	MKB	KRW
2	21/04/2022	ESIA – Volume 4 Terrestrial Ecology (WF & OHTL)	EMO	MKB	KRW
3	13/05/2022	ESIA – Volume 4 Terrestrial Ecology (WF & OHTL)	EMO	MKB	KRW
4	30/09/2022	ESIA – Volume 4 Terrestrial Ecology (WF & OHTL)	EMO	MKB	KRW

1	Financial Capital
2	Social Capital
3	Natural Capital
4	Manufactured Capital
5	Human Capital

Regardless of location, mode of delivery or function, all organisations are dependent on *The 5 Capitals of Sustainable Development* to enable long term delivery of its products or services.

Sustainability is at the heart of everything that 5 Capitals achieves. Wherever we work, we strive to provide our clients with the means to maintain and enhance these stocks of capital assets.

DISCLAIMER

5 Capitals cannot accept responsibility for the consequences of this document being relied upon by any other party, or being used for any other purpose.
This document contains confidential information and proprietary intellectual property. It should not be shown to other parties without consent from the party which commissioned it.

This document is issued for the party which commissioned it and for specific purposes connected with the above-identified project only. It should not be relied upon by any other party or used for any other purpose

5 Capitals Environmental and Management Consulting
Principal office: PO Box 119899 Sheikh Zayed Road, Dubai, UAE
☏+971 4 343 5955 🖷+971 4 343 9366

APPENDIX B-1: WIND FARM AND OHTL TERRESTRIAL ECOLOGY REPORTS OF APPENDIX PART A -APPENDIX G,H & I

BASH WF – BIODIVERSITY REPORTS – DIGITAL APPENIDIX

Contents:

1. Botanical survey report
2. Spring Quartely Bird Monitoring report
3. Summer Quartely Bird Monitoring report
4. Autumn Bird Monitoring report
5. Winter survey on Lake Ayakagitma
6. Asian Houbara survey report
7. Collision Risk Modelling Analysis
8. Bats Monitoring Report Summer-Autumn
9. Bats Monitoring Report Spring-Summer
10. Bat roost search Report
11. Mammal survey report
12. Herpetological survey report
13. Invertebrates report

Botanical survey report

Report Title	Botanical survey
Scope	BOTANY
Areas Covered	DZHANKELDY WF / DZHANKELDY TO BASH OHTL / BASH WF / BASH TO KARAKOL OHTL
Seasons Covered	SPRING 2021 / SUMMER 2021
Notes	

Juru Energy

Botanical survey

BASH WIND FARM PROJECT

DZANKELDY WIND FARM PROJECT

CLIENT: 5 CAPITALS

Date: June 2021

Beshko Natalya, PhD

Juru Energy Ltd.

Suite 1, One George Yard, London

United Kingdom, EC3V 9DF

T: +44 207 859 4028

Contents

1. Aims and objectives 5
2. Background 5
2.1. Project area 5
2.2. Literature review 6
3. Materials and methods 13
4. Results of the field survey 15
4.1. Bash site 15
4.1.1. Sandy and sandy-loamy desert plain 15
4.1.2. Cliffs and eroded slopes of saline depression 41
4.1.3. Fixed and semi-fixed sands 50
4.1.4. Relic uplands 63
4.1.5. Anthropogenic disturbed areas 70
4.2. Dzhankeldy site 71
4.2.1. Weakly inclined piedmont plain of relic low mountains 71
4.2.2. Foothills of relic low mountains 82
4.2.3. Outcrops of variegated beds 94
4.2.4. Stony slopes of relic low mountains 99
4.2.5. Anthropogenic habitats 115
4.3. "Bash-Dzhankeldy" power line 117
4.3.1. Sandy and sandy-loamy desert plain 117
4.3.2. Fixed and semi-fixed sands 119
4.3.3. Complex of fixed and semi-fixed sands, saline depressions and takyrs 122
4.3.4. Weakly inclined piedmont plain of relic low mountains 124
4.3.5. Foothills of relic low mountains 129
4.3.6. Outcrops of variegated beds 131
4.3.7. Saline lands 131
4.4. "Bash-Karakul" power line 134
4.4.1. Sandy and sandy-loamy desert plain 134
4.4.2. Fixed and semi-fixed sands 138
4.4.3. Saline lands and wetlands 143
4.4.5. Agricultural lands 148
5. Conclusion 152
References 156
Annex 1. A check-list of plants recorded in "Bash" site 159

Annex 2. A check-list of plants recorded in the "Dzhankeldy" site during the field survey in 2021 162

Annex 3. A check-list of plants recorded along the planned power line "Bash-Dzhankeldy" during the field survey in 2021 166

Annex 4. A check-list of plants recorded along the planned power line "Bash-Karakul" during the field survey in 2021 171

Annex 5. Trigger plant species for critical habitat assessment (recorded during the field survey) 176

Annex 6. Distribution maps of trigger plant species (based on the field survey, herbarium and published data) 179

1. Aims and objectives

In accordance with TOR, the main tasks of expert-botanist are following:

- carrying out a field botanical survey at springtime and summer (April and early June) and processing of field data; particular attention should be given to the proposed turbine locations and any areas where new roads can be constructed;
- analysis of any previous botanical surveys and other available data (publications, reports, etc.) compared with the results of the field survey conducted in 2021;
- detailed description and GIS-based mapping of habitat types present within the project sites, compilation of Habitat map and LULC (Land Use – Land Cover) map;
- compilation of the check-list of plant species recorded within the project site (in particular, threatened species included in the Red Data Book of Uzbekistan and/or the IUCN Red List);
- reporting.

2. Background

2.1. Project area

The project area is situated in south-western part of the desert Kyzylkum, in Gizhduvan and Peshku administrative districts of the Bukhara Province of Uzbekistan, and consists of two sites and power lines between these two sites and Karakul substation (Figure 1). The distance between two sites is about 90 km. The 1st project site named “Dzhankeldy” covers an area of 26x20 km in the western part of insular low mountains Kuldzhuktau, in surroundings of the village Dzhankeldy. Within this area, preliminary locations of 125 wind turbines and 10 vantage points for the ornithological survey have been selected (Figure 2). The 2nd site named “Bash” is located in surroundings of depression Ayakagytma, to the east of the lake Ayakagytma, and covers an area of 18x18 km; locations of 105 wind turbines and 9 bird survey plots have been selected there (Figure 3).

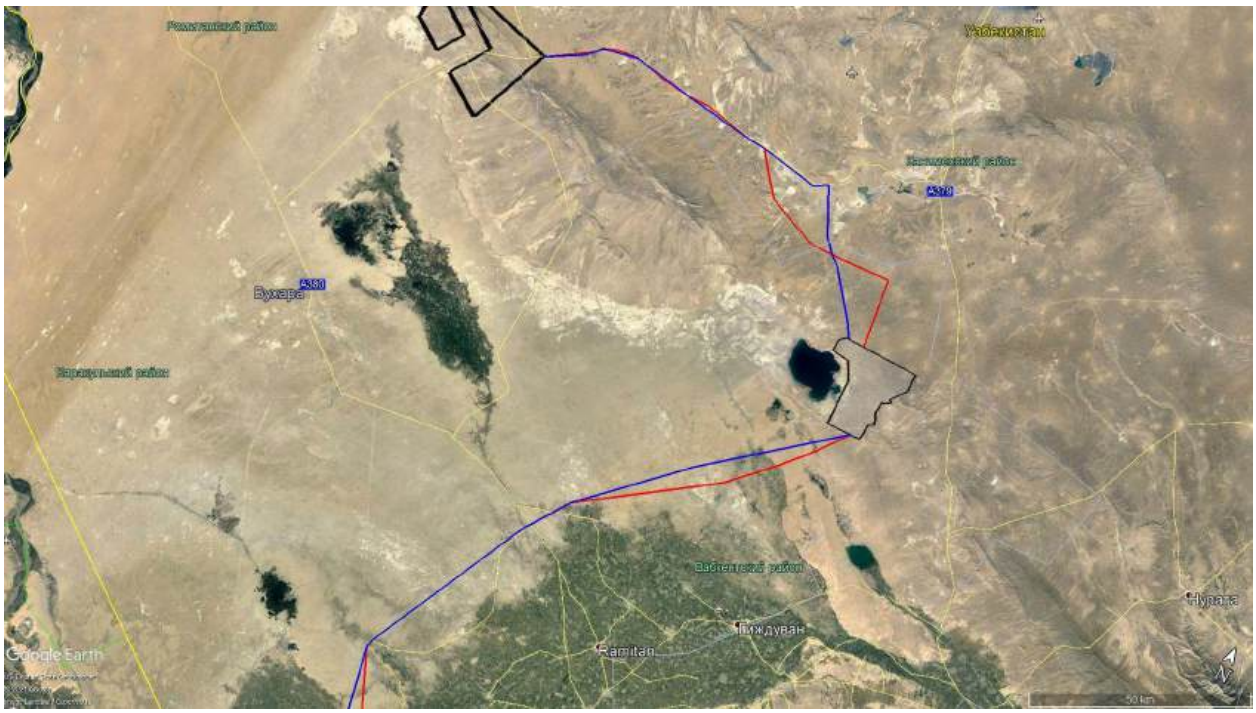


Figure 1. Project sites and proposed power lines

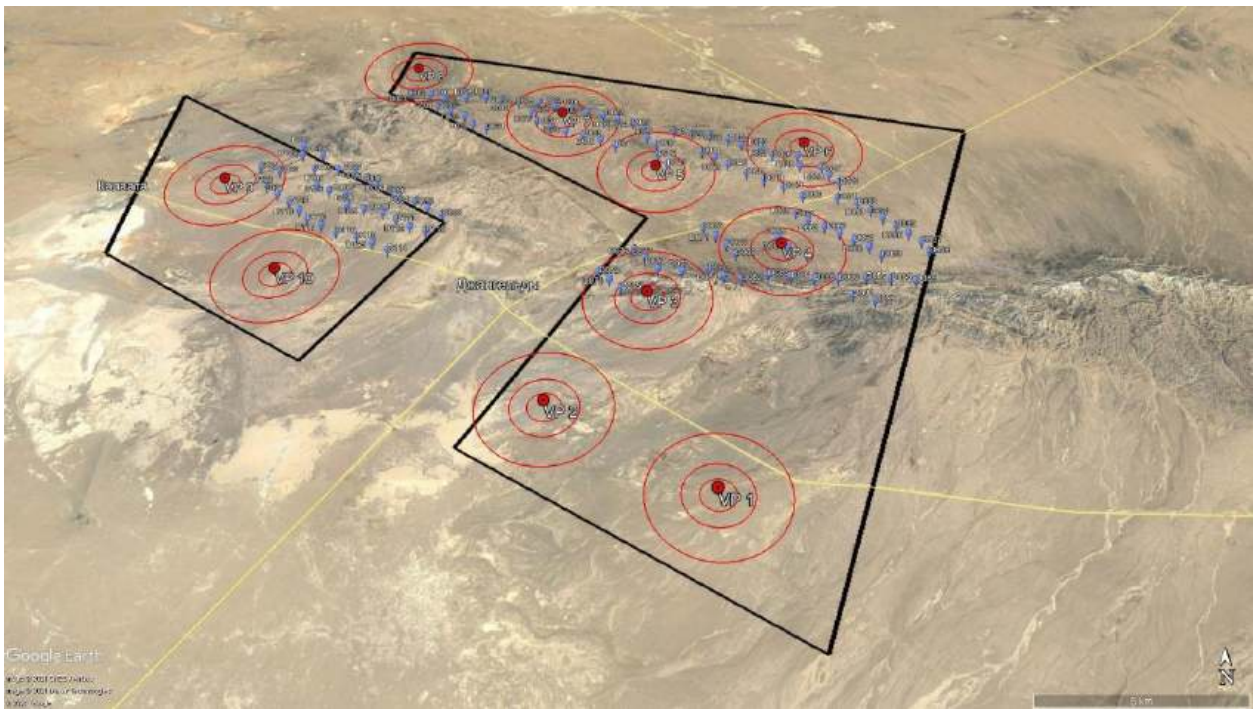


Figure 2. Project site “Dzhankeldy”. Symbols: VP 1–VP 10 – ornithological vantage poins, D001–D125 – proposed turbine locations.

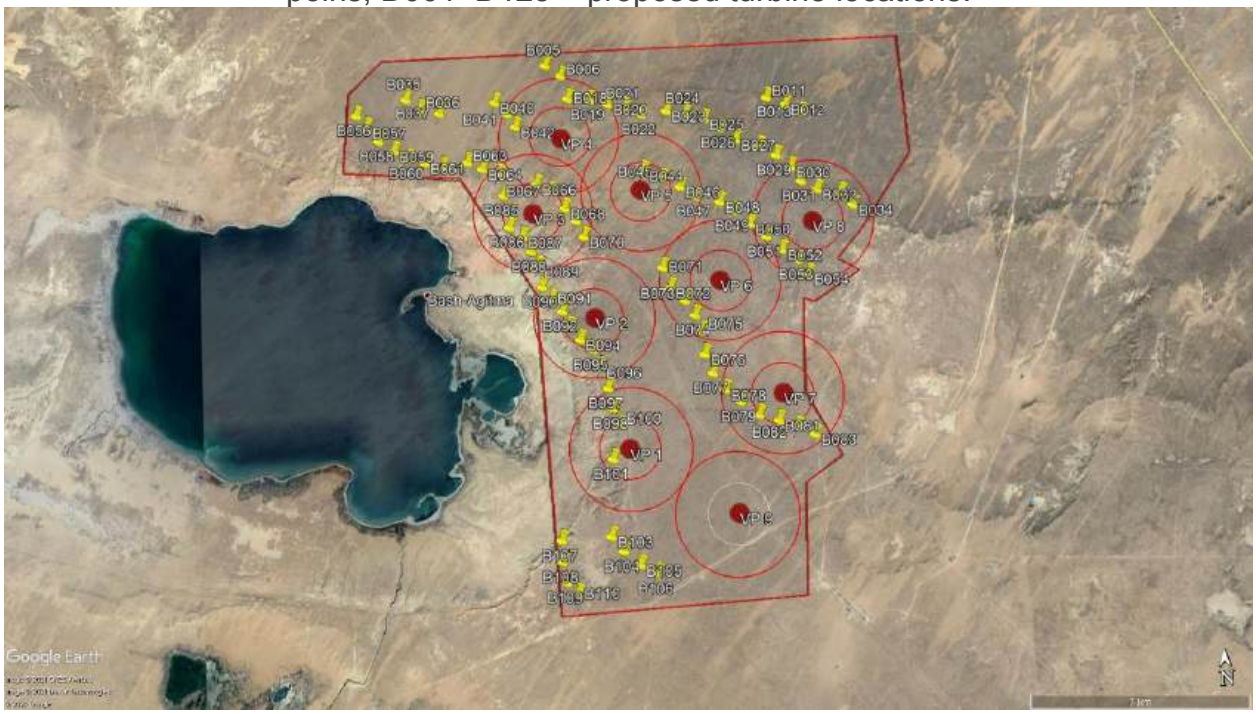


Figure 3. Project site “Bash”. Symbols: VP 1–VP 9 – ornithological vantage poins, B005–B110 – proposed turbine locations.

2.2. Literature review

The flora of the south-western Kyzylkum has been well studied. The history of botanical research in this region has about 200 years. The first scientific data on landscapes and plant diversity of this region have been obtained in the 19th Century by European and Russian naturalists who took part in several Russian diplomatic missions to Bukhara Khanate (E.A. Ewersmann and G. von Meyendorff in 1820–1821, and A. Lehmann in 1841–1842, A.P. Khoroshkhin in 1872, M.N. Bogdanov and F.I. Lobysevich in 1873, N. Barbot-de-Marni in 1874, and others). In 1887–1903, Russian botanist

Vladimir Lipsky performed large-scale expeditions in Central Asia, including surroundings of Bukhara, and provided one of the first scientific descriptions of the flora and vegetation, as well as published detailed history of botanical research in this region in the 19th Century and early 20th Century in his work “Flora of Central Asia, i.e. Russian Turkestan and Bukhara and Khiva Khanates” (1902–1905). Many naturalists and officials of Russian Empire, who worked in Central Asia or visited this region in the late 19th and early 20th Century, also collected herbarium specimens and contributed to the accumulation of floristic data. E.g., Nikolay Korolkow, general of Russian army and naturalist-amateur collected herbarium, living plants, seeds and bulbs on the way from Tashkent to Khiva during the Khivan campaign of 1873, and sent these materials to the Imperial Botanical Garden in Saint Petersburg. Herbarium collections made by above mentioned pioneers of the study of Central Asian flora laid the basis for our contemporary knowledge on the plant diversity of the great desert Kyzylkum.

In 1908–1917, the Migration Department of Russian government organized a number of expeditions for investigation of soils and vegetation of Central Asia within the framework of colonization of this region. Thus, in 1913–1916, zoologist N.A. Zarudny and botanists E.P. Korovin and M.G. Popov studied some areas of the south-western Kyzylkum. As a result of these large-scale surveys, a huge amount of herbarium was collected, numerous new taxa and a diversity of plant communities were described for the first time, the first geobotanical maps were compiled, and the outlines of the theory of the genesis of Central Asian flora and vegetation were laid.

In 1918, the Turkestan State University was established in Tashkent (it was given a name of Central Asian State University from 1923 to 1960, Tashkent State University in 1960–2000, and National University of Uzbekistan since 2000). Several prominent botanists including M.G. Popov, E.P. Korovin, M.V. Kultiasow and A.I. Vvedensky began to work there since 1920. The department of botany and geography headed by Mikhail Popov, the herbarium headed by Aleksei Vvedensky and the Institute of Soil Science and Geobotany headed by Nikolay Dimo have been created at the university in the initial period. Since early 1920s, botanists of the University performed field surveys covering the entire territory of Central Asia and focused mainly on the inventory of the flora, investigation of the vegetation cover and identification of plant resources. In the 1930–1940s, geobotanical studies (first of all, survey of pastures) were also carried out in different regions of Uzbekistan by special expeditions of the Committee of Sciences (which in 1940 was reorganized into the Academy of Sciences of Uzbekistan); the results were used for creation of the first geobotanical map of Uzbekistan. As a result of these expeditions, dozens of new species and genera were found and described from different regions of Central Asia.

In 1934–1936, the Kenimekh complex expedition led by prominent expert in phytosociology I.I Granitov explored the south-western part of Kyzylkum, Kenimekhchul and the western piedmonts of the Nuratau Mountains. The mission of this expedition was a comprehensive study the climate, soil, vegetation, flora and fauna of this region. The Kenimekh expedition collected extensive data were on the natural conditions and biodiversity of the territory, including a huge amount of herbarium (currently kept at the National Herbarium of Uzbekistan, TASH).

After the completion of the Kenimekh expedition, I.I. Granitov continued studies of the flora and vegetation of south-western Kyzylkum; the results of his long-term research have been summarized in a 2-volume monograph “Vegetation cover of the South-Western Kyzylkum” (1964, 1967). II Granitov provided the list of flora with 580 species from 290 genera and 55 families (272 species of them were reported for relic mountains Kuldzhuktau). Until now, this work remains the most fundamental publication on the plant diversity of south-western Kyzylkum. The monograph contains an essay of the history of botanical research, description of the physiographical and environmental conditions of

the region, provides the analysis of the flora and vegetation, and a scheme of phytogeographical division of the territory, as well as the assessment of the influence of humans and wildlife on the vegetation.

A significant amount of material was collected by the subsequent geobotanical expeditions of the 1950–1970s focused mainly on the investigation of rangelands. At that period, the specialists of the Institute of Botany of the Academy of Sciences of the Uzbek SSR experimented there with different methods of pastures restoration and improvement. Several prominent botanists from Uzbekistan and Russia, as T.A. Adylov, V.P. Botschantzev, R.V. Kamelin, E.V. Kljuykov, M.G. Pimenov, U.P. Pratov, M.I. Pryakhin, A.I. Vvedensky, I.F. Momotov, A.D. Lee, P.K. Zakirov and others performed numerous field expeditions in Kyzylkum. These scientists made a significant contribution to the knowledge of the flora and vegetation of this region.

The most important publications of the second half of the 20th Century containing the data on flora and vegetation of the south-western Kyzylkum also are the two-volume monograph by K.Z. Zakirov “Flora and vegetation of the Zeravshan River basin” (1955, 1961) and the monograph of his son P.K. Zakirov “The botanical geography of Nuratau Range and low mountains of Kyzylkum” (1971). K.Z. Zakirov compiled a summary checklist (with reference to herbarium collections) of 2588 plant species recorded for the entire Zeravshan River basin covering several phytogeographical regions of Mountain Central Asian and Turan provinces, among them, 320 species have been cited for lower reaches and ancient delta of Zeravshan River with adjacent areas of south-western Kyzylkum. PK Zakirov published a detailed description of the vegetation and a summary checklist of the flora of all relic mountains of Kyzylkum and the range Nuratau; it contains 983 species of vascular plants belonging to 312 genera and 65 families, 679 species of them recorded for relic mountains. Among them, 452 species from 233 genera and 46 families have been listed for the all insular low mountains of Central and South-Western Kyzylkum, including Kuldzhuktau.

“Weed vegetation of the Bukhara region and measures of its control” (Guzairov, 1951, 1968), I.F. Momotov "Theoretical foundations and methods of phytomelioration of desert pastures in south-western Kyzylkum" (Momotov, 1973) and “Guide to a botanical excursion to the southern edge of Western Kyzylkum” (Saidov et al., 1975) should also be mentioned among the important publications on the flora and vegetation of this area.

Several new botanical studies have been performed in the south-western Kyzylkum and Bukhara Oasis since 2000 (Tojibaev, Beshko, 2007; Khassanov et al., 2011; Esanov, 2017, 2019; Abduraimov, 2017; Akhmedov, 2018; Shomurodov et al., 2018; Shomurodov, 2018, etc.). In particular, F.O. Khassanov et al. (2011) estimated the entire flora of the Kyzylkum desert to be no less than 1043 species with 41 endemic and 11 sub-endemic species and noted that most of endemic species are localized in the relic mountains. However, the most actual data show that some species previously considered to be endemic to Kyzylkum have been found in neighboring areas and should be regarded as sub-endemics (Tojibaev et al., 2017).

The most important results of botanical research in the project region are summarized in recently published monographs, “Coenopopulations of rare and endangered plant species of remnant low mountains of Kyzylkum” (Shomurodov et al., 2018) which contains detailed data on populations of 12 threatened species, “Inventory of the flora of Uzbekistan: Navoi Province” (Tojibaev et al., 2019), and “Inventory of the flora of Uzbekistan: Bukhara Province” (Tojibaev et al., 2020). The “Inventory of the flora of Uzbekistan: Bukhara Province” contains a checklist of 764 species vascular plants growing in the wild in this large administrative region. The following information for each species is provided: life form, habitat, distribution within the Bukhara Province, conservation status, and economic use. Among them, 543 species are listed for the desert plain of Kyzylkum, 546 species – for lower reaches and ancient delta of Zeravshan

River (Bukhara Oasis), and 463 species are recorded for the remnant low mountains Kuldzhuktau; 25 species are red-listed at the national level (15 of them grow in the Kuldzhuktau Mountains); descriptions, photographs and distribution maps for threatened plant species are included.

Fundamental taxonomical treatments, as “Flora of the U.S.S.R.” (1934–1964, in 30 volumes), “Flora of Kazakhstan” (1956–1966, in 9 volumes), 1st edition of the “Flora of Uzbekistan” (1941–1962, in 6 volumes), “Conspectus Florae Asiae Mediae” (1963–2015, in 11 volumes), and recently published first three volumes of the 2nd edition of the “Flora of Uzbekistan” (2016, 2017, 2019), should also be mentioned among the most important sources of information on the plant diversity of the project zone. In the new “Flora of Uzbekistan” the treatment of 15 families with 58 genera and 375 species performed to date (8.6% of the national flora); for each species, herbarium specimens are cited and a distribution map based on their georeferencing is given. “Vegetation of Central Asia and South Kazakhstan” by E.P. Korovin (1934; 1961, 1962), “Vegetation cover of Uzbekistan and the ways of its practical use” (1971–1984, in 4 volumes), “Rangelands of the arid and semi-arid zones in Uzbekistan” (Gintzburger et al., 2003) and “Botanical geography of Kazakhstan and Middle Asia” by E.I. Rachkovskaya et al. (2003) also contains useful data about the flora and vegetation of the south-western Kyzylkum and their genesis. In particular, the general patterns of vegetation and a description of the main plant communities of Kyzylkum are given in the 2nd volume of the “Vegetation cover of Uzbekistan” (1973). The “Botanical Geography of Central Asia and Kazakhstan” by Rachkovskaya et al. (2003) describes in the main plant formations of the whole desert zone of Central Asia.

A huge amount of herbarium material collected from the south-western Kyzylkum and Bukhara Oasis during about two centuries is kept mainly in the National Herbarium of Uzbekistan in Tashkent (TASH), Herbarium of the Komarov Botanical Institute in St. Petersburg (LE), Herbarium of the Lomonosov Moscow State University (MW).

The list of plants of the Bukhara Province included in the Red Data Book of Uzbekistan (2019) and a map of their distribution in the project region (Figure 4) is presented below.

1. *Acanthophyllum cyrtostegium* Vved. UzbRDB Category 3. The Kuldzhuktau Mountains and their piedmonts. National endemic, endemic to south-western Kyzylkum and Zirabulak-Ziadin Mountains.

2. *Astragalus adylovii* F.O. Khass., Ergashev & Kadyrov. UzbRDB Category 1. The Kuldzhuktau Mountains. National endemic, endemic to Kuldzhuktau Mountains.

3. *Calligonum matteianum* Drobow. IUCN EN B2ab(iii,v). UzbRDB Category 1. Sundukli Sands. Endemic to sandy deserts of southern part of Central Asia.

4. *Calligonum molle* Litv. IUCN EN B2ab(iii,v). UzbRDB Category 2. Sundukli Sands. Endemic to southern Central Asian deserts.

5. *Calligonum paletzkianum* Litv. IUCN (VU B2ab(iii,v). UzbRDB Category 3. Sundukli Sands. Endemic to Irano-Turanian deserts.

6. *Calligonum zakirovii* (Khalk.) Czerep. UzbRDB Category 1. The Kuldzhuktau Mountains and their piedmonts. National endemic, endemic to relic mountains of Kyzylkum.

7. *Climacoptera amblyostegia* (Botsch.) Botsch. UzbRDB Category 2. Lower reaches and ancient delta of Zeravshan River.

8. *Climacoptera merkulowiczii* (Zakirov) Botsch. UzbRDB Category 2. Lower reaches and ancient delta of Zeravshan River. National endemic.

9. *Eremosparton flaccidum* Litv. UzbRDB Category 2. Sands of Kyzylkum. Endemic to sandy deserts of Central Asia.

10. *Eremostachys eriolarynx* Pazij & Vved. UzbRDB Category 1. South-western Kyzylkum, southern piedmonts of insular low mountains Kokchatau. National endemic, endemic to Kyzylkum.

11. *Ferula kyzylkumica* Korovin. UzbRDB Category 3. The Kuldzhuktau Mountains. National endemic, endemic to relic mountains of Kyzylkum with a disjunction in the Nuratau Mountains.

12. *Iris hippolyti* (Vved.) Kamelin. UzbRDB Category 1. Insular low mountains Kokchatau. National endemic, endemic to Kokchatau.

13. *Jurinea psammophila* Iljin. UzbRDB Category 3. The Kuldzhuktau Mountains and their piedmonts. National endemic, endemic to relic mountains of Kyzylkum.

14. *Lagochilus inebrians* Bunge. UzbRDB Category 3. The Kuldzhuktau and Kokchatau Mountains and their piedmonts. Endemic to western Pamir-Alay and adjacent areas including Kyzylkum, Karshi Steppe, valley of the river Zeravshan and Fergana valley.

15. *Lagochilus vvedenskyi* Kamelin & Zukerw. UzbRDB Category 3. The Kuldzhuktau Mountains and their piedmonts. National endemic, endemic to relic mountains of Kyzylkum.

16. *Lepidium subcordatum* Botsch. & Vved. UzbRDB Category 2. The Kuldzhuktau Mountains. National endemic, endemic to relic mountains of Kyzylkum and plateau Ustyurt.

17. *Oligochaeta vvedenskyi* (Popov) Tscherneva. UzbRDB Category 3. South-western Kyzylkum, Karnabchul. National endemic, endemic to Kyzylkum, Sundukli Sands and Karshi Steppe.

18. *Onobrychis tavernierifolia* Stocks ex Boiss. UzbRDB Category 1. The Kuldzhuktau Mountains and their piedmonts. Very rare species with fragmented range in Iran, Afghanistan and the Kuldzhuktau Mountains in Uzbekistan.

19. *Phlomoides aralensis* (Bunge) Salmaki (Paraeremostachys aralensis (Bunge) Adylov, Kamelin & Makhm.). UzbRDB Category 2. South-western Kyzylkum. National endemic, endemic to Kyzylkum desert.

20. *Phlomoides transoxana* (Bunge) Salmaki (Paraeremostachys transoxana (Bunge) Adylov, Kamelin & Makhm.). UzbRDB Category 2. South-western Kyzylkum. National endemic, endemic to Kyzylkum desert.

21. *Silene tomentella* Schischk. UzbRDB Category 2. The Kuldzhuktau Mountains. National endemic, endemic to relic mountains of Kyzylkum.

22. *Stipa aktauensis* Roshev. UzbRDB Category 2. The Kuldzhuktau Mountains. National endemic, endemic to relic mountains of Kyzylkum.

23. *Tulipa korolkowii* Regel. UzbRDB Category 3. Insular low mountains Kokchatau. Rare species of south-western Tien Shan and Pamir-Alay, Kokchatau is the most western site of distribution of this species.

24. *Tulipa lehmanniana* Merckl. UzbRDB Category 3. The Kuldzhuktau and Kokchatau Mountains and their piedmonts, south-western Kyzylkum, Karnabchul. Vulnerable species of Irano-Turanian deserts with decreasing range and populations.

25. *Tulipa micheliana* Th. M. Hoog. UzbRDB Category 3. Insular low mountains Kokchatau. Vulnerable species of Western Pamir-Alay and Kopetdag with decreasing range and populations.

Following species are endemic to the Kyzylkum desert: *Allium oxianum* F.O. Khass. et Tojibaev, *Allium rinae* F.O. Khass., Shomuradov & Tojibaev, *Astragalus adylovii* F.O.Khass., Ergashev & Kadyrov, *Astragalus centralis* Sheld., *Astragalus holargyreus* Bunge, *Astragalus kuldzhuktauense* F.O.Khass., Shomur. & Esankulov, *Astragalus leiophysa* Bunge, *Astragalus remanens* Nabiev, *Bryonia melanocarpa* Nabiev, *Calligonum zakirovii* (Khalk.) F.O. Khass., *Cleome quinquenervia* DC., *Convolvulus affanasevii* Luferov, *Cousinia juzepczukii* Tscherneva, *Cousinia dolichoclada* Juz.,

Cousinia sylvicola Bunge, *Cousinia umbilicata* Juz., *Diarthron macrorhachis* (Pobed.) Kit Tan (*Dendrostellera macrorhachis* Pobed.), *Eremostachys eriolarynx* Pazij & Vved., *Eremurus korolkowii* Regel, *Evax arenaria* Smoljan., *Gagea deserticola* Levichev, *Jurinea psammophila* Iljin, *Lagochilus vvedenskyi* Kamelin & Tzukerv., *Lappula aktaviensis* Popov & Zakirov, *Lappula parvula* Nabiev & Zakirov, *Phlomoides aralensis* (Bunge) Salmaki, *Phlomoides transoxana* (Bunge) Salmaki, *Psylliostachys x androssovii* Roshkova, *Salsola androssovii* Litv., *Salsola angusta* Botsch., *Salsola deserticola* Iljin, *Scorzonera gageoides* Boiss., *Silene tomentella* Schischk., *Scrophularia rudolfii* F.O. Khass., Serekeeva & Kadyrov, *Stipa aktauensis* Roshev.

Sub-endemic species reported for south-western Kyzylkum are *Allium karakense* Regel, *Allium kysylkumi* Kamelin and *Ferula kyzylkumica* Korovin (fragmented range in relic mountains of Kyzylkum and western part of the Nuratau Mountains), *Calligonum matteianum* Drobow, *Calligonum molle* Litv. and *Eremosparton flaccidum* Litv. (sandy deserts of southern part of Central Asia), *Halimocnemis latifolia* Iljin (Kyzylkum and Karshi Steppe), *Cousinia sogdiana* Bornm. and *Oligochaeta vvedenskyi* (Popov) Tscherneva (Kyzylkum, Sundukli Sands and Karshi Steppe), *Lepidium subcordatum* Botsch. & Vved. (fragmented range in relic mountains Kyzylkum and plateau Ustyurt), *Jurinea derderioides* C. Winkl. and *Tulipa sogdiana* Bunge (Central Asian deserts), etc.

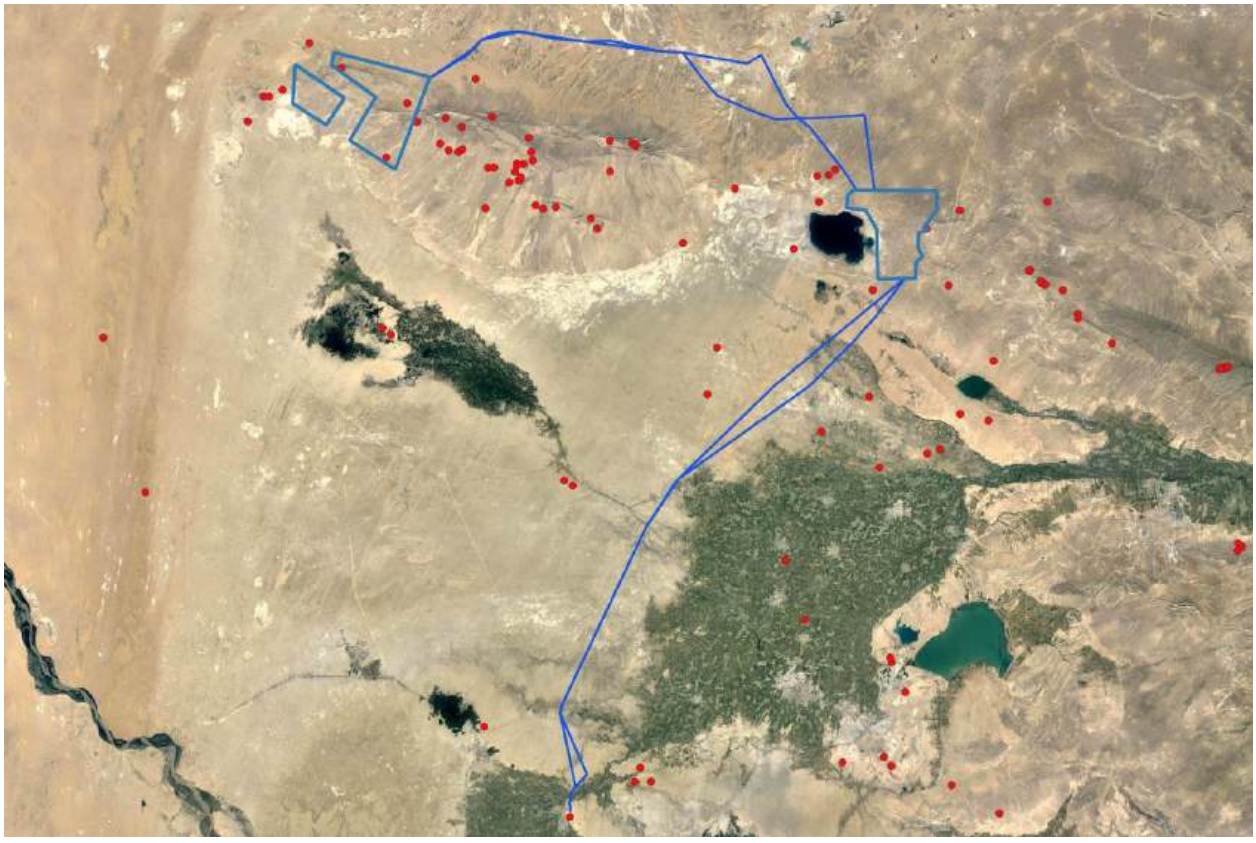


Figure 4. Distribution of nationally red-listed plants in the project region (according to “Inventory of the flora of Uzbekistan: Navoi Province”, 2019, and “Inventory of the flora of Uzbekistan: Bukhara Province”, 2020). Known locations of rare plants showed by red dots.

Since a number of threatened, endemic and restricted range plant species occurs in the project area, the Critical Habitat Assessment is required, according to IFC Performance Standard 6 (PS6) and EBRD Performance Requirement 6 (PR6).

An analysis of published data shows, that similar assessments of areas with high biodiversity conservation significance have been performed in Uzbekistan within the framework of UNDP-GEF project “Strengthening Sustainability of the National Protected

Area System by Focusing on Strictly Protected Areas" and CEPF project "Mountains of Central Asia Biodiversity Hotspot". According to results of the first project published in the "Recommendations for protected areas system development in Uzbekistan" (Ismatov, 2013), 17 sites important for plant diversity were identified within Uzbekistan, among them, the insular range Kuldzhuktau was qualified as one of priority areas for conservation of diversity of natural landscapes, flora and fauna, and recommended for protected area. The second international project has been focused on the assessment of Key Biodiversity Areas within Mountains of Central Asia Global Biodiversity Hotspot using the KBA standards, and the region of south-western Kyzylkum was not included in this analysis (Mountains of Central Asia Biodiversity Hotspot, 2017).

At the global level, the screening of critical habitats was performed by UNEP-WCMC (2017) and Brauneder et al. (2018). For Uzbekistan, potential critical habitats have been identified by authors mainly on the basis of assessment of Important Bird Areas (2008).

3. Materials and methods

The field studies were conducted 9–11 April, 12–20 May and 18–30 June 2021 by traditional methods of botanical survey commonly used for sampling and mapping of native non-forest vegetation, recognition of floristic composition and spatial patterns of plant communities (Field geobotany, 1959–1976; Granitov, 1980; Kent, 2011). All vantage points (bird survey circles) and the majority of proposed turbine locations within two project sites were inspected, as well as a strip about 100 m in width along the planned electric lines. The check-lists of plant species recorded for each project site were compiled.

Plant species were identified using special literature, as “Conspectus Florae Asiae Mediae” (1963–1993), “Flora of Uzbekistan” (1941–1963, 2016, 2017, 2019) and “Flora of USSR” (1934–1964). Avaiable publications and online databases (Nikitin, 1983; IUCN/ISSG, 2014; CABI, 2017; Sennikov et al., 2018) were used for identification of alien species, while the Red Data Book of Uzbekistan (1984, 1998, 2006, 2009, 2019) and the IUCN Red List (www.iucnredlist.org) were used for identification of threatened species. Other relevant published data on flora and vegetation of the region also has been analyzed (listed below in References).

In the general check-lists and check-lists compiled for survey plots and habitat types, species are arranged in alphabetic order. Accepted names of species are provided in accordance with the online global databases Plants of the World Online (www.plantsoftheworldonline.org/), International Plant Names Index (www.ipni.org) and Catalogue of Life (www.catalogueoflife.org), as well as with recently published treatments of different taxonomical groups of the flora of Uzbekistan (Sennikov, 2016, 2017, 2019).

The draft habitat maps for “Bash” and “Dzhankeldy” project sites were created on the basis of visual interpretation of free satellite imagery from USGS Earth Explorer (https://earthexplorer.usgs.gov/), Google Earth and Bing Maps, a topographic map (1:100,000, available online for free at http://loadmap.net/) and a soil map of the Bukhara Province (Geographical atlas of Uzbekistan, 2012). QGIS 3.18 free software was used for habitat mapping. During the field survey, all habitat types were inspected; their descriptions, boundaries and character of land use have been clarified and corrected.

The structure of vegetation communities was described on 50x50 m geobotanical sample plots (squares) chosen in an area with homogeneous vegetation, representative for each habitat type, as well as in proposed turbine locations. For each sample plot, photographs of the landscape and vegetation were taken using a digital camera, and following data were recorded: location and physical environment (including GPS coordinates, elevation, topography, and soil type), state of vegetation, landuse type and disturbance factors (grazing, roads, etc.), plant association, canopy cover (%), canopy height, all plant species present at the plot, their cover and abundance, phenological stage and height.

Coordinates of populations of endemic, redlisted or alien plant species, number of individuals and area occupied by population also were recorded.

Species cover and abundance was determined using the Braun-Blanquet cover-abundance scale (1965) widely used in geobotanical and ecological studies as rapid visual assessment technique, but robust and highly repeatable, minimizing among-observer differences:

+ – occasional and less than 1% cover of the sample plot area;

1 – abundant with low cover, or less abundant but with higher cover, 1–5% of the sample plot area;

2 – abundant with >5–25% of the sample plot area, irrespective of the number of individuals;

3 – >25–50% cover of the sample plot area, irrespective of the number of individuals;

4 – >50–75% cover of the sample plot area, irrespective of the number of individuals;

5 – >75% cover of the sample plot area, irrespective of the number of individuals.

The relative abundance of each species also was assessed using the DAFOR scale: D = Dominant; A = Abundant, F = Frequent, O = Occasional, R = Rare.

The conservation status of plant species is given according the Red Data Book of Uzbekistan (2019). National categories of threatened plants are follows: 0 (probably extinct species) – corresponds to EX or EW categories of the IUCN Red List (www.iucnredlist.org), 1 (endangered, disappearing species) – meets CR or EN categories of IUCN, 2 (rare species) – meets VU category of IUCN and 3 (vulnerable, declining species) – corresponds to NT category of IUCN. To date, 5 editions of the Red Data Book of Uzbekistan have been published. The first (1984) included 163 plant species, the second (1998) – 301, the third (2006) – 302, the fourth (2009) – 321, and an actual, fifth edition (2019), includes 314 plant species.

IUCN Red List (www.iucnredlist.org) is unapplicable in our case because currently only 236 taxa (5.4%) of more than 4380 species recorded for the flora of Uzbekistan were assessed by IUCN, 16 species of them were included in the IUCN Red List as threatened (CR, EN and VU categories), and only 5 of them are red-listed at the national level. The rest 94.6% of species have not yet been assessed by IUCN and belong to NE category – Not Evaluated. 350 plant species of 112 genera are national endemics of Uzbekistan (including all endemics of relic low mountains of Kyzylkum), 137 of them are red-listed at the national level, and none of them assessed as threatened (CR, EN, VU) in the IUCN Red List.

As defined by the International Finance Corporation (IFC) Performance Standard 6 (PS6) and EBRD Performance Requirement 6 (PR6), critical habitats are areas with high biodiversity value, including (i) habitat of significant importance to Critically Endangered and/or Endangered species; (ii) habitat of significant importance to endemic and/or restricted-range species; (iii) habitat supporting globally significant concentrations of migratory species and/or congregatory species; (iv) highly threatened and/or unique ecosystems; and/or (v) areas associated with key evolutionary processes. Numerical thresholds have been defined for the first four critical habitat criteria (i.e., CR/EN species; endemic/restricted-range species; migratory/congregatory species; threatened and unique ecosystems); these tresholds are based on these published by IUCN in “A Global Standard for the Identification of Key Biodiversity Areas” (2016) and “IUCN Red List Categories and Criteria” (2012). For Criterion 5, there are no numerical thresholds.

Criterion 1 is triggered by species listed as CR or EN on the IUCN Red List, and nationally/regionally listed species assessed using similar criteria. Criterion 2 is triggered by habitats of significant importance for endemic or restricted-range species. Criterion 3 (migratory species) in unapplicable for plants. As for Criterion 4, unfortunately, the officially approved national list of highly threatened and/or unique ecosystems and habitats does not exist in Uzbekistan. But the National Biodiversity Conservation Strategy (1998), National reports on biodiversity conservation (2006, 2015) and other documents (Ismatov, 2013) indicated that the problem of conservation of all types of forest ecosystems (including shrublands) is a very critical issue in Uzbekistan. A specific legislation, management and forest protection measures are present at the national level. Forests and shrublands are key habitats for the conservation of many rare animals and plants in Central Asia. In the sandy desert, psammophilous shrublands and saxaul stands have essential importance for sand fixation and combat desertification. But these ecosystems are under serious threat from over-exploitation and over-grazing. Therefore, natural and planted desert “forests” must be taken into account.

4. Results of the field survey
4.1. Bash site

A total check-list of vascular plants recorded within the project site "Bash" during the field survey in April and June includes 49 species (Appendix 1). In June, the same species were found in each survey area, the only difference was their phenological stage (all ephemers and ephemeroids were fruiting or dried). Following habitat types (map units) were identified for the "Bash" site:

4.1.1. Sandy and sandy-loamy desert plain

The field survey showed that the main habitat type in the western part of "Bash" area (to the west of railway) is sandy and sandy-loamy desert plain with flat and flat-wavy terrain, covered with native ephemeroid-sagebrush (*Artemisia diffusa, Poa bulbosa, Carex subphysodes*) and saltwort-ephemeroid-sagebrush vegetation (*Artemisia diffusa, Poa bulbosa, Carex subphysodes, Caroxylon orientale (Salsola orientalis)*) on sandy desert soil and sabulous-loamy grey-brown desert soil. *Ferula foetida* and *Iris songarica* are subdominants on local areas. There is no clear boundary between sandy and sandy-loamy desert plain, and between ephemeroid-sagebrush and saltwort-ephemeroid-sagebrush communities; thus, they can be combined into one type of habitat.

The plant species diversity is low (8 to 18 species). The canopy cover is 20–50%. The vegetation is more or less uniform (with local abundance of saltworts, *Ferula foetida* and *Iris songarica*). One moss species (*Tortula desertorum*) has been found in all plots; on some local areas it covers up to 5%. One nationally red-listed species, *Tulipa lehmanniana,* occurs sporadically within all territory of this habitat type, its abundance is R to O, population density varies from solitary specimens to 900–1000 per 1 hectare. Tulips were recorded mainly in April. In middle May and June, only solitary specimens were recorded because they finished the vegetation, and their aboveground part completely withered away.

The main type of land use is pasture; an impact of grazing is medium; several shepherds houses are situated in this territory. Local impact is connected with several ground roads, and with an underground gas pipeline that runs across the southern part of the project site.

Within this habitat type, following geobotanical sample plots were described.

[redacted]. Sandy desert plain with hilly-wavy terrain and native ephemeroid-sagebrush vegetation (*Artemisia diffusa, Poa bulbosa, Carex subphysodes*) (Photo 1–3). 13 plant and 1 moss species were recorded (Table 1), none of them are red-listed or alien. The canopy cover is 25–30%. The differences between these 4 survey plots are negligible, species diversity is very low, and the vegetation cover is uniform.

Table 1. Check-list of plants recorded in s[redacted]

Species	Life form	Height, cm	Abundance		Phenol. Stage
			DAFOR	Braun-Blanquet	
Alyssum desertorum	annual	5–6	O	+	flowering
Artemisia diffusa	semishrub	15–20	D	2–3	vegetation
Carex subphysodes	Perennial	12–15	A	1	flowering
Caroxylon orientale (Salsola orientalis)	dwarf shrub	35-40	R	+	vegetation

Ceratocarpus arenarius	annual	15-20	R	+	Dried
Convolvulus hamadae	semishrub	25–30	R	+	vegetation
Cousinia hamadae	Perennial	15–20	R	+	vegetation
Ferula foetida	Perennial	30–35	R	+	vegetation
Holosteum umbellatum	annual	6–8	R	+	flowering
Hypecoum pendulum	annual	12–15	R	+	flowering
Iris songarica	Perennial	30–35	O	+	vegetation
Peganum garmala	Perennial	15-20	R	+	vegetation
Poa bulbosa	Perennial	15–17	A	1	vegetation
Tortula desertorum	moss	0.3–0.5	O	+	vegetation



Photo [redacted] Sandy plain with hilly-wavy terrain and ephemeroid-sagebrush vegetation



Photo 2. [redacted] (below). Sandy plain with hilly-wavy terrain and ephemeroid-sagebrush vegetation



Photo 3. Sagebrush (*Artemisia diffusa*), a dominant plant of ephemeroid-sagebrush communities of the south-western Kyzylkum

[redacted] s.l. Wavy sandy-stony desert plain with native ephemeroid-sagebrush-saltwort vegetation (*Xylosalsola arbuscula*, *Caroxylon orientale, Artemisia diffusa, Poa bulbosa, Carex physodes*) (Photo 4–5). 20 plant and 1 moss species were recorded (Table 2). The canopy cover is 35–40%. 6 generative and 17 pre-

generative specimens of red-listed *Tulipa lehmanniana* were found within the survey square.



[redacted]. Sandy plain with saltwort-ephemeroid-sagebrush vegetation



Photo 5. *Xylosalsola arbuscula (Salsola arbuscula),* or white saltwort

Table 2. Check-list of plants recorded in survey plot [redacted]

Species	Life form	Height, cm	Abundance		Phenol. Stage
			DAFOR	Braun-Blanquet	
Acanthophyllum elatius	Perennial	40–45	R	+	vegetation
Alyssum desertorum	annual	5–6	O	+	flowering

Artemisia diffusa	semishrub	15–20	A	1	vegetation
Astragalus villosissimus	dwarf shrub	35-40	O	+	vegetation
Carex physodes	Perennial	12–15	A	1	flowering
Caroxylon orientale (Salsola orientalis)	dwarf shrub	35-40	D	2	vegetation
Ceratocarpus arenarius	annual	15-20	R	+	Dried
Ceratocephala falcata	annual	3–4	R	+	flowering
Convolvulus hamadae	semishrub	25–30	O	+	vegetation
Cousinia hamadae	Perennial	15–20	R	+	vegetation
Ferula foetida	Perennial	30–35	R	+	vegetation
Halothamnus subaphyllus	semishrub	40–45	R	+	vegetation
Holosteum umbellatum	annual	6–8	O	+	flowering
Hypecoum pendulum	annual	12–15	O	+	flowering
Iris songarica	Perennial	30–35	O	+	vegetation
Peganum garmala	Perennial	15-20	R	+	vegetation
Poa bulbosa	Perennial	15–17	A	1	vegetation
Streptoloma desertorum	annual	6–7	R	+	flowering
Tortula desertorum	moss	0.3–0.5	O	+	vegetation
Tulipa lehmanniana	Perennial	10–15	R	+	vegetation
Xylosalsola arbuscula (Salsola arbuscula)	shrub	40–50	A	1	vegetation

B0[redacted]
40.68719 – 40.685428° N, 64.582273 – 64.589908° [redacted]ort (*Xylosalsola arbuscula, Caroxylon orientale, Artemisia diffusa, Poa bulbosa, Carex physodes*) (photo 6–7); 18 plant and 1 moss species were recorded (Table 3). The canopy cover is 30–40%. 11 generative and 78 pre-generative specimens of red-listed *Tulipa lehmanniana* were found within the B037 survey square, and solitary pre-generative specimens were found within the B036 plot. Alien plants are absent. The terrain is somewhat wavy.



Photo [redacted] Sandy plain with saltwort-ephemeroid-sagebrush vegetation



Photo [redacted] (below). Sandy plain with saltwort-ephemeroid-sagebrush vegetation

Table 3. Check-list of plants recorded in survey plots [redacted]

Species	Life form	Height, cm	Abundance		Phenol. Stage
			DAFOR	Braun-Blanquet	
Acanthophyllum elatius	Perennial	40–45	O	+	vegetation
Alyssum desertorum	annual	5–6	O	+	flowering
Artemisia diffusa	semishrub	15–20	A	1	vegetation

Astragalus villosissimus	dwarf shrub	35-40	O	+	vegetation
Carex physodes	Perennial	12–15	A	1	flowering
Caroxylon orientale (Salsola orientalis)	dwarf shrub	35-40	D	2	vegetation
Ceratocarpus arenarius	annual	15-20	R	+	Dried
Ceratocephala falcata	annual	3–4	O	+	flowering
Convolvulus hamadae	semishrub	25–30	O	+	vegetation
Cousinia hamadae	Perennial	15–20	R	+	vegetation
Cousinia resinosa	Perennial	30–35	R	+	vegetation
Ferula foetida	Perennial	30–35	R	+	vegetation
Halothamnus subaphyllus	semishrub	40–45	R	+	vegetation
Holosteum umbellatum	annual	6–8	O	+	flowering
Hypecoum pendulum	annual	12–15	O	+	flowering
Iris songarica	Perennial	30–35	O	+	vegetation
Ixiolirion tataricum	Perennial	12–15	R	+	vegetation
Peganum garmala	Perennial	15-20	R	+	vegetation
Poa bulbosa	Perennial	15–17	A	1	vegetation
Tortula desertorum	moss	0.3–0.5	O	+	vegetation
Tulipa lehmanniana	Perennial	10–15	R	+	vegetation
Xylosalsola arbuscula (Salsola arbuscula)	shrub	40–50	A	1	vegetation

[redacted] saltwort-ephemeroid-sagebrush community (*Artemisia diffusa, Poa bulbosa, Carex physodes, Xylosalsola arbuscula, Caroxylon orientale*) on sandy desert soil (photo 8); 23 plant and 1 moss species were recorded (Table 4), including nationally red-listed *Tulipa lehmanniana* (numerous mainly pre-generative specimens occurs sporadically within and between survey plots). The canopy cover is 40–50%. Alien plants are absent. The differences between these 5 plots are negligible. The terrain is somewhat hilly-wavy.



Pho [redacted] Sandy plain with saltwort-ephemeroid-sagebrush vegetation. In the foreground – *Ferula foetida.*

Table 4. Check-list of plants recorded in survey plots [redacted]

Species	Life form	Height, cm	Abundance		Phenol. Stage
			DAFOR	Braun-Blanquet	
Acanthophyllum elatius	Perennial	40–45	O	+	vegetation
Alyssum desertorum	annual	5–6	O	+	flowering
Artemisia diffusa	semishrub	25–30	A	1	vegetation
Astragalus villosissimus	dwarf shrub	35-40	A	1	vegetation
Bromus tectorum	annual	12–15	O	+	flowering
Carex physodes	Perennial	12–15	D	1	flowering
Caroxylon orientale (Salsola orientalis)	dwarf shrub	35-40	D	2	vegetation
Ceratocarpus arenarius	annual	15-20	R	+	Dried
Ceratocephala falcata	annual	3–4	O	+	flowering
Convolvulus hamadae	semishrub	25–30	A	1	vegetation
Cousinia hamadae	Perennial	15–20	R	+	vegetation
Ferula foetida	Perennial	50–60	O	1	flowering
Halothamnus subaphyllus	semishrub	40–45	O	1	vegetation
Haplophyllum sp.	Perennial	10–15	R	+	vegetation
Holosteum umbellatum	annual	6–8	O	+	flowering
Hypecoum pendulum	annual	12–15	O	+	flowering
Iris longiscapa	perennial	17-20	R	+	flowering
Iris songarica	Perennial	30–35	R	+	vegetation
Mausolea eriocarpa	semishrub	45–50	O	1	vegetation
Peganum garmala	Perennial	15-20	R	+	vegetation

Poa bulbosa	Perennial	15–17	A	1	vegetation
Tortula desertorum	moss	0.3–0.5	O	+	vegetation
Tulipa lehmanniana	Perennial	10–15	O	+	vegetation
Xylosansola arbuscula (Salsola arbuscula)	shrub	40–50	A	1	vegetation

[redacted]

Sandy plain with native saltwort-ephemeroid-sagebrush community (*Artemisia diffusa, Poa bulbosa, Carex physodes, Xylosalsola arbuscula, Caroxylon orientale*) (photo 9); 23 plant and 1 moss species were recorded (Table 5), including nationally red-listed *Tulipa lehmanniana* (solitary mainly pre-generative specimens). The canopy cover is 50%. Alien plants are absent.

Table 5. Check-list of plants recorded in survey plo[redacted]

Species	Life form	Height, cm	Abundance		Phenol. Stage
			DAFOR	Braun-Blanquet	
Acanthophyllum elatius	Perennial	40–45	R	+	vegetation
Alyssum desertorum	annual	5–6	O	+	flowering
Artemisia diffusa	semishrub	25–30	D	2	vegetation
Astragalus flexus	perennial	15-17	R	+	flowering
Astragalus villosissimus	dwarf shrub	35-40	O	+	vegetation
Bromus tectorum	annual	12–15	O	+	flowering
Calligonum microcarpum	shrub	50–70	R	+	vegetation
Carex physodes	Perennial	12–15	D	1	flowering
Caroxylon orientale (Salsola orientalis)	dwarf shrub	40–50	D	1	vegetation
Ceratocarpus arenarius	annual	15-20	R	+	Dried
Ceratocephala falcata	annual	3–4	O	+	flowering
Convolvulus hamadae	semishrub	25–30	A	1	vegetation
Cousinia hamadae	Perennial	15–20	R	+	vegetation
Ferula foetida	Perennial	50–60	O	1	flowering
Halothamnus subaphyllus	semishrub	40–45	R	+	vegetation
Holosteum umbellatum	annual	6–8	O	+	flowering
Hypecoum pendulum	annual	12–15	O	+	flowering
Iris songarica	Perennial	30–35	R	+	vegetation
Mausolea eriocarpa	semishrub	45–50	O	1	vegetation
Peganum garmala	Perennial	15-20	R	+	vegetation
Poa bulbosa	Perennial	15–17	A	1	vegetation
Tortula desertorum	moss	0.3–0.5	O	+	vegetation
Tulipa lehmanniana	Perennial	10–15	R	+	vegetation
Xylosalsola arbuscula (Salsola arbuscula)	shrub	40–50	O	+	vegetation



Pho[redacted]. Sandy plain with saltwort-ephemeroid-sagebrush vegetation

[redacted]

Native saltwort-ephemeroid-sagebrush community (*Artemisia diffusa, Poa bulbosa, Carex subphysodes, Xylosalsola arbuscula, Caroxylon orientale, Ferula foetida*) (photo 10); 18 plant and 1 moss species were recorded (Table 6). The canopy cover is 40%. 23 generative and 131 pre-generative specimens of red-listed *Tulipa lehmanniana* were found within the survey square. Alien plants are absent. The the terrain is somewhat wavy.

Table 6. Check-list of plants recorded in survey plot [redacted]

Species	Life form	Height, cm	Abundance		Phenol. Stage
			DAFOR	Braun-Blanquet	
Artemisia diffusa	semishrub	25–30	A	1	vegetation
Astragalus flexus	perennial	15-17	R	+	flowering
Astragalus villosissimus	dwarf shrub	35-40	O	+	vegetation
Carex subphysodes	Perennial	12–15	A	1	flowering
Caroxylon orientale (Salsola orientalis)	dwarf shrub	35-40	A	1	vegetation
Ceratocarpus arenarius	annual	15-20	R	+	Dried
Ceratocephala falcata	annual	3–4	O	+	flowering
Convolvulus hamadae	semishrub	25–30	O	+	vegetation
Ferula foetida	Perennial	50–60	O	1	flowering
Holosteum umbellatum	annual	6–8	O	+	flowering
Hypecoum pendulum	annual	12–15	O	+	flowering
Iris songarica	Perennial	30–35	O	+	vegetation
Peganum garmala	Perennial	15-20	R	+	vegetation

Phlomoides desertotum	Perennial	15-20	R	+	vegetation
Poa bulbosa	Perennial	15–17	A	1	vegetation
Salsola paulsenii	annual	30–40	R	+	Dried
Tortula desertorum	moss	0.3–0.5	A	1	vegetation
Tulipa lehmanniana	Perennial	10–15	R	+	vegetation
Xylosalsola arbuscula (Salsola arbuscula)	shrub	40–50	A	2	vegetation



[redacted] Sandy plain with saltwort-ephemeroid-sagebrush vegetation

[redacted]

This survey plot is situated near the border of flat sandy desert plain and steep slopes of saline depression. Native saltwort-ephemeroid-sagebrush community (*Artemisia diffusa, Poa bulbosa, Carex subphysodes, Caroxylon orientale, Ferula foetida*) (photo 11); 16 plant and 1 moss species were recorded (Table 7). The canopy cover is 40%. 25 generative and 121 pre-generative specimens of red-listed *Tulipa lehmanniana* were found within the survey square. Alien plants are absent. The the terrain is somewhat wavy.

Table 7. Check-list of plants recorded in survey plot [redacted]

Species	Life form	Height, cm	Abundance		Phenol. Stage
			DAFOR	Braun-Blanquet	
Artemisia diffusa	semishrub	25–30	D	2	vegetation
Astragalus rubromarginatus	perennial	12-15	R	+	vegetation
Astragalus villosissimus	dwarf shrub	35-40	R	+	vegetation
Carex subphysodes	Perennial	12–15	A	1	flowering

Caroxylon orientale (Salsola orientalis)	dwarf shrub	35-40	D	2	vegetation
Caroxylon scleranthum (Salsola sclerantha)	annual	20-25	R	+	Dried
Ceratocarpus arenarius	annual	15-20	R	+	Dried
Ceratocephala falcata	annual	3–4	R	+	flowering
Convolvulus hamadae	semishrub	25–30	A	1	vegetation
Ferula foetida	Perennial	50–60	O	1	flowering
Holosteum umbellatum	annual	6–8	R	+	flowering
Iris songarica	Perennial	30–35	O	+	vegetation
Peganum garmala	Perennial	15-20	R	+	vegetation
Poa bulbosa	Perennial	15–17	A	1	vegetation
Tortula desertorum	moss	0.3–0.5	A	1	vegetation
Tulipa lehmanniana	Perennial	10–15	R	+	vegetation
Xylosalsola arbuscula (Salsola arbuscula)	shrub	40–50	R	+	vegetation



[redacted] Sandy plain with saltwort-ephemeroid-sagebrush vegetation. In the foreground – *Ferula foetida.*

[redacted] A flat sandy desert plain, near the border of saline depression. Native ephemeroid-saltwort community with canopy cover of 30% on sandy desert soil (Photo 12). 17 plant and 1 moss species were recorded (Table 8), includins 3 generative and 18 pre-generative specimens of nationally red-listed *Tulipa lehmanniana*. Alien plants are absent.

Table 8. Check-list of plants recorded in survey plot [redacted]

Species	Life form	Height, cm	Abundance		Phenol. Stage
			DAFOR	Braun-Blanquet	

Acanthophyllum elatius	Perennial	35-40	R	+	vegetation
Alyssum desertorum	annual	5–6	O	+	flowering
Artemisia diffusa	semishrub	20–25	D	2	vegetation
Astragalus rubromarginatus	Perennial	12–15	R	+	vegetation
Astragalus villosissimus	dwarf shrub	35-40	R	+	vegetation
Caroxylon orientale (Salsola orientalis)	dwarf shrub	35-40	A	1	vegetation
Ceratocarpus arenarius	annual	15-20	R	+	Dried
Ceratocephala falcate	annual	3–4	O	+	flowering
Convolvulus hamadae	semishrub	25–30	O	+	vegetation
Ferula foetida	Perennial	30–35	O	+	flowering
Halothamnus subaphyllus	semishrub	40–45	R	+	vegetation
Hypecoum pendulum	annual	12–15	O	+	flowering
Ixiolirion tataricum	Perennial	12–15	R	+	vegetation
Oreosalsola arbusculiformis (Salsola arbusculiformis)	dwarf shrub	35-40	O	+	vegetation
Peganum garmala	Perennial	15-20	R	+	vegetation
Poa bulbosa	Perennial	15–17	A	1	vegetation
Tortula desertorum	moss	0.3–0.5	O	+	vegetation
Tulipa lehmanniana	Perennial	12–15	R	+	vegetation



Flat sandy desert plain with ephemeroid-saltwort vegetation, near the edge of the cliffs of saline depression

[redacted] Native saltwort-ephemeroid-sagebrush community (*Artemisia diffusa, Poa bulbosa, Carex subphysodes, Caroxylon orientale, Ferula foetida*) on sabulous soil (photo 13); 11 plant and 1 moss species were recorded (Table 9). 9 pre-generative specimens of red-listed *Tulipa lehmanniana* were found. Alien plants are absent.

Table 9. Check-list of plants recorded in survey plot [redacted]

Species	Life form	Height, cm	Abundance		Phenol. Stage
			DAFOR	Braun-Blanquet	
Artemisia diffusa	semishrub	25–30	D	2	vegetation
Astragalus villosissimus	dwarf shrub	35-40	R	+	vegetation
Bassia prostrata (*Kochia prostrata)*	semishrub	15–20	R	+	vegetation
Carex subphysodes	Perennial	12–15	A	1	flowering
Caroxylon orientale (Salsola orientalis)	dwarf shrub	35-40	A	1	vegetation
Convolvulus hamadae	semishrub	25–30	R	+	vegetation
Ferula foetida	Perennial	40–50	O	1	Vegetation, flowering
Peganum garmala	Perennial	15-20	R	+	vegetation
Poa bulbosa	Perennial	15–17	A	1	vegetation
Tortula desertorum	moss	0.3–0.5	O	+	vegetation
Tulipa lehmanniana	Perennial	10–15	R	+	vegetation
Xylosalsola arbuscula (Salsola arbuscula)	shrub	40–50	R	+	vegetation



Photo 13. [redacted] Sandy plain with saltwort-ephemeroid-sagebrush vegetation

[redacted]

[redacted]The same native ephemeroid-sagebrush community (*Artemisia diffusa, Poa bulbosa, Carex subphysodes*) was described on 4 survey plots situated along the border of flat sandy desert plain and steep slopes of saline depression (photo 14–15); the differences between these areas are negligible. 12 plant and 1 moss species were recorded (Table 10), includins solitary specimens of red-listed *Tulipa lehmanniana*. The second tulip species, *Tulipa sogdiana,* has been included in first, second and third editions of the Red Data Book of Uzbekistan (1984, 1998, 2006). As a result of field surveys performed during the last 20 years, it has been revealed that *Tulipa sogdiana* is common in desert zone of Uzbekistan, and it has been removed from the national Red Data Book. Alien plants are absent. The soil is sabulous and somewhat gravelly, and the terrain is flat.

Table 10. Check-list of plants recorded in survey plots [redacted]

Species	Life form	Height, cm	Abundance		Phenol. stage
			DAFOR	Braun-Blanquet	
Artemisia diffusa	semishrub	25–30	D	2	vegetation
Astragalus villosissimus	dwarf shrub	35-40	R	+	vegetation
Bassia prostrata (*Kochia prostrata)*	semishrub	15–20	R	+	vegetation
Carex subphysodes	Perennial	12–15	A	1	flowering
Caroxylon orientale (Salsola orientalis)	dwarf shrub	35-40	O	+	vegetation
Ceratocarpus arenarius	annual	15-20	R	+	Dried
Convolvulus hamadae	semishrub	25–30	R	+	vegetation
Ferula foetida	Perennial	30–35	O	+	Vegetation, flowering
Peganum garmala	Perennial	15-20	R	+	vegetation
Poa bulbosa	Perennial	15–17	A	1	vegetation
Tortula desertorum	moss	0.3–0.5	A	1	vegetation
Tulipa lehmanniana	Perennial	10–5	R	+	vegetation
Tulipa sogdiana	Perennial	7–10	R	+	vegetation



Photo 14. [redacted] Flat sandy desert plain with ephemeroid-sagebrush vegetation



Photo 15. [redacted] Flat sandy desert plain with ephemeroid-sagebrush vegetation

[redacted]

Native ephemeroid-sagebrush community (*Artemisia diffusa, Poa bulbosa, Carex subphysodes*) (photo 16); 11 plant and 1 moss species were recorded (Table 11). 3 specimens of red-listed *Tulipa lehmanniana* were found. Alien plants are absent. The soil is sabulous and somewhat gravelly, and the terrain is somewhat hilly-wavy.

Table 11. Check-list of plants recorded in survey plo[redacted]

Species	Life form	Height, cm	Abundance		Phenol. Stage
			DAFOR	Braun-Blanquet	
Artemisia diffusa	semishrub	25–30	D	2	vegetation
Astragalus villosissimus	dwarf shrub	35-40	R	+	vegetation
Bassia prostrata (*Kochia prostrata*)	semishrub	15–20	R	+	vegetation
Carex subphysodes	Perennial	12–15	A	1	flowering
Caroxylon orientale (*Salsola orientalis*)	dwarf shrub	35-40	O	+	vegetation
Caroxylon scleranthum (*Salsola sclerantha*)	annual	20-25	R	+	Dried
Ceratocarpus arenarius	annual	15-20	R	+	Dried
Convolvulus hamadae	semishrub	25–30	R	+	vegetation
Peganum garmala	Perennial	15-20	R	+	vegetation
Poa bulbosa	Perennial	15–17	O	+	vegetation
Tortula desertorum	moss	0.3–0.5	O	+	vegetation
Tulipa lehmanniana	Perennial	10–15	R	+	vegetation



[redacted] Hilly-wavy sandy desert plain with ephemeroid-sagebrush vegetation

[redacted] Native ephemeroid-sagebrush community (*Artemisia diffusa, Poa bulbosa, Carex subphysodes*) (photo 17); 11 plant and 1 moss species were recorded (Table 12), red-listed and alien plants are absent. The soil is sabulous and somewhat gravelly, and the terrain is somewhat wavy.

Table 12. Check-list of plants recorded in survey pl[redacted]

Species	Life form	Height, cm	Abundance	Phenol. stage

			DAFOR	Braun-Blanquet	
Artemisia diffusa	semishrub	25–30	D	2	vegetation
Astragalus villosissimus	dwarf shrub	35-40	R	+	vegetation
Bassia prostrata (*Kochia prostrata)*	semishrub	15–20	R	+	vegetation
Carex subphysodes	Perennial	12–15	A	1	flowering
Caroxylon orientale (Salsola orientalis)	dwarf shrub	35-40	O	+	vegetation
Ceratocarpus arenarius	annual	15-20	R	+	Dried
Convolvulus hamadae	semishrub	25–30	R	+	vegetation
Ferula foetida	Perennial	50–60	R	+	flowering
Peganum garmala	Perennial	15-20	O	+	vegetation
Poa bulbosa	Perennial	15–17	O	+	vegetation
Tortula desertorum	moss	0.3–0.5	O	+	vegetation
Tulipa sogdiana	Perennial	7–10	R	+	vegetation



[redacted] Sandy desert plain with ephemeroid-sagebrush vegetation

[redacted]

Native ephemeroid-sagebrush community (*Artemisia diffusa, Poa bulbosa, Carex subphysodes*) (photo 18); 8 plant and 1 moss species were recorded (Table 13), red-listed and alien plants are absent. The soil is sabulous and somewhat gravelly. The same vegetation is in the center of bird monitoring point VP1.

Table 13. Check-list of plants recorded in survey plot [redacted]

Species	Life form	Height, cm	Abundance		Phenol. Stage
			DAFOR	Braun-Blanquet	
Artemisia diffusa	semishrub	25–30	D	2	vegetation

Astragalus villosissimus	dwarf shrub	35-40	R	+	vegetation
Carex subphysodes	Perennial	12–15	A	1	flowering
Caroxylon orientale (Salsola orientalis)	dwarf shrub	25-30	R	+	vegetation
Ceratocarpus arenarius	annual	15-20	R	+	Dried
Convolvulus hamadae	semishrub	25–30	R	+	vegetation
Peganum garmala	Perennial	15-20	R	+	vegetation
Poa bulbosa	Perennial	15–17	O	+	vegetation
Tortula desertorum	moss	0.3–0.5	A	1	vegetation



[redacted] Flat sandy desert plain with ephemeroid-sagebrush vegetation

[redacted]

Native ephemeroid-sagebrush community (*Artemisia diffusa, Poa bulbosa, Carex subphysodes*) (photo 19); 14 plant and 1 moss species were recorded (Table 14), one of them is nationally red-listed (*Tulipa lehmanniana,* photo 20); alien plants are absent. 1 generative and 8 pre-generative specimens of *Tulipa lehmanniana* have been count. A colony of gerbils (*Meriones sp.*) is situated on the area. The sandy soil is somewhat gravelly.

Table 14. Check-list of plants recorded in survey plot [redacted]

Species	Life form	Height, cm	Abundance		Phenol. Stage
			DAFOR	Braun-Blanquet	
Artemisia diffusa	semishrub	25–30	D	2	vegetation
Astragalus villosissimus	dwarf shrub	35-40	R	+	vegetation
Carex subphysodes	Perennial	12–15	A	1	flowering
Caroxylon orientale (Salsola orientalis)	dwarf shrub	25-30	R	+	vegetation

Ceratocarpus arenarius	annual	15-20	R	+	Dried
Convolvulus hamadae	semishrub	25–30	O	+	vegetation
Cousinia hamadae	Perennial	15–20	R	+	vegetation
Ferula foetida	Perennial	50–60	O	+	flowering
Iris songarica	Perennial	30–35	R	+	vegetation
Oreosalsola arbusculiformis (Salsola arbusculiformis)	dwarf shrub	35-40	O	+	vegetation
Peganum garmala	Perennial	15-20	R	+	vegetation
Poa bulbosa	Perennial	15–17	A	1	vegetation
Tortula desertorum	moss	0.3–0.5	A	1	vegetation
Tulipa lehmanniana	Perennial	7–10	R	+	vegetation
Tulipa sogdiana	Perennial	7–10	R	+	vegetation



Flat sandy desert plain with ephemeroid-sagebrush vegetation



[redacted] Non-flowering generative specimen of nationally red-listed *Tulipa lehmanniana*

[redacted]

Native saltwort-ephemeroid-sagebrush community (*Artemisia diffusa, Poa bulbosa, Carex subphysodes, Salsola orientalis*) (photo 21); 13 plant species were recorded (Table 15), red-listed or alien plants are absent.

Table 15. Check-list of plants recorded in survey plot [redacted]

Species	Life form	Height, cm	Abundance		Phenol. Stage
			DAFOR	Braun-Blanquet	
Artemisia diffusa	semishrub	25–30	D	2	vegetation
Astragalus campylorrhynchus	annual	10-12	R	+	vegetation
Astragalus villosissimus	dwarf shrub	35-40	R	+	vegetation
Bassia prostrata (*Kochia prostrata*)	semishrub	15–20	R	+	vegetation
Carex subphysodes	Perennial	12–15	A	1	flowering
Caroxylon orientale (*Salsola orientalis*)	dwarf shrub	25–30	A	1	vegetation
Ceratocarpus arenarius	annual	15-20	R	+	Dried
Convolvulus hamadae	semishrub	25–30	R	+	vegetation
Ferula foetida	Perennial	50–60	O	+	flowering
Iris songarica	Perennial	30–35	O	+	vegetation
Oreosalsola arbusculiformis (*Salsola arbusculiformis*)	dwarf shrub	35-40	R	+	vegetation
Poa bulbosa	Perennial	15–17	A	1	vegetation
Tortula desertorum	moss	0.3–0.5	O	+	vegetation
Tulipa sogdiana	Perennial	7–10	R	+	vegetation



[redacted] Flat sandy plain with saltwort-ephemeroid-sagebrush vegetation

[redacted] Native saltwort-ephemeroid-sagebrush community (*Artemisia diffusa, Poa bulbosa, Carex subphysodes, Ferula foetida, Iris songarica, Caroxylon orientale*) (photo 22); 17 plant species and 1 moss species (*Tortula desertorum*) were recorded (Table 16), one of them is nationally red-listed (*Tulipa lehmanniana*) (photo 23); alien plants are absent. Number of specimens of *Tulipa lehmanniana* is 16: 4 generative, 12 pre-generative. 22 generative and 34 pre-generative specimens aslo have been count on 190–300 m from the plot. A colony of gerbils (*Meriones sp.*) is situated on the area.



[redacted]. Flat sandy plain with saltwort-ephemeroid-sagebrush vegetation with local abundance of giant umbelliferous *Ferula foetida*.



Photo 23. Non-flowering generative specimen of nationally red-listed species *Tulipa lehmanniana*.

Table 16. Check-list of plants recorded in survey plot [redacted]

Species	Life form	Height, cm	Abundance	

			DAFOR	Braun-Blanquet	Phenol. Stage
Artemisia diffusa	semishrub	25–30	D	2	vegetation
Astragalus campylorrhynchus	annual	10-12	R	+	vegetation
Astragalus rubromarginatus	perennial	12-15	R	+	vegetation
Astragalus villosissimus	dwarf shrub	35-40	R	+	vegetation
Bassia prostrata (*Kochia prostrata*)	semishrub	15–20	R	+	vegetation
Carex subphysodes	Perennial	12–15	A	1	flowering
Caroxylon orientale (*Salsola orientalis*)	dwarf shrub	35-40	A	1	vegetation
Ceratocarpus arenarius	annual	15-20	R	+	Dried
Convolvulus hamadae	semishrub	25–30	R	+	vegetation
Cousinia hamadae	Perennial	15–20	R	+	vegetation
Ferula foetida	Perennial	50–60	A	1	flowering
Iris songarica	Perennial	30–35	A	1	vegetation
Peganum garmala	Perennial	15-20	R	+	vegetation
Poa bulbosa	Perennial	15–17	D	2	vegetation
Tortula desertorum	moss	0.3–0.5	A	1	vegetation
Tulipa lehmanniana	Perennial	7–10	R	+	vegetation
Tulipa sogdiana	Perennial	7–10	R	+	Vegetation
Xylosalsola arbuscula (*Salsola arbuscula*)	Shrub	50–60	R	+	vegetation

[redacted]Native ephemeroid-sagebrush community (*Artemisia diffusa, Poa bulbosa, Carex subphysodes*) on sabulous, somewhat gravelly desert soil (photo 24). The canopy cover is 20–25%. One moss and 9 plant species were recorded (Table 17), none of them are red-listed or alien.

Table 17. Check-list of plants recorded in survey plot [redacted]

Species	Life form	Height, cm	Abundance		Phenol. stage
			DAFOR	Braun-Blanquet	
Artemisia diffusa	semishrub	25–30	D	2	vegetation
Bassia prostrata (*Kochia prostrata*)	semishrub	15–20	R	+	vegetation
Carex subphysodes	Perennial	12–15	A	1	flowering
Cousinia hamadae	Perennial	15–20	R	+	vegetation
Ferula foetida	Perennial	50–60	O	+	flowering
Iris songarica	Perennial	30–35	R	+	vegetation
Poa bulbosa	Perennial	15–17	A	1	vegetation
Tortula desertorum	moss	0.3–0.5	A	1	vegetation
Tulipa sogdiana	Perennial	7–10	R	+	vegetation
Xylosalsola arbuscula (*Salsola arbuscula*)	Shrub	50–60	R	+	vegetation



[redacted] Flat sandy plain with ephemeroid-sagebrush vegetation

[redacted]ative ephemeroid-sagebrush community (*Artemisia diffusa, Poa bulbosa, Carex subphysodes*) on sabulous, somewhat gravelly desert soil. One moss and 9 plant species were recorded (Table 18), none of them are red-listed or alien.

Table 18. Check-list of plants recorded in survey p[redacted]

Species	Life form	Height, cm	Abundance		Phenol. stage
			DAFOR	Braun-Blanquet	
Artemisia diffusa	semishrub	25–30	D	2	vegetation
Astragalus villosissimus	dwarf shrub	35-40	R	+	vegetation
Carex subphysodes	Perennial	12–15	A	1	flowering
Caroxylon orientale (Salsola orientalis)	dwarf shrub	35-40	R	+	vegetation
Convolvulus hamadae	semishrub	25–30	R	+	vegetation
Ferula foetida	Perennial	50–60	F	+	flowering
Iris songarica	Perennial	30–35	R	+	vegetation
Poa bulbosa	Perennial	15–17	A	1	vegetation
Tortula desertorum	moss	0.3–0.5	A	1	vegetation
Zygophyllum macrophyllum	Perennial	10–12	R	+	flowering

[redacted]Native ephemeroid-sagebrush community (*Artemisia diffusa, Poa bulbosa, Carex subphysodes*) (photo 25). One moss and 11 plant species were recorded (Table 19), none of them are red-listed or alien.

Table 20. Check-list of plants recorded in survey plo[redacted]

Species	Life form	Height, cm	Abundance		Phenol. stage
			DAFOR	Braun-Blanquet	
Artemisia diffusa	semishrub	25–30	D	2	vegetation
Astragalus villosissimus	dwarf shrub	35-40	R	+	vegetation
Bassia prostrata (*Kochia prostrata*)	semishrub	15–20	R	+	vegetation
Carex subphysodes	Perennial	12–15	A	1	flowering
Caroxylon orientale (*Salsola orientalis*)	dwarf shrub	35-40	O	+	vegetation
Convolvulus hamadae	semishrub	25–30	R	+	vegetation
Ferula foetida	Perennial	50–60	R	+	flowering
Iris songarica	Perennial	30–35	R	+	vegetation
Peganum garmala	Perennial	15-20	R	+	vegetation
Poa bulbosa	Perennial	15–17	A	1	vegetation
Tortula desertorum	moss	0.3–0.5	O	+	vegetation
Tulipa sogdiana	Perennial	7–10	R	+	vegetation



[redacted] Flat sandy plain with ephemeroid-sagebrush vegetation

[redacted] Native ephemeroid-sagebrush community (*Artemisia diffusa, Poa bulbosa, Carex subphysodes, Ferula foetida*). One moss and 18 plant species were recorded (Table 21), none of them are red-listed or alien.

Table 21. Check-list of plants recorded in survey plot [redacted]

Species	Life form	Height, cm	Abundance		Phenol. Stage
			DAFOR	Braun-Blanquet	
Alyssum desertorum	annual	5–6	R	+	Flowering, fruiting
Artemisia diffusa	semishrub	25–30	D	2	vegetation

Astragalus campylorrhynchus	annual	10-12	R	+	vegetation
Astragalus villosissimus	dwarf shrub	35-40	R	+	vegetation
Carex subphysodes	Perennial	12–15	A	1	flowering
Caroxylon orientale (Salsola orientalis)	dwarf shrub	35-40	O	+	vegetation
Ceratocarpus arenarius	annual	15-20	R	+	Dried
Climacoptera sp.	annual	7–10	R	+	vegetation
Convolvulus hamadae	semishrub	25–30	R	+	vegetation
Cousinia hamadae	Perennial	15–20	R	+	vegetation
Ferula foetida	Perennial	50–60	A	1	flowering
Hypecoum pendulum	annual	12–15	R	+	flowering
Iris songarica	Perennial	30–35	R	+	vegetation
Peganum garmala	Perennial	15-20	R	+	vegetation
Poa bulbosa	Perennial	15–17	D	2	vegetation
Suaeda sp.	annual	7–10	R	+	vegetation
Tortula desertorum	moss	0.3–0.5	A	1	vegetation
Tulipa sogdiana	Perennial	7–10	R	+	vegetation
Xylosalsola arbuscula (Salsola arbuscula)	Shrub	50–60	R	+	vegetation



[redacted] Flat-wavy sandy plain with ephemeroid-sagebrush vegetation

4.1.2. Cliffs and eroded slopes of saline depression

[redacted] Slopes and bottom of saline depression. Native sparse ephemeroid-saltwort community was described on 4 survey plots on steep eroded sandstone slopes and bottom of saline depression (canopy cover is 0–10%); the differences between these areas are negligible.

17 plant and 1 moss species were recorded (Table 22), includins solitary specimens of red-listed *Tulipa lehmanniana*. Alien plants are absent.

Table 22. Check-list of plants recorded in survey plots [redacted] April 2021.

Species	Life form	Height, cm	Abundance		Phenol. Stage
			DAFOR	Braun-Blanquet	
Artemisia diffusa	semishrub	20–25	O	+	vegetation
Astragalus ammotrophus	Perennial	12–15	R	+	vegetation
Astragalus villosissimus	dwarf shrub	35-40	R	+	vegetation
Atraphaxis spinosa	shrub	20–25	R	+	vegetation
Bassia prostrata (*Kochia prostrata)*	semishrub	15–20	R	+	vegetation
Caroxylon orientale (Salsola orientalis)	dwarf shrub	35-40	O	+	vegetation
Ceratocarpus arenarius	annual	15-20	R	+	Dried
Climacoptera sp.	annual	15-20	R	+	Dried
Convolvulus hamadae	semishrub	25–30	O	+	vegetation
Cousinia hamadae	Perennial	15–20	R	+	vegetation
Ferula foetida	Perennial	30–35	R	+	flowering
Oreosalsola arbusculiformis (Salsola arbusculiformis)	dwarf shrub	35-40	A	1	vegetation
Peganum garmala	Perennial	15-20	R	+	vegetation
Poa bulbosa	Perennial	15–17	A	1	vegetation
Tortula desertorum	moss	0.3–0.5	O	+	vegetation
Tulipa lehmanniana	Perennial	12–15	R	+	vegetation
Tulipa sogdiana	Perennial	7–10	R	+	vegetation
Zygophyllum macrophyllum	Perennial	10–12	R	+	flowering



[redacted] Eroded sandstone slopes of saline depression with very sparse saltwort vegetation



[redacted] Eroded sandstone slopes of saline depression with very sparse saltwort vegetation

[redacted] Slopes of saline depression.

Native sparse saltwort community on steep eroded sandstone slopes and bottom of saline depression (canopy cover is 0–10%). One moss and 13 plant species were

recorded (Table 23), none of them are alien. 7 generative and 18 non-generative specimens of nationally red-listed *Tulipa lehmanniana* were found within the sample plot.

Table 23. Check-list of plants recorded in survey plo[redacted] pril 2021.

Species	Life form	Height, cm	Abundance		Phenol. stage
			DAFOR	Braun-Blanquet	
Artemisia diffusa	semishrub	25–30	D	2	vegetation
Astragalus villosissimus	dwarf shrub	35-40	O	+	vegetation
Atraphaxis spinosa	shrub	20–25	R	+	vegetation
Bassia prostrata (*Kochia prostrata)*	semishrub	15–20	R	+	vegetation
Carex subphysodes	Perennial	12–15	A	1	flowering
Caroxylon orientale (Salsola orientalis)	dwarf shrub	35-40	O	+	vegetation
Ceratocarpus arenarius	annual	15-20	R	+	Dried
Convolvulus hamadae	semishrub	25–30	R	+	vegetation
Ferula foetida	Perennial	50–60	R	+	flowering
Oreosalsola arbusculiformis (Salsola arbusculiformis)	dwarf shrub	35-40	O	+	vegetation
Peganum garmala	Perennial	15-20	R	+	vegetation
Poa bulbosa	Perennial	15–17	A	1	vegetation
Tortula desertorum	moss	0.3–0.5	O	+	vegetation
Tulipa lehmanniana	Perennial	12–15	R	+	vegetation





[redacted] Flat sandy desert plain with sparse saltwort-ephemeroid-sagebrush vegetation intensively grazed by livestock on the top of cliff (above). Eroded steep sandstone slopes of saline depression with very sparse saltwort vegetation (below).

[redacted] A border of flat sandy desert plain and steep slopes of saline depression.

Intensively grazed by livestock native saltwoth-ephemeroid-sagebrush community (*Artemisia diffusa, Poa bulbosa, Carex subphysodes, Caroxylon orientale*) with canopy cover of 10–15% on saline sabulous-loamy grey-brown desert soil on the top of cliff, and very sparse saltwort community on steep eroded sandstone slopes and bottom of saline depression (canopy cover is 0–10%). One moss and 14 plant species were recorded (Table 24), none of them are alien. 4 generative and 21 non-generative specimens of nationally red-listed *Tulipa lehmanniana* were found within the sample plot.

Table 24. Check-list of plants recorded in survey plot [redacted]

Species	Life form	Height, cm	Abundance		Phenol. stage
			DAFOR	Braun-Blanquet	
Artemisia diffusa	semishrub	25–30	A	1 to 2	vegetation
Astragalus ammotrophus	Perennial	12–15	R	+	vegetation
Astragalus villosissimus	dwarf shrub	35-40	O	+	vegetation
Atraphaxis spinosa	shrub	20–25	R	+	vegetation
Bassia prostrata (*Kochia prostrata)*	semishrub	15–20	R	+	vegetation
Carex subphysodes	Perennial	12–15	A	+	flowering
Caroxylon orientale (Salsola orientalis)	dwarf shrub	35-40	A	+ to 1	vegetation
Ceratocarpus arenarius	annual	15-20	R	+	Dried
Convolvulus hamadae	semishrub	25–30	O	+	vegetation

Cousinia hamadae	Perennial	15–20	R	+	vegetation
Ferula foetida	Perennial	30–35	R	+	vegetation
Oreosalsola arbusculiformis (Salsola arbusculiformis)	dwarf shrub	35-40	A	+ to 1	vegetation
Peganum garmala	Perennial	15-20	R	+	vegetation
Poa bulbosa	Perennial	15–17	A	1	vegetation
Tortula desertorum	moss	0.3–0.5	O	+	vegetation
Tulipa lehmanniana	Perennial	12–15	R	+	vegetation
Zygophyllum macrophyllum	Perennial	10–12	R	+	flowering





[redacted]. Eroded steep sandstone slopes of saline depression with very sparse saltwort vegetation (above and in the center). Flat sandy desert plain with sparse saltwort-ephemeroid-sagebrush vegetation intensively grazed by livestock on the top of cliff (below).

[redacted]

80 m to the south-west of [redacted] turbine location. [redacted] m.s.l. A border of flat sandy desert plain and steep slopes of saline depression.

Native ephemeroid-sagebrush community (*Artemisia diffusa, Poa bulbosa, Carex subphysodes*) with canopy cover of 30% on the top of cliff and very sparse saltwort community on steep eroded sandstone slopes (canopy cover is 0–10%). One moss and

13 plant species were recorded (Table 25), none of them are alien. 6 generative and 8 non-generative specimens of nationally red-listed *Tulipa lehmanniana* were found within the sample plot. A colony of gerbils (*Meriones sp.*) is situated on the area of turbine location.

Table 25. Check-list of plants recorded in survey plo[redacted]

Species	Life form	Height, cm	Abundance		Phenol. stage
			DAFOR	Braun-Blanquet	
Artemisia diffusa	semishrub	25–30	D	2	vegetation
Astragalus villosissimus	dwarf shrub	35-40	R	+	vegetation
Atraphaxis spinosa	shrub	20–25	R	+	vegetation
Bassia prostrata (*Kochia prostrata)*	semishrub	15–20	R	+	vegetation
Carex subphysodes	Perennial	12–15	A	1	flowering
Caroxylon orientale (Salsola orientalis)	dwarf shrub	35-40	O	+	vegetation
Ceratocarpus arenarius	annual	15-20	R	+	Dried
Convolvulus hamadae	semishrub	25–30	R	+	vegetation
Ferula foetida	Perennial	50–60	R	+	flowering
Oreosalsola arbusculiformis (Salsola arbusculiformis)	dwarf shrub	35-40	O	+	vegetation
Peganum garmala	Perennial	15-20	R	+	vegetation
Poa bulbosa	Perennial	15–17	A	1	vegetation
Tortula desertorum	moss	0.3–0.5	O	+	vegetation
Tulipa lehmanniana	Perennial	7–10	R	+	vegetation





[redacted] Flat sandy desert plain with ephemeroid-sagebrush vegetation on the top of cliff (above). Eroded steep sandstone slopes of saline depression with very sparse saltwort vegetation (below). Parallel paths trampled by livestock are visible in the foreground

[redacted] 100 m to the north-west o[redacted]urbine location. [redacted] A border of sandy desert plain and steep eroded slopes of saline depression.

Native ephemeroid-sagebrush community (*Artemisia diffusa, Poa bulbosa, Carex subphysodes*) on the top of cliff and very sparse saltwort community on steep sandstone slopes (canopy cover is less than 5%). One moss and 17 plant species were recorded (Table 26), none of them are alien. 4 generative and 11 non-generative specimens of nationally red-listed *Tulipa lehmanniana* were found.

Table 26. Check-list of plants recorded in survey p[redacted]

Species	Life form	Height, cm	Abundance		Phenol. stage
			DAFOR	Braun-Blanquet	
Artemisia diffusa	semishrub	25–30	D	2	vegetation
Astragalus villosissimus	dwarf shrub	35-40	R	+	vegetation
Atraphaxis spinosa	shrub	20–25	R	+	vegetation
Bassia prostrata (*Kochia prostrata)*	semishrub	15–20	R	+	vegetation
Carex subphysodes	Perennial	12–15	A	1	flowering
Caroxylon orientale (Salsola orientalis)	dwarf shrub	35-40	O	+	vegetation
Climacoptera sp.	annual	12–15	R	+	vegetation
Convolvulus hamadae	semishrub	25–30	R	+	vegetation
Ferula foetida	Perennial	50–60	R	+	flowering
Iris falcifolia	Perennial	12–15	R	+	flowering
Iris songarica	Perennial	30–35	R	+	vegetation

Oreosalsola arbusculiformis (Salsola arbusculiformis)	dwarf shrub	35-40	O	+	vegetation
Peganum garmala	Perennial	15-20	R	+	vegetation
Poa bulbosa	Perennial	15–17	A	1	vegetation
Tortula desertorum	moss	0.3–0.5	O	+	vegetation
Tulipa lehmanniana	Perennial	7–10	R	+	vegetation
Tulipa sogdiana	Perennial	7–10	R	+	vegetation
Zygophyllum macrophyllum	Perennial	10–12	R	+	flowering



Steep sandstone slopes of saline depression with very sparse saltwort vegetation

4.1.3. Fixed and semi-fixed sands

Fixed and semi-fixed ridge-hilly sands prevail in the north-eastern part of “Bash” area. The vegetation of this habitat type is represented with native calligonum-saltwort-ephemeroid-sagebrush community (*Artemisia diffusa, Poa bulbosa, Carex physodes, Salsola arbuscula, Calligonum leucocladum, C. microcarpum*) and saltwort-ephemeroid-sagebrush vegetation (*Artemisia diffusa, Poa bulbosa, Carex physodes, Caroxylon orientale*). Psammophilous vegetation, particularly desert shrubs and saxaul woodlands, plays an important ecological role forming a unique landscape of sandy deserts of Central Asia and fixing sands.

The plant species diversity is higher than on flat and flat-wavy sandy desert plain (up to 30–31 species). The canopy cover is 40–50%. The vegetation is more or less uniform, only local abundance of saltworts and *Calligonum* varies on different areas. One moss species (*Tortula desertorum*) has been found in all plots; on some local areas it covers up to 5%. One nationally red-listed species, *Tulipa lehmanniana,* occurs sporadically within all territory of this habitat type, its abundance is R to O, population density varies from solitary specimens to 900–1000 per 1 hectare. The main type of land

use is pasture; an impact of grazing is medium; several shepherds houses are situated in this territory. Local impact is connected with several ground roads, railway and with electric lines. Within this habitat type, following geobotanical sample plots were described.

[redacted]

Fixed hilly sands covered with native ephemeroid-sagebrush vegetation (*Artemisia diffusa, Poa bulbosa, Carex physodes*), with psammophilous shrubs (*Calligonum leucocladum, C. microcarpum*) on the tops. The canopy cover is 30–40%. 25 plant and 1 moss species were recorded (Table 27), including solitary specimens of nationally red-listed *Tulipa lehmanniana*. Endemic to Central Asian deserts *Cousinia sogdiana* previously also was included in the Red Data Book of Uzbekistan (1984, 1998, 2006, 2009), but as a result of field surveys performed during the last 20 years, it has been revealed that this species is common in desert zone of Uzbekistan, and it has been removed from the 5th edition of the national Red Data Book. Alien plants are absent. Several colonies of gerbils (*Meriones sp.*) are situated on the area.

Table 27. Check-list of plants recorded in survey plots [redacted]

Species	Life form	Height, cm	Abundance		Phenol. Stage
			DAFOR	Braun-Blanquet	
Alyssum desertorum	annual	5–6	O	+	flowering
Artemisia diffusa	semishrub	25–30	D	2	vegetation
Astragalus villosissimus	dwarf shrub	35-40	O	+	vegetation
Bromus tectorum	annual	12–15	O	+	flowering
Calligonum leucocladum	shrub	50–70	R	+	vegetation
Calligonum microcarpum	shrub	50–70	R	+	vegetation
Carex physodes	Perennial	12–15	D	1	flowering
Caroxylon orientale (Salsola orientalis)	dwarf shrub	35-40	O	+	vegetation
Caroxylon scleranthum (Salsola sclerantha)	annual	30-35	R	+	Dried
Ceratocarpus arenarius	annual	15-20	O	+	Dried
Ceratocephala falcata	annual	3–4	O	+	flowering
Convolvulus divaricatus	semishrub	25–30	O	+	vegetation
Convolvulus hamadae	semishrub	25–30	O	1	vegetation
Cousinia sogdiana	biennial	20–35	R	+	vegetation
Ferula foetida	Perennial	50–60	O	1	flowering
Holosteum umbellatum	annual	6–8	O	+	flowering
Hypecoum pendulum	annual	12–15	O	+	flowering
Iris longiscapa	perennial	17-20	R	+	flowering
Peganum garmala	Perennial	15-20	R	+	vegetation
Poa bulbosa	Perennial	15–17	A	1	vegetation
Salsola paulsenii	annual	40–45	R	+	Dried
Sophora pachycarpa	Perennial	15–20	R	+	vegetation
Stipagrostis pennata	Perennial	30–35	R	+	vegetation
Tortula desertorum	moss	0.3–0.5	O	+	vegetation
Tulipa lehmanniana	Perennial	10–15	R	+	vegetation

Xylosalsola arbuscula (Salsola arbuscula)	shrub	40–50	O	+	vegetation



Photo 37, 38. [redacted] (above) and [redacted] (below). Fixed hilly sands with ephemeroid-sagebrush vegetation, and with psammophilous shrubs (*Calligonum leucocladum, C. microcarpum*) on the tops

[redacted]

Native calligonum-saltwort-ephemeroid-sagebrush community (*Artemisia diffusa, Poa bulbosa, Carex physodes, Xylosalsola arbuscula, Calligonum leucocladum, C.*

microcarpum) on fixed hilly sands; 30 plant and 1 moss species were recorded (Table 28), including nationally red-listed *Tulipa lehmanniana* (occurs sporadically within and between plots). The canopy cover is 40–50%. Alien plants are absent. Several colonies of gerbils (*Meriones sp.*) are situated on the territory.

Table 28. Check-list of plants recorded in survey [redacted]

Species	Life form	Height, cm	Abundance		Phenol. Stage
			DAFOR	Braun-Blanquet	
Acanthophyllum elatius	Perennial	40–45	R	+	vegetation
Alhagi pseudalhagi	Perennial	35–40	O	+	Dried
Alyssum desertorum	annual	5–6	O	+	flowering
Artemisia diffusa	semishrub	25–30	A–D	1–2	vegetation
Astragalus flexus	perennial	15-17	R	+	flowering
Astragalus villosissimus	dwarf shrub	35-40	A	1	vegetation
Bromus tectorum	annual	12–15	O	+	flowering
Calligonum leucocladum	shrub	50–100	A–O	1–2	vegetation
Calligonum microcarpum	shrub	50–100	A–O	1–2	vegetation
Carex physodes	Perennial	12–15	D	1	flowering
Caroxylon orientale (Salsola orientalis)	dwarf shrub	35-40	O	+	vegetation
Caroxylon scleranthum (Salsola sclerantha)	annual	30-35	R	+	Dried
Ceratocarpus arenarius	annual	15-20	O	+	Dried
Ceratocephala falcata	annual	3–4	O	+	flowering
Convolvulus divaricatus	semishrub	25–30	O	+	vegetation
Convolvulus hamadae	semishrub	25–30	O	+	vegetation
Cousinia hamadae	Perennial	15–20	R	+	vegetation
Cousinia sogdiana	biennial	20–35	R	+	vegetation
Ferula foetida	Perennial	50–60	O	1	flowering
Heliotropium arguzioides	Perennial	25–30	R	+	vegetation
Holosteum umbellatum	annual	6–8	O	+	flowering
Hypecoum pendulum	annual	12–15	O	+	flowering
Iris longiscapa	perennial	17-20	R	+	flowering
Iris songarica	Perennial	30–35	R	+	vegetation
Mausolea eriocarpa	semishrub	45–50	O	1	vegetation
Peganum garmala	Perennial	15-20	R	+	vegetation
Poa bulbosa	Perennial	15–17	A	1	vegetation
Salsola paulsenii	annual	40–45	R	+	Dried
Stipagrostis pennata	Perennial	30–35	O	+	vegetation
Tortula desertorum	moss	0.3–0.5	O	+	vegetation
Tulipa lehmanniana	Perennial	10–15	O	+	vegetation

Xylosalsola arbuscula (Salsola arbuscula)	shrub	40–50	A–O	1–+	vegetation

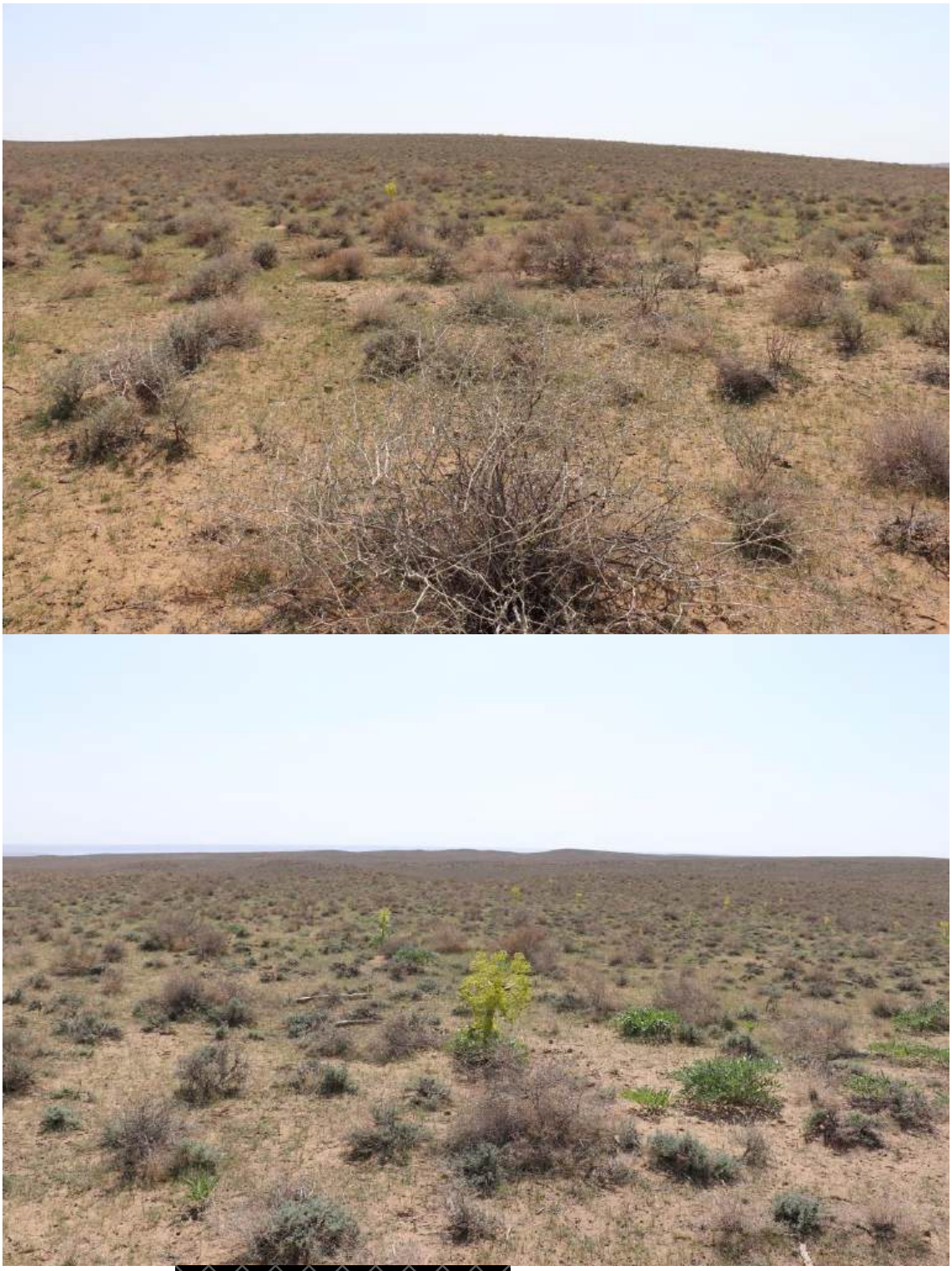


Photo 39, 40. P[redacted] (below). Fixed sands with calligonum-saltwort-ephemeroid-sagebrush vegetation



[redacted] Flowering and non-flowering generative specimens of *Tulipa lehmanniana,* nationally red-listed plant

[redacted]

Native saltwort-ephemeroid-sagebrush community (*Artemisia diffusa, Poa bulbosa, Carex physodes, Xylosalsola arbuscula, Caroxylon orientale*) on fixed hilly sands; 24 plant and 1 moss species were recorded (Table 29), including nationally red-listed *Tulipa lehmanniana* (solitary specimens occur sporadically within and between plots). The canopy cover is 30–40%. Alien plants are absent. A shepherd's house is situated on this territory, but the impact of grazing is medium.

Table 29. Check-list of plants recorded in survey plots [redacted]

Species	Life form	Height, cm	Abundance		Phenol. Stage
			DAFOR	Braun-Blanquet	
Alhagi pseudalhagi	Perennial	35–40	R	+	Dried
Alyssum desertorum	annual	5–6	O	+	flowering
Artemisia diffusa	semishrub	25–30	D	2	vegetation
Astragalus villosissimus	dwarf shrub	35-40	R	+	vegetation
Bromus tectorum	annual	12–15	O	+	flowering
Calligonum microcarpum	shrub	50–100	R	+	vegetation
Carex physodes	Perennial	12–15	D	1	flowering
Caroxylon orientale (Salsola orientalis)	dwarf shrub	35-40	A	1	vegetation
Ceratocarpus arenarius	annual	15-20	R	+	Dried
Ceratocephala falcata	annual	3–4	O	+	flowering
Convolvulus divaricatus	semishrub	25–30	R	+	vegetation

Convolvulus hamadae	semishrub	25–30	R	+	vegetation
Cousinia hamadae	Perennial	15–20	R	+	vegetation
Cousinia sogdiana	biennial	20–35	R	+	vegetation
Ferula foetida	Perennial	50–60	O–A	1	flowering
Holosteum umbellatum	annual	6–8	O	+	flowering
Hypecoum pendulum	annual	12–15	O	+	flowering
Iris longiscapa	perennial	17-20	R	+	flowering
Iris songarica	Perennial	30–35	R	+	vegetation
Peganum garmala	Perennial	15-20	R	+	vegetation
Poa bulbosa	Perennial	15–17	A	1	vegetation
Salsola paulsenii	annual	40–45	R	+	Dried
Tortula desertorum	moss	0.3–0.5	O	+	vegetation
Tulipa lehmanniana	Perennial	10–15	R	+	vegetation
Xylosalsola arbuscula (Salsola arbuscula)	shrub	40–50	O	+	vegetation





Photo 42, 43. Plot B044. Fixed sands with saltwort-ephemeroid-sagebrush vegetation, and a shepherd's house (below)

[redacted]

Native calligonum-saltwort-ephemeroid-sagebrush community (*Artemisia diffusa, Poa bulbosa, Carex physodes, Xylosalsola arbuscula, Calligonum leucocladum, C. microcarpum*) on fixed small-hilly sands; 31 plant and 1 moss species were recorded (Table 30), including nationally red-listed *Tulipa lehmanniana* (numerous mainly pre-generative specimens occurs sporadically within survey squares and between plots). The canopy cover is 40–50%. Alien plants are absent. Several colonies of gerbils (*Meriones sp.*) are situated on the area.

Table 30. Check-list of plants recorded in survey plots [redacted]

Species	Life form	Height, cm	Abundance		Phenol. Stage
			DAFOR	Braun-Blanquet	
Acanthophyllum elatius	Perennial	40–45	R	+	vegetation
Alyssum desertorum	annual	5–6	O	+	flowering
Artemisia diffusa	semishrub	25–30	A	1	vegetation
Astragalus chiwensis	perennial	25–30	R	+	vegetation
Astragalus flexus	perennial	15-17	R	+	flowering
Astragalus rubromarginatus	Perennial	12–15	R	+	vegetation
Astragalus villosissimus	dwarf shrub	35-40	A	1	vegetation
Bromus tectorum	annual	12–15	O	+	flowering
Calligonum leucocladum	shrub	50–100	A	1	vegetation
Calligonum microcarpum	shrub	50–100	A	1	vegetation

Carex physodes	Perennial	12–15	D	1	flowering
Caroxylon orientale (Salsola orientalis)	dwarf shrub	35-40	O	+	vegetation
Ceratocarpus arenarius	annual	15-20	R	+	Dried
Ceratocephala falcata	annual	3–4	O	+	flowering
Convolvulus divaricatus	semishrub	25–30	O	+	vegetation
Convolvulus hamadae	semishrub	25–30	A	1	vegetation
Cousinia hamadae	Perennial	15–20	R	+	vegetation
Cousinia sogdiana	biennial	20–35	R	+	vegetation
Ferula foetida	Perennial	50–60	O	1	flowering
Heliotropium arguzioides	Perennial	25–30	R	+	vegetation
Holosteum umbellatum	annual	6–8	O	+	flowering
Hypecoum pendulum	annual	12–15	O	+	flowering
Iris longiscapa	perennial	17-20	R	+	flowering
Iris songarica	Perennial	30–35	R	+	vegetation
Mausolea eriocarpa	semishrub	45–50	O	1	vegetation
Peganum garmala	Perennial	15-20	R	+	vegetation
Phlomoides desertotum	Perennial	15-20	R	+	vegetation
Poa bulbosa	Perennial	15–17	A	1	vegetation
Salsola paulsenii	annual	40–45	R	+	Dried
Stipagrostis pennata	Perennial	30–35	O	+	vegetation
Tortula desertorum	moss	0.3–0.5	A	1	vegetation
Tulipa lehmanniana	Perennial	10–15	O	+	vegetation
Xylosalsola arbuscula (Salsola arbuscula)	shrub	40–50	A	1	vegetation

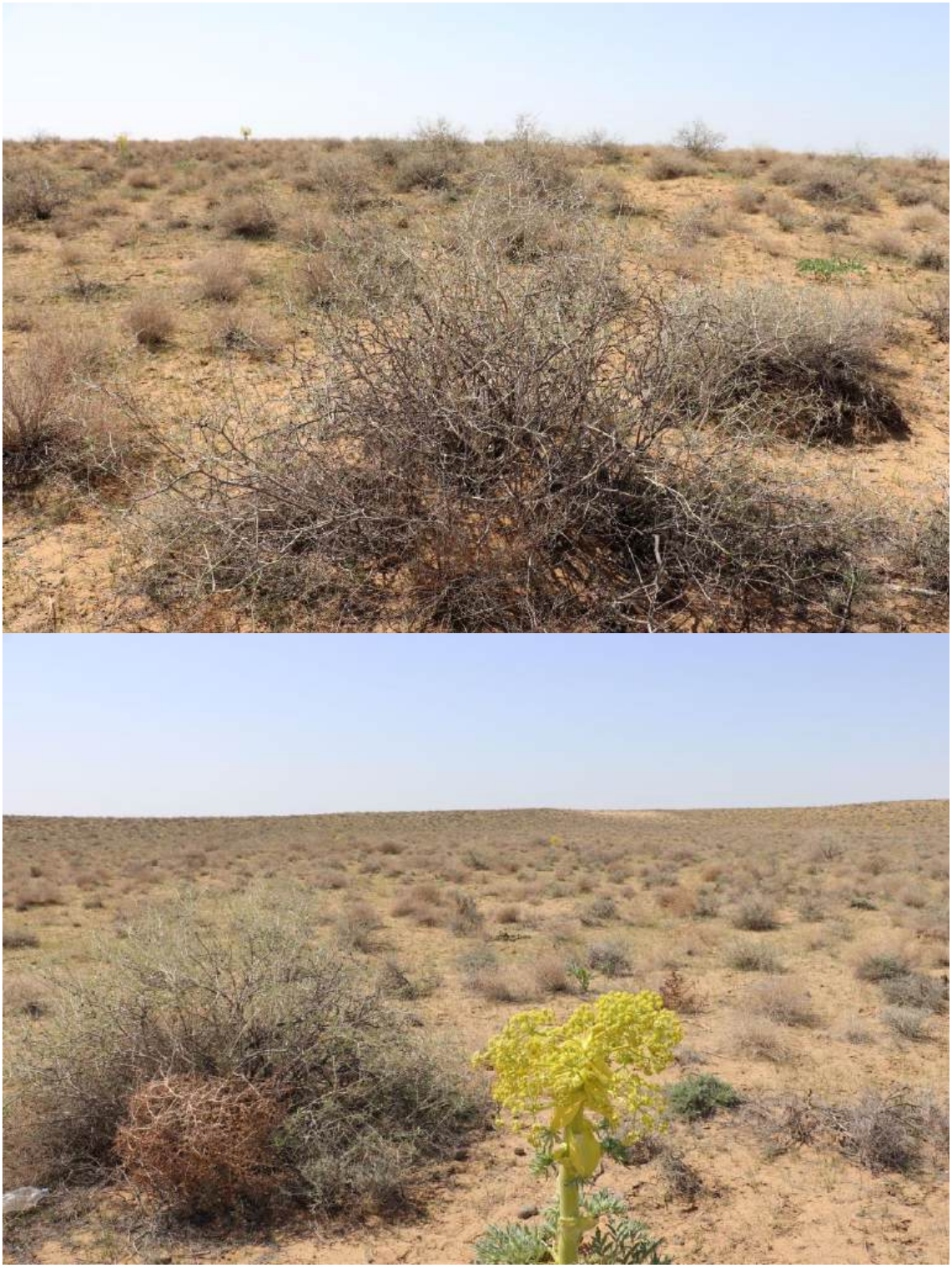


Photo 44, 45. Plots B068 (above) and B067 (below). Fixed sands with calligonum-saltwort-ephemeroid-sagebrush vegetation



Photo 46. *Calligonum microcarpum,* one of main dominant species of psammophilous shrubs of the Kyzylkum

[redacted]

The plantation of white saxaul (*Haloxylon persicum*), native dominant species of Central Asian sandy deserts, covers an area of 9x3 km of hilly sands between railway and electric line in the south-eastern part of project site. This plantation has been created in the past for fixation of sands. The saxaul stands are rather sparse, unclosed or partially closed on local areas; dominant plants of the herbaceous layer are sagebrush (*Artemisia diffusa*), desert sedge (*Carex physodes*), and *Ferula foetida*; 25 plant and 1 moss species were recorded in total within this area (Table 31), including nationally red-listed *Tulipa lehmanniana* (numerous generative and pre-generative specimens occur sporadically within and between survey squares). The canopy cover is 40–50%. Alien plants are absent. Several colonies of gerbils (*Meriones sp.*) are situated on the area.

Table 31. Check-list of plants recorded in survey plots [redacted].

Species	Life form	Height, cm	Abundance		Phenol. Stage
			DAFOR	Braun-Blanquet	
Acanthophyllum elatius	Perennial	40–45	R	+	vegetation
Alyssum desertorum	annual	5–6	O	+	flowering
Artemisia diffusa	semishrub	25–30	A	1	vegetation
Astragalus flexus	perennial	15-17	R	+	flowering
Astragalus villosissimus	dwarf shrub	35-40	O	+	vegetation
Bromus tectorum	annual	12–15	O	+	flowering
Calligonum microcarpum	shrub	50–100	R	+	vegetation
Carex physodes	Perennial	12–15	D	1	flowering

Caroxylon orientale (Salsola orientalis)	dwarf shrub	35-40	O	+	vegetation
Ceratocarpus arenarius	annual	15-20	R	+	Dried
Ceratocephala falcata	annual	3–4	O	+	flowering
Convolvulus divaricatus	semishrub	25–30	O	+	vegetation
Convolvulus hamadae	semishrub	25–30	O	+	vegetation
Ferula foetida	Perennial	50–60	D–O	2–+	flowering
Haloxylon persicum	Small tree	180–200	A–D	1–3	
Heliotropium arguzioides	Perennial	25–30	R	+	vegetation
Holosteum umbellatum	annual	6–8	O	+	flowering
Hypecoum pendulum	annual	12–15	O	+	flowering
Iris longiscapa	perennial	17-20	R	+	flowering
Iris songarica	Perennial	30–35	O	+	vegetation
Peganum garmala	Perennial	15-20	R	+	vegetation
Poa bulbosa	Perennial	15–17	A–O	1–+	vegetation
Salsola paulsenii	annual	40–45	R	+	Dried
Tortula desertorum	moss	0.3–0.5	O	+	vegetation
Tulipa lehmanniana	Perennial	10–15	O	+	vegetation
Xylosalsola arbuscula (Salsola arbuscula)	shrub	40–50	O	+	vegetation







Photo 47, 48, 49. [redacted] (below). Fixed sands with plantations of white saxaul and ephemeroid-sagebrush herbaceous layer



Photo 50. [redacted] Flowering generative specimen of *Tulipa lehmanniana,* nationally red-listed plant

4.1.4. Relic uplands

Gently sloping stony relic hills with blown sandy cover are situated in the eastern part of the project site, and small insular uplands are found in the north-western part, at the border of saline depression Ayakagytma. The landscape of its sabulous slopes covered with ephemeroid-sagebrush and ephemeroid-sagebrush-saltwort vegetation is similar with neighboring sandy desert plain. On the small areas with outcrops of beds, the stony desert with ephemeroid-dwarf shrub-sagebrush-saltwort vegetation is represented. The canopy cover varies from 10–20% on stony areas to 30–40% on sabulous places. As in other types of landscapes of the project site, the main type of land use is rangeland; an impact of grazing is medium; several shepherds houses are situated here. Local impact is connected with several ground roads and electric lines. Within this habitat type, following geobotanical sample plots were described.

[redacted]

Gently sloping sandy-stony relics hills with eroded slopes, small outcrops of beds, and with native ephemeroid-sagebrush vegetation (*Artemisia diffusa, Poa bulbosa, Carex subphysodes*); species diversity is low; 12 plant and 1 moss species were recorded (Table 32). The canopy cover is 25–30%. The impact of grazing is medium to low.

Table 32. Check-list of plants recorded in survey plots [redacted]

Species	Life form	Height, cm	Abundance		Phenol. Stage
			DAFOR	Braun-Blanquet	
Artemisia diffusa	semishrub	15–20	D	2–3	vegetation
Carex subphysodes	Perennial	12–15	A	1	flowering
Caroxylon orientale (Salsola orientalis)	dwarf shrub	35-40	R	+	vegetation
Ceratocarpus arenarius	annual	15-20	R	+	Dried

Convolvulus hamadae	semishrub	25–30	R	+	vegetation
Cousinia hamadae	Perennial	15–20	R	+	vegetation
Ferula foetida	Perennial	30–35	R–O	+	vegetation
Holosteum umbellatum	annual	6–8	R	+	flowering
Iris songarica	Perennial	30–35	R	+	vegetation
Meniocus linifolius	annual	6–7	O	+	Flowering, fruiting
Oreosalsola arbusculoformis (Salsola arbusculiformis)	dwarf shrub	35-40	R	+	vegetation
Poa bulbosa	Perennial	15–17	A	1	vegetation
Tortula desertorum	moss	0.3–0.5	O–A	+–1	vegetation



Photo 51. Plot B034. Gently sloping sandy-stony relic hills with ephemeroid-sagebrush vegetation

[redacted]

Gently sloping stony relic hill with sandy cover and with native ephemeroid-saltwort-sagebrush vegetation (*Oreosalsola arbusculiformis, Caroxylon orientale, Artemisia diffusa, Poa bulbosa, Carex subphysodes*). 16 plant and 1 moss species were recorded (Table 33), including solitary specimens of nationally red-listed *Tulipa lehmanniana*. The canopy cover is 40%.

Table 33. Check-list of plants recorded in survey plots [redacted].

Species	Life form	Height, cm	Abundance		Phenol. Stage
			DAFOR	Braun-Blanquet	
Alyssum desertorum	annual	5–6	O	+	flowering

Artemisia diffusa	semishrub	15–20	D	2	vegetation
Astragalus villosissimus	dwarf shrub	35-40	O	+	vegetation
Carex subphysodes	Perennial	12–15	A	1	flowering
Caroxylon orientale (Salsola orientalis)	dwarf shrub	35-40	A	1	vegetation
Ceratocarpus arenarius	annual	15-20	R	+	Dried
Convolvulus divaricatus	semishrub	25–30	R	+	vegetation
Convolvulus hamadae	semishrub	25–30	O	+	vegetation
Cousinia hamadae	Perennial	15–20	R	+	vegetation
Ferula foetida	Perennial	30–35	R	+	vegetation
Holosteum umbellatum	annual	6–8	O	+	flowering
Iris songarica	Perennial	30–35	R	+	vegetation
Oreosalsola arbusculiformis (Salsola arbusculiformis)	dwarf shrub	35-40	A	1	vegetation
Poa bulbosa	Perennial	15–17	A	1	vegetation
Tortula desertorum	moss	0.3–0.5	O	+	vegetation
Tulipa lehmanniana	Perennial	10–15	R	+	vegetation
Tulipa sogdiana	Perennial	7–10	R	+	vegetation



Photo 52. [redacted]. Gently sloping sandy-stony relic hill with ephemeroid-saltwort-sagebrush vegetation

[redacted]

Gently sloping stony relic hill with blown sandy cover, sometimes with local outcrops of beds, and with native ephemeroid-sagebrush vegetation (*Artemisia diffusa, Poa bulbosa, Carex subphysodes*). 16 plant and 1 moss species were recorded (Table 34), including solitary specimens of nationally red-listed *Tulipa lehmanniana*. The giant umbelliferous *Ferula foetida* is abundant on local areas on top of the hills. The canopy cover is 25–30%. The impact of grazing is medium to low. Colonies of gerbils (*Meriones sp.*) occur sporadically on the area, and nationally red-listed Central Asian turtles (*Testudo horsfieldii*) are very numerous on this part of project site.

Table 34. Check-list of plants recorded in survey plots [redacted]

Species	Life form	Height, cm	Abundance		Phenol. Stage
			DAFOR	Braun-Blanquet	
Acanthophyllum elatius	Perennial	25–30	R	+	vegetation
Alyssum desertorum	annual	5–6	O	+	flowering
Artemisia diffusa	semishrub	15–20	D	2–3	vegetation
Astragalus villosissimus	dwarf shrub	30-35	R	+	vegetation
Carex subphysodes	Perennial	12–15	O–A	+–1	flowering
Caroxylon orientale (Salsola orientalis)	dwarf shrub	35-40	R	+	vegetation
Ceratocarpus arenarius	annual	15-20	R	+	Dried
Convolvulus hamadae	semishrub	25–30	R	+	vegetation
Cousinia hamadae	Perennial	15–20	R	+	vegetation
Ferula foetida	Perennial	30–35	R–A	+–1	vegetation
Holosteum umbellatum	annual	6–8	R	+	flowering
Iris songarica	Perennial	30–35	R	+	vegetation
Oreosalsola arbusculiformis (Salsola arbusculiformis)	dwarf shrub	35-40	R	+	vegetation
Poa bulbosa	Perennial	15–17	O–A	+–1	vegetation
Tortula desertorum	moss	0.3–0.5	O–A	+–1	vegetation
Tulipa lehmanniana	Perennial	10–15	R	+	vegetation
Tulipa sogdiana	Perennial	7–10	R	+	vegetation







Photo 53, 54, 55 [redacted] Gently sloping sandy-stony relic hills with uniform ephemeroid-sagebrush vegetation

[redacted]

Rather small, gently sloping stony hill with blown sandy cover and native ephemeroid-dwarf shrub-sagebrush-saltwort vegetation (*Oreosalsola arbusculiformis, Caroxylon orientale, Artemisia diffusa, Astragalus villosissimus, Convolvulus hamadae, Poa bulbosa, Carex subphysodes*). This insular relic hill is situated on the boundary between sandy desert plain and saline depression. 19 plant and 1 moss species were recorded (Table 35). The canopy cover is 20–30%. Solitary generative and numerous pre-generative specimens of nationally red-listed *Tulipa lehmanniana* occurs sporadically within and between the survey squares.

Table 35. Check-list of plants recorded in survey plots [redacted]

Species	Life form	Height, cm	Abundance		Phenol. Stage
			DAFOR	Braun-Blanquet	
Alyssum desertorum	annual	5–6	O	+	flowering
Artemisia diffusa	semishrub	15–20	A	1	vegetation
Astragalus villosissimus	dwarf shrub	35-40	A	1	vegetation
Carex subphysodes	Perennial	12–15	A	1	flowering
Caroxylon orientale (Salsola orientalis)	dwarf shrub	35-40	A	1	vegetation
Ceratocarpus arenarius	annual	15-20	R	+	Dried
Convolvulus hamadae	semishrub	25–30	A	1	vegetation
Cousinia hamadae	Perennial	15–20	O	+	vegetation
Ferula foetida	Perennial	30–35	R	+	vegetation

Halothamnus subaphyllus	semishrub	40–45	R	+	vegetation
Holosteum umbellatum	annual	6–8	O	+	flowering
Iris songarica	Perennial	30–35	R	+	vegetation
Ixiolirion tataricum	Perennial	12–15	R	+	vegetation
Oreosalsola arbusculiformis (Salsola arbusculiformis)	dwarf shrub	35-40	A	1	vegetation
Peganum garmala	Perennial	15-20	R	+	vegetation
Phlomoides desertotum	Perennial	15-20	R	+	vegetation
Poa bulbosa	Perennial	15–17	A	1	vegetation
Tortula desertorum	moss	0.3–0.5	O	+	vegetation
Tulipa lehmanniana	Perennial	10–15	R	+	vegetation
Tulipa sogdiana	Perennial	7–10	R	+	vegetation





Photo 56, 57. [redacted] and an area between plots [redacted] (below). Sandy-stony relic hill with ephemeroid- dwarf shrub-sagebrush-saltwort vegetation

4.1.5. Anthropogenic disturbed areas

At the present, technologically disturbed areas occupy only very small part of the project site, mainly in a narrow strip along the railway and underground gas pipeline (approximately 500–100 m wide). Small disturbed areas (construction sites or quarries about 250x150 and 350x250 m in size) with almost completely exterminated vegetation are located also in the south-eastern part of the project site, in surroundings of the survey plot B054. The plant species recorded here are the same that in surroundings of disturbed areas, but the canopy cover is extremely sparse, or the vegetation is almost completely exterminated (photo 58). Alien or red-listed plants are absent.

Such technogenically disturbed areas in the Kyzylkum desert, as well as overgrazed areas around farms, wells and villages, usually become centers of erosion which can lead to the formation of moving sands. Often this process can reach disaster scale. In the past, moving sands have frequently caused the death of cities and oases in desert zone of Central Asia.



Photo 58. Technologically disturbed area (construction site?) with almost completely exterminated vegetation, 1 km to the south of survey plot [redacted]



Photo 59 *Peganum garmala*, an indicator of overgrazing and degradation of pastures

4.2. Dzhankeldy site

A total check-list of vascular plants recorded within the project site “Dzhankeldy” during the field survey in springtime and early summer includes … species (Appendix 2). Following habitat types (map units) were identified for the “Dzhankeldy” site:

4.2.1. Weakly inclined piedmont plain of relic low mountains

The field survey showed that this habitat type is present mainly in the southern part of “Dzhankeldy” area (on the southern proluvial piedmont trails of the mountains Kuldzhuktau), including the bird survey circles VP1, VP2, VP9 and VP10, as well as in the north-eastern part of the project site. The terrain is flat, wavy or gently hilly, sometimes with dry riverbeds and debris cones. The vegetation is represented with native ephemeroid-sagebrush, ephemeroid-saltwort-sagebrush, sagebrush-saltwort and saltwort plant communities on sabulous, loamy, slightly saline, gypsaceous or skeleton sabulous-loamy grey-brown desert soil. Dominant plants are *Artemisia turanica, Artemisia diffusa, Poa bulbosa, Carex pachystylis, Caroxylon orientale (Salsola orientalis)* and *Oreosalsola arbusculiformis (Salsola arbusculiformis))*. The dwarf shrub *Astragalus villosissimus,* giant umbellifer *Ferula foetida* and endemic desert-candle *Eremurus korolkowii* are subdominants on local areas. The canopy cover is sparse (10–30% or less), and plant species diversity is low (8 to 18 species). One moss species (*Tortula desertorum*) has been found in this habitat type; on some local areas it covers up to 1%. One nationally red-listed species, *Tulipa lehmanniana,* occurs sporadically within all territory of this habitat type, its abundance is R to O, population density varies from solitary specimens to 900–1000 per 1 hectare. The main type of land use is pasture; an impact of grazing is medium. Local impact is connected with asphalt road and several ground roads, and with geological exploration. Within this habitat type, following geobotanical sample plots were described.

[redacted]

Weakly inclined loamy-gravelly piedmont desert plain with native sagebrush-saltwort vegetation on gypsaceous, skeleton grey-brown desert soil (Photo 60–61). The canopy cover is 10–20%; 17 plant and 1 moss species were recorded (Table 36), none of them are alien. One species, *Eremurus korolkowii,* is national endemic of Uzbekistan and endemic to relic mountains of Kyzylkum (Photo 62). This species has been included in second and third editions of the Red Data Book of Uzbekistan (1998, 2006), but later it has been removed from the national Red Data Book (2009, 2019). This plant is not evaluated in the IUCN Red List.

Table 36. Check-list of plants recorded in survey plot [redacted]

Species	Life form	Height, cm	Abundance		Phenol. Stage
			DAFOR	Braun-Blanquet	
Artemisia diffusa	semishrub	20–25	A	1	vegetation
Artemisia turanica	semishrub	20–25	A	1	vegetation
Astragalus villosissimus	dwarf shrub	30–35	O	+	vegetation
Atraphaxis spinosa	shrub	30–35	R	+	vegetation
Carex pachystylis	Perennial	12–15	O	+	flowering
Caroxylon orientale (Salsola orientalis)	dwarf shrub	30-35	A	1	vegetation
Ceratocarpus arenarius	annual	15-20	O	+	Dried
Climacoptera sp.	annual	25–30	O	+	Dried
Eremurus korolkowii	Perennial	25–30	O	+	Vegetation, flowering

Ferula foetida	Perennial	50–60	R	+	Vegetation, flowering
Lycium ruthenicum	shrub	40–50	R	+	vegetation
Nanophyton erinaceum	semishrub	7–10	O	+	vegetation
Oreosalsola arbusculiformis (Salsola arbusculiformis)	dwarf shrub	30-35	A	1	vegetation
Peganum garmala	Perennial	20–25	R	+	vegetation
Poa bulbosa	Perennial	15–17	O	+	vegetation
Takhtajaniantha pusilla (*Scorzonera pusilla*)	Perennial	15–17	R	+	vegetation
Tortula desertorum	moss	0.3–0.5	R	+	vegetation
Zygophyllum miniatum	Perennial	10–15	R	+	Vegetation, flowering



Photo 60. [redacted] Southern piedmont plain of Kuldzhuktau mountains with sparse sagebrush-saltwort vegetation



Photo 61. Western part of survey [redacted] Southern piedmont plain of Kuldzhuktau mountains with sparse sagebrush-saltwort vegetation



Photo 62. Korolkow's desert-candle (*Eremurus korolkowii*) national endemic of Uzbekistan and endemic to relic mountains of Kyzylkum

[redacted] Weakly inclined loamy-gravelly piedmont desert plain and gently sloping foothills with native ephemeroid-saltwort-sagebrush and sagebrush-saltwort vegetation on gypsaceous, skeleton or gravelly grey-brown desert soil (Photo 63–64). The canopy cover is 5–20%; 23 plant and 1 moss species were recorded (Table 37), none of them are alien or red-listed. One

species, *Eremurus korolkowii,* is national endemic of Uzbekistan and endemic to relic mountains of Kyzylkum.

Table 37. Check-list of plants recorded in survey plo[redacted]

Species	Life form	Height, cm	Abundance		Phenol. Stage
			DAFOR	Braun-Blanquet	
Anabasis eriopoda	semishrub	15–20	R	+	vegetation
Artemisia diffusa	semishrub	20–25	A	1	vegetation
Artemisia turanica	semishrub	20–25	A–D	1	vegetation
Astragalus villosissimus	dwarf shrub	30–35	R–O	+	vegetation
Carex pachystylis	Perennial	12–15	A–D	+–1	flowering
Caroxylon gemmascens (Salsola gemmascens)	dwarf shrub	20–30	R–O	+	vegetation
Caroxylon orientale (Salsola orientalis)	dwarf shrub	30–35	O–A	1	vegetation
Ceratocarpus arenarius	annual	15–20	R–O	+	Dried
Climacoptera sp.	annual	25–30	R	+	Dried
Eremurus korolkowii	Perennial	25–30	R–O	+	Vegetation, flowering
Ferula foetida	Perennial	50–60	R–O	+	Vegetation, flowering
Haloxylon ammodendron (*Haloxylon aphyllum*)	Small tree	40–70	R	+–1	vegetation
Iris longiscapa	Perennial	15–17	R	+	flowering
Koelpinia linearis	annual	10–12	R	+	fruiting
Lactuca orientalis	semishrub	35–40	R	+	vegetation
Lomelosia olivieri (*Scabiosa olivierii*)	annual	15–17	R	+	fruiting
Lycium ruthenicum	shrub	35–45	R	+	vegetation
Nanophyton erinaceum	semishrub	7–10	R–O	+	vegetation
Oreosalsola arbusculiformis (Salsola arbusculiformis)	dwarf shrub	30-35	O–A	1	vegetation
Peganum garmala	Perennial	20–25	R	+	vegetation
Poa bulbosa	Perennial	15–17	O	+	vegetation
Takhtajaniantha pusilla (*Scorzonera pusilla*)	Perennial	15–17	R	+	vegetation
Tortula desertorum	moss	0.3–0.5	R	+	vegetation
Zygophyllum miniatum	Perennial	10–15	R	+	Vegetation, flowering



Photo 63. Southern piedmont plain of Kuldzhuktau mountains with ephemeroid-saltwort-sagebrush vegetation



Photo 64. Gravelly southern piedmont plain of Kuldzhuktau mountains with sparse saltwort-sagebrush vegetation



Photo 65. Desert sedge (*Carex pachystylis*), a dominant of ephemeroid-saltwort-sagebrush and ephemeroid-sagebrush communities

[redacted]

Gently inclined northern piedmonts of the mountains Kuldzhuktau with native ephemeroid-saltwort-sagebrush vegetation and solitary black saxaul (remains of plantations) on sandy-loamy grey-brown desert soil (Photo 66–67). The canopy cover is 30%. 25 plant and 1 moss species were recorded (Table 38), none of them are alien or listed in the Red Data Book of Uzbekistan (2019).

Table 38. Check-list of plants recorded in survey plots [redacted]

Species	Life form	Height, cm	Abundance		Phenol. Stage
			DAFOR	Braun-Blanquet	
Acanthophyllum elatius	Perennial	25–35	R	+	vegetation
Anabasis eriopoda	semishrub	15–20	R	+	vegetation
Artemisia diffusa	semishrub	20–25	O	+	vegetation
Artemisia turanica	semishrub	20–25	A-D	1-2	vegetation
Astragalus villosissimus	dwarf shrub	30–35	O	+	vegetation
Carex subphysodes	Perennial	10–12	A	1	fruiting
Caroxylon gemmascens (Salsola gemmascens)	dwarf shrub	20–30	R	+	vegetation
Ceratocarpus arenarius	annual	15–20	O–A	+	Dried
Convolvulus hamadae	semishrub	25–30	O	+	vegetation
Ferula foetida	Perennial	50–60	O–A	+-1	Vegetation, flowering
Haloxylon ammodendron (*Haloxylon aphyllum*)	Small tree	100–150	R	+–1	vegetation
Haplophyllum robustum	perennial	25-30	R	+	vegetation
Nanophyton erinaceum	semishrub	7–10	O	+	vegetation

Oreosalsola arbusculiformis (Salsola arbusculiformis)	dwarf shrub	30–40	A	1	vegetation
Peganum garmala	Perennial	20–25	R	+	vegetation
Poa bulbosa	Perennial	15–17	O	+	vegetation
Tortula desertorum	moss	0.3–0.5	O	1	vegetation
Xylosalsola arbuscula (Salsola arbuscula)	shrub	40–50	R	+	vegetation



Photo 66. Northern piedmonts of the mountains Kuldzhuktau with native ephemeroid-saltwort-sagebrush vegetation and solitary black saxaul



Photo 67. [redacted] Northern piedmonts of the mountains Kuldzhuktau with native ephemeroid-saltwort-sagebrush vegetation and solitary black saxaul

[redacted]

Weakly inclined southern piedmont plain of and foothills with gently sloping terrain, covered with native ephemeroid-saltwort-sagebrush vegetation and plantations of black saxaul on gypsaceous, loamy-gravelly grey-brown desert soil, sometimes with outcrops of variegated beds (Photo 68–72). The density of saxaul is up to 500–800 specimens per 1 hectare. The canopy cover is 5–30%. 23 plant and 1 moss species were recorded (Table 39), none of them are alien. One species, *Acanthophyllum cyrtostegium,* is listed in the Red Data Book of Uzbekistan (2019) with the category 3 (reducing); it is endemic to the south-western Kyzylkum and north-western spurs of Pamir-Alay, and national endemic. Solitary specimens of *Acanthophyllum cyrtostegium* occurs sporadically within and between survey plots D114–D118, the density of population is 40–45 individuals per 1 hectare. One species, *Eremurus korolkowii,* is national endemic of Uzbekistan and endemic to relic mountains of Kyzylkum.

Table 39. Check-list of plants recorded in survey plots [redacted]

Species	Life form	Height, cm	Abundance		Phenol. Stage
			DAFOR	Braun-Blanquet	
Acanthophyllum cyrtostegium	Perennial	20–25	R	+	vegetation
Anabasis eriopoda	semishrub	15–20	R	+	vegetation
Artemisia diffusa	semishrub	20–25	A	1	vegetation
Artemisia turanica	semishrub	20–25	A–D	1	vegetation
Astragalus villosissimus	dwarf shrub	30–35	R–O	+	vegetation
Carex pachystylis	Perennial	12–15	O	+	flowering
Caroxylon orientale (Salsola orientalis)	dwarf shrub	30–35	A	1	vegetation
Ceratocarpus arenarius	annual	15–20	O	+	Dried
Climacoptera sp.	annual	25–30	O	+	Dried
Eremurus korolkowii	Perennial	25–30	R–O	+	Vegetation, flowering
Ferula foetida	Perennial	50–60	R	+	Vegetation, flowering
Haloxylon ammodendron (*Haloxylon aphyllum*)	Small tree	100–180	O–A	1–2	vegetation
Iris longiscapa	Perennial	15–17	R	+	flowering
Koelpinia linearis	annual	10–12	R	+	fruiting
Lycium ruthenicum	shrub	40–50	R	+	vegetation
Nanophyton erinaceum	semishrub	7–10	R	+	vegetation
Oreosalsola arbusculiformis (Salsola arbusculiformis)	dwarf shrub	30–35	A	1	vegetation
Peganum garmala	Perennial	20–25	R	+	vegetation
Poa bulbosa	Perennial	15–17	O	+	vegetation
Scrophularia leucoclada	semishrub	40–50	R	+	vegetation
Takhtajaniantha pusilla (*Scorzonera pusilla*)	Perennial	15–17	R	+	vegetation

Tortula desertorum	moss	0.3–0.5	R	+	vegetation
Zygophyllum macrophyllum	Perennial	12–15	R	+	Vegetation, flowering
Zygophyllum miniatum	Perennial	10–15	R	+	Vegetation, flowering



[redacted]Southern piedmont plain of Kuldzhuktau mountains with saltwort-sagebrush vegetation and plantations of black saxaul (April)



Photo 69. [redacted]Southern piedmont plain of Kuldzhuktau mountains with saltwort-sagebrush vegetation and plantations of black saxaul (June)



Photo 70[redacted] Southern piedmont plain of Kuldzhuktau mountains with saltwort-sagebrush vegetation and plantations of black saxaul (June)



Photo 71.[redacted]. Southern piedmont plain of Kuldzhuktau mountains with saltwort-sagebrush vegetation and plantations of black saxaul (April)



Photo [redacted] Southern piedmont plain of Kuldzhuktau Mountains with saltwort-sagebrush vegetation and plantations of black saxaul (June)

4.2.2. Foothills of relic low mountains

This habitat type is characterized by more or less rugged hilly terrain, and the vegetation is represented with native saltwort-sagebrush vegetation on sandy-loamy, loamy, more or less skeleton grey-brown desert soils. The slopes of foothills are dissected with dry riverbeds.

[redacted]

Gently sloping foothills of the mountains Kuldzhuktau with native saltwort-sagebrush vegetation and solitary black saxaul on sabulous-loamy, skeleton grey-brown desert soil (Photo 73–76). The canopy cover is 20–30%. 31 plant and 1 moss species were recorded (Table 40), none of them are alien, and 3 species, *Acanthophyllum cyrtostegium, Ferula kyzylkumica* and *Tulipa lehmanniana,* are listed in the Red Data Book of Uzbekistan (2019) with the category 3 (reducing) (Photo 77–78). 3 generative and 11 pre-generative specimens of *Tulipa lehmanniana* and 6 specimens of *Acanthophyllum cyrtostegium* were count in survey plot [redacted]; 6 generative and 31 pre-generative specimens of *Tulipa lehmanniana* and 4 specimens of *Acanthophyllum cyrtostegium* were count in survey plo[redacted]; 8 specimens of *Ferula kyzylkumica* were found in survey plot[redacted]

Table 40. Check-list of plants recorded in survey plots [redacted]

Species	Life form	Height, cm	Abundance		Phenol. Stage
			DAFOR	Braun-Blanquet	
Acanthophyllum cyrtostegium	Perennial	20–25	R	+	vegetation
Allium protensum	perennial	15-20	R	+	fruiting
Anabasis eriopoda	semishrub	15–20	R	+	vegetation
Artemisia diffusa	semishrub	20–25	O	+	vegetation
Artemisia turanica	semishrub	20–25	A–D	1	vegetation

Astragalus ammotrophus	Perennial	12–15	R	+	vegetation
Astragalus villosissimus	dwarf shrub	30–35	R–O	+	vegetation
Carex pachystylis	Perennial	10–12	O–A	1	fruiting
Carex subphysodes	Perennial	10–12	A	1	fruiting
Caroxylon gemmascens (Salsola gemmascens)	dwarf shrub	20–30	R	+	vegetation
Ceratocarpus arenarius	annual	15–20	A	+	Dried
Ceratocephala falcata	annual	3–4	R	+	fruiting
Convolvulus hamadae	semishrub	25–30	O	+	vegetation
Ferula foetida	Perennial	50–60	O	+	Vegetation
Ferula kyzylkumica	Perennial	10–15	R	+	Vegetation
Fritillaria karelinii	Perennial	10–12	R	+	fruiting
Gagea afghanica	Perennial	10–12	R	+	flowering
Gagea bergii	Perennial	5–7	R	+	flowering
Halimocnemis villosa	annual	10–12	O	+	vegetation
Haloxylon ammodendron (*Haloxylon aphyllum*)	Small tree	50–70	R	+	vegetation
Haplophyllum robustum	perennial	25-30	R	+	vegetation
Heliotropium arguzioides	Perennial	20–25	R	+	vegetation
Leontice inserta	perennial	10–12	R	+	vegetation
Nanophyton erinaceum	semishrub	7–10	O	+	vegetation
Oreosalsola arbusculiformis (Salsola arbusculiformis)	dwarf shrub	30–40	A	1	vegetation
Peganum garmala	Perennial	20–25	O	+	vegetation
Poa bulbosa	Perennial	15–17	A	1	vegetation
Scorzonera gageoides	Perennial	12–15	R	+	vegetation
Tortula desertorum	moss	0.3–0.5	O	+	vegetation
Tulipa lehmanniana	Perennial	10-20	R	+	Vegetation, flowering
Tulipa sogdiana	Perennial	7–10	R	+	fruiting
Ziziphora tenuior	annual	7–10	R	+	flowering



Photo 73[redacted]. Gently sloping foothills of Kuldzhuktau Mountains with saltwort-sagebrush vegetation (April)



Photo 74. [redacted] Gently sloping foothills of Kuldzhuktau Mountains with saltwort-sagebrush vegetation (June)



Photo 75. [redacted] Gently sloping foothills of Kuldzhuktau Mountains with saltwort-sagebrush vegetation (April)



Photo 76. [redacted] Gently sloping foothills of Kuldzhuktau Mountains with saltwort-sagebrush vegetation (June)



Photo 77. Plot [redacted]. Pre- generative specimen of nationally red-listed *Ferula kyzylkumica*



Photo 78. P[redacted] One generative and 2 pre-generative specimens of nationally red-listed *Tulipa lehmanniana*

[redacted]

Foothills with rather gently sloping, hilly terrain, covered with native ephemeroid-saltwort-sagebrush and sagebrush-salthwort vegetation and sometimes with sparse plantations of black saxaul on loamy and skeleton-loamy grey-brown desert soil (Photo 79–81). The canopy cover is 10–30%. 24 plant and 1 moss species were recorded (Table 41), none of them are alien. Three species, *Acanthophyllum cyrtostegium, Ferula*

kyzylkumica and *Tulipa lehmanniana,* are listed in the Red Data Book of Uzbekistan (2019) with the category 3 (reducing) (photo 82–83); they occur sporadically within and between survey plots, solitary or in small groups.

Table 41. Check-list of plants recorded in survey plots [redacted]

Species	Life form	Height, cm	Abundance		Phenol. Stage
			DAFOR	Braun-Blanquet	
Acanthophyllum cyrtostegium	Perennial	20–25	R	+	vegetation
Anabasis eriopoda	semishrub	15–20	R	+	vegetation
Artemisia diffusa	semishrub	20–25	A-D	1	vegetation
Artemisia turanica	semishrub	20–25	O–D	+-1	vegetation
Astragalus ammotrophus	Perennial	12–15	R	+	vegetation
Astragalus villosissimus	dwarf shrub	30–35	R–O	+	vegetation
Atraphaxis spinosa	shrub	50-70	R	+-1	fruiting
Carex pachystylis	Perennial	12–15	O-A	+	flowering
Carex subphysodes	Perennial	10–12	O–A	+–1	fruiting
Caroxylon gemmascens (Salsola gemmascens)	dwarf shrub	20–30	R–O	+	vegetation
Ceratocarpus arenarius	annual	15–20	O	+	Dried
Climacoptera sp.	annual	25–30	O	+	Dried
Convolvulus divaricatus	semishrub	25–30	R	+	flowering
Convolvulus hamadae	semishrub	25–30	R	+	vegetation
Cousinia hamadae	Perennial	15–20	R	+	vegetation
Eremurus korolkowii	Perennial	25–30	R	+	Vegetation, flowering
Gagea afghanica	Perennial	10–12	R	+	flowering
Ferula foetida	Perennial	50–60	R–O	+	Vegetation, flowering
Ferula kyzylkumica	Perennial	10–15	R	+	Vegetation
Halimocnemis villosa	annual	10–12	R–O	+	vegetation
Haloxylon ammodendron (*Haloxylon aphyllum*)	Small tree	50–100	R	+–1	vegetation
Haplophyllum robustum	perennial	25-30	R	+	vegetation
Koelpinia linearis	annual	10–12	R	+	fruiting
Nanophyton erinaceum	semishrub	7–10	R	+	vegetation
Oreosalsola arbusculiformis (Salsola arbusculiformis)	dwarf shrub	30–50	O–A	+–1	vegetation
Peganum garmala	Perennial	20–25	R	+	vegetation
Poa bulbosa	Perennial	15–17	O–A	+-1	vegetation
Scorzonera gageoides	Perennial	12–15	R	+	vegetation
Tortula desertorum	moss	0.3–0.5	R-O	+-1	vegetation
Tulipa lehmanniana	Perennial	10–20	R	+	Vegetation, flowering
Zygophyllum macrophyllum	Perennial	12–15	R	+	Vegetation, flowering
Zygophyllum miniatum	Perennial	10–15	R	+	Vegetation, flowering



Photo 79. [redacted] Gently sloping foothills of Kuldzhuktau Mountains with ephemeroid-saltwort-sagebrush vegetation (April)



Photo 80. [redacted]. Gently sloping foothills of Kuldzhuktau Mountains with ephemeroid-saltwort-sagebrush vegetation (April)



Photo 81. Gently sloping foothills of Kuldzhuktau Mountains with sagebrush-salthwort vegetation (June)



Photo 82. Dried generative specimen of nationally red-listed endemic *Ferula kyzylkumica* (June)



Photo 83. Plot [redacted] Flowering specimen of nationally red-listed *Tulipa lehmanniana*

[redacted]

Foothills with rather gentle hilly terrain, covered with native ephemeroid-saltwort-sagebrush vegetation and sparse plantations of black saxaul on sandy-loamy, loamy and skeleton-loamy grey-brown desert soil. The differences between these survey plots are negligible; landscapes and the vegetation cover are uniform (Photo 84–87). The canopy cover is 20–30%. 43 plant and 1 moss species were recorded (Table 42), none of them are alien, 3 species, *Acanthophyllum cyrtostegium, Calligonum zakirovii* and *Tulipa lehmanniana* are listed in the Red Data Book of Uzbekistan (2019). Solitary specimens and small groups of *Acanthophyllum cyrtostegium* and *Tulipa lehmanniana* occur sporadically within and between survey plots, the density of population is up to 40–50 individuals per 1 hectare. 23 individuals of *Calligonum zakirovii* (category 1 – endangered, disappearing species; national endemic, endemic to south-western Kyzylkum) were count on an area of 0.5 hectare between [redacted] (Photo 88).

Table 42. Check-list of plants recorded in survey plots [redacted]

Species	Life form	Height, cm	Abundance		Phenol. Stage
			DAFOR	Braun-Blanquet	
Acanthophyllum cyrtostegium	Perennial	20–25	R	+	vegetation
Allium griffithianum	Perennial	7–10	R	+	fruiting
Allium sabulosum	Perennial	15–20	R	+	vegetation
Anabasis eriopoda	semishrub	15–20	R	+	vegetation
Artemisia diffusa	semishrub	20–25	A–D	1	vegetation
Artemisia juncea	semishrub	30–35	O	+–1	vegetation
Artemisia scoparia	biennial	25–30	O	+	vegetation
Artemisia turanica	semishrub	20–25	A–D	1	vegetation
Astragalus ammotrophus	Perennial	12–15	R	+	vegetation

Astragalus villosissimus	dwarf shrub	30–35	R–O	+	vegetation
Atraphaxis spinosa	shrub	50–70	R	+–1	fruiting
Calligonum leucocladum	shrub	50–70	R	+–1	fruiting
Calligonum zakirovii	shrub	40–50	R	+	fruiting
Carex pachystylis	Perennial	7–10	O–A	+–1	flowering
Carex physodes	perennial	12–15	O	+	flowering
Carex subphysodes	Perennial	10–12	O–A	+–1	fruiting
Caroxylon orientale (Salsola orientalis)	dwarf shrub	30–35	O	+	vegetation
Ceratocarpus arenarius	annual	15–20	O	+	Dried
Climacoptera sp.	Annual	25–30	O	+	Dried
Convolvulus hamadae	semishrub	25–30	O–A	+–1	vegetation
Cousinia hamadae	Perennial	15–20	R	+	vegetation
Ephedra strobilacea	shrub	40–50	R	+	vegetation
Eremurus korolkowii	Perennial	25–30	R	+	Vegetation
Ferula foetida	Perennial	50–60	R–O	+	Vegetation, flowering
Gagea afghanica	Perennial	10–12	R	+	flowering
Haloxylon ammodendron (*Haloxylon aphyllum*)	Small tree	100–150	R–O	1	vegetation
Haplophyllum robustum	perennial	25-30	R	+	vegetation
Holosteum umbellatum	annual	6–8	R	+	fruiting
Hypecoum pendulum	annual	12–15	R	+	fruiting
Iris songarica	Perennial	20–25	R	+	vegetation
Koelpinia linearis	annual	10–12	R	+	fruiting
Nanophyton erinaceum	semishrub	7–10	R	+	vegetation
Oreosalsola arbusculiformis (Salsola arbusculiformis)	dwarf shrub	30–35	O–A	+–1	vegetation
Peganum garmala	Perennial	20–25	R	+	vegetation
Poa bulbosa	Perennial	15–17	O	+	vegetation
Scrophularia leucoclada	semishrub	40–50	R	+	vegetation
Smirnowia turkestana	Perennial	30–35	R	+	vegetation
Stipa hohenackeriana	Perennial	25–30	R	+	vegetation
Takhtajaniantha pusilla (*Scorzonera pusilla*)	Perennial	15–17	R	+	vegetation
Tortula desertorum	moss	0.3–0.5	R	+	vegetation
Tulipa lehmanniana	Perennial	10–20	R	+	Vegetation, flowering
Xylosalsola arbuscula (Salsola arbuscula)	shrub	40–50	R	+	vegetation
Ziziphora tenuior	annual	5–7	R	+	flowering



Photo 84[redacted] Northern foothills of Kuldzhuktau mountains with saltwort-sagebrush vegetation (June)



Photo 85. [redacted]. Northern foothills of Kuldzhuktau mountains with saltwort-sagebrush vegetation (June)



Photo 86. [redacted] Northern foothills of Kuldzhuktau mountains with saltwort-sagebrush vegetation (April)



Photo 87. [redacted]. Northern foothills of Kuldzhuktau mountains with saltwort-sagebrush vegetation (June)



Photo 88. *Calligonum zakirovii,* nationally red-listed endemic to the south-western Kyzylkum, between [redacted]

4.2.3. Outcrops of variegated beds

Variegated hills composed with outcrops of gypsaceous red, yellow or white clays, sandstones and limestones are very widely distributed in the southern and northern piedmonts of Kuldzhuktau Mountains.

[redacted] Variegated southern foothills of Kuldzhuktau mountains within survey circle VP2 and between VP1 and VP2. Very sparse native community of saltworts and gypsophytes with *Artemisia turanica* (canopy cover is 1–10%) (photo 89–91); 22 plant species were recorded (Table 43); red-listed and alien plants are absent. One species, *Eremurus korolkowii,* is national endemic of Uzbekistan and endemic to relic mountains of Kyzylkum.

Table 43. Check-list of plants recorded for outcrops of variegated beds in survey plot [redacted]

Species	Life form	Height, cm	Abundance		Phenol. Stage
			DAFOR	Braun-Blanquet	
Artemisia turanica	semishrub	20–25	O–A	+–1	vegetation
Astragalus ammotrophus	Perennial	12–15	R	+	vegetation
Astragalus villosissimus	dwarf shrub	35-40	R	+	vegetation
Atraphaxis spinosa	shrub	20–25	R	+	vegetation
Bassia prostrata (*Kochia prostrata)*	semishrub	15–20	R	+	vegetation
Caroxylon orientale (Salsola orientalis)	dwarf shrub	35–40	O	+	vegetation
Ceratocarpus arenarius	annual	15–20	R	+	Dried
Climacoptera sp.	Annual	15–20	R	+	Dried

Convolvulus hamadae	semishrub	25–30	R	+	vegetation
Cousinia hamadae	Perennial	15–20	R	+	vegetation
Eremurus korolkowii	Perennial	25–30	R–O	+	Vegetation, flowering
Ferula foetida	Perennial	30–60	R	+	Vegetation, flowering
Haloxylon ammodendron (*Haloxylon aphyllum*)	Small tree	40–70	R	1	vegetation
Iris longiscapa	Perennial	15–17	R	+	flowering
Lycium ruthenicum	shrub	40–50	R	+	vegetation
Nanophyton erinaceum	semishrub	7–10	O	+	vegetation
Oreosalsola arbusculiformis (Salsola arbusculiformis)	dwarf shrub	35–40	R–O	+–1	vegetation
Peganum garmala	Perennial	15–20	R–O	+	vegetation
Poa bulbosa	Perennial	15–17	O	+	vegetation
Takhtajaniantha pusilla (*Scorzonera pusilla*)	Perennial	15–17	R	+	vegetation
Zygophyllum macrophyllum	Perennial	10–15	R	+	flowering
Zygophyllum miniatum	Perennial	10–15	R	+	Vegetation, flowering



Outcrops of variegated beds with very sparse community of saltworts and gypsophytes in southern piedmonts of Kuldzhuktau mountains.



[redacted] Outcrops of variegated beds with very sparse saltworts and gypsophytes in southern piedmonts of Kuldzhuktau mountains.



[redacted] Outcrops of variegated beds with very sparse saltworts and gypsophytes in southern piedmonts of Kuldzhuktau mountains.

[redacted] Variegated southern foothills of Kuldzhuktau mountains in the southern part of ornithological survey circle VP3. Very sparse native community of saltworts and gypsophytes with *Artemisia turanica* (canopy cover is 1–5%) (photo 92–93); 28 plant species were recorded (Table 44), including one species red-listed at the national level. It is *Calligonum zakirovii* (category 1 – endangered,

disappearing species; national endemic, endemic to south-western Kyzylkum) (photo 94). 17 individuals were count per 1 hectare. One species, *Eremurus korolkowii,* is national endemic of Uzbekistan and endemic to relic mountains of Kyzylkum. Alien plants are absent.

Table 44. Check-list of plants recorded on outcrops of variegated beds in survey circle

Species	Life form	Height, cm	Abundance		Phenol. Stage
			DAFOR	Braun-Blanquet	
Anabasis eriopoda	semishrub	15–20	R	+	vegetation
Artemisia turanica	semishrub	20–25	O	+	vegetation
Astragalus ammotrophus	Perennial	12–15	R	+	dried
Astragalus villosissimus	dwarf shrub	35-40	R	+	fruiting
Atraphaxis spinosa	shrub	20–25	R	+	fruiting
Bromus tectorum	annual	12–15	R	+	dried
Calligonum zakirovii	shrub	40–50	R	+	fruiting
Caroxylon orientale (Salsola orientalis)	dwarf shrub	35–40	O	+	vegetation
Ceratocarpus arenarius	annual	10–15	R	+	fruiting
Climacoptera sp.	Annual	10–15	R	+	vegetation
Convolvulus hamadae	semishrub	25–30	R	+	flowering
Cousinia hamadae	Perennial	15–20	R	+	fruiting
Eremopyrum bonaepartis	annual	7–10	R	+	dried
Eremopyrum distans	annual	7–10	R	+	dried
Eremurus korolkowii	Perennial	25–30	R–O	+	dried
Ferula foetida	Perennial	30–60	R	+	dried
Halimocnemis gamocarpa	annual	12–15	R	+	Vegetation
Halimocnemis latifolia	annual	12–15	R	+	Vegetation
Haplophyllum robustum	perennial	25-30	R	+	vegetation
Haloxylon ammodendron (*Haloxylon aphyllum*)	Small tree	40–70	R	1	vegetation
Lycium ruthenicum	shrub	40–50	R	+	fruiting
Nanophyton erinaceum	semishrub	7–10	O	+	vegetation
Oreosalsola arbusculiformis (Salsola arbusculiformis)	dwarf shrub	35–40	R–O	+–1	vegetation
Peganum garmala	Perennial	15–20	R–O	+	fruiting
Poa bulbosa	Perennial	15–17	O	+	dried
Scrophularia leucoclada	semishrub	40–50	R	+	vegetation
Takhtajaniantha pusilla (*Scorzonera pusilla*)	Perennial	15–17	R	+	dried
Zygophyllum macrophyllum	Perennial	10–15	R	+	dried



Outcrops of variegated beds with very sparse saltworts and gypsophytes in southern piedmonts of Kuldzhuktau mountains



Outcrops of variegated beds with very sparse saltworts and gypsophytes in southern piedmonts of Kuldzhuktau mountains



Photo 94. *Calligonum zakirovii,* nationally red-listed endemic to the south-western Kyzylkum (category 1 – endangered, disappearing species), [redacted]

4.2.4. Stony slopes of relic low mountains

This habitat type is characterized by stongly rugged terrain, and the vegetation is represented with native sagebrush-saltwort and ephemeroid-saltwort-sagebrush vegetation on loamy and skeleton grey-brown desert soils with outcrops of bedrocks. The slopes are eroded and dissected with numerous dry riverbeds.

[redacted]

Stony and rocky slopes with rugged terrain, and wide watershed ridges with rather gentle, hilly terrain, covered with native saltwort-sagebrush and sagebrush vegetation on sandy-loamy, skeleton-loamy and skeleton grey-brown desert soil (Photo 95–99). The canopy cover is 5–30%. 43 plant and 1 moss species were recorded (Table 45), none of them are alien. Two species, *Ferula kyzylkumica* and *Tulipa lehmanniana* (photo 100), are listed in the Red Data Book of Uzbekistan (2019) with the category 3 (reducing); both species occur sporadically, solitary or in groups, within and between survey plots. One species, *Eremurus korolkowii,* is national endemic of Uzbekistan and endemic to relic mountains of Kyzylkum; it also occurs sporadically within and between survey plots.

Table 45. Check-list of plants recorded in survey plots [redacted]

Species	Life form	Height, cm	Abundance		Phenol. Stage
			DAFOR	Braun-Blanquet	
Alyssum desertorum	annual	5–6	R–O	+	fruiting
Alyssum linifolium (Meniocus linifolius)	annual	5–7	R–O	+	fruiting
Anabasis eriopoda	semishrub	15–20	R	+	vegetation
Artemisia diffusa	semishrub	20–25	O–A	+–1	vegetation
Artemisia turanica	semishrub	20–25	A–D	1–2	vegetation
Astragalus ammotrophus	Perennial	12–15	R	+	vegetation

Astragalus villosissimus	dwarf shrub	30–35	R–O	+	vegetation
Carex pachystylis	Perennial	10–12	O–A	+–1	Flowering, fruiting
Carex physodes	Perennial	12–15	O	+	fruiting
Carex subphysodes	Perennial	10–12	O–A	+–1	fruiting
Caroxylon gemmascens (Salsola gemmascens)	dwarf shrub	20–30	R–O	+	vegetation
Caroxylon orientale (Salsola orientalis)	dwarf shrub	30–35	O–A	+–1	vegetation
Ceratocarpus arenarius	annual	15–20	R–O	+	Dried
Climacoptera sp.	Annual	25–30	R–O	+	Dried
Convolvulus hamadae	semishrub	25–30	O	+	vegetation
Cousinia hamadae	Perennial	15–20	R	+	fruiting
Eremopyrum bonaepartis	annual	7–10	R	+	dried
Eremopyrum distans	annual	7–10	R	+	dried
Eremurus korolkowii	Perennial	25–30	R	+	Vegetation, flowering
Ferula foetida	Perennial	50–60	R–O	+	Vegetation, flowering
Ferula kyzylkumica	Perennial	15–20	R–O	+	Vegetation
Fritillaria karelinii	Perennial	10–12	R	+	fruiting
Gagea afghanica	Perennial	10–12	R	+	flowering
Gagea bergii	Perennial	5–7	R	+	flowering
Halimocnemis villosa	annual	10–12	R–O	+	vegetation
Haloxylon ammodendron (*Haloxylon aphyllum*)	Small tree	100–180	R–O	+–1	vegetation
Haplophyllum robustum	perennial	25-30	R	+	vegetation
Koelpinia linearis	annual	10–12	R	+	fruiting
Lactuca orientalis	semishrub	35–40	R	+	vegetation
Leontice inserta	perennial	10–12	R	+	vegetation
Leptaleum filifolium	annual	4–5	R	+	fruiting
Lomelosia olivieri (*Scabiosa olivierii*)	annual	15–17	R	+	fruiting
Nanophyton erinaceum	semishrub	7–10	R–O	+	vegetation
Oreosalsola arbusculiformis (Salsola arbusculiformis)	dwarf shrub	30–35	O–A	1–2	vegetation
Peganum garmala	Perennial	20–25	R	+	vegetation
Poa bulbosa	Perennial	15–17	O–A	+–1	vegetation
Rheum turkestanicum	Perennial	20–40	R	+	vegetation
Scrophularia leucoclada	semishrub	40–50	R	+	vegetation
Takhtajaniantha pusilla (*Scorzonera pusilla*)	Perennial	15–17	R	+	vegetation
Tortula desertorum	moss	0.3–0.5	R	+	vegetation
Tulipa lehmanniana	Perennial	10–20	R–O	+	Vegetation, fruiting
Tulipa sogdiana	Perennial	7–10	R	+	fruiting
Ziziphora tenuior	annual	7–10	R	+	flowering
Zygophyllum macrophyllum	Perennial	12–15	R	+	Vegetation, flowering



[redacted]. Watershed of Kuldzhuktau range with gentle terrain and sparse saltwort-sagebrush vegetation (April)



[redacted] Watershed of Kuldzhuktau range with gentle terrain and saltwort-sagebrush vegetation (June)



Photo 97. Surroundings [redacted] Steep rocky northern slopes of Kuldzhuktau range with very sparse vegetation (April)



Photo 98. Surroundings of [redacted] Steep rocky northern slopes of Kuldzhuktau range with very sparse vegetation (June)



Photo 99. Surroundings o [redacted]. Steep stony slopes of Kuldzhuktau range with sagebrush-saltwort vegetation, intensively grazed by livestock (April)



Photo 100. Plot [redacted] Flowering specimens of nationally red-listed *Tulipa lehmanniana*

[redacted]

Stony and rocky slopes with rugged terrain, and wide watersheds with rather gentle, hilly terrain, covered with native saltwort-sagebrush and sagebrush vegetation on loamy, skeleton-loamy and skeleton grey-brown desert soil (Photo 101–105). The canopy cover is 5–30%. 56 plant and 1 moss species were recorded (Table 46), none of them are alien. Two species, *Ferula kyzylkumica* and *Tulipa lehmanniana,* are listed in the Red Data Book of Uzbekistan (2019) with the category 3 (reducing) (Photo 106–107). Solitary

specimens and populations of 50–100 individuals occur sporadically within and between survey plots. One species, *Eremurus korolkowii,* is national endemic of Uzbekistan and endemic to relic mountains of Kyzylkum; it also occurs sporadically within and between survey plots [redacted]

Table 46. Check-list of plants recorded in survey plots [redacted]

Species	Life form	Height, cm	Abundance		Phenol. Stage
			DAFOR	Braun-Blanquet	
Allium griffithianum	Perennial	7–10	R	+	fruiting
Allium karakense	Perennial	15–17	R	+	vegetation
Allium sabulosum	Perennial	15–20	R	+	vegetation
Alyssum desertorum	annual	5–6	R–O	+	fruiting
Alyssum linifolium (Meniocus linifolius)	annual	5–7	R–O	+	fruiting
Ammodendron conollyi	Small tree	100–150	R	+	vegetation
Anabasis eriopoda	semishrub	15–20	R	+	vegetation
Anabasis turkestanica	semishrub	20–25	R	+	vegetation
Artemisia diffusa	semishrub	20–25	O	+–1	vegetation
Artemisia juncea	semishrub	30–35	O	+–1	vegetation
Artemisia turanica	semishrub	20–25	A–D	1–2	vegetation
Astragalus ammotrophus	Perennial	12–15	R	+	vegetation
Astragalus villosissimus	dwarf shrub	30–35	R–A	+–1	vegetation
Atraphaxis spinosa	shrub	50–70	O	1	fruiting
Bassia prostrata (*Kochia prostrata)*	semishrub	20–25	R	+	vegetation
Bromus tectorum	annual	12–15	O	+	fruiting
Carex pachystylis	Perennial	10–12	O–A	+	flowering
Caroxylon gemmascens (Salsola gemmascens)	dwarf shrub	20–30	R–O	+	vegetation
Caroxylon orientale (Salsola orientalis)	dwarf shrub	30–35	O–A	+–1	vegetation
Ceratocarpus arenarius	annual	15–20	R–O	+	Dried
Convolvulus hamadae	semishrub	25–30	O–A	+–1	vegetation
Cousinia hamadae	Perennial	15–20	R	+	fruiting
Eminium lehmannii	Perennial	15–20	R	+	fruiting
Ephedra intermedia	shrub	15–30	R	+	vegetation
Eremopyrum bonaepartis	annual	7–10	R	+	dried
Eremopyrum distans	annual	7–10	R	+	dried
Eremurus korolkowii	Perennial	25–30	R–O	+	Vegetation, flowering
Ferula foetida	Perennial	50–60	R–O	+	Vegetation, flowering
Ferula kyzylkumica	Perennial	15–20	R–O	+	Vegetation
Ferula varia	Perennial	25–30	R	+	Vegetation
Haloxylon ammodendron (*Haloxylon aphyllum*)	Small tree	100–150	R	+–1	vegetation
Haplophyllum robustum	perennial	25-30	R	+	vegetation
Holosteum umbellatum	annual	6–8	O	+	fruiting
Hypecoum pendulum	annual	12–15	R	+	Flowering, fruiting
Isatis minima	annual	15–17	R	+	fruiting

Iris longiscapa	Perennial	15–17	R	+	flowering
Koelpinia linearis	annual	10–12	R	+	fruiting
Krascheninnikovia ceratoides	semishrub	40–50	R	+	vegetation
Lactuca orientalis	semishrub	35–40	R–O	+–1	vegetation
Lallemantia royleana	annual	7–8	R	+	flowering
Leptaleum filifolium	annual	4–5	R	+	fruiting
Lomelosia olivieri (*Scabiosa olivierii*)	annual	15–17	R	+	fruiting
Nanophyton erinaceum	semishrub	7–10	R–O	+	vegetation
Oreosalsola arbusculiformis (Salsola arbusculiformis)	dwarf shrub	30–35	A–D	1–2	vegetation
Peganum garmala	Perennial	20–25	R–O	+	vegetation
Poa bulbosa	Perennial	15–17	O–A	+–+1	vegetation
Rheum turkestanicum	Perennial	20–40	R	+	vegetation
Scrophularia leucoclada	semishrub	40–50	R–O	+	vegetation
Scorzonera gageoides	Perennial	12–15	R	+	vegetation
Stipa hohenackeriana	Perennial	25–30	R–O	+	vegetation
Takhtajaniantha pusilla (*Scorzonera pusilla*)	Perennial	15–17	R	+	vegetation
Tortula desertorum	moss	0.3–0.5	R	+	vegetation
Tulipa sogdiana	Perennial	7–10	R	+	Vegetation, fruiting
Tulipa lehmanniana	Perennial	10–20	R	+	Vegetation, flowering
Ziziphora tenuior	annual	7–8	R	+	flowering
Zygophyllum macrophyllum	Perennial	12–15	R	+	Vegetation, flowering
Zygophyllum miniatum	Perennial	10–15	R	+	Vegetation, flowering



Photo 10[redacted] Stony slopes of Kuldzhuktau mountains with sagebrush-saltwort vegetation (June)



[redacted]. Stony slopes of Kuldzhuktau mountains with sagebrush-saltwort vegetation (April)



[redacted] Stony slopes of Kuldzhuktau mountains with sagebrush-saltwort vegetation (April)



[redacted] Stony slopes of Kuldzhuktau mountains with sagebrush-saltwort vegetation (April)



[redacted] Stony northern slopes of Kuldzhuktau mountains with sparse sagebrush-saltwort vegetation (June)



[redacted] On the foreground – Korolkow's desert-candle (*Eremurus korolkowii*), national endemic of Uzbekistan and endemic to relic mountains of Kyzylkum, and on the background – black saltwort (*Oreosalsola arbusculiformis*), main dominant of sagebrush-saltwort communities of vegetation of relic mountains



[redacted]. Dried generative specimen of nationally red-listed endemic *Ferula kyzylkumica* (June)

[redacted]

Stony and rocky slopes with rugged terrain, and wide watershed ridges with rather gentle, hilly terrain, covered with native saltwort-sagebrush and sagebrush vegetation on loamy, skeleton-loamy and skeleton grey-brown desert soil (Photo 108–115). The canopy cover is 5–30%. 44 plant and 1 moss species were recorded (Table 47), none of them are alien. One species, *Ferula kyzylkumica,* is listed in the Red Data Book of Uzbekistan (2019) with the category 3 (reducing); it is endemic to the relic mountains of Kyzylkum with a disjunction in the Nuratau Mountains, and national endemic. Solitary specimens and populations of 50–100 individuals occur sporadically within and between survey plots D092–D113 and D119–D124. For example, 94 specimens *Ferula kyzylkumica* were count on a plot 50x10 m of near the [redacted] photo 116). One species, *Eremurus korolkowii,* is national endemic of Uzbekistan and endemic to relic mountains of Kyzylkum; it also occurs sporadically within and between survey [redacted]

Table 47. Check-list of plants recorded in survey plots [redacted]

Species	Life form	Height, cm	Abundance		Phenol. Stage
			DAFOR	Braun-Blanquet	
Alyssum desertorum	annual	5–6	R–O	+	fruiting
Alyssum linifolium (Meniocus linifolius)	annual	5–7	R–O	+	fruiting
Anabasis eriopoda	semishrub	15–20	R	+	vegetation
Anabasis turkestanica	semishrub	20–25	R	+	vegetation
Artemisia diffusa	semishrub	20–25	O–A	+–1	vegetation
Artemisia turanica	semishrub	20–25	A–D	1–2	vegetation
Astragalus ammotrophus	Perennial	12–15	R	+	vegetation
Astragalus villosissimus	dwarf shrub	30–35	R–O	+	vegetation

Atraphaxis spinosa	shrub	50-70	R	+-1	fruiting
Carex pachystylis	Perennial	10–12	O–A	+	flowering
Caroxylon gemmascens (Salsola gemmascens)	dwarf shrub	20–30	R–O	+	vegetation
Caroxylon orientale (Salsola orientalis)	dwarf shrub	30–35	O–A	+–1	vegetation
Ceratocarpus arenarius	annual	15–20	R–O	+	Dried
Cousinia hamadae	Perennial	15–20	R	+	fruiting
Ephedra intermedia	shrub	15–30	R	+	vegetation
Eremopyrum bonaepartis	annual	7–10	R	+	dried
Eremopyrum distans	annual	7–10	R	+	dried
Eremurus korolkowii	Perennial	25–30	R	+	Vegetation, flowering
Ferula foetida	Perennial	50–60	R–O	+	Vegetation, flowering
Ferula kyzylkumica	Perennial	15–20	R–O	+	Vegetation
Halimocnemis latifolia	annual	12–15	R	+	Vegetation
Haloxylon ammodendron (*Haloxylon aphyllum*)	Small tree	100–180	R–O	+–1	vegetation
Hypecoum pendulum	annual	12–15	R	+	Flowering, fruiting
Isatis minima	annual	15–17	R	+	fruiting
Iris longiscapa	Perennial	15–17	R	+	flowering
Koelpinia linearis	annual	10–12	R	+	fruiting
Krascheninnikovia ceratoides	semishrub	40–50	R–O	+	vegetation
Lactuca orientalis	semishrub	35–40	R–O	+–1	vegetation
Lallemantia royleana	annual	7–8	R	+	flowering
Leptaleum filifolium	annual	4–5	R	+	fruiting
Lomelosia olivieri (*Scabiosa olivierii*)	annual	15–17	R	+	fruiting
Lycium ruthenicum	shrub	40–50	R–O	+–1	vegetation
Nanophyton erinaceum	semishrub	7–10	R–O	+	vegetation
Oreosalsola arbusculiformis (Salsola arbusculiformis)	dwarf shrub	30–35	O–A	1–2	vegetation
Peganum garmala	Perennial	20–25	R	+	vegetation
Poa bulbosa	Perennial	15–17	O–A	+–+1	vegetation
Rheum turkestanicum	Perennial	20–40	R–O	+–1	vegetation
Scrophularia leucoclada	semishrub	40–50	R–O	+	vegetation
Scorzonera gageoides	Perennial	12–15	R	+	vegetation
Takhtajaniantha pusilla (*Scorzonera pusilla*)	Perennial	15–17	R	+	vegetation
Tortula desertorum	moss	0.3–0.5	R	+	vegetation
Tulipa sogdiana	Perennial	7–10	R	+	Vegetation, fruiting
Ziziphora tenuior	annual	7–8	R	+	flowering
Zygophyllum macrophyllum	Perennial	12–15	R	+	Vegetation, flowering
Zygophyllum miniatum	Perennial	10–15	R	+	Vegetation, flowering



Photo 108. [redacted] Southern slopes of Kuldzhuktau mountains with saltwort-sagebrush vegetation (April)



Photo 109 [redacted] Southern slopes of Kuldzhuktau mountains with saltwort-sagebrush vegetation (April)



Photo 110. [redacted] Southern slopes of Kuldzhuktau mountains with saltwort-sagebrush vegetation (April)



Photo 111. [redacted] Southern slopes of Kuldzhuktau mountains with saltwort-sagebrush vegetation (June)



Photo 112. [redacted] Stony slopes of Kuldzhuktau mountains with very sparse vegetation (April)



Photo 113. [redacted] Stony slopes of Kuldzhuktau mountains with sparse sagebrush-saltwort vegetation (June)



Photo 114. [redacted] Slopes of western part of Kuldzhuktau mountains with saltwort-sagebrush vegetation (June)



[redacted] Southern slopes of the relic ridge Kuldzhuktau with saltwort-sagebrush vegetation (June)



Photo 116. *Ferula kyzylkumica*, nationally red-listed endemic species, surroundings of [redacted]

4.2.5. Anthropogenic habitats

Several small villages (the largest are Dzhankeldy and Kalata) and farmsteads are situated within the project site, on the piedmont plain and foothills of the relic ridge Kuldzhuktau (Photo 117–118). In addition, the impact of mining operations is more expressed in “Dzhankeldy” site than in “Bash”; there are numerous active and abandoned mines and quarries, geological exploration is underway at the present (Photo 119). Dense thickets of *Peganum garmala* typical for degraded rangelands of arid zone of Uzbekistan occur around settlements, farmsteads and wells. Halophytic shrubs (*Lycium ruthenicum, Halimodendron halodendron, Tamarix hispida* and *Tamarix laxa*) grows near the springs and wells. In surroundings of quarries and mines, the canopy cover is extremely sparse, or the vegetation is almost completely exterminated. Alien or red-listed plants were not found.



Photo 117. Surroundings of the village Kalata (April)



Photo 118. *Peganum harmala* in surroundings of the village Dzhankeldy (June)



Photo 119. Ruins of an abandoned mining village

4.3. "Bash-Dzhankeldy" power line

Following types of habitats (mapping units) were identified along the "Bash-Dzhankeldy" line:

4.3.1. Sandy and sandy-loamy desert plain

This habitat type occupies the southernmost part of planned power line, at the northern edge of the "Bash" project site, as well as along the railway, between the "Bash" project site and the rail crossing.

Sandy and sandy-loamy desert plain with flat or flat-wavy terrain is covered with native ephemeroid-sagebrush (*Artemisia diffusa, Poa bulbosa, Carex physodes, Carex subphysodes*) and saltwort-ephemeroid-sagebrush vegetation (*Artemisia diffusa, Poa bulbosa, Carex physodes, Carex subphysodes, Caroxylon orientale (Salsola orientalis), Xylosalsola arbuscula, (Salsola arbuscula*), sometimes with small plots of fixed sands with psammophilous shrubs (*Calligonum leucocladum, C. microcarpum*), or with saxaul plantations (*Haloxylon ammodendron*) or solitary saxaul trees on sabulous grey-brown desert soil and sandy desert soil (photo 120–121). The elevation is 263–180 m a.s.l. The canopy cover is 20 to 40%, and the density saxaul stands is up to 0.1–0.2. Plant communities are characterized with low species diversity and low to medium level of anthropogenic disturbance. A check-list of 16 plant species and 1 moss recorded for this habitat is presented below (table 48).

Table 48. Check-list of plants recorded for sandy and sandy-loamy desert plain with ephemeroid-sagebrush and saltwort-ephemeroid-sagebrush vegetation, and with saxaul plantations

Species	Life form	Height, cm	Abundance		Phenol. Stage
			DAFOR	Braun-Blanquet	
Acanthophyllum elatius	Perennial	40–45	R	+	flowering

Alyssum desertorum	annual	5–6	R–O	+	dried
Artemisia diffusa	semishrub	25–35	A–D	1–2	vegetation
Astragalus villosissimus	dwarf shrub	30–35	O	+	vegetation
Bromus tectorum	annual	12–15	R–O	+	fruiting
Calligonum leucocladum	shrub	50–100	R–O	+	fruiting
Calligonum microcarpum	shrub	50–70	R–O	+	fruiting
Carex physodes	Perennial	12–15	O–A	+–1	dried
Carex subphysodes	Perennial	10–12	A–D	1	dried
Caroxylon orientale (Salsola orientalis)	dwarf shrub	30–35	R–A	+–1	vegetation
Ceratocarpus arenarius	annual	15–20	R–O	+	Dried
Convolvulus hamadae	semishrub	25–30	R–O	+	flowering
Cousinia hamadae	Perennial	15–20	R	+	vegetation
Ferula foetida	Perennial	30–35	R–A	+	Fruiting, dried
Haloxylon ammodendron (*Haloxylon aphyllum*)	Small tree	150–170	R–A	1–2	vegetation
Heliotropium arguzioides	Perennial	20–25	R	+	vegetation
Iris songarica	Perennial	30–35	R–O	+	vegetation
Peganum garmala	Perennial	30–35	R	+	flowering
Poa bulbosa	Perennial	15–17	O–A	+–1	dried
Stipagrostis pennata	Perennial	30–35	R	+	vegetation
Tortula desertorum	moss	0.3–0.5	O	+	vegetation
Xylosalsola arbuscula (Salsola arbuscula)	shrub	40–50	R–A	+–1	vegetation



Photo 121. Sandy-loamy desert plain with native ephemeroid-sagebrush plant community and sparse black saxaul (remains of plantations), [redacted] E



Photo 122. Sandy plain with native ephemeroid-saltwort-sagebrush vegetation and plantations of black saxaul, [redacted]

4.3.2. Fixed and semi-fixed sands

Fixed and semi-fixed sands with hilly, ridge-hilly, ridge and wavy terrain are covered with psammophilous shrublands (photo 123). Dominants and subdominants are *Calligonum leucocladum, Calligonum microcarpum, Haloxylon persicum, H. ammodendron,*

Astragalus villosissimus, Artemisia diffusa, Carex physodes, and on local plots – sand acacia (*Ammodendron conollyi)*. The grass cover of the sandy desert is formed by desert sedge (*Carex physodes*) which plays a key role in sands fixation through its densely branched root system. The giant Umbelliferae *Ferula foetida* often is a subdominant. 36 plant species and one moss were recorded for this habitat type (table 49), including one nationally red-listed species, *Tulipa lehmanniana* (solitary fruiting and dried specimens were found on the route betwee[redacted] E). This habitat is located in the southern part of the previous variant of the power line (red line), and also along the railway, between the rail crossing and village Chengeldy.

Table 49. Check-list of plants recorded for fixed and semi-fixed sands with psammophilous shrubs and ephemeroid-sagebrush vegetation

Species	Life form	Height, cm	Abundance		Phenol. Stage
			DAFOR	Braun-Blanquet	
Acanthophyllum elatius	Perennial	40–45	R–O	+	flowering
Alhagi pseudalhagi	Perennial	30–35	R–O	+	vegetation
Alyssum desertorum	annual	5–6	R	+	dried
Ammodendron conollyi	Small tree	100–150	R–A	+–1	fruiting
Arnebia decumbens	annual	15–20	R	+	fruiting
Artemisia diffusa	semishrub	35–40	A–D	1–2	vegetation
Astragalus flexus	perennial	15-17	R	+	dried
Astragalus villosissimus	dwarf shrub	35-40	A	1	vegetation
Bromus tectorum	annual	12–15	O–A	+	dried
Calligonum leucocladum	shrub	50–100	D–O	1–2	fruiting
Calligonum microcarpum	shrub	50–100	A–O	1	fruiting
Carex physodes	Perennial	12–15	D	1	flowering
Caroxylon orientale (Salsola orientalis)	dwarf shrub	35-40	R–O	+	vegetation
Ceratocarpus arenarius	annual	15-20	O	+	vegetation
Convolvulus divaricatus	semishrub	30–45	O	+	flowering
Convolvulus hamadae	semishrub	30–40	O	+	flowering
Cousinia hamadae	Perennial	30–35	R–O	+	vegetation
Eremopyrum bonaepartis	annual	10–12	O	+	fruiting
Eremopyrum distans	annual	10–12	O	+	fruiting

Euphorbia turczaninowii	annual	10–12	R	+	Flowering, fruiting
Ferula foetida	Perennial	50–60	O–A	1	Fruiting, dried
Haplophyllum ramosissimum	Perennial	25–30	R	+	vegetation
Haloxylon ammodendron (*Haloxylon aphyllum*)	Small tree	150–170	R–O	+–1	vegetation
Haloxylon persicum	Small tree	150–170	O–A	1	vegetation
Heliotropium arguzioides	Perennial	25–30	R–O	+	flowering
Iris songarica	Perennial	30–35	R	+	vegetation
Mausolea eriocarpa	semishrub	45–50	O–A	1	flowering
Oreosalsola arbusculiformis (Salsola arbusculiformis)	dwarf shrub	50–60	O	+–1	vegetation
Peganum garmala	Perennial	30–35	R–O	+	flowering
Poa bulbosa	Perennial	15–17	O	+	dried
Salsola paulsenii	annual	30–35	R	+	vegetation
Sophora pachycarpa	Perennial	20–25	R	+	flowering
Smirnowia turkestana	Perennial	30–35	R–O	+	flowering
Stipagrostis pennata	Perennial	30–35	O	+	vegetation
Tortula desertorum	moss	0.3–0.5	O	+	vegetation
Tulipa lehmanniana	Perennial	10–15	R	+	fruiting
Xylosalsola arbuscula (Salsola arbuscula)	shrub	40–50	R–O	+	vegetation



Photo 123. Fixed hilly sands with Calligonum-sagebrush vegetation with participation of black saxaul, [redacted]

4.3.3. Complex of fixed and semi-fixed sands, saline depressions and takyrs

This habitat is located in surroundings of the village Shengeldy (2–6 km to the south), on the edge of the saline depression Karakata. Sandy areas are covered with psammophytic shrubs and ephemeroid-sagebrush vegetation (photo 124). Dominants are sand acacia (*Ammodendron conollyi), Calligonum leucocladum, Artemisia diffusa, Carex physodes,* subdominants – *Haloxylon ammodendron, Calligonum microcarpum, Astragalus villosissimus, Oreosalsola arbusculiformis (Salsola arbusculiformis), Ferula foetida*. Small saline depressions and takyrs have very sparse vegetation (canopy cover less than 10%) represented with the same species that on the sands, with participation of *Tamarix sp.* and *Lycium ruthenicum.* 35 plant species and one moss were recorded for this habitat type in total (table 50).

Table 50. Check-list of plants recorded for complex of fixed and semi-fixed hilly and wavy sands, small saline depressions and takyrs

Species	Life form	Height, cm	Abundance		Phenol. Stage
			DAFOR	Braun-Blanquet	
Acanthophyllum elatius	Perennial	40–45	R	+	flowering
Alhagi pseudalhagi	Perennial	30–35	R–O	+	vegetation
Alyssum desertorum	annual	5–6	R	+	dried
Ammodendron conollyi	Small tree	100–150	O–D	+–12	fruiting
Arnebia decumbens	annual	15–20	R	+	fruiting
Artemisia diffusa	semishrub	35–40	O–A	+–1	vegetation

Astragalus villosissimus	dwarf shrub	35-40	O–A	+–1	vegetation
Bassia eriophora	annual	12–15	O	+	fruiting
Bromus tectorum	annual	12–15	O–A	+	dried
Calligonum leucocladum	shrub	50–100	A–O	1	fruiting
Calligonum microcarpum	shrub	50–100	A–O	1	fruiting
Carex physodes	Perennial	12–15	O–A	+	flowering
Caroxylon orientale (Salsola orientalis)	dwarf shrub	35-40	R–O	+	vegetation
Ceratocarpus arenarius	annual	15-20	O–A	+	vegetation
Convolvulus divaricatus	semishrub	30–45	O–R	+	flowering
Convolvulus hamadae	semishrub	30–40	O–R	+	flowering
Cousinia hamadae	Perennial	30–35	R	+	vegetation
Eremopyrum bonaepartis	annual	10–12	O–R	+	fruiting
Eremopyrum distans	annual	10–12	O–R	+	fruiting
Euphorbia turczaninowii	annual	10–12	R	+	Flowering, fruiting
Ferula foetida	Perennial	50–60	O–R	+–1	Fruiting, dried
Haplophyllum ramosissimum	Perennial	25–30	R	+	vegetation
Haloxylon ammodendron (*Haloxylon aphyllum*)	Small tree	150–170	R–O	+–1	vegetation
Heliotropium arguzioides	Perennial	25–30	R–O	+	flowering
Lycium ruthenicum	Shrub	50–70	R–O	+–1	flowering
Mausolea eriocarpa	semishrub	45–50	R–O	+–1	flowering
Oreosalsola arbusculiformis (Salsola arbusculiformis)	dwarf shrub	50–60	O–A	+–1	vegetation
Peganum garmala	Perennial	30–35	R–A	+–1	flowering
Poa bulbosa	Perennial	15–17	R–O	+	dried
Salsola paulsenii	annual	30–35	R–O	+	vegetation
Sophora pachycarpa	Perennial	20–25	R–O	+	flowering
Smirnowia turkestana	Perennial	30–35	R–O	+	flowering

Stipagrostis pennata	Perennial	30–35	R	+	vegetation
Tamarix sp.	Shrub	100–150	R	+–1	vegetation
Tortula desertorum	moss	0.3–0.5	O	+	vegetation
Xylosalsola arbuscula (Salsola arbuscula)	shrub	40–50	R	+	vegetation



Photo 124. Fixed sands with native psammophilous vegetation with domination of sand aca[redacted]

4.3.4. Weakly inclined piedmont plain of relic low mountains

Weakly inclined piedmonts of relic low mountains Kuldzhuktau with flat, wavy or gently sloping terrain are covered with native ephemeroid-sagebrush and saltwort-sagebrush vegetation, sometimes with *Calligonum* and plantations of black saxaul on sabulous grey-brown desert soil (photos 125–127). This habitat type is located along the road P-61, between the village Shengeldy and the eastern edge of “Dzhankeldy” project site. Canopy cover is 20–40%. 31 plant species and one moss were recorded for this habitat type (table 51), including 3 species listed in the Red Data Book of Uzbekistan (2019). They are *Acanthophyllum cyrtostegium* (category 3 – reducing; national endemic) (photo 128), *Calligonum zakirovii* (category 1 – endangered, disappearing species; national endemic) (photo 129), and *Tulipa lehmanniana* (category 3 – reducing). A small population of *Acanthophyllum cyrtostegium* (8 plants) was found near the route P-61 ([redacted] plants were found near the village Shengeldy ([redacted] Solitary individuals of *Calligonum zakirovii* (30–40 per 1 hectare) were recorded among *Calligonum leucocladum* and *C. microcarpum* along the route P-61, on the border of saline depression ([redacted] During the April expedition, it has been noted that *Tulipa lehmanniana* (several dozens of individuals in each population, mostly pre-generative) occur sporadically along the road P-61, between the village Shengeldy and the eastern edge of “Dzhankeldy” project site (photo 130).

Table 51. Check-list of plants recorded for piedmont plains with ephemeroid-sagebrush and saltwort-sagebrush vegetation, with plantations of black saxaul

Species	Life form	Height, cm	Abundance		Phenol. Stage
			DAFOR	Braun-Blanquet	
Acanthophyllum cyrtostegium	Perennial	25–30	R	+	flowering
Acanthophyllum elatius	Perennial	40–45	R	+	flowering
Alyssum desertorum	annual	5–6	R	+	dried
Anabasis eriopoda	semishrub	15–20	R	+	vegetation
Arnebia decumbens	annual	15–20	R	+	fruiting
Artemisia diffusa	semishrub	30–35	A–D	1–2	vegetation
Artemisia turanica	semishrub	30–35	O–A	+–1	vegetation
Astragalus villosissimus	dwarf shrub	40–60	O–A	+–1	vegetation
Bassia prostrata (*Kochia prostrata)*	semishrub	15–20	R	+	vegetation
Bromus tectorum	annual	12–15	R–O	+	fruiting
Calligonum leucocladum	shrub	50–100	R–O	+	fruiting
Calligonum microcarpum	shrub	50–70	R–O	+	fruiting
Calligonum zakirovii	shrub	40–50	R	+	fruiting
Carex physodes	Perennial	12–15	O–A	+	dried
Carex subphysodes	Perennial	10–12	O–A	+	dried
Caroxylon orientale (Salsola orientalis)	dwarf shrub	35-40	O–A	+–1	vegetation
Caroxylon scleranthum (Salsola sclerantha)	annual	15–20	R	+	vegetation
Ceratocarpus arenarius	annual	10-12	R–O	+	vegetation
Convolvulus hamadae	semishrub	25–30	O–A	+–1	flowering
Cousinia hamadae	Perennial	25–30	R	+	vegetation
Eremopyrum bonaepartis	annual	10–12	R–O	+	fruiting
Eremopyrum distans	annual	10–12	R–O	+	fruiting
Ferula foetida	Perennial	100–150	O–A	+–1	Fruiting, dried

Haloxylon ammodendron (*Haloxylon aphyllum*)	Small tree	100–150	R–O	+–1	vegetation
Heliotropium arguzioides	Perennial	20–25	R	+	vegetation
Oreosalsola arbusculiformis (Salsola arbusculiformis)	dwarf shrub	50–60	O	+–1	vegetation
Peganum garmala	Perennial	30–35	R–O	+	flowering
Poa bulbosa	Perennial	15–17	O–A	+	dried
Salsola paulsenii	annual	30–35	R	+	vegetation
Smirnowia turkestana	Perennial	30–35	R	+	flowering
Tortula desertorum	moss	0.3–0.5	O	+	vegetation
Tulipa lehmanniana	Perennial	10–20	R–O	+	Vegetation, flowering
Ziziphora tenuior	annual	6–7	R–O	+	dried



Photo 125. Weakly inclined piedmont plain of the relic ridge Kuldzhuktau with saltwort-sagebrush vegetation, [redacted]



Photo 126. Piedmont plain of the relic ridge Kuldzhuktau with ephemeroid-sagebrush vegetation and sparse black saxaul (remains of plantation), [redacted]



Photo 127. Piedmont plain of the relic ridge Kuldzhuktau with ephemeroid-sagebrush vegetation and plantation of black saxaul, surroundings of the village Chontabay, [redacted]



Photo 128. *Acanthophyllum cyrtostegium,* nationally red-listed endemic species (category 3 – reducing species).



Photo 129. *Calligonum zakirovii,* nationally red-listed endemic to the south-western Kyzylkum (category 1 – endangered, disappearing species).



Photo 130. *Tulipa lehmanniana,* nationally red-listed species. Roadside of the road P-61, between the villages Shengeldy and Chontabay, April 2021

4.3.5. Foothills of relic low mountains

This habitat type is found on some plots along the previous variant of the power line (red line) running across the foothills of the relic ridge Kuldzhuktau. The terrain is more or less rugged, and the vegetation is represented with native saltwort-sagebrush communities on gypsiferous grey-brown desert soil and outcrops of variegated beds (photo 131), sometimes with tamarisk along dry riverbeds. Canopy cover is 10–30%. 27 plant species and one moss were recorded for this habitat type (table 52).

Table 52. Check-list of plants recorded for eroded foothills with outcrops of variegated beds and saltwort-sagebrush vegetation

Species	Life form	Height, cm	Abundance		Phenol. Stage
			DAFOR	Braun-Blanquet	
Anabasis turkestanica	semishrub	15–20	R	+	vegetation
Arnebia decumbens	annual	15–20	R	+	fruiting
Artemisia diffusa	semishrub	30–35	A	1–2	vegetation
Artemisia turanica	semishrub	30–35	O–A	+–1	vegetation
Astragalus villosissimus	dwarf shrub	40–60	O	+	vegetation
Bassia prostrata (Kochia prostrata)	semishrub	15–20	R	+	vegetation
Bromus tectorum	annual	12–15	R	+	fruiting
Caroxylon orientale (Salsola orientalis)	dwarf shrub	35-40	A	1	vegetation

Caroxylon scleranthum (Salsola sclerantha)	annual	15–20	R–O	+	vegetation
Ceratocarpus arenarius	annual	10-12	R–O	+	vegetation
Climacoptera sp.	annual	10–15	R–O	+	vegetation
Convolvulus hamadae	semishrub	25–30	O–A	+–1	flowering
Cousinia hamadae	Perennial	25–30	R–O	+	vegetation
Eremopyrum bonaepartis	annual	10–12	R–O	+	fruiting
Eremopyrum distans	annual	10–12	R–O	+	fruiting
Ferula foetida	Perennial	100–120	R	+	Fruiting, dried
Halimocnemis villosa	annual	10–15	R–O	+	vegetation
Haloxylon ammodendron (*Haloxylon aphyllum*)	Small tree	100–150	R	+	vegetation
Haplophyllum bungei	perennial	20–25	R	+	flowering
Haplophyllum robustum	perennial	25–30	R	+	flowering
Heliotropium arguzioides	Perennial	20–25	R	+	vegetation
Oreosalsola arbusculiformis (Salsola arbusculiformis)	dwarf shrub	50–60	O–A	+–1	vegetation
Peganum garmala	Perennial	30–35	R–O	+	flowering
Poa bulbosa	Perennial	15–17	O	+	dried
Salsola paulsenii	annual	30–35	R	+	vegetation
Tamarix sp.	shrub	100–120	R	+	vegetation
Tortula desertorum	moss	0.3–0.5	O	+	vegetation
Ziziphora tenuior	annual	6–7	R	+	dried



Photo 131. Eroded foothills of the relic ridge Kuldzhuktau with saltwort-sagebrush vegetation, [redacted]

4.3.6. Outcrops of variegated beds

This habitat type is found on rather small plots along the previous variant of the power line (red line) running across the northern foothills of the relic ridge Kuldzhuktau. The terrain is more or less rugged; the vegetation is very sparse (canopy cover is 1–10%) and composed by saltworts and gypsophytes. The species composition is the same that is described in 4.2.3.

4.3.7. Saline lands

Several rather small saline depressions with very sparse saltworts or with takyrs and without any vegetation are situated along the road P-61, between the village Shengeldy and the eastern edge of "Dzhankeldy" project site, among the weakly inclined northern piedmonts of the relic mountains Kuldzhuktau (photos 132–133). Canopy cover is 0–5%. 22 plant species were recorded for this habitat type (table 53), including one red-listed species, *Tulipa lehmanniana* (4 dried pre-generative specimens, [redacted]

Note: "takyr" is a peculiar type of landscape occurring in the deserts of Central Asia, which is formed on periodically inundated depressions with loamy soil, forming a cracked crust at the dry season.

Table 53. Check-list of plants recorded for saline depressions and takyrs

Species	Life form	Height, cm	Abundance		Phenol. Stage
			DAFOR	Braun-Blanquet	
Alhagi pseudalhagi	Perennial	30–35	R–O	+	vegetation
Anabasis turkestanica	semishrub	15–20	R	+	vegetation
Artemisia turanica	semishrub	30–35	R–O	+	vegetation

Bassia eriophora	annual	12–15	O	+	fruiting
Caroxylon orientale (Salsola orientalis)	dwarf shrub	35-40	R–O	+	vegetation
Caroxylon scleranthum (Salsola sclerantha)	annual	15–20	R–O	+	vegetation
Ceratocarpus arenarius	annual	10-12	R–O	+	vegetation
Climacoptera sp.	annual	10–15	R–O	+	vegetation
Convolvulus hamadae	semishrub	25–30	R–O	+	flowering
Cousinia hamadae	Perennial	25–30	R–O	+	vegetation
Eremopyrum bonaepartis	annual	10–12	R	+	fruiting
Eremopyrum distans	annual	10–12	R	+	fruiting
Ferula foetida	Perennial	70–100	R	+	Fruiting, dried
Halimocnemis villosa	annual	10–15	R–O	+	vegetation
Halimodendron halodendron	Shrub	50–70	R	+	vegetation
Haloxylon ammodendron (*Haloxylon aphyllum*)	Small tree	100–150	R	+	vegetation
Lycium ruthenicum	Shrub	50–70	R–O	+–1	flowering
Oreosalsola arbusculiformis (Salsola arbusculiformis)	dwarf shrub	50–60	R–O	+1	vegetation
Peganum garmala	Perennial	30–35	R–O	+	flowering
Tamarix sp.	shrub	100–120	R	+	vegetation
Tulipa lehmanniana	Perennial	10–15	R	+	dried
Ziziphora tenuior	annual	6–7	R	+	dried



Photo 132. Saline depression with sparse saltworts, [redacted]



Photo 133. Depression with takyr, vegetation is absent, [redacted]

It has been found that the vegetation along the planned power line “Bash-Dzhankeldy” is represented with native plant communities typical for South-western Kyzylkum, somewhere with saxaul plantations created in the past to prevent erosion of soils. The vegetation of studied area is characterized with sparse canopy cover, low species diversity and low to medium level of anthropogenic disturbance. At the present, the human impact is connected mainly with use of rangelands and a network of ground roads, as well as with littering by household waste near farms and villages and along roads.

A total check-list of vascular plants recorded along the planned power line "Bash-Dzhankeldy" during the field survey in May includes 52 species (Appendix 1); 3 species are nationally red-listed. *Calligonum zakirovii,* an endemic to south-western Kyzylkum and national endemic, is included in the Red Data Book of Uzbekistan (2019) with the status 1 (endangered, disappearing species). *Acanthophyllum cyrtostegium* and *Tulipa lehmanniana* are included in the Red Data Book of Uzbekistan (2019) with the status 3 (reducing).

4.4. "Bash-Karakul" power line

Following types of habitats (mapping units) were identified along the "Bash-Karakul" line:

4.4.1. Sandy and sandy-loamy desert plain

Sandy and sandy-loamy desert plain with flat, flat-wavy or wavy terrain is covered with native ephemeroid-sagebrush (*Artemisia diffusa, Poa bulbosa, Carex physodes, Carex subphysodes*) and ephemeroid-saltwort-sagebrush vegetation (*Artemisia diffusa, Poa bulbosa, Carex physodes, Caroxylon orientale (Salsola orientalis), Xylosalsola arbuscula, (Salsola arbuscula*)), sometimes with psammophilous shrubs (*Calligonum leucocladum, C. microcarpum*) and with saxaul plantations (*Haloxylon ammodendron*) on sandy desert soil (photo 134–135). On some areas, subdominants are *Alhagi pseudalhagi, Ferula foetida* and *Iris songarica* (photo 136–137). Local thickets of *Peganum garmala* have been found on overgrazed areas around farms and wells (photo 138). The elevation is 265–223 m a.s.l. The canopy cover is 10 to 40%, and the density of saxaul stands is up to 10–20%. A check-list of 29 plant species and 1 moss recorded for this habitat is presented below (table 54). This habitat is situated in the northern part of the power line, between the "Bash" project site and the discharge channel Agytma.

Table 54. Check-list of plants recorded for sandy desert plain with ephemeroid-sagebrush ephemeroid-saltwort-sagebrush vegetation, with psammophilous shrubs and saxaul plantations

Species	Life form	Height, cm	Abundance		Phenol. Stage
			DAFOR	Braun-Blanquet	
Acanthophyllum elatius	Perennial	40–45	R	+	flowering
Alhagi pseudalhagi	Perennial	30–35	R–A	+–1	vegetation
Alyssum desertorum	annual	5–6	R	+	dried
Artemisia diffusa	semishrub	20–35	A–D	1–2	vegetation
Astragalus villosissimus	dwarf shrub	35-45	O–A	+	vegetation
Bromus tectorum	annual	12–15	R–O	+	fruiting
Calligonum leucocladum	shrub	50–100	R–O	+	fruiting
Calligonum microcarpum	shrub	50–70	R–O	+	fruiting
Carex physodes	Perennial	12–15	A–D	1	dried
Carex subphysodes	Perennial	10–12	O–D	1	dried
Calligonum leucocladum	shrub	50–100	R–O	+–1	fruiting
Calligonum microcarpum	shrub	50–100	R–O	+–1	fruiting

Caroxylon orientale (Salsola orientalis)	dwarf shrub	35-40	R–A	+–1	vegetation
Ceratocarpus arenarius	annual	10-12	R–A	+–1	vegetation
Convolvulus divaricatus	semishrub	25–35	R–O	+	flowering
Convolvulus hamadae	semishrub	25–30	R–A	+–1	flowering
Cousinia hamadae	Perennial	25–30	R–O	+	vegetation
Ferula foetida	Perennial	50–80	R–A	+–1	Fruiting, dried
Halothamnus subaphyllus	semishrub	50–60	R	+	vegetation
Haloxylon ammodendron (*Haloxylon aphyllum*)	Small tree	100–150	R–A	+–2	vegetation
Heliotropium arguzioides	Perennial	20–25	R	+	vegetation
Iris songarica	Perennial	30–35	R–A	+–1	vegetation
Peganum garmala	Perennial	30–35	R–A	+–1	flowering
Poa bulbosa	Perennial	15–17	A	+	dried
Salsola paulsenii	annual	30–35	R	+	vegetation
Sophora pachycarpa	Perennial	20–25	R–O	+	flowering
Smirnowia turkestana	Perennial	30–35	R	+	flowering
Stipagrostis pennata	Perennial	30–35	R	+	vegetation
Tortula desertorum	moss	0.3–0.5	O–A	+–1	vegetation
Xylosalsola arbuscula (Salsola arbuscula)	shrub	40–50	O–A	+–1	vegetation



Photo 134. Sandy plain with native ephemeroid-sagebrush vegetation and remains of plantations of black saxaul, [redacted]



Photo 135. Sandy plain with native ephemeroid-saltwort-sagebrush vegetation and plantations of black saxaul, [redacted]



Photo 136. Sandy plain with native ephemeroid-sagebrush vegetation, with abundance of *Ferula foetida* and *Iris songarica*, [redacted]



Photo 137. Wavy sandy plain with native ephemeroid-sagebrush vegetation, with abundance of *Ferula foetida*, [redacted]



Photo 138. Overgrazed rangelands with abundance of *Peganum garmala* on sandy plain near the sheep farm, [redacted]

4.4.2. Fixed and semi-fixed sands

Fixed and semi-fixed sands with hilly, ridge-hilly, ridge and wavy terrain are covered with native stands of saxaul, communities of psammophytic shrubs, dwarf shrubs, ephemers and ephemeroids (photo 139–141), and with plots of saxaul plantations. This habitat prevails in the central and southern part of the power line, between the discharge channel Agytma and Karakul. Dominants and subdominants are *Haloxylon persicum, H. ammodendron, Ammodendron conollyi,* species of *Calligonum* and *Xylosalsola, Artemisia diffusa, Astragalus villosissimus, Carex physodes, Ferula foetida, Convolvulus divaricatus*. The density of saxaul stands is up to 0.3–0.4. Local plots of unfixed moving sands and communities of pastoral weeds *Peganum garmala* and *Sophora pachycarpa* have been found on overgrazed and other disturbed areas around farms and wells, and along roads (photo 142). 48 plant species and one moss were recorded for this habitat type (table 55), including one nationally red-listed species, *Calligonum zakirovii* (fruiting specimens were found near the southern edge of saline wetland situated along the discharge channel Agytma, [redacted]

Table 55. Check-list of plants recorded for fixed and semi-fixed sands with psammophytic shrubs and ephemeroid-sagebrush vegetation

Species	Life form	Height, cm	Abundance		Phenol. Stage
			DAFOR	Braun-Blanquet	
Acanthophyllum elatius	Perennial	40–45	R–O	+	flowering
Agriophyllum lateriflorum	annual	20–30	R–O	+	vegetation
Alhagi pseudalhagi	Perennial	30–40	R–A	+–1	vegetation

Alyssum desertorum	annual	5–6	R	+	dried
Ammodendron conollyi	Small tree	100–150	R–A	+–1	fruiting
Arnebia decumbens	annual	15–20	R	+	fruiting
Artemisia diffusa	semishrub	35–40	O–D	+–2	vegetation
Astragalus unifoliolatus	dwarf shrub	35-40	R–O	+	fruiting
Astragalus villosissimus	dwarf shrub	35-40	O–A	+–1	fruiting
Atriplex dimorphostegia	annual	10–15	R	+	fruiting
Bassia eriophora	annual	10–15	R	+	fruiting
Bromus tectorum	annual	12–15	O–A	+	dried
Calligonum caput-medusae	shrub	100–150	R–O	+–1	fruiting
Calligonum eriopodum	shrub	150–170	R–O	+	fruiting
Calligonum leucocladum	shrub	100–150	O–D	1–2	fruiting
Calligonum microcarpum	shrub	50–100	O–A	1	fruiting
Calligonum zakirovii	shrub	40–50	R	+	fruiting
Carex physodes	Perennial	12–15	A–D	+–1	flowering
Caroxylon orientale (Salsola orientalis)	dwarf shrub	35–40	R–O	+	vegetation
Caroxylon scleranthum (Salsola sclerantha)	annual	20–25	R–O	+	vegetation
Ceratocarpus arenarius	annual	15–20	O–A	+	vegetation
Climacoptera sp.	annual	15–20	R–O	+	vegetation
Convolvulus divaricatus	semishrub	30–45	R–A	+–1	flowering
Convolvulus hamadae	semishrub	30–40	R–A	+–1	flowering
Cousinia hamadae	Perennial	30–35	R–O	+	vegetation
Ephedra strobilacea	shrub	50–150	R–O	+	fruiting
Eremopyrum bonaepartis	annual	10–12	R–O	+	fruiting
Eremopyrum distans	annual	10–12	R–O	+	fruiting
Euphorbia cheirolepis	annual	25–30	R	+	Flowering, fruiting

Euphorbia turczaninowii	annual	10–12	R	+	Flowering, fruiting
Ferula foetida	Perennial	50–60	R–A	+–1	Fruiting, dried
Haplophyllum ramosissimum	Perennial	25–30	R	+	vegetation
Haloxylon ammodendron (*Haloxylon aphyllum*)	Small tree	150–200	R–A	+–1	vegetation
Haloxylon persicum	Small tree	150–200	O–D	1–3	vegetation
Heliotropium arguzioides	Perennial	25–30	R–O	+	flowering
Iris songarica	Perennial	30–35	R	+	vegetation
Mausolea eriocarpa	semishrub	45–50	O–A	1	flowering
Oreosalsola arbusculiformis (Salsola arbusculiformis)	dwarf shrub	50–60	O	+–1	vegetation
Peganum garmala	Perennial	30–35	R–A	+–1	flowering
Poa bulbosa	Perennial	15–17	O	+	dried
Salsola paulsenii	annual	30–35	R	+	vegetation
Sophora pachycarpa	Perennial	20–25	R–A	+–1	flowering
Smirnowia turkestana	Perennial	30–35	R–O	+	flowering
Stipagrostis karelinii	Perennial	35–45	O	+	vegetation
Stipagrostis pennata	Perennial	30–35	O	+	vegetation
Tortula desertorum	moss	0.3–0.5	O	+	vegetation
Xylosalsola arbuscula (Salsola arbuscula)	shrub	40–50	R–O	+–1	vegetation
Xylosalsola richteri (Salsola richteri)	shrub	100–150	R–O	+–1	vegetation



Photo 139. Semi-fixed hilly sands with native stands of saxaul and psammophytic shrubs, [redacted]



Photo 140. Fixed hilly sands with native stands of saxaul, [redacted]



Photo 141. Fixed sands with native community of *Calligonum* in surroundings of Kara[redacted]



Photo 142. An overgrazed area with unfixed sands and community of pastoral weeds *Peganum garmala* and *Sophora pachycarpa,* [redacted]



Photo 143. *Calligonum zakirovii,* nationally red-listed endemic to the south-western Kyzylkum (category 1 – endangered, disappearing species), [redacted]

4.4.3. Saline lands and wetlands

Saline lands and wetlands are situated in the ancient delta of the Zeravshan River, in depressions and along several irrigation and discharge channels and collectors of the irrigation system of Bukhara oasis (Agytma and Echkiliksay discharge channels, Northern and Central Bukhara collectors, Gazli channel, Karakuldarya, etc.). The vegetation is represented by tugay and salt marsh communities with halophilic shrubs (*Tamarix sp., Halimodendron halodendron, Halostachys belangeriana, Lycium ruthenicum*), reeds (*Phragmites australis, Typha latifolia, T. minima*), camel thorn (*Alhagi pseudalhagi*), saltworts (*Halocnemum strobilaceum*, *Ceratocarpus arenarius, Climacoptera sp., Salicornia europaea, Salsola paulsenii, Suaeda sp.*), other halophytes, halomesophytes and halohydrophytes, as *Limonium otolepis, Karelinia caspia*, and pastoral weeds (*Peganum garmala, Sophora pachycarpa*). Canopy cover and species composition are variable in different locations (photos 144–149). In total, 43 plant species were recorded for this habitat type (table 56), red-listed plants are absent.

Note: “tugay” (or “tugai”) is a local name of riparian ecosystems occurring in the river valleys of the desert zone of Central Asia.

Table 56. Check-list of plants recorded for saline lands and wetlands

Species	Life form	Height, cm	Abundance		Phenol. Stage
			DAFOR	Braun-Blanquet	
Aeluropus litoralis	Perennial	10–20	O–A	+–1	Vegetation, flowering
Alhagi persarum	Perennial	35–45	O	+	vegetation
Alhagi pseudalhagi	Perennial	35–45	O–D	+–3	vegetation
Artemisia scoparia	Annual, biennial	35–40	R–A	+–1	vegetation

Bassia eriophora	annual	12–15	R–O	+	fruiting
Bromus tectorum	annual	12–15	O–A	+	dried
Caroxylon scleranthum (Salsola sclerantha)	annual	20–25	R–O	+	vegetation
Ceratocarpus arenarius	annual	10-12	R–A	+–1	vegetation
Climacoptera sp.	Annual	10–15	R–O	+	vegetation
Convolvulus hamadae	semishrub	25–30	R–O	+	flowering
Cousinia resinosa	Perennial	25–30	R–O	+	vegetation
Elaeagnus angustifolia	tree	250–350	R	1	vegetation
Eremopyrum bonaepartis	annual	10–12	R–O	+	fruiting
Eremopyrum distans	annual	10–12	R–O	+	fruiting
Erianthus ravennae	perennial	150–250	R	+	vegetation
Euphorbia granulata	annual	5–10	R–O	+	Flowering, fruiting
Ferula foetida	Perennial	70–100	R–O	+	Fruiting, dried
Glycyrrhiza glabra	Perennial	50–100	R–O	+	Vegetation
Halimocnemis villosa	annual	10–15	R–O	+	vegetation
Halimodendron halodendron	Shrub	70–150	R–O	1–2	vegetation
Halocnemum strobilaceum	semishrub	40–100	R–A	+–1	vegetation
Halostachys belangeriana	Shrub	50–100	R–O	+–1	vegetation
Haloxylon ammodendron (*Haloxylon aphyllum*)	Small tree	100–150	R–O	1–2	vegetation
Heliotropium ellipticum	annual	15–20	R–O	+	flowering
Karelinia caspia	Perennial	40–100	R–A	+–1	vegetation
Limonium otolepis	Perennial	35–50	R–A	+–1	flowering
Limonium suffruticosum	semishrub	25–35	R–O	+	vegetation
Lycium ruthenicum	Shrub	50–70	R–A	+–2	flowering
Peganum garmala	Perennial	30–35	R–A	+–1	flowering
Phragmites australis	Perennial	200–400	O–D	1–4	vegetation
Poa bulbosa	Perennial	15–17	O–A	+	dried
Salicornia europaea	annual	10–20	O	+	vegetation

Salsola paulsenii	annual	30–35	R–O	+	vegetation
Sophora pachycarpa	Perennial	20–25	R–A	+–1	flowering
Sphaerophysa salsula	Perennial	30–35	R–O	+	vegetation
Suaeda altissima	annual	25–35	R–O	+	vegetation
Suaeda sp.	Annual	10–20	R–O	+	vegetation
Tamarix hispida	shrub	70–150	R–A	1–2	vegetation
Tamarix laxa	shrub	70–150	R–A	1–2	vegetation
Tamarix ramosissima	shrub	150–200	R–D	+–4	vegetation
Typha latifolia	Perennial	150–200	R–O	+–1	vegetation
Typha minima	Perennial	100–150	R	+	vegetation
Zygophyllum oxianum	Perennial	20–30	R	+	fruiting



[redacted] seasonal lake with tamarisk, reeds and halophytes in a small depression between the “Bash” site and Agytma discharge channel, 40.4746° N, [redacted]



Photo 145. Reeds along the Echkiliksay discharge channel, 4[redacted] E.



Photo 146. Saline wetland and a seasonal lake with tamarisk, reeds and halophytes in a small depression between the “Bash” site and Agytma discharge channel, [redacted]



Photo 147. Sparse tamarisk in saline depression near the collector Karakyr, [redacted]



Photo 148. Saline land with community of *Lycium ruthenicum* and camel thorn near the Echkiliksay discharge channel, [redacted]



Photo 149. Camel thorn community on saline sands near the Agytma discharge channel (at the border between saline lands and sandy desert, [redacted]

4.4.5. Agricultural lands

This is the anthropogenic agricultural landscape of the ancient Bukhara Oasis situated in the lower course and the ancient delta of Zeravshan River. There are irrigated croplands, saline fallow lands, wastelands, villages, farmsteads, branched irrigation system of numerous channels and collectors, roads, power lines, and other disturbed areas; vegetation is represented by cultural crops (wheat, rice, cotton, vegetables, etc.), weeds (*Cynodon dactylon, Descurainia sophia, Peganum garmala, Sophora pachycarpa, Tribulus terrestris*) and small plots of above-mentioned vegetation of saline lands and wetlands (photo 150–151). Canopy cover and species composition are variable in different locations. The check-list of wild growing plant species is almost the same than the previos habitat type (table 57); 42 species were recorded; red-listed plants are absent, and 2 species are alien (*Cynodon dactylon, Tribulus terrestris*).

Table 57. Check-list of plants recorded for agricultural lands

Species	Life form	Height, cm	Abundance		Phenol. Stage
			DAFOR	Braun-Blanquet	
Aeluropus litoralis	Perennial	10–20	O–A	+–1	Vegetation, flowering
Alhagi kirghisorum	Perennial	35–45	O–A	+–2	vegetation
Alhagi persarum	Perennial	35–45	O	+	vegetation
Alhagi pseudalhagi	Perennial	35–45	O–D	+–3	vegetation
Artemisia scoparia	Annual, biennial	35–40	R–A	+–1	vegetation
Bromus tectorum	annual	12–15	O–A	+	dried

Ceratocarpus arenarius	annual	10-12	R–A	+–1	vegetation
Climacoptera sp.	Annual	10–15	R–O	+	vegetation
Cousinia resinosa	Perennial	25–30	R–O	+	vegetation
Cynodon dactylon	Perennial	10–15	R–O	+	Vegetation, flowering
Descurainia sophia	annual	20–25	O	+	fruiting
Elaeagnus angustifolia	tree	250–350	R	1	vegetation
Eremopyrum bonaepartis	annual	10–12	R–O	+	fruiting
Eremopyrum distans	annual	10–12	R–O	+	fruiting
Erianthus ravennae	perennial	150–250	R	+	vegetation
Euphorbia granulata	annual	5–10	R–O	+	Flowering, fruiting
Glycyrrhiza glabra	Perennial	50–100	R–O	+	Vegetation
Halimocnemis villosa	annual	10–15	R–O	+	vegetation
Halimodendron halodendron	Shrub	70–150	R–O	1–2	vegetation
Halocnemum strobilaceum	semishrub	40–100	R–A	+–1	vegetation
Halostachys belangeriana	Shrub	50–100	R–O	+–1	vegetation
Haloxylon ammodendron (*Haloxylon aphyllum*)	Small tree	50–150	R	+–1	vegetation
Heliotropium ellipticum	annual	15–20	R–O	+	flowering
Karelinia caspia	Perennial	40–100	R–A	+–1	vegetation
Limonium otolepis	Perennial	35–50	R–A	+–1	flowering
Lycium ruthenicum	Shrub	50–70	R–A	+–2	flowering
Peganum garmala	Perennial	30–35	R–A	+–1	flowering
Phragmites australis	Perennial	200–400	O–D	1–4	vegetation
Poa bulbosa	Perennial	15–17	O–A	+	dried
Populus pruinosa	tree	400–600	R–O	1–2	Vegetation, fruiting
Salicornia europaea	annual	10–20	O	+	vegetation
Salsola paulsenii	annual	30–35	R–O	+	vegetation
Sophora pachycarpa	Perennial	20–25	R–A	+–1	flowering
Suaeda altissima	annual	25–35	R–O	+	vegetation
Suaeda sp.	Annual	10–20	R–O	+	vegetation
Tamarix hispida	shrub	70–150	R–A	1–2	vegetation

Tamarix laxa	shrub	70–150	R–A	1–2	vegetation
Tamarix ramosissima	shrub	150–200	R–D	+–4	vegetation
Tribulus terrestris	annual	10–20	R–O	+	Vegetation, flowering
Typha latifolia	Perennial	150–200	R–O	+–1	vegetation
Typha minima	Perennial	100–150	R–O	+	vegetation
Zygophyllum oxianum	Perennial	20–30	R–O	+	fruiting



Photo 150. Rice fields, [redacted]



Photo 151. Saline fallow lands, [redacted]

5. Conclusion

Results of the field surveys conducted in both project sites in springtime (April) and early summer (middle May and middle June) showed that the species composition has been identified almost completely during the first survey. The main difference between data of springtime and summer surveys is that all ephemers and ephemeroids completed their vegetation and dried, so their abundance and coverage decreased. Some representatives of Amarantaceae family (Climacoptera, Suaeda) were identified only at generic level, because the correct identification of these plants is possible at the flowering or fruiting stage (second half of August to October).

It has been found that the vegetation of the project zone, including “Bash” and “Dzhankeldy” sites, and an area between these sites along the planned power line, is represented with native ephemeroid-sagebrush, saltwort-sagebrush, saltwort-ephemeroid-sagebrush and saltwort plant communities on sandy, sandy-loamy and skeleton grey-brown desert soils, with sparse halophilous and gypsophilous vegetation on saline depressions and outcrops of variegated beds, with psammophilous shrubs on fixed and semi-fixed sands, and sometimes with saxaul plantations created in the past for fixation of sands and combat soil deflation. The vegetation of the project zone is typical for South-western Kyzylkum (and for the desert zone of Central Asia). The field survey showed that the draft maps of habitats created on the basis of proxy data are generally correct, and only some adjustmens are necessary.

Plant communities of the project zone are characterized with sparse canopy cover, low species diversity and low to medium level of anthropogenic disturbance. The canopy cover is 20–40% on most areas, less than 10% (sometimes almost 0%) on saline depressions, takyrs and outcrops of variegated beds, and up to 40–50% for communities of psammophilous shrubs or saxaul stands.

A total check-list of vascular plants were recorded within the project site “Bash” during the field surveys includes 49 species (Annex 1); 85 species were recorded within the “Dzhankeldy” site (Annex 2), 52 species – along the planned power line “Bash-Dzhankeldy” (Annex 3), and 76 species – along the “Bash-Karakul” line (Annex 4). Among them, 4 species are nationally red-listed. *Calligonum zakirovii,* an endemic to south-western Kyzylkum and national endemic, is included in the Red Data Book of Uzbekistan (2019) with the status 1 (endangered, disappearing species). *Acanthophyllum cyrtostegium, Ferula kyzylkumica* and *Tulipa lehmanniana* are included in the Red Data Book of Uzbekistan (2019) with the status 3 (reducing). Among them, 3 species are endemics with restricted range (*Acanthophyllum cyrtostegium, Calligonum zakirovii, Ferula kyzylkumica)*.

Nationally red-listed *Tulipa lehmanniana* occurs sporadically within two project sites and along the planned power line “Bash-Dzhankeldy”; its relative abundance according the DAFOR scale is R (rare) to O (occasional), population density varies from solitary specimens to 900–1000 per 1 hectare. Due to the dry weather conditions of last winter and this spring, mainly pre-generative and non-flowering generative specimens of this tulip were observed; the number of flowering specimens is very low. *Tulipa lehmanniana* included in the Red Data Book of Uzbekistan (2019) with the status 3 (vulnerable, reducing), it is nationally red-listed also in Kazakhstan, Tajikistan and Turkmenistan, and not evaluated in the IUCN Red List. The main threats are overgrazing, habitat loss, collection of flowers and bulbs. This species is quite widely spread in the desert zone of Irano-Turanian region of Tethyan (Ancient Mediterranean) floristic subkingdom of Holarctic (Takhtajan, 1986), and it grows in Uzbekistan, Kazakhstan, Tajikistan, Turkmenistan, Afghanistan, Pakistan, and Iran. Recent field studies (Abduraimov, 2017; Shomurodov & al., 2018) showed that large populations with thousands of specimens grow in the Uzbek part of the Kyzylkum desert. Tojibaev &

Beshko (2015) noted that this species can be assessed as Least Concern (LC) by the IUCN Red List Categories and Criteria (IUCN, 2012).

Another plant listed in the Red Data Book of Uzbekistan (2019) with the category 3 (reducing), *Ferula kyzylkumica,* is endemic to the relic mountains of Kyzylkum with a disjunction in the Nuratau Mountains, and national endemic. This species also is widely spread in the Kuldzhuktau Mountains; solitary specimens and populations of 50–100 individuals occur sporadically on stony slopes and foothills within and between survey plots in "Dzhankeldy" project site.

Nationally red-listed endemic to south-western Kyzylkum and Zirabulak-Ziadin Mountains, *Acanthophyllum cyrtostegium,* occurs sporadically in the piedmont plains and foothills of Kuldzhuktau, solitary or in small groups, the population density is up to 40–50 individuals per 1 hectare.

As for *Calligonum zakirovii,* only several small populations were found in "Dzhankeldy" project site and along the "Bash-Dzhankeldy" power line during the field studies.

Three species (*Cousinia sogdiana, Eremurus korolkowii* and *Tulipa sogdiana*) are endemic to Central Asian deserts, which previously were included in the Red Data Book of Uzbekistan, but on the basis of field surveys performed during the last 20 years they have been removed from the national Red Data Book. Among them, endemic to relic mountains of Kyzylkum *Eremurus korolkowii* has most restricted range and habitat.

None of these nationally red-listed or endemic plants were evaluated in the IUCN Red List.

Other threatened or endemic species known for the study area from literature (see Chapter 2.2 above) were not recorded during our field surveys in 2021, but can potentially be found with more detailed studies in the future. Taking into account the published and field data, the insular mountains Kuldzhuktau (and "Dzhankeldy" project site in particular) meets the critical habitat criteria 1 and 2 as a habitat of several nationally red-listed and restricted range endemic plant species (Annex 5).

Within the whole project area, anthropogenically transformed ecosystems are mainly concentrated along the "Bash-Karakul" power line; there are irrigated croplands, fallow lands, wastelands, villages, farmsteads, irrigation systems, roads, power lines, and other infrastructure; vegetation is represented by cultural crops, weeds and small plots of vegetation of saline lands and wetlands.

At the present, the human impact within the "Bash" and "Dzhankeldy" sites and along the "Bash-Dzhankeldy" power line is connected mainly with economical activities of local people inhabiting several small villages and farmsteads (use of rangelands and ground roads). *Peganum garmala*, a plant species which is an indicator of overgrazing and degradation of pastures, has been found in all natural habitats and majority of survey plots, but its abundance is low. Within the "Navoi-Bah" site, we did not observe dense thickets of *Peganum garmala* typical for degraded rangelands of arid zone of Uzbekistan, but in "Dzhankeldy" site and along the power lines these thickets occur around settlements, farmsteads and wells. As for invasive alien plants, these were not recorded during our field surveys in "Bash" and "Dzhankeldy" sites and along "Bash-Dzhankeldy" power line, and 2 alien weeds (*Cynodon dactylon* and *Tribulus terrestris*) were found along the "Bash-Karakul" power line, in anthropogenic landscapes.

Technologically disturbed areas occupy very small part of the "Bash" project site in a narrow strip along the railway and underground gas pipeline. Small disturbed areas (construction sites or quarries about 250x150 and 350x250 m in size) with almost completely exterminated vegetation are located also in the south-eastern part of this project site. In "Dzhankeldy" site, the impact of mining operations is more expressed (there are numerous active and abandoned mines and quarries, geological exploration is underway at the present). Such technogenically disturbed areas in the Kyzylkum desert,

as well as overgrazed territories around farms, wells and villages, usually become centers of erosion which can lead to the formation of moving sands.

Table 58. Summary table

SPECIES	ABUNDANCE ON SITE (RARE/OCCASIONAL/FREQUENT/DOMINANT)	RANGE (ENDEMIC / REGIONAL / TRANSCONTINENTAL)	IUCN /RDB STATUS
"Bash WF" site			
Tulipa lehmanniana Merckl.	Occasional to Rare	Regional	Not Evaluated (NE) / UzbRDB 3 (vulnerable, declining species)
"Dzhankeldy WF" site			
Acanthophyllum cyrtostegium Vved.	Rare	Endemic	Not Evaluated (NE) / UzbRDB 3 (vulnerable, declining species)
Calligonum zakirovii (Khalk.) Czerep.	Rare	Endemic	Not Evaluated (NE) / UzbRDB 1 (endangered species)
Eremurus korolkowii Regel (see note below)	Occasional to Rare	Endemic	Not Evaluated (NE) / UzbRDB 2 (rare species) in former editions, currently excluded
Ferula kyzylkumica Korovin	Occasional to Rare	Endemic	Not Evaluated (NE) / UzbRDB 3 (vulnerable, declining species)
Tulipa lehmanniana Merckl.	Occasional to Rare	Regional	Not Evaluated (NE) / UzbRDB 3 (vulnerable, declining species)
OHTL segment 1 ("Bash WF – Dzhankeldy WF")			
Acanthophyllum cyrtostegium Vved.	Rare	Endemic	Not Evaluated (NE) / UzbRDB 3 (vulnerable, declining species)
Calligonum zakirovii (Khalk.) Czerep.	Rare	Endemic	Not Evaluated (NE) / UzbRDB 1 (endangered species)
Tulipa lehmanniana Merckl.	Occasional to Rare	Regional	Not Evaluated (NE) / UzbRDB 3 (vulnerable, declining species)
OHTL segment 2 ("Bash WF – Karakul sub-stantion")			
Calligonum zakirovii (Khalk.) Czerep.	Rare	Endemic	Not Evaluated (NE) / UzbRDB 1 (endangered species)

Note: In the international taxonomic databases, Eremurus korolkowii currently treated as a synonym of Eremurus anisopterus (assessed as LC by IUCN). But experts in Central Asian flora do not support this point of view and consider these plants as two separated species, which morphologically and ecologically well differ from each other. Additional molecular-genetic studies are needed.

	NAME OF SPECIES		IUCN /RDB STATUS	ABUNDANCE/ DENSITY
	LATIN	ENGLISH		
1	Acanthophyllum cyrtostegium Vved.	-	Not Evaluated (NE) / UzbRDB 3 (vulnerable, declining species)	Rare / up to 40–50 individuals per 1 hectare
2	Calligonum zakirovii (Khalk.) Czerep.	Zakirov's calligonum	Not Evaluated (NE) / UzbRDB 1 (endangered species)	Rare / density varies from solitary plants to 30–40 per 1 hectare
3	Eremurus korolkowii Regel	Korolkow's desert-candle	Not Evaluated (NE) / UzbRDB 2 (rare species) in former editions, currently excluded	Occasional to Rare / density varies from solitary plants to 100–150 per 1 hectare
4	Ferula kyzylkumica Korovin	Kyzylkum's ferula	Not Evaluated (NE) / UzbRDB 3 (vulnerable, declining species)	Occasional to Rare / density varies from solitary plants to 50–100 per 1 hectare
5	Tulipa lehmanniana Merckl.	Lehmann's tulip	Not Evaluated (NE) / UzbRDB 3 (vulnerable, declining species)	Occasional to Rare / density varies from solitary plants to 900–1000 per 1 hectare

References

A Global Standard for the Identification of Key Biodiversity Areas. Version 1.0. (2016) IUCN, Gland, Switzerland. 37 p.

Abduraimov O.S. (2017) Biological features and state of coenopopulations of species of the genus *Tulipa* L. in Kyzylkum. Abstr. PhD Diss. Tashkent. 44 p. (In Uzbek and Russian).

Akhmedov A.K. (2018) Onthogenetic structure and state of coenopopulations of rare and endemic species of the genus *Lagochilus* Bunge (Lamiaceae Lindl.) of the flora of Uzbekistan. Abstr. PhD Diss. Tashkent. 46 p. (In Uzbek and Russian)

Braun-Blanquet, J. (1965) Plant Sociology. The Study of Plant Communities. Hafner, London. 439 p.

Brauneder K.M., Montes C., Blyth S., Bennun L., Butchart S.H., Hoffmann M., Burgess N.D., Cuttelod A., Jones M.I., Kapos V., Pilgrim J., Tolley M.J., Underwood E.C., Weatherdon L.V., Brooks S.E. (2018) Global screening for Critical Habitat in the terrestrial realm. PloS one, 13(3), p.e0193102. doi:10.1371/journal.pone.0193102

CABI (2017) Invasive Species Compendium. CAB International, Wallingford, UK. Available from: www.cabi.org/isc.

Catalogue of Life: 2019 Annual Checklist (2019) Available from: http://www.catalogueoflife.org/annual-checklist/2019/search/all.

Conspectus Florae Asiae Mediae. In 11 vol. (1963–2015) Fan Publishers, Tashkent. (In Russian).

Esanov H.K. (2017) Analysis of the flora of Bukhara Oasis. Abstr. PhD Diss. Tashkent. 45 p. (In Uzbek and Russian)

Esanov H.K. (2019) Flora of Bukhara Oasis. Durdona Publishers, Bukhara. 128 p. (In Uzbek)

Field geobotany. In 4 vol. (1959–1976) Academy of Sciences of the USSR, Moscow & Leningrad. (In Russian).

Flora of the U.S.S.R. In 30 vol. (1934–1964) Academy of Sciences of the USSR, Moscow & Leningrad. (In Russian).

Flora of Uzbekistan. In 6 vol. (1941–1963) Academy of Sciences of the Uzbek SSR, Tashkent. (In Russian).

Geographical atlas of Uzbekistan. (2012) Goskomgeodeskadastr, Tashkent. 119 p. (In Russian).

Gintzburger G., Toderich K.N., Mardonov B.K. & Mahmudov M.M. (2003) Rangelands of the arid and semi-arid zones in Uzbekistan. CIRAD, ICARDA. 434 p.

Granitov A.I. (ed.) (1980) Methodological guidelines for geobotanical survey of natural rangelands in Uzbekistan. Uzgiprozem, Tashkent. 170 pp. (In Russian)

Granitov I.I. (1964, 1967) Vegetation cover of the South-Western Kyzylkum. Vol. 1–2. Fan Publishers, Tashkent. 335 p., 419 p. (In Russian).

Guidelines for Using the IUCN Red List Categories and Criteria. Version 8.1. (2010) IUCN, Gland, Switzerland and Cambridge, U.K. 85 p.

Guzairov H.H. (1951) Weed vegetation of the Bukhara region and measures of its control. Abstr. PhD Diss. Bukhara-Samarkand. 11 p. (In Russian).

Guzairov H.H. (1968) Weeds of fallow lands and croplands of Bukhara. In: Harmful and useful wild plants of Bukhara Oasis. No. 1. Fan Publishers, Tashkent. P. 52-90. (In Russian).

IFC (International Finance Corporation) (January 1, 2012, updated June 27, 2019) Guidance Note 6: Biodiversity Conservation and Sustainable Management of Living Natural Resources. Word Bank Group, Washington, DC. 69 p.

International Plant Names Index (2020) Available from: http://www.ipni.org.

Ismatov A.T. (ed.) (2013) Recommendations for protected areas system development in Uzbekistan. UNDP, GEF, Main Department of Forestry of Ministry of

Agriculture and Water Resources of the Republic of Uzbekistan. Baktria Press, Tashkent. 256 p. (In Russian).

IUCN Red List Categories and Criteria. Version 3.1 Second edition. (2012) IUCN, Gland, Switzerland and Cambridge, U.K. 32 p.

IUCN Red List of Threatened species (2020) Available from: http://www.iucnredlist.org.

IUCN/SSC Invasive Species Specialist Group (ISSG) (2014) Global Invasive Species Database version 2014-2. Available from: http://193.206.192.138/gisd/

Kent M. (2011) Vegetation Description and Data Analysis: A Practical Approach, 2nd Edition. Wiley-Blackwell. 428 pp.

Khassanov F. O., Shomuradov Kh. F. & Kadyrov G. (2011) A short description and analysis of endemism of the Kyzylkum desert. Bot. Journ. (96) 2: 237–245. (In Russian).

Korovin E.P. (1934) Vegetation of Middle Asia and South Kazakhstan. Moscow & Tashkent. 479 p. (In Russian).

Korovin E.P. (1961) Vegetation of Middle Asia and South Kazakhstan. Vol. 1. Tashkent. 452 p. (In Russian).

Korovin E.P. (1962) Vegetation of Middle Asia and South Kazakhstan. Vol. 2. Tashkent. 547 p. (In Russian).

Lipsky V. I. (1902–1905) Flora of Central Asia, i.e. Russian Turkestan and Bukhara and Khiva Khanates. Vol. 1–3. Herald Publishers, St. Petersburg (In Russian).

Maps of the whole world. Available from: http://loadmap.net/

Momotov I.F. (1973) Theoretical foundations and methods of phytomelioration of desert pastures in south-western Kyzylkum. Fan Publishers, Tashkent (In Russian).

Mountains of Central Asia Biodiversity Hotspot: Ecosystem Profile. (2017). CEPF, Switzerland. 183 p.

Nikitin V.V. (1983) Weeds of the flora of the USSR. Science Publishers, Leningrad. 454 p. (In Russian).

Nurov U.N. (1981) Main features of nature of Bukhara Oasis. In: Wild plants and crops of Bukhara Oasis. Vol. 211. Tashkent. P. 1-4.

Plants of the World Online (2021). Available from: www.plantsoftheworldonline.org/)

Rachkovskaya E. I., Volkova E. A. & Khramtsov V. N. (eds.) (2003) Botanical geography of Kazakhstan and Middle Asia. Leningrad. 425 p. (In Russian and Engl.).

Red Data Book of the Uzbek SSR (1984) Vol. 2. Plants. Tashkent. 150 p. (in Uzbek and Russian).

Red Data Book of the Republic of Uzbekistan (1998) Vol. 1. Plants. Chinor ENK, Tashkent. 335 p. (in Uzbek and Russian).

Red Data Book of the Republic of Uzbekistan (2006) Vol. 1. Plants and Fungi. Chinor ENK, Tashkent. 250 p. (in Uzbek, Russian and English).

Red Data Book of the Republic of Uzbekistan (2009) Vol. 1. Plants and Fungi. Chinor ENK, Tashkent. 360 p. (in Uzbek, Russian and English).

Red Data Book of the Republic of Uzbekistan (2019) Vol. 1. Plants. Tasvir, Tashkent. 356 p. (in Uzbek, Russian and English).

Saidov D.K., Markova L.E., Momotov I.F. (1975) Guide to a botanical excursion to the southern edge of Western Kyzylkum. Leningrad. P. 2-12 (In Russian).

Sennikov A.N. (ed.) (2016) Flora of Uzbekistan, 2nd Edition. Vol. 1. Amaryllidaceae. Navro'z Publishers, Tashkent. Xxviii + 173 p. (In Russian).

Sennikov A.N. (ed.) (2017) Flora of Uzbekistan, 2nd Edition. Vol. 2. Navro'z Publishers, Tashkent. Xii + 200 pp. (In Russian)

Sennikov A.N. (ed.) (2019) Flora of Uzbekistan, 2nd Edition. Vol. 3. Ma'naviat Publishers, Tashkent. Xii + 201 pp. (In Russian)

Sennikov A.N., Tojibaev K.Sh., Beshko N.Yu., Esanov H.K., Jenna Wong L. & Pagad S. (2018) Global Register of Introduced and Invasive Species – Uzbekistan. Version 1.3. Invasive Species Specialist Group ISSG. Available from: https://doi.org/10.15468/m5vdwk.

Shomurodov Kh.F. (2018) Fodder plants of Kyzylkum and the prospects fortheir use. Dsci Diss. Tashkent. 296 p. (In Russian).

Shomurodov Kh.F., Rakhimova T., Rakhimova N.K., Adylov B.A., Sarybaeva Sh., Abduraimov O.S. & Esov R.A. (2018) Coenopopulations of rare and endangered plant species of remnant low mountains of Kyzylkum. Navro‘z Publishers, Tashkent. 230 p. (In Russian)

Takhtajan A. (1986) Floristic regions of the World. Berkeley, Los Angeles, London. 522 p.

Tojibaev K.Sh., Beshko N.Yu. (2007) The cadaster of rare and endemic plants of Dzhizak and Navoi provinces of the Republic of Uzbekistan. In: Biodiversity of Uzbekistan – monitoring and use. Tashkent. Pp. 200-208. (In Russian).

Tojibaev K.Sh., Beshko N.Yu. (2015) Reassessment of diversity and analysis of distribution in *Tulipa* (Liliaceae) in Uzbekistan. Nordic Journal of Botany 33: 324–334.

Tojibaev K.Sh., Beshko N.Yu. & Popov V.A. (2016) Botanical-geographical regionalization of Uzbekistan. Bot. Journ. 101 (10): 1105–1132. (In Russian).

Tojibaev K.Sh., Beshko N.Yu., Popov V.A., Jang C.G. & Chang K.S. (2017) Botanical Geography of Uzbekistan. Korea National Arboretum, Pocheon, Republic of Korea. 250 p.

Tojibaev K.Sh., Beshko N.Yu., Shomurodov Kh.F. & al. (2019) Inventory of the flora of Uzbekistan: Navoi Province. Fan Publishers, Tashkent. 216 p. (In Russian).

Tojibaev K.Sh., Beshko N.Yu., Shomurodov Kh.F. & al. (2020) Inventory of the flora of Uzbekistan: Bukhara Province. O’kituvchi Publishers, Tashkent. 128 p. (In Russian).

UNEP-WCMC (2017) Global Critical Habitat screening layer (Version 1.0). Cambridge (UK): UN Environment World Conservation Monitoring Centre. DOI: https://doi.org/10.34892/nc6d-0z73

USGS Earth Explorer. Available from: https://earthexplorer.usgs.gov/

Vegetation cover of Uzbekistan and the ways of its practical use (1971–1984) In 4 vol. Fan Publishers, Tashkent. (In Russian).

Zakirov K.Z. (1955) Flora and vegetation of the Zeravschan river basin. Vol. 1. Fan Publishers, Tashkent. 205 p. (In Russian).

Zakirov K.Z. (1961) Flora and vegetation of the Zeravschan river basin. Vol. 2. Fan Publishers, Tashkent. 446 p. (In Russian).

Zakirov P.K. (1971) Botanical geography of low mountains of Kyzylkum and Nuratau ridge. Fan Publishers, Tashkent. 203 p. (In Russian).

Annex 1. A check-list of plants recorded in "Bash" site

Plant species	Life form	Family	Abundance	Habitat
1. Acanthophyllum elatius	Perennial	Caryophyllaceae	O–R	Sandy and sandy-loamy desert plain, fixed and semi-fixed sands, relic hills
2. Alhagi pseudalhagi	Perennial	Fabaceae	O–R	Fixed and semi-fixed sands
3. Alyssum desertorum	annual	Brassicaceae	O–R	Sandy and sandy-loamy desert plain, fixed and semi-fixed sands, relic hills
4. Artemisia diffusa	semishrub	Asteraceae	D–A	All natural habitats and all survey plots
5. Atraphaxis spinosa	shrub	Polygonaceae	R	Cliffs and eroded slopes of saline depression
6. Astragalus ammotrophus	perennial	Fabaceae	R	Cliffs and eroded slopes of saline depression
7. Astragalus chiwensis	perennial	Fabaceae	R	Fixed and semi-fixed sands (B067, B068)
8. Astragalus flexus	perennial	Fabaceae	R	Sandy and sandy-loamy desert plain, fixed and semi-fixed sands
9. Astragalus rubromarginatus	perennial	Fabaceae	R	Sandy and sandy-loamy desert plain, fixed and semi-fixed sands
10. Astragalus villosissimus	dwarf shrub	Fabaceae	A–R	All natural habitats and majority of survey plots
11. Bassia prostrata (*Kochia prostrata)*	semishrub	Amaranthaceae	R	Sandy and sandy-loamy desert plain, cliffs and eroded slopes of saline depression
12. *Bromus tectorum*	annual	Poaceae	O	Sandy and sandy-loamy desert plain, fixed and semi-fixed sands
13. Calligonum leucocladum	shrub	Polygonaceae	A–R	Fixed and semi-fixed sands
14. Calligonum microcarpum	shrub	Polygonaceae	A–R	Sandy and sandy-loamy desert plain, fixed and semi-fixed sands
15. Carex physodes	Perennial	Cyperaceae	D–A	Sandy and sandy-loamy desert plain, fixed and semi-fixed sands
16. Carex subphysodes	Perennial	Cyperaceae	A–O	Sandy and sandy-loamy desert plain, cliffs and eroded

				slopes of saline depression, relic hills
17. Caroxylon orientale (Salsola orientalis)	dwarf shrub	Amaranthaceae	D–R	All natural habitats and all survey plots
18. Caroxylon scleranthum (Salsola sclerantha)	annual	Amaranthaceae	R	Sandy and sandy-loamy desert plain, fixed and semi-fixed sands
19. *Ceratocarpus arenarius*	annual	Amaranthaceae	R	All natural habitats and majority of survey plots
20. Ceratocephala falcata	annual	Ranunculaceae	O–R	Sandy and sandy-loamy desert plain, fixed and semi-fixed sands
21. Climacoptera sp.	Annual	Amaranthaceae	R	Sandy and sandy-loamy desert plain, cliffs and eroded slopes of saline depression
22. Convolvulus divaricatus	semishrub	Convolvulaceae	O-R	fixed and semi-fixed sands, relic hills
23. Convolvulus hamadae	semishrub	Convolvulaceae	A-R	All natural habitats and majority of survey plots
24. Cousinia hamadae	perennial	Asteraceae	R	All natural habitats and majority of survey plots
25. Cousinia sogdiana	biennial	Asteraceae	R	fixed and semi-fixed sands
26. Cousinia resinosa	perennial	Asteraceae	R	Sandy and sandy-loamy desert plain (B036, B037)
27. Ferula foetida	Perennial, ephemeroid	Apiaceae	D-R	All natural habitats and majority of survey plots
28. Halothamnus subaphyllus	semishrub	Amaranthaceae	R	Sandy and sandy-loamy desert plain, relic hills
29. Haloxylon persicum	Small tree	Amaranthaceae	A-D	fixed and semi-fixed sands
30. Heliotropium arguzioides	Perennial	Boraginaceae	R	fixed and semi-fixed sands
31. Holosteum umbellatum	annual	Caryophyllaceae	O-R	Sandy and sandy-loamy desert plain, cliffs and eroded slopes of saline depression, relic hills
32. Hypecoum pendulum	annual	Papaveraceae	O-R	Sandy and sandy-loamy desert plain, fixed and semi-fixed sands
33. Iris falcifolia	Perennial	Iridaceae	R	cliffs and eroded slopes of saline depression

34. Iris longiscapa	Perennial	Iridaceae	R	Sandy and sandy-loamy desert plain, fixed and semi-fixed sands
35. Iris songarica	Perennial	Iridaceae	A–R	All natural habitats and majority of survey plots
36. Ixiolirion tataricum	Perennial, ephemeroid	Ixioliriaceae	R	Sandy and sandy-loamy desert plain, relic hills
37. Mausolea eriocarpa	semishrub	Asteraceae	O	fixed and semi-fixed sands
38. Oreosalsola arbusculiformis (Salsola arbusculiformis)	dwarf shrub	Amaranthaceae	A-R	Sandy and sandy-loamy desert plain, cliffs and eroded slopes of saline depression, relic hills
39. Peganum harmala **Indicator of overgrazing**	Perennial	Nitrariaceae	R	All natural habitats and majority of survey plots
40. Phlomoides desertotum	Perennial	Lamiaceae	R	Sandy and sandy-loamy desert plain, fixed and semi-fixed sands, relic hills
41. Poa bulbosa	Perennial	Poaceae	A-O	All natural habitats and all survey plots
42. Salsola paulsenii	annual	Amaranthaceae	R	Sandy and sandy-loamy desert plain, fixed and semi-fixed sands
43. Sophora pachycarpa	Perennial	Fabaceae	R	fixed and semi-fixed sands (B005, B006)
44. Stipagrostis pennata	Perennial	Poaceae	O-R	fixed and semi-fixed sands
45. Streptoloma desertorum	annual	Brassicaceae	R	Sandy and sandy-loamy desert plain
46. Tulipa lehmanniana **Nationally red-listed (status 3 – reducing species)**	Perennial	Liliaceae	O–R	All natural habitats and majority of survey plots
47. Tulipa sogdiana	Perennial	Liliaceae	R	Sandy and sandy-loamy desert plain, cliffs and eroded slopes of saline depression, relic hills
48. Xylosalsola arbuscula (Salsola arbuscula.)	Shrub	Amaranthaceae	A–R	Sandy and sandy-loamy desert plain, fixed and semi-fixed sands
49. Zygophyllum macrophyllum	Perennial	Zygophyllaceae	R	Sandy and sandy-loamy desert plain, cliffs and eroded slopes of saline depression

Annex 2. A check-list of plants recorded in the "Dzhankeldy" site during the field survey in 2021

Plant species	Life form	Family	Abundance	Habitat
1. Acanthophyllum cyrtostegium **Nationally red-listed (status 3 – reducing species), national endemic**	Perennial	Caryophyllaceae	R	Weakly inclined piedmont plain and foothills
2. Acanthophyllum elatius	Perennial	Caryophyllaceae	R	weakly inclined piedmont plain
3. Alhagi pseudalhagi	Perennial	Fabaceae	R–O	Anthropogenic disturbed areas
4. Allium griffithianum	perennial	Amaryllidaceae	R	Foothills, stony slopes
5. Allium karakense	perennial	Amaryllidaceae	R	Stony slopes
6. Allium protensum	perennial	Amaryllidaceae	R	All habitats, except for anthropogenic
7. Allium sabulosum	perennial	Amaryllidaceae	R	Foothills, stony slopes
8. Alyssum desertorum	annual	Brassicaceae	R–O	All habitats
9. Alyssum linifolium (Meniocus linifolius)	annual	Brassicaceae	R–O	Foothills, stony slopes
10. Ammodendron conollyi	Small tree	Fabaceae	R	weakly inclined piedmont plain, foothills
11. Anabasis eriopoda	semishrub	Amaranthaceae	R	All habitats, except for anthropogenic
12. Anabasis turkestanica	semishrub	Amaranthaceae	R	weakly inclined piedmont plain, foothills, outcrops of variegated beds
13. Arnebia decumbens	annual	Boraginaceae	R	All habitats, except for anthropogenic
14. Artemisia diffusa	semishrub	Asteraceae	A–D	All habitats, except for anthropogenic and outcrops of variegated beds
15. Artemisia juncea	semishrub	Asteraceae	R–O	Foothills, stony slopes
16. Artemisia scoparia	Annual, biennial	Asteraceae	A–D	All habitats
17. Artemisia turanica	semishrub	Asteraceae	O–D	All habitats
18. Astragalus ammotrophus	perennial	Fabaceae	R	All habitats, except for anthropogenic
19. Astragalus villosissimus	dwarf shrub	Fabaceae	A–R	All habitats, except for anthropogenic
20. Atraphaxis spinosa	shrub	Polygonaceae	R	All habitats, except for anthropogenic

21. Bassia eriophora	annual	Amaranthaceae	O	outcrops of variegated beds
22. Bassia prostrata (*Kochia prostrata)*	semishrub	Amaranthaceae	R	Foothills, outcrops of variegated beds
23. *Bromus tectorum*	annual	Poaceae	R–O	All habitats
24. Calligonum leucocladum	shrub	Polygonaceae	A–R	weakly inclined piedmont plain
25. Calligonum microcarpum	shrub	Polygonaceae	A–R	weakly inclined piedmont plain
26. Calligonum zakirovii **Nationally red-listed (status 1 – endangered species), national endemic**	shrub	Polygonaceae	R	weakly inclined piedmont plain, outcrops of variegated beds
27. Carex pachystylis	Perennial	Cyperaceae	D–A	All habitats, except for anthropogenic
28. Carex subphysodes	Perennial	Cyperaceae	D–O	weakly inclined piedmont plain
29. Carex physodes	Perennial	Cyperaceae	O	weakly inclined piedmont plain
30. Caroxylon gemmascens (Salsola gemmascens)	dwarf shrub	Amaranthaceae	O–R	All habitats, except for anthropogenic
31. Caroxylon orientale (Salsola orientalis)	dwarf shrub	Amaranthaceae	A–R	All habitats, except for anthropogenic
32. Caroxylon scleranthum (Salsola sclerantha)	annual	Amaranthaceae	R–O	All habitats, except for anthropogenic
33. *Ceratocarpus arenarius*	annual	Amaranthaceae	R	All habitats
34. Ceratocephala falcata	annual	Ranunculaceae	O–R	All habitats
35. Climacoptera sp.	Annual	Amaranthaceae	R	All habitats, except for anthropogenic
36. Convolvulus divaricatus	semishrub	Convolvulaceae	O-R	weakly inclined piedmont plain
37. Convolvulus hamadae	semishrub	Convolvulaceae	A–R	All habitats, except for anthropogenic
38. Cousinia hamadae	perennial	Asteraceae	R–O	All habitats, except for anthropogenic
39. Eminium lehmannii	perennial	Araceae	R	Foothills, stony slopes
40. Ephedra intermedia	shrub	Ephedraceae	R–O	Foothills, stony slopes
41. Eremopyrum bonaepartis	annual	Poaceae	R–O	All habitats
42. Eremopyrum distans	annual	Poaceae	R–O	All habitats
43. Ferula foetida	Perennial, ephemeroid	Apiaceae	A–R	All habitats
44. Ferula kyzylkumica	perennial	Apiaceae	A–R	Stony slopes

Nationally red-listed (status 3 – reducing species), national endemic				
45. Fritillaria karelinii	Perennial	Liliaceae	R	Foothills, stony slopes
46. Gagea afghanica	Perennial	Liliaceae	R	Foothills, stony slopes
47. Gagea bergii	Perennial	Liliaceae	R	Foothills, stony slopes
48. Halimocnemis gamocarpa	annual	Amaranthaceae	R	Foothills, stony slopes, outcrops of variegated beds
49. Halimocnemis latifolia	annual	Amaranthaceae	R	Foothills, stony slopes, outcrops of variegated beds
50. Halimocnemis villosa	annual	Amaranthaceae	R–O	Foothills, outcrops of variegated beds
51. Halimodendron halodendron	Shrub	Fabaceae	R	Foothills, outcrops of variegated beds, anthropogenic habitats
52. Haloxylon ammodendron (*Haloxylon aphyllum*)	Small tree	Amaranthaceae	R–A	All habitats
53. Haplophyllum bungei	perennial	Rutaceae	R	Foothills, outcrops of variegated beds
54. Haplophyllum robustum	perennial	Rutaceae	R	All habitats, except for anthropogenic
55. Heliotropium arguzioides	Perennial	Boraginaceae	R	weakly inclined piedmont plain
56. Holosteum umbellatum	annual	Caryophyllaceae	R	Foothills, stony slopes
57. Hypecoum pendulum	annual	Papaveraceae	R	foothills, stony slopes
58. Iris longiscapa	Perennial	Iridaceae	R	Foothills, stony slopes, outcrops of variegated beds
59. Iris songarica	Perennial	Iridaceae	R–O	weakly inclined piedmont plain, foothills
60. Isatis minima	annual	Brassicaceae	R	stony slopes
61. Koelpinia linearis	annual	Asteraceae	R	All habitats
62. Krascheninnikovia ceratoides	semishrub	Amaranthaceae	R–O	stony slopes
63. Lactuca orientalis	semishrub	Asteraceae	R	All habitats, except for anthropogenic
64. Leontice inserta	perennial	Berberidaceae	R	Stony slopes, outcrops of variegated beds

65. Leptaleum filifolium	annual	Brassicaceae	R–O	foothills, stony slopes
66. Lycium ruthenicum	Shrub	Solanaceae	R–O	All habitats, except for anthropogenic
67. Nanophyton erinaceum	semishrub	Amaranthaceae	R–O	All habitats, except for anthropogenic
68. Oreosalsola arbusculiformis (Salsola arbusculiformis)	dwarf shrub	Amaranthaceae	D–O	All habitats, except for anthropogenic
69. Peganum harmala **Indicator of overgrazing**	Perennial	Nitrariaceae	R–A	All habitats
70. Poa bulbosa	Perennial	Poaceae	A–O	All habitats
71. Rheum turkestanicum	Perennial	Polygonaceae	R–O	Stony slopes
72. Salsola paulsenii	annual	Amaranthaceae	R	All habitats
73. Scorzonera gageoides	perennial	Asteraceae	R	foothills, stony slopes
74. Scrophularia leucoclada	semishrub		R–O	All habitats, except for anthropogenic
75. Smirnowia turkestana	Perennial	Fabaceae	R–O	weakly inclined piedmont plain
76. Stipa hohenackeriana	Perennial	Poaceae	R	foothills, stony slopes
77. Takhtajaniantha pusilla (*Scorzonera pusilla*)	Perennial	Asteraceae	R	All habitats, except for anthropogenic
78. Tamarix hispida	shrub	Tamaricaceae	R–O	Anthropogenic habitats
79. Tamarix laxa	shrub	Tamaricaceae	R–O	All habitats
80. Tulipa lehmanniana **Nationally red-listed (status 3 – reducing species)**	Perennial	Liliaceae	R–O	All habitats, except for anthropogenic
81. Tulipa sogdiana	Perennial	Liliaceae	R	All habitats, except for anthropogenic
82. Xylosalsola arbuscula (Salsola arbuscula.)	Shrub	Amaranthaceae	O–R	weakly inclined piedmont plain
83. Ziziphora tenuior	annual	Lamiaceae	R	All habitats, except for anthropogenic
84. Zygophyllum macrophyllum	Perennial	Zygophyllaceae	R	All habitats, except for anthropogenic
85. Zygophyllum miniatum	Perennial	Zygophyllaceae	R	All habitats, except for anthropogenic

Annex 3. A check-list of plants recorded along the planned power line "Bash-Dzhankeldy" during the field survey in 2021

Plant species	Life form	Family	Abundance	Habitat
1. Acanthophyllum cyrtostegium **Nationally red-listed (status 3 – reducing species), national endemic**	Perennial	Caryophyllaceae	R	Weakly inclined piedmont plain and foothills of relic low mountains
2. Acanthophyllum elatius	Perennial	Caryophyllaceae	R–O	Sandy and sandy-loamy desert plain, fixed and semi-fixed sands, weakly inclined piedmont plain
3. Alhagi pseudalhagi	Perennial	Fabaceae	R–O	Fixed and semi-fixed sands, saline depressions and takyrs
4. Alyssum desertorum	annual	Brassicaceae	R	Sandy and sandy-loamy desert plain, fixed and semi-fixed sands, weakly inclined piedmont plain
5. Ammodendron conollyi	Small tree	Fabaceae	R–A	fixed and semi-fixed sands
6. Anabasis eriopoda	semishrub	Amaranthaceae	R	eroded foothills with outcrops of variegated beds, saline depressions and takyrs
7. Anabasis turkestanica	semishrub	Amaranthaceae	R	eroded foothills with outcrops of variegated beds, saline depressions and takyrs
8. Arnebia decumbens	annual	Boraginaceae	R	fixed and semi-fixed sands, weakly inclined piedmont plain, eroded foothills with outcrops of variegated beds
9. Artemisia diffusa	semishrub	Asteraceae	A–D	All habitats, except for saline depressions and takyrs
10. Artemisia turanica	semishrub	Asteraceae	O–A	weakly inclined piedmont plain,

				eroded foothills with outcrops of variegated beds, saline depressions
11. Astragalus flexus	perennial	Fabaceae	R	fixed and semi-fixed sands
12. Astragalus villosissimus	dwarf shrub	Fabaceae	A–R	All habitats, except for saline depressions and takyrs
13. Bassia eriophora	annual	Amaranthaceae	O	Fixed and semi-fixed sands, saline depressions and takyrs
14. Bassia prostrata (*Kochia prostrata)*	semishrub	Amaranthaceae	R	eroded foothills with outcrops of variegated beds
15. *Bromus tectorum*	annual	Poaceae	R–O	All habitats, except for saline depressions and takyrs
16. Calligonum leucocladum	shrub	Polygonaceae	A–R	Sandy desert plain, fixed and semi-fixed sands, weakly inclined piedmont plain
17. Calligonum microcarpum	shrub	Polygonaceae	A–R	Sandy and sandy-loamy desert plain, fixed and semi-fixed sands, weakly inclined piedmont plain
18. Calligonum zakirovii **Nationally red-listed (status 1 – endangered species), national endemic**	shrub	Polygonaceae	R	weakly inclined piedmont plain
19. Carex physodes	Perennial	Cyperaceae	D–A	Sandy desert plain, fixed and semi-fixed sands
20. Carex subphysodes	Perennial	Cyperaceae	D–O	Sandy and sandy-loamy desert plain, weakly inclined piedmont plain
21. Caroxylon orientale (Salsola orientalis)	dwarf shrub	Amaranthaceae	A–R	All habitats
22. Caroxylon scleranthum (Salsola sclerantha)	annual	Amaranthaceae	R	weakly inclined piedmont plain, eroded foothills with outcrops of variegated beds,

				saline depressions and takyrs
23. *Ceratocarpus arenarius*	annual	Amaranthaceae	R	All habitats
24. Climacoptera sp.	annual	Amaranthaceae	R	eroded foothills with outcrops of variegated beds, saline depressions and takyrs
25. Convolvulus divaricatus	semishrub	Convolvulaceae	O-R	fixed and semi-fixed sands
26. Convolvulus hamadae	semishrub	Convolvulaceae	A–R	All habitats
27. Cousinia hamadae	perennial	Asteraceae	R–O	All habitats
28. Eremopyrum bonaepartis	annual	Poaceae	R–O	fixed and semi-fixed sands, weakly inclined piedmont plain, eroded foothills with outcrops of variegated beds, saline depressions and takyrs
29. Eremopyrum distans	annual	Poaceae	R–O	fixed and semi-fixed sands, weakly inclined piedmont plain, eroded foothills with outcrops of variegated beds, saline depressions and takyrs
30. Euphorbia turczaninowii	annual	Euphorbiaceae	R	fixed and semi-fixed sands
31. Ferula foetida	Perennial, ephemeroid	Apiaceae	A–R	All habitats
32. Halimocnemis villosa	annual	Amaranthaceae	R–O	eroded foothills with outcrops of variegated beds, saline depressions and takyrs
33. Halimodendron halodendron	Shrub	Fabaceae	R	saline depressions and takyrs
34. Haloxylon ammodendron (*Haloxylon aphyllum*)	Small tree	Amaranthaceae	R–A	All habitats
35. Haloxylon persicum	Small tree	Amaranthaceae	A-D	fixed and semi-fixed sands
36. Haplophyllum bungei	perennial	Rutaceae	R	eroded foothills with outcrops of variegated beds

37. Haplophyllum ramosissimum	Perennial	Rutaceae	R	fixed and semi-fixed sands
38. Haplophyllum robustum	perennial	Rutaceae	R	eroded foothills with outcrops of variegated beds
39. Heliotropium arguzioides	Perennial	Boraginaceae	R–O	fixed and semi-fixed sands
40. Iris songarica	Perennial	Iridaceae	A–R	Sandy and sandy-loamy desert plain, fixed and semi-fixed sands
41. Lycium ruthenicum	Shrub	Solanaceae	R–O	saline depressions and takyrs
42. Mausolea eriocarpa	semishrub	Asteraceae	O–A	fixed and semi-fixed sands
43. Oreosalsola arbusculiformis (Salsola arbusculiformis)	dwarf shrub	Amaranthaceae	A–R	fixed and semi-fixed sands, weakly inclined piedmont plain, eroded foothills with outcrops of variegated beds, saline depressions and takyrs
44. Peganum harmala **Indicator of overgrazing**	Perennial	Nitrariaceae	R–O	All habitats
45. Poa bulbosa	Perennial	Poaceae	A–O	All habitats, except for saline depressions and takyrs
46. Salsola paulsenii	annual	Amaranthaceae	R	fixed and semi-fixed sands, weakly inclined piedmont plain, eroded foothills with outcrops of variegated beds, saline depressions and takyrs
47. Sophora pachycarpa	Perennial	Fabaceae	R–O	fixed and semi-fixed sands
48. Smirnowia turkestana	Perennial	Fabaceae	R–O	fixed and semi-fixed sands, weakly inclined piedmont plain
49. Stipagrostis pennata	Perennial	Poaceae	R–O	fixed and semi-fixed sands
50. Tamarix sp.	Shrub	Tamaricaceae	R	saline depressions and takyrs
51. Tulipa lehmanniana **Nationally red-listed**	Perennial	Liliaceae	R	fixed and semi-fixed sands, saline

(status 3 – reducing species)				depressions and takyrs
52. Xylosalsola arbuscula (Salsola arbuscula.)	Shrub	Amaranthaceae	A–R	Sandy and sandy-loamy desert plain, fixed and semi-fixed sands
53. Ziziphora tenuior	annual	Lamiaceae	R	weakly inclined piedmont plain, eroded foothills with outcrops of variegated beds, saline depressions and takyrs

Annex 4. A check-list of plants recorded along the planned power line "Bash-Karakul" during the field survey in 2021

Plant species	Life form	Family	Abundance	Habitat
1. Acanthophyllum elatius	Perennial	Caryophyllaceae	R–O	Sandy and sandy-loamy desert plain, fixed and semi-fixed sands
2. Agriophyllum lateriflorum	annual	Amaranthaceae	R–O	Fixed and semi-fixed sands
3. Alhagi pseudalhagi	Perennial	Fabaceae	R–O	All habitats
4. Alyssum desertorum	annual	Brassicaceae	R	Sandy and sandy-loamy desert plain, fixed and semi-fixed sands
5. Ammodendron conollyi	Small tree	Fabaceae	R–A	fixed and semi-fixed sands
6. Arnebia decumbens	annual	Boraginaceae	R	fixed and semi-fixed sands
7. Artemisia diffusa	semishrub	Asteraceae	A–D	Sandy and sandy-loamy desert plain, fixed and semi-fixed sands
8. Artemisia turanica	semishrub	Asteraceae	O–A	Sandy and sandy-loamy desert plain
9. Astragalus flexus	perennial	Fabaceae	R	fixed and semi-fixed sands
10. Astragalus unifoliolatus	dwarf shrub	Fabaceae	O–R	fixed and semi-fixed sands
11. Astragalus villosissimus	dwarf shrub	Fabaceae	A–R	Sandy and sandy-loamy desert plain, fixed and semi-fixed sands
12. Atriplex dimorphostegia	annual	Amaranthaceae	R	fixed and semi-fixed sands
13. Bassia eriophora	annual	Amaranthaceae	O	Fixed and semi-fixed sands, saline lands
14. *Bromus tectorum*	annual	Poaceae	R–O	All habitats
15. Calligonum leucocladum	shrub	Polygonaceae	A–R	Sandy and sandy-loamy desert plain, fixed and semi-fixed sands
16. Calligonum microcarpum	shrub	Polygonaceae	A–R	Sandy and sandy-loamy desert plain, fixed and semi-fixed sands
17. Calligonum zakirovii **Nationally red-listed (status 1 – endangered species), national endemic**	shrub	Polygonaceae	R	fixed and semi-fixed sands

18. Carex physodes	Perennial	Cyperaceae	D–A	Sandy and sandy-loamy desert plain, fixed and semi-fixed sands
19. Carex subphysodes	Perennial	Cyperaceae	D–O	Sandy and sandy-loamy desert plain
20. Caroxylon orientale (Salsola orientalis)	dwarf shrub	Amaranthaceae	A–R	Sandy and sandy-loamy desert plain, fixed and semi-fixed sands
21. Caroxylon scleranthum (Salsola sclerantha)	annual	Amaranthaceae	R	fixed and semi-fixed sands, saline lands
22. *Ceratocarpus arenarius*	annual	Amaranthaceae	R	All habitats
23. Climacoptera sp.	annual	Amaranthaceae	R	fixed and semi-fixed sands, saline lands
24. Convolvulus divaricatus	semishrub	Convolvulaceae	O-R	fixed and semi-fixed sands
25. Convolvulus hamadae	semishrub	Convolvulaceae	A–R	Sandy and sandy-loamy desert plain, fixed and semi-fixed sands
26. Cousinia hamadae	perennial	Asteraceae	R–O	Sandy and sandy-loamy desert plain, fixed and semi-fixed sands
27. Cousinia resinosa	perennial	Asteraceae	R–O	All habitats
28. Cousinia sogdiana	biennial	Asteraceae	R	fixed and semi-fixed sands
29. Cynodon dactylon **Alien weed**	Perennial	Poaceae	R–O	agricultural lands
30. Descurainia sophia	annual	Brassicaceae	O	agricultural lands
31. Elaeagnus angustifolia	tree	Elaeagnaceae	R–O	Saline and agricultural lands
32. Eremopyrum bonaepartis	annual	Poaceae	R–O	All habitats
33. Eremopyrum distans	annual	Poaceae	R–O	All habitats
34. Erianthus ravennae	perennial	Poaceae	R–O	Saline and agricultural lands
35. Euphorbia cheirolepis	annual	Euphorbiaceae	R	fixed and semi-fixed sands
36. Euphorbia granulata	annual	Euphorbiaceae	R–O	Saline and agricultural lands
37. Euphorbia turczaninowii	annual	Euphorbiaceae	R	fixed and semi-fixed sands
38. Ferula foetida	Perennial, ephemeroid	Apiaceae	A–R	All habitats, except for agricultural

39. Glycyrrhiza glabra	Perennial	Fabaceae	R–O	Saline and agricultural lands
40. Halimocnemis villosa	annual	Amaranthaceae	R–O	eroded foothills with outcrops of variegated beds, saline depressions and takyrs
41. Halimodendron halodendron	Shrub	Fabaceae	R	Saline and agricultural lands
42. Halocnemum strobilaceum	semishrub	Amaranthaceae	R–A	Saline and agricultural lands
43. Halostachys belangeriana	Shrub	Amaranthaceae	R–O	Saline and agricultural lands
44. Halothamnus subaphyllus	semishrub	Amaranthaceae	R	Sandy and sandy-loamy desert plain, fixed and semi-fixed sands
45. Haloxylon ammodendron (*Haloxylon aphyllum*)	Small tree	Amaranthaceae	R–A	All habitats
46. Haloxylon persicum	Small tree	Amaranthaceae	A-D	fixed and semi-fixed sands
47. Haplophyllum ramosissimum	Perennial	Rutaceae	R	fixed and semi-fixed sands
48. Heliotropium arguzioides	Perennial	Boraginaceae	R–O	fixed and semi-fixed sands
49. Heliotropium ellipticum	annual			
50. Iris songarica	Perennial	Iridaceae	A–R	Sandy and sandy-loamy desert plain, fixed and semi-fixed sands
51. Karelinia caspia	Perennial	Asteraceae	R–A	Saline and agricultural lands
52. Limonium otolepis	Perennial	Plumbaginaceae	R–A	Saline and agricultural lands
53. Limonium suffruticosum	semishrub	Plumbaginaceae	R–O	Saline lands
54. Lycium ruthenicum	Shrub	Solanaceae	R–O	Saline and agricultural lands
55. Mausolea eriocarpa	semishrub	Asteraceae	O–A	fixed and semi-fixed sands
56. Oreosalsola arbusculiformis (Salsola arbusculiformis)	dwarf shrub	Amaranthaceae	A–R	fixed and semi-fixed sands, weakly inclined piedmont plain, eroded foothills with outcrops of variegated beds, saline depressions and takyrs

57. Peganum harmala **Indicator of overgrazing**	Perennial	Nitrariaceae	R–O	All habitats
58. Phragmites australis	Perennial	Poaceae	O–D	Saline and agricultural lands
59. Poa bulbosa	Perennial	Poaceae	A–O	All habitats, except for saline depressions and takyrs
60. Populus pruinosa	tree	Salicaceae	R–O	agricultural lands
61. Salicornia europaea	annual	Amaranthaceae	O	Saline and agricultural lands
62. Salsola paulsenii	annual	Amaranthaceae	R	fixed and semi-fixed sands, weakly inclined piedmont plain, eroded foothills with outcrops of variegated beds, saline depressions and takyrs
63. Sophora pachycarpa	Perennial	Fabaceae	R–O	fixed and semi-fixed sands
64. Smirnowia turkestana	Perennial	Fabaceae	R–O	fixed and semi-fixed sands, weakly inclined piedmont plain
65. Stipagrostis pennata	Perennial	Poaceae	R–O	fixed and semi-fixed sands
66. Suaeda altissima	annual	Amaranthaceae	R–O	Saline and agricultural lands
67. Suaeda sp.	Annual	Amaranthaceae	R–O	Saline and agricultural lands
68. Tamarix hispida	Shrub	Tamaricaceae	A–R	Saline and agricultural lands
69. Tamarix laxa	Shrub	Tamaricaceae	A–R	Saline and agricultural lands
70. Tamarix ramosissima	Shrub	Tamaricaceae	A–R	Saline and agricultural lands
71. Tribulus terrestris **Alien weed**	annual	Zygophyllaceae	R–O	agricultural lands
72. Typha latifolia	Perennial	Typhaceae	R–O	Saline and agricultural lands
73. Typha minima	Perennial	Typhaceae	R–O	Saline and agricultural lands
74. Xylosalsola arbuscula (Salsola arbuscula)	Shrub	Amaranthaceae	A–R	Sandy and sandy-loamy desert plain, fixed and semi-fixed sands
75. Xylosalsola richteri (Salsola richteri)	Shrub	Amaranthaceae	R–O	fixed and semi-fixed sands

76. Zygophyllum oxianum	Perennial	Zygophyllaceae	R–O	Saline and agricultural lands

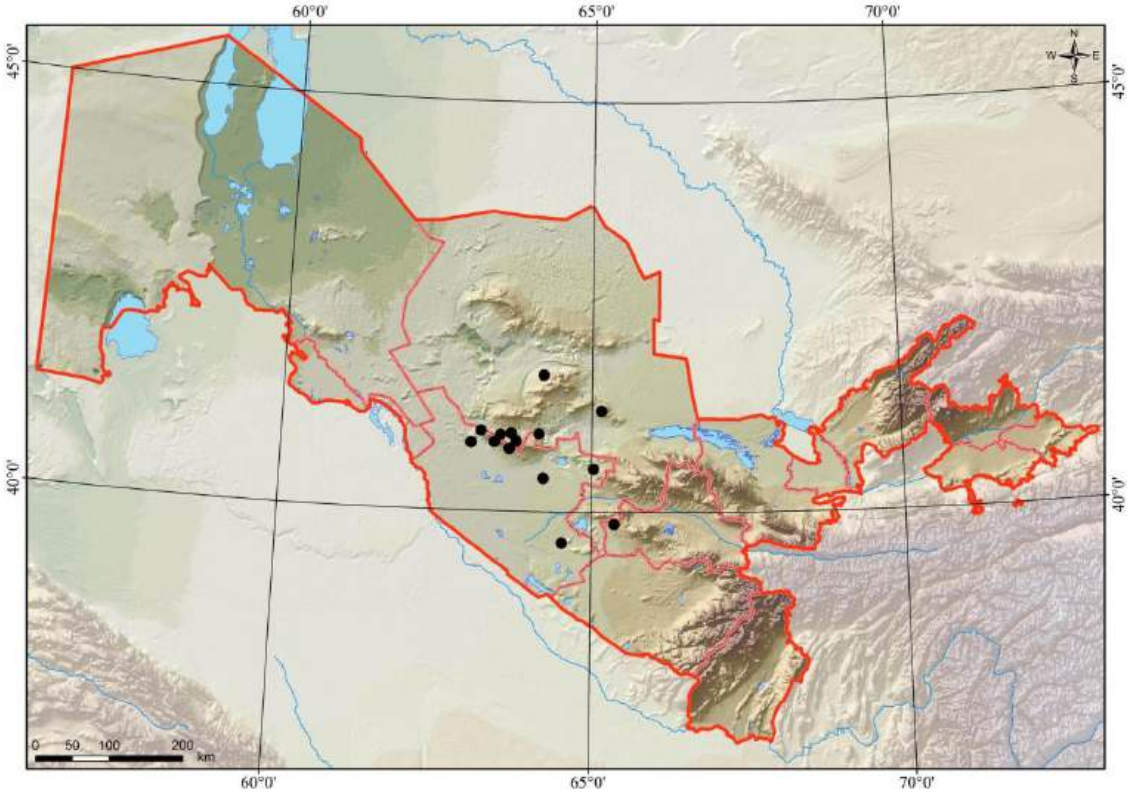
Annex 5. Trigger plant species for critical habitat assessment (recorded during the field survey)

Species	IUCN RL status	National status	Population	Distribution	Data sources	Threats	Criteria	Assessment
Acanthophyllum cyrtostegium Vved.	Not Evaluated (NE)	UzbRDB 2009 – 2 (rare) UzbRDB 2019 – 3 (vulnerable, declining)	Estimated population – about 500–600 individuals	National endemic, endemic to south-western Kyzylkum and Zirabulak-Ziadin Mountains, estimated AOO – about 50 hectares. Within the "Dzhankeldy" project site occurs sporadically, solitary or in small groups	Field survey - 2021 Red Data Book of the Republic of Uzbekistan (2009) Vol. 1. Plants and Fungi. Chinor ENK, Tashkent. 360 p. Red Data Book of the Republic of Uzbekistan (2019) Vol. 1. Plants. Tasvir, Tashkent. 356 p. Tojibaev K.Sh., Beshko N.Yu., Shomurodov Kh.F. & al. (2019) Inventory of the flora of Uzbekistan: Navoi Province. Fan Publishers, Tashkent. 216 p. Tojibaev K.Sh., Beshko N.Yu., Shomurodov Kh.F. & al. (2020) Inventory of the flora of Uzbekistan: Bukhara Province. O'kituvchi Publishers, Tashkent. 128 p.	Overgrazing, mining, road and infrastructure construction	Critical habitat Criterion 2. Habitat of significant importance to endemic and/or restricted-range species. KBA Criterion B1	Due to the restricted geographic range and population of the species, project area likely to support ≥ 10% of the global habitat and population. Triggering Critical Habitat Criterion 2

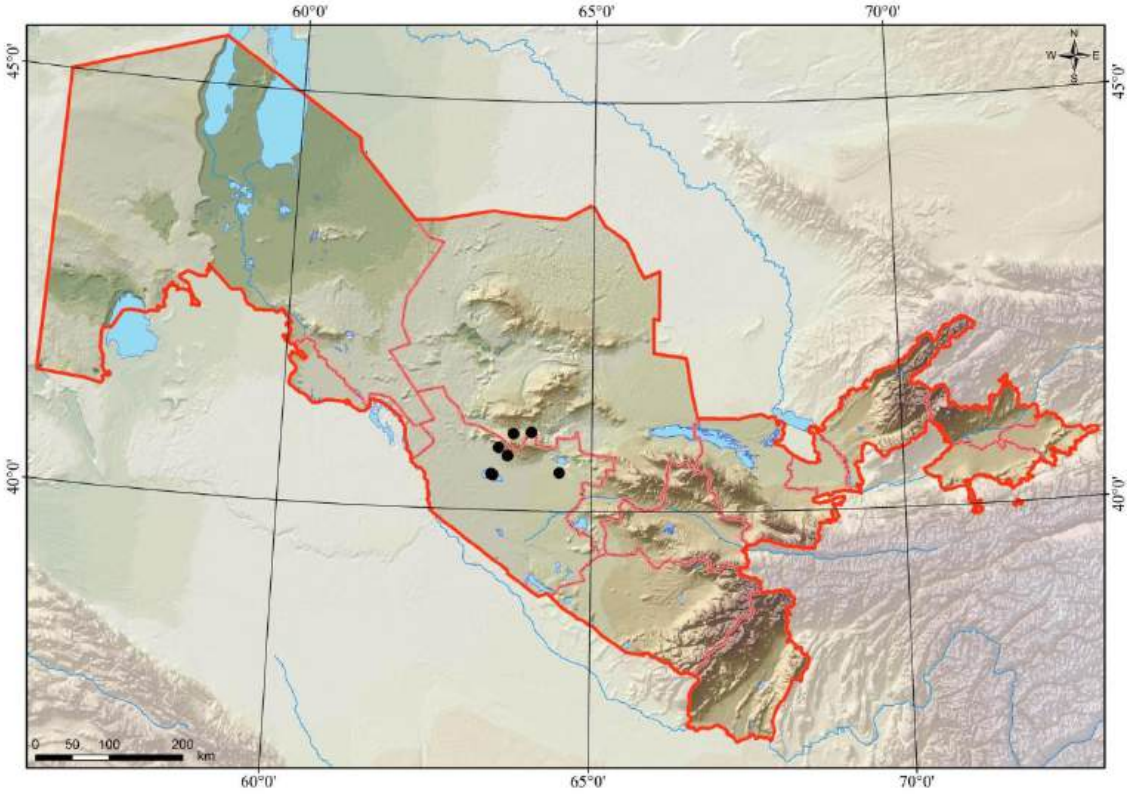
Calligonum zakirovii (Khalk.) Czerep.	Not Evaluated (NE)	UzbRDB 2019 – 1 (endangered)	Estimated population – about 500 individuals	National endemic, endemic to relic mountains of Kyzylkum, estimated AOO – about 50 hectares. Within the "Dzhankeldy" project site occurs sporadically, solitary or in small groups	Field survey - 2021 Red Data Book of the Republic of Uzbekistan (2009) Vol. 1. Plants and Fungi. Chinor ENK, Tashkent. 360 p. Red Data Book of the Republic of Uzbekistan (2019) Vol. 1. Plants. Tasvir, Tashkent. 356 p. Tojibaev K.Sh., Beshko N.Yu., Shomurodov Kh.F. & al. (2019) Inventory of the flora of Uzbekistan: Navoi Province. Fan Publishers, Tashkent. 216 p. Tojibaev K.Sh., Beshko N.Yu., Shomurodov Kh.F. & al. (2020) Inventory of the flora of Uzbekistan: Bukhara Province. O'kituvchi Publishers, Tashkent. 128 p.	Overgrazing, mining, road and infrastructure construction	Critical habitat Criterion 1. (i) Habitat of significant importance to species listed as CR or EN on the IUCN Red List, and nationally/regionally listed species assessed using similar criteria. Criterion 2. Habitat of significant importance to endemic and/or restricted-range species. KBA Criterion B1	Due to the national status, restricted geographic range and population of the species, project area likely to support ≥ 10% of the global habitat and population. Triggering Critical Habitat Criterion 1 and 2
Ferula kyzylkumica Korovin	Not Evaluated (NE)	UzbRDB 2009 – 2 (rare) UzbRDB 2019 – 3 (vulnerable, declining)	Estimated population – about 4000–4500 individuals in Navoi Province and 400–500 in Bukhara Province	National endemic, endemic to relic mountains of Kyzylkum with disjunction in Nuratau Mountains, estimated AOO in Bukhara Province – about 10	Field survey - 2021 Red Data Book of the Republic of Uzbekistan (2009) Vol. 1. Plants and Fungi. Chinor ENK, Tashkent. 360 p. Red Data Book of the Republic of Uzbekistan (2019) Vol. 1. Plants. Tasvir, Tashkent. 356 p. Tojibaev K.Sh., Beshko N.Yu., Shomurodov Kh.F. & al. (2019) Inventory of the flora of	Overgrazing, mining	Critical habitat Criterion 2. Habitat of significant importance to endemic and/or restricted-range species. KBA Criterion B1	Due to the restricted geographic range and population of the species, project area likely to support ≥ 10% of the global habitat and population. Triggering Critical Habitat Criterion 2

				hectares. Within the “Dzhankeldy” project site occurs sporadically, solitary or in groups	Uzbekistan: Navoi Province. Fan Publishers, Tashkent. 216 p. Tojibaev K.Sh., Beshko N.Yu., Shomurodov Kh.F. & al. (2020) Inventory of the flora of Uzbekistan: Bukhara Province. O’kituvchi Publishers, Tashkent. 128 p.			

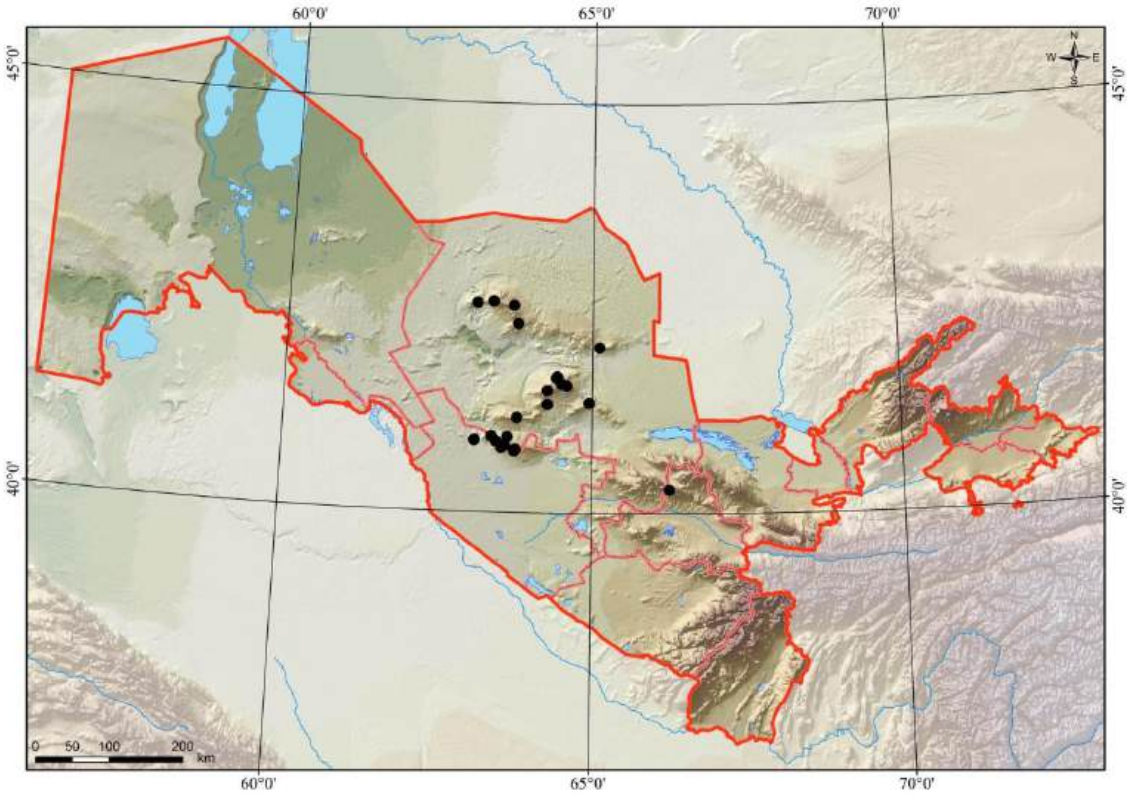
Annex 6. Distribution maps of trigger plant species (based on the field survey, herbarium and published data)



Acanthophyllum cyrtostegium



Calligonum zakirovii



Ferula kyzylkumica

Juru Energy

Spring Quarterly Bird monitoring Report

Report Title	Spring Quarterly Bird monitoring Report
Scope	BIRDS VP / BIRDS NESTING / WATERBIRDS
Areas Covered	BASH WF
Seasons Covered	SPRING 2020
Notes	

Juru Energy

Quarterly Bird monitoring Report (Spring)

Bash Wind Farm Site

Client: 5 Capitals

This report is prepared by: Juru Energy Date: _____

CHECKED BY _____ Date: _____

APRROVED BY _____ Date: _____

Juru Energy

Contents

INTRODUCTION 4
SURVEY METHODS 6
TERRITORY DESCRIPTION 11
VANTAGE POINTS 14
BIRD OBSERVATIONS RESULTS 16
SPECIALIZED SURVEY ON WATER BIRDS AND ASIAN HOUBARA *Chlamydotis macqueenii* 26
SPECIALIZED RAPTOR NEST SURVEY 37
CONCLUSIONS AND RECCOMENDATIONS 41
Appendix 1. Weather conditions during VP Spring surveys 44
Appendix 2. Vantage Point Data Logs 48
VP survey results in March 48
VP survey results in April 65
VP survey results in May 145
ATTACHMENTS 181

Juru Energy

INTRODUCTION

The Renewable energy resources Sector in Uzbekistan started to develop rapidly after the Law “On the Use of Renewable Resources of Energy” No.ZRU-539 was passed on the 21 May 2019, closely followed by the Decree “On Acceleration of Measures to Improve Energy Efficiency of Economic Sectors and Social Spheres, Implementation of Energy Saving Technologies and Developing of Renewable Energy Resources” No. PP-4422 by the President of Uzbekistan on 22 August 2019.

Wind power is defined under Uzbekistan law as renewable energy resource along with solar, geothermal, hydro power, and biomass energy.

Bird baseline studies are necessary part of the Environmental Impact Assessment for Wind Power Plant projects. The primary objective of bird baseline studies at wind farms is to estimate the risk that the proposed project poses to characteristic bird species.

Birds are the most mobile animals among vertebrates and are an important bio indicator of the changing environment. As far as we know, the impact of wind power plants on birds depends on several factors, such as the topography of a particular site and the entire range, the surrounding ecosystems, natural habitats, the number of bird species permanently resident or migratory in the vast project area, etc.

The main potential hazards to birds from windfarms are:

- disturbance leading to displacement or exclusion, including barriers to movement
- collision mortality
- loss of, or damage to, habitat resulting from wind turbines and associated infrastructure.

Juru Energy

Being previously involved in projects directly connected with Wind-power stations (Support for the Implementation of Wind Auctions in Uzbekistan; Local support for ESIA for the Zarafshan Wind Project in Uzbekistan), Juru Energy Ltd. has experience in bird monitoring.

The Bash Wind Farm Project is being developed by ACWA Power. ESIA studies for the project are undertaken by 5 Capitals Environmental & Management Consulting who have subcontracted Juru Energy to undertake Bird Monitoring studies in accordance with international Lenders requirements.

In the framework of the Bash Wind Farm Project, bird survey was conducted in the project area in Spring 2020. The purpose of ornithological monitoring was to conduct systematic field studies at specific vantage points to assess bird species composition that occur within the project's area of influence, its abundance and territorial distribution, the nature of the stay, and daily activity of birds during spring migration and the beginning of nesting and also to identify birds that are of conservation interest under IUCN and Uzbekistan Redlist.

This report presents the primary materials of field studies in this territory from March 14 to May 15, 2020.

It is planned to conduct regular bird monitoring during 9 months (March 2020 - November 2020), which will allow us to take into account the risks from the wind farm for birds in the project area.

This report is a statement of work made by Juru Energy` local ornitologists Alisher Atakhodjaev and R. Sohibnazarov and international expert Caleb Gordon. However, it should be noted that help in collecting survey material was also provided by the company’s employees, and expedition members.

Juru Energy

SURVEY METHODS

The research methods were based on international best practice recommendations, in particular those set forth in the Scottish Natural Heritage: recommended bird survey methods to justify the assessment of the impact of surface wind farms. The range of detection and identification of large species as golden eagles was up to 2 km, and small passerines 50 m. Directions and flight altitude were taken into account.

The observations were carried out at 9 Vantage points (Table 2). The number and location of Vantage points for stationary observation in the project area have been agreed with the company employees and international expert, Caleb Gordon. The points are located so as to cover the territory as completely as possible (Fig.1-2).

The duration of one bird count at each Vantage point (VP) was 3 hours. The total duration of all the observations in the territory was 288 hours.

During observations weather conditions such as wind speed and direction, and air temperature were recorded. Wind speed and air temperature were measured using an anemometer. Whenever possible, the number of species, approximate flight altitude, speed, and flight direction of each target species were recorded every 15 seconds.

During the observations, photographing and short video shooting of birds were carried out, which is used to confirm the correct determination of species and obtain additional data on the number of individuals. Following equipment was used: binoculars (Viking) with 10x zoom; cameras (Nikon P1000, Canon 550D) with 24x and 50x zoom, with focal length of 550 mm and 1200 mm, respectively; field telescope (Viking).

Juru Energy

Target and Secondary Species

Some species are more sensitive than others from a wind farm risk management standpoint. This is generally because they are classified as highly protected species by national and/or international authorities, because they are known or suspected to be highly susceptible to wind farm impacts (especially collision with rotors), or both. In addition, some species may be regarded as sensitive due to their cultural or iconic significance, or based on ecological/demographic factors (e.g. slow reproductive rate, naturally low population density). In present, these different criteria have been integrated and considered together to produce a preliminary list of suggested target species for the NBWEP, to be used to prioritize the Project's biological monitoring and mitigation programs, including the biological baseline studies.

Asian Houbara and Houbara Bustard are considered as target species. The main reason is these species are classified as "Vulnerable" by the IUCN, also included on the national redlist for Uzbekistan, and likely occur within the project area, based on a review of records in the eBird database[1].

Pelicans and cranes were not included into target species list. To begin with, water bird collisions with wind turbine rotors is rare, even at wind farms located close to water bodies, indicating low susceptibility of most water birds to collisions with wind turbine rotors. Cranes, as a group, generally exhibit very low susceptibility to collision with wind turbines; and where such risk occurs, it is usually highly concentrated at the water bodies. The minimum distance of this Project's turbines to the Lake (roughly 2-3km) puts the project in a zone of very low risk. To give a more concrete example of this, the IFC's typically recommended setback of turbines from water bodies to minimize water bird collision risk is 500m.

Table 1 below presents a suggested list of sensitive, or "target" bird species for the NBWEP, subdivided into two tiers, reflecting different priority levels (tier 1 is higher sensitivity, higher priority than tier 2).

[1] eBird.org accessed 27 March 2020

Juru Energy

Table 1. Target and secondary species

Latin name	English name	IUCN status	Uzbek status	Notes on Likely Occurrence/Risk
Tier 1 Target Species (top priority)				
1. *Aquila nipalensis*	Steppe Eagle	EN	2 (VU:D)	Common migrant. In March 2018 observed on project area (Ten A)
2. *Aquila chrysaetos*	Golden Eagle	LC	listed 2 (VU:R)	Common resident and nests in project area (powerlines) and in cliffs of Ayakagytma depression (Ten, Soldatov 2018)
3. *Aquila heliaca*	Imperial Eagle	VU	2 (VU:D)	Common migrant. In March 2018 observed on project area (Ten A)
4. *Neophron percnopterus*	Egyptian Vulture	EN	2 (VU:D)	Common nesting species in cliffs of Ayakagytma depression (Ten, Soldatov 2018)
5. *Falco cherrug*	Saker Falcon	EN	EN	Common nesting species in cliffs of Ayakagytma depression (Ten, Soldatov 2018)
6. *Chlamydotis macqueenii*	Houbara Bustard	VU	2 (V*U:D)	Nesting and migration species in project area (Burnside oral comm., Koshkin 2016)
7. *Vanellus gregarius*	Sociable Lapwing	CR	2 (VU:R)	possible rarity, recent eBird photo record in desert habitat ca 75km SW suggests possibility of

Juru Energy

				occurrence. Extremely sensitive species with CR status
Tier 2 Target Species (second priority)				
1. *Pelecanus onocrotalus*	Great White Pelican	LC	VU:D	Common migrant and rare summering in Ayakagytma lake
2. *Pelecanus crispus*	Dalmatian Pelican	NT	EN	Common migrant and rare summering in Ayakagytma lake
3. *Aegypius monachus*	Cinereous Vulture	NT	3 (NT)	Resident in region
4. *Gyps fulvus*	Eurasian Griffon	NT	2 (VU:D)	Resident in region
5. *Circaetus gallicus*	Short-toed Snake-Eagle	LC	2 (VU:D)	Rare nesting bird in region
6. *Hieraaetus pennatus*	Booted Eagle	LC	2 (VU:D)	Possible rarity, very rare in region
7. *Circus aeruginosus*	Eurasian Marsh-Harrier	LC	*not listed*	Fairly common in region
8. *Circus cyaneus*	Hen Harrier	LC	*not listed*	Fairly common in region
9. *Circus macrourus*	Pallid Harrier	NT	3 (NT)	Fairly common in region
10. *Circus pygargus*	Montagu's Harrier	LC	*not listed*	Uncommon in region
11. *Accipiter badius*	Shikra	LC	*not listed*	Uncommon in region

Juru Energy

12. Accipiter nisus	Eurasian Sparrowhawk	LC	*not listed*	Uncommon in region
13. Buteo rufinus	Long-legged Buzzard	LC	*not listed*	Fairly common in region
14. Buteo buteo	Common Buzzard	LC	*not listed*	Fairly common in region
15. Milvus migrans	Black Kite	LC	*not listed*	Uncommon in region
16. Anthropoides virgo	Demoiselle Crane	LC	*not listed*	Uncommon in region
17. Grus grus	Common Crane	LC	*not listed*	Rare migrant. Observed in 2018 on the project area (Ten A)
18. Falco tinnunculus	Common Kestrel	LC	*not listed*	Numerous in region
19. Falco naumanni	Lesser Kestrel	LC	NT	Observed at site
20. Oxyura leucocephala	White-headed Duck	EN	1 (EN)	Possible on Lake Agitma
21. Anser erythropus	Lesser White-fronted Goose	VU	2 (VU:R)	Possible on Lake Agitma
22. Branta ruficollis	Red-breasted Goose	VU	2 (VU:R)	Possible on Lake Agitma
23. Marmaronetta angustirostris	Marbled Teal	VU	1 (EN)	Possible on Lake Agitma
24. Aythya ferina	Common Pochard	VU	*not listed*	Possible on Lake Agitma
25. Podiceps auritus	Horned Grebe	VU	*not listed*	Possible on Lake Agitma

Juru Energy

TERRITORY DESCRIPTION

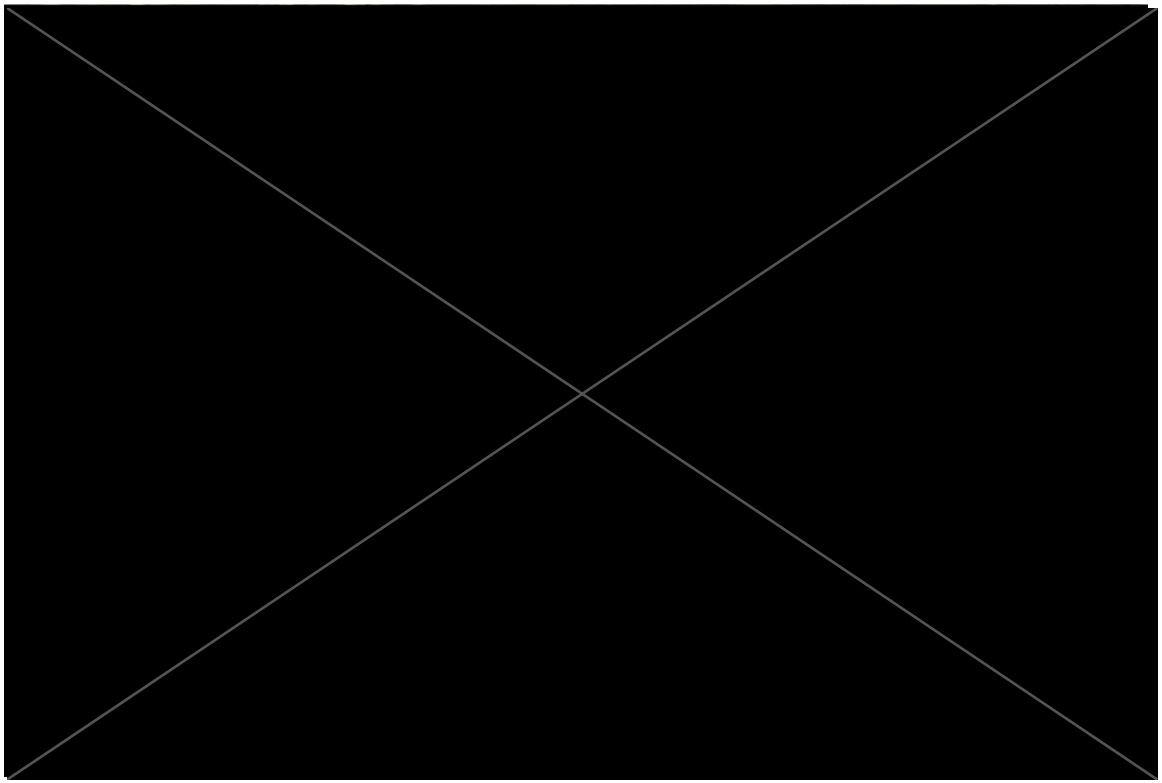


Fig. 1 Location of the site and sensitive receptors

The project area for the planned wind farm is situated in the Navoi region next to Agitma Lake and local village called Agitma/ Ayakagytma. The lake is located on the western part of the site; the local village is about 8 km from the site on the northwest side of the lake (Fig.1).

Juru Energy

The landscape of the project area is steppe, fairly homogeneous and arid. Accordingly, steppe and desert species of animals and plants live here. But during the migration period, you can also meet representatives of other biotopes.

The history of the Agitma lake is not far, for the first time water was allowed here in the 80s of the last century through drainage channels and therefore the lake is only about 40 years old. Until this time, this site was designated as the Ayakagitma hollow. This is an artificial lake, a byproduct of desert development.

Agitma (Ogitma in Uzbek) is a very small local village with only 42 houses, mostly inhabited by Kazakhs. They speak a mixture of Kazakh and Uzbek languages, so our local ornithologists could communicate with them easily. There is no state organization there but school (with 48 students). Our experts discussed birds and the everyday routine of the local villagers with the school director, history and biology teachers. Consultations were carried out by our local ornithologists orally in an informal form. They presented binoculars and a printed guide to the bird species of the region to the biology teacher in order to involve him in birdwatching. Local villagers are mainly engaged in cattle breeding (close to the village) and fishing, many people from the village go to work in Bukhara and Navoi, and even Kazakhstan. Shepherds on the project territory come from Gijduvan and Bukhara, they have temporary cabins on the project territory. Unfortunately, both local residents and shepherds, pay very little attention to birds, and can give almost no information about the bird species living on the project territory. They do not distinguish between different species of birds of prey. The only thing they mentioned is that Houbara bustards are frequently seen on the project territory in Spring and Summer, and also that birds of prey can attack new-born lambs in spring, so shepherds should always be near them.

From the border of the project area to the shore of the reservoir there is a decrease, sometimes sharp with cliffs and ravines, accumulating rainfall which causes the presence of more abundant and long-growing vegetation compared to the surface of the plateau. Gullies are shelters for mammals and reptiles from critical temperatures, nesting places for birds. Here on the cliffs many species of small and large birds of prey nest.

Agitma Lake attracts waterfowl during seasonal migrations. The water in the lake is slightly salty: at the canal mouth it is more fresh, on the north side it is salty, and therefore is not suitable for irrigation. There are a sufficient number

Juru Energy

of waterfowl, such as ducks, coots, pelicans and other birds, and large and small birds of prey nest on the cliffs. Some of them remain for nesting.

In the middle of the project area there is a power transmission line and a railway from the South-East to the North-West, from the city of Navoi to the city of Zarafshan. Inside the territory there is not a single crossing for a car. To get to the western part of the territory you need to go through a crossing outside the territory of the wind farm.

In spring, entrepreneurs from Bukhara stock up the lake, that is, they release fish fry for subsequent fishing and sale. Local residents are mainly engaged in cattle breeding. Locals bring drinking water from over 40 km, because water from the lake and the keys near the village is not suitable for drinking and irrigation.

Juru Energy

VANTAGE POINTS

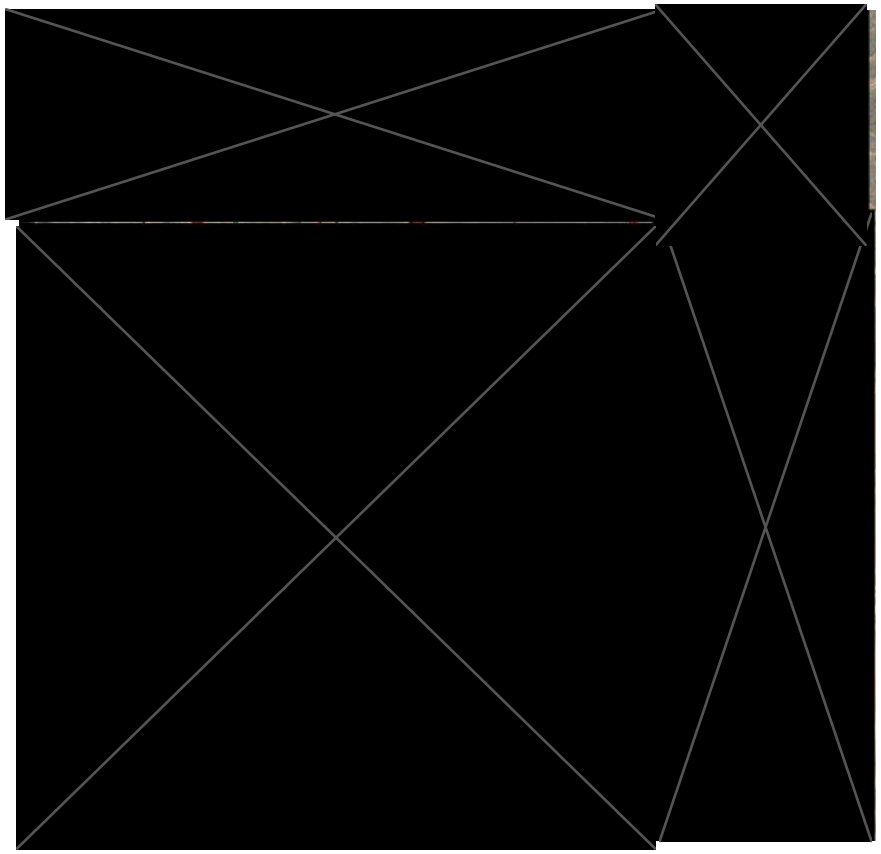


Fig. 2 Vantage Points locations (green line – railway road)

The number of Vantage Points was agreed with the Client. Points are located so as to cover the project territory as fully as possible (Fig.2). The coordinates of the Vantage Points of Navoi Bash are shown in Table 2. The radius of a single observation point is 2 km. Time spent at one point is 3 hours' average.

Juru Energy

Table 2 The coordinates of the VPs of Navoi Bash

Vantage Points	Coordinates
VP 1	[redacted]
VP 2	
VP 3	
VP 4	
VP 5	
VP 6	
VP 7	
VP 8	
VP 9	
Crossing the railway on the north side of the area	

Juru Energy

BIRD OBSERVATIONS RESULTS

Among birds registered during bird survey in 3 spring months (Tables 3-4-5), following bird species belonging to top priority target species were found in the project area: Steppe Eagle (*Aquila nipalensis*), Golden Eagle (*Aquila chrysaetos*), Imperial Eagle (*Aquila heliacal*), Egyptian Vulture (*Neophron percnopterus*).

Among the secondary species, following bird species were found in the project area: Booted Eagle (*Hieraaetus pennatus*), Eurasian Marsh-Harrier (*Circus aeruginosus*), Hen Harrier (*Circus cyaneus*), Shikra (*Accipiter badius*), Eurasian Sparrowhawk (*Accipiter nisus*), Long-legged Buzzard (*Buteo rufinus*), Demoiselle Crane (*Anthropoides virgo*), Common Crane (*Grus grus*), Common Kestrel (*Falco tinnunculus*).

Table 3 Results of bird observations in March

SPECIES			VANTAGE POINTS									IUCN status	Uzb Red Book status	Nature of stay
№	Latin	English	VP 1	VP 2	VP 3	VP 4	VP 5	VP 6	VP 7	VP 8	VP 9			
TARGET SPECIES														
1.	*Aquila chrysaetos*	Golden Eagle										LC	2 (VU:R)	**R**
2.	*Aquila heliaca*	Imperial Eagle										VU	2 (VU:D)	**NMS**
3.	*Aquila nipalensis*	Steppe Eagle				1	2			1		EN	2 (VU:D)	**NMW**
4.	*Chlamydotis macqueenii*	Houbara Bustard										VU	2 (VU:D)	**NM**

Juru Energy

5.	*Falco cherrug*	Saker Falcon										EN	1 (NT)	**RW**
6.	*Neophron percnopterus*	Egyptian Vulture		1		1	1	2	1	1		EN	2 (VU:D)	**NMW**
7.	*Vanellus gregarius*	Sociable Lapwing										CR	2 (VU:R)	M
SECONDARY SPECIES														
1.	*Accipiter badius*	Shikra										LC	-	**NM**
2.	*Accipiter nisus*	Eurasian Sparrowhawk				1			1			LC	-	**NMW**
3.	*Aegypius monachus*	Cinereous Vulture										NT	3 (NT)	**R**
4.	*Anser erythropus*	Lesser White-fronted Goose										VU	2 (VU:R)	**M**
5.	*Anthropoides virgo*	Demoiselle Crane										LC	-	M
6.	*Aythya ferina*	Common Pochard										VU	*not listed*	**NMW**
7.	*Branta ruficollis*	Red-breasted Goose										VU	2 (VU:R)	**M**
8.	*Buteo buteo*	Common Buzzard										LC	LC	
9.	*Buteo rufinus*	Long-legged Buzzard				2		2				LC	-	**NMW**

Juru Energy

10.	*Circaetus gallicus*	Short-toed Snake-Eagle										LC	2 (VU:D)	NM
11.	*Circus aeruginosus*	Eurasian Marsh-Harrier				1	1		1			LC	-	**NMW**
12.	*Circus cyaneus*	Hen Harrier				1	1		1	1		LC	-	**MW**
13.	*Circus macrourus*	Pallid Harrier										NT	3 (NT)	MS
14.	*Circus pygargus*	Montagu's Harrier										LC	-	**NM**
15.	*Falco naumanni*	Lesser Kestrel			1							LC	NT	
16.	*Falco tinnunculus*	Common Kestrel								1		LC	-	**NMW**
17.	*Grus grus*	Common Crane										LC	LC	
18.	*Gyps fulvus*	Eurasian Griffon										NT	2 (VU:D)	R
19.	*Hieraaetus pennatus*	Booted Eagle										LC	2 (VU:D)	NM
20.	*Marmaronetta angustirostris*	Marbled Teal										VU	1 (EN)	**NM**
21.	*Milvus migrans*	Black Kite										LC	*not listed*	**NMW**
22.	*Oxyura leucocephala*	White-headed Duck										EN	1 (EN)	**NMW**
23.	*Pelecanus crispus*	Dalmatian										NT	EN	**M**

Juru Energy

		Pelican												
	Pelecanus onocrotalus	Great White Pelican										LC	VU:D	**NMW**
25.	*Podiceps auritus*	Horned Grebe										VU	*not listed*	**M**

Juru Energy

Table 4 Results of bird observations in April

SPECIES			VANTAGE POINTS									IUCN status	Uzbekistan Red Book status	Nature of stay
№	Latin	English	VP 1	VP 2	VP 3	VP 4	VP 5	VP 6	VP 7	VP 8	VP 9			
TARGET SPECIES														
1.	*Aquila chrysaetos*	Golden Eagle	1, 1	1	2	2, 2, 2, 1	2, 1	2	1, 1	1	2	LC	listed 2 (VU:R)	**R**
2.	*Aquila heliaca*	Imperial Eagle										VU	2 (VU:D)	**NMS**
	Aquila nipalensis	Steppe Eagle	1	1		1	2, 1, 1	1	1, 2			EN	2 (VU:D)	**NMW**
4.	*Chlamydotis macqueenii*	Houbara Bustard										VU	2 (VU:D)	**NM**
5.	*Falco cherrug*	Saker Falcon										EN	1 (NT)	**RW**
6.	*Neophron percnopterus*	Egyptian Vulture	1, 1		2	1, 2, 2, 1, 2	1, 1	1, 1	1	1, 2		EN	2 (VU:D)	**NMW**
7.	*Vanellus gregarius*	Sociable Lapwing										CR	2 (VU:R)	**M**
SECONDARY SPECIES														
1.	*Accipiter badius*	Shikra							1			LC	*not listed*	**NM**
2.	*Accipiter nisus*	Eurasian Sparrowhawk	1	1	1	1	1				1	LC	*not listed*	**NMW**

Juru Energy

3.	*Aegypius monachus*	Cinereous Vulture										NT	3 (NT)	R
4.	*Anser erythropus*	Lesser White-fronted Goose										VU	2 (VU:R)	**M**
5.	*Anthropoides virgo*	Demoiselle Crane						150	86			LC	*not listed*	**M**
6.	*Aythya ferina*	Common Pochard										VU	*not listed*	**NMW**
7.	*Branta ruficollis*	Red-breasted Goose										VU	2 (VU:R)	**M**
8.	*Buteo buteo*	Common Buzzard										LC	*not listed*	**MW**
9.	*Buteo rufinus*	Long-legged Buzzard	1, 1, 2	1, 2		2, 1, 1, 1	1, 2	1	1, 1, 1	1, 1		LC	*not listed*	**NMW**
10.	*Circaetus gallicus*	Short-toed Snake-Eagle										LC	2 (VU:D)	**NM**
11.	*Circus aeruginosus*	Eurasian Marsh-Harrier	1			1, 1, 1	1, 2	1	1, 1, 1	1, 1		LC	*not listed*	**NMW**
12.	*Circus cyaneus*	Hen Harrier	1, 1, 1, 2, 2			1, 1, 2, 2	1, 1	1	2, 1, 1, 2	2, 1		LC	*not listed*	**MW**
13.	*Circus macrourus*	Pallid Harrier										NT	3 (NT)	**MS**

Juru Energy

14.	*Circus pygargus*	Montagu's Harrier										LC	*not listed*	**NM**
15.	*Falco naumanni*	Lesser Kestrel										LC	NT	
16.	*Falco tinnunculus*	Common Kestrel		1	1, 1	1, 1	1	1	1	1	1	LC	*not listed*	**NMW**
17.	*Grus grus*	Common Crane										LC	*not listed*	**MW**
18.	*Gyps fulvus*	Eurasian Griffon							1			NT	2 (VU:D)	R
19.	*Hieraaetus pennatus*	Booted Eagle		1								LC	2 (VU:D)	**NM**
20.	*Marmaronetta angustirostris*	Marbled Teal										VU	1 (EN)	**NM**
21.	*Milvus migrans*	Black Kite										LC	*not listed*	**NMW**
22.	*Oxyura leucocephala*	White-headed Duck										EN	1 (EN)	**NMW**
23.	*Pelecanus crispus*	Dalmatian Pelican										NT	EN	**M**
	Pelecanus onocrotalus	Great White Pelican										LC	VU:D	**NMW**
25.	*Podiceps auritus*	Horned Grebe										VU	*not listed*	**M**

Juru Energy

Table 5 Results of bird observations in May[2]

SPECIES			VANTAGE POINTS									IUCN status	Uzbekistan Red Book status	Nature of stay
№	Latin	English	VP 1	VP 2	VP 3	VP 4	VP 5	VP 6	VP 7	VP 8	VP 9			
TARGET SPECIES														
1.	*Aquila chrysaetos*	Golden Eagle										LC	listed 2 (VU:R)	**R**
2.	*Aquila heliaca*	Imperial Eagle										VU	2 (VU:D)	**NMS**
	Aquila nipalensis	Steppe Eagle					1			1		EN	2 (VU:D)	**NMW**
4.	*Chlamydotis macqueenii*	Houbara Bustard										VU	2 (VU:D)	**NM**
5.	*Falco cherrug*	Saker Falcon										EN	1 (NT)	**RW**
6.	*Neophron percnopterus*	Egyptian Vulture	1	1	1	1	1				1	EN	2 (VU:D)	**NMW**
7.	*Vanellus gregarius*	Sociable Lapwing										CR	2 (VU:R)	**M**
SECONDARY SPECIES														
1.	*Accipiter badius*	Shikra										LC	*not listed*	**NM**

[2] In Table 5 number of bird species are separated by comma implies detection of bird species in different days

Juru Energy

2.	*Accipiter nisus*	Eurasian Sparrowhawk				1				1		LC	*not listed*	**NMW**
3.	*Aegypius monachus*	Cinereous Vulture										NT	3 (NT)	R
4.	*Anser erythropus*	Lesser White-fronted Goose										VU	2 (VU:R)	**M**
5.	*Anthropoides virgo*	Demoiselle Crane										LC	*not listed*	**M**
6.	*Aythya ferina*	Common Pochard										VU	*not listed*	**NMW**
7.	*Branta ruficollis*	Red-breasted Goose										VU	2 (VU:R)	**M**
8.	*Buteo buteo*	Common Buzzard										LC	*not listed*	**MW**
9.	*Buteo rufinus*	Long-legged Buzzard			1	2		1	1		1	LC	*not listed*	**NMW**
10.	*Circaetus gallicus*	Short-toed Snake-Eagle										LC	2 (VU:D)	**NM**
11.	*Circus aeruginosus*	Eurasian Marsh-Harrier	1			1					1	LC	*not listed*	**NMW**
12.	*Circus cyaneus*	Hen Harrier		1				1				LC	*not listed*	**MW**

Juru Energy

13.	*Circus macrourus*	Pallid Harrier										NT	3 (NT)	**MS**
14.	*Circus pygargus*	Montagu's Harrier										LC	*not listed*	**NM**
15.	*Falco naumanni*	Lesser Kestrel										LC	NT	
16.	*Falco tinnunculus*	Common Kestrel					1	1	1			LC	*not listed*	**NMW**
17.	*Grus grus*	Common Crane										LC	*not listed*	**MW**
18.	*Gyps fulvus*	Eurasian Griffon										NT	2 (VU:D)	R
19.	*Hieraaetus pennatus*	Booted Eagle			1	1				1		LC	2 (VU:D)	**NM**
20.	*Marmaronetta angustirostris*	Marbled Teal										VU	1 (EN)	**NM**
21.	*Milvus migrans*	Black Kite										LC	*not listed*	**NMW**
22.	*Oxyura leucocephala*	White-headed Duck										EN	1 (EN)	**NMW**
23.	*Pelecanus crispus*	Dalmatian Pelican										NT	EN	**M**
	Pelecanus onocrotalus	Great White Pelican										LC	VU:D	**NMW**
25.	*Podiceps auritus*	Horned Grebe										VU	*not listed*	**M**

Juru Energy

SPECIALIZED SURVEY ON WATER BIRDS AND ASIAN HOUBARA *Chlamydotis macqueenii*

We decided to implement specialized survey to document the abundance and distribution of the Asian Houbara (*Chlamydotis macqueenii*) within the project area and near Agitma lake. The Asian Houbara is a species of bustard (family Otitidae) that is classified as "Vulnerable" by the IUCN, is also included on the national redlist for Uzbekistan, and likely occurs within the project area, based on a review of records in the eBird database. Bustards such as the Asian Houbara spend most of their time on the ground, and are therefore not well covered by VP surveys. However, they are considered a potential risk factor for wind energy development both because they may be susceptible to collisions with anthropogenic structures when they do fly, and also because they may suffer displacement effects from the development of wind energy projects. This species' breeding season extends from March through May, and the early part of the breeding season, when males are displaying, may be the most appropriate seasonal time frame for surveys.

Additionally, as we noted in March report, Agitma lake located near the project area attracts many water birds. And in this regard, we decided to conduct a specialized water birds survey around the lake. We went ashore for the first time on March 23, 2020 (Fig. 3). The weather was cloudy, there was a strong wind, visibility was poor and there were almost no birds.

Juru Energy

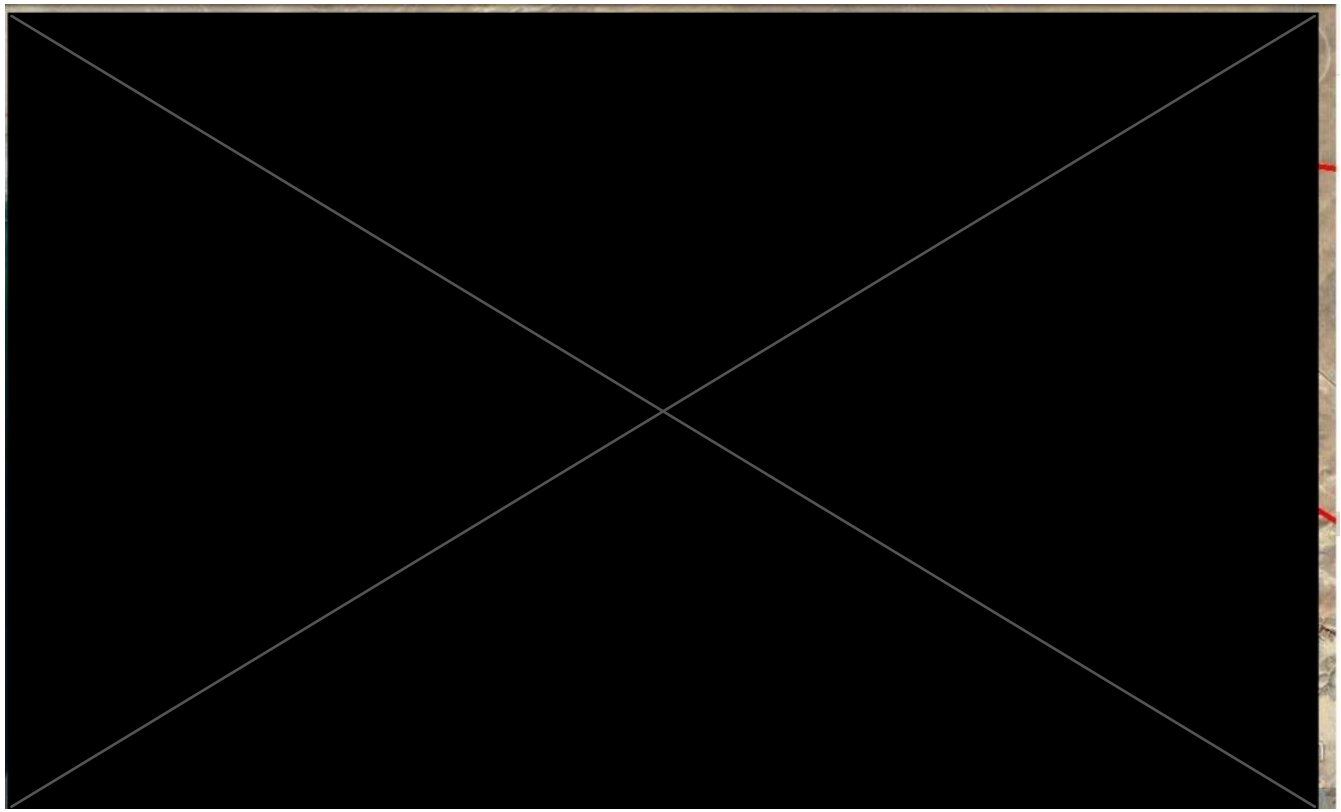


Fig. 3 First water birds survey transects

Juru Energy



Fig. 4 Ruddy Shelduck on 03.23.2020 [redacted]



Fig. 5 Shore line of Agitma lake

Juru Energy

On this day we observed only 3 bird species (Table 6)

Table 6 Results of water bird observations on Agitma lake shore in March

№	Latin name	English name	Number
1.	Motacilla alba personata	Pied Wagtail	3
2.	Tadorna ferruginea	Ruddy Shelduck	2
3.	Larus cachinnans	Yellow-legged (Caspian) Gull	2

We planned the next trip thoroughly. On May 17, 2020, we started exploring shoreline of the lake, we spent the night on the shore, and the next day we explored the entire coastline around the lake. A strong wind with rain blew at night, in the morning it was overcast, near 9 a.m. the sky cleared. Driving along the coastline, we carefully watched the open water and the shore. Sometimes we stopped and looked through the field telescope.

Juru Energy

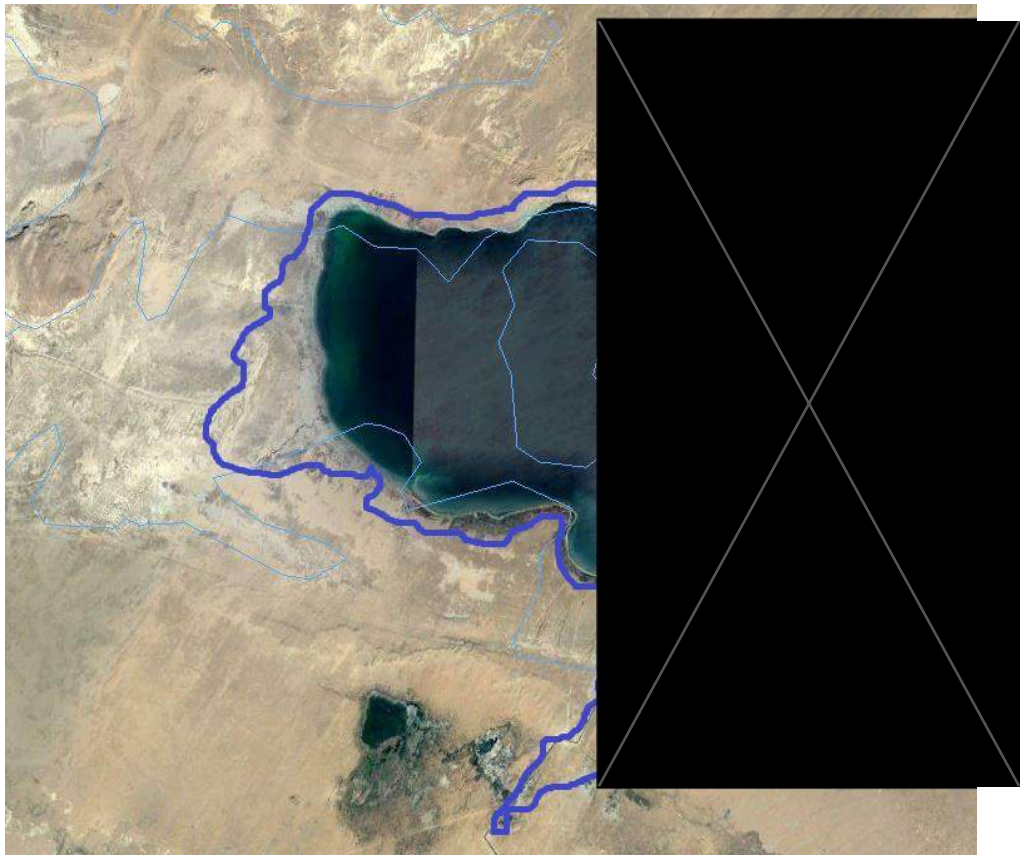


Fig. 6 Water birds survey route around the lake on May 17-18, 2020

Juru Energy



Fig. 7 Camp site [redacted]

Juru Energy

Table 7 Results of water bird observations on Agitma lake shore in May

№	Latin name	English name	Number	IUCN status	Uzbekistan Red Book status	Nature of stay
1.	Phalacrocorax pygmaeus	Pygmy Cormorant	12	LC	3 (NT)	**NMW**
2.	Ardea cinerea	Grey Heron	2	LC	-	**NMW**
3.	Ardea purpurea	Purple Heron	3	LC	-	**NM**
4.	Pelecanus onocrotalus	Great White Pelican	2	LC	2 (VU:D)	**NMW**
5.	Phoenicopterus roseus	Greater Flamingo	23	LC	2 (VU:D)	**NM**
6.	Tadorna ferruginea	Ruddy Shelduck	10	LC	-	**NMW**
7.	Cygnus olor	Mute Swan	4	LC	3 (NT)	**NMW**
8.	Tadorna tadorna	Common Shelduck	6	LC	-	**NMW**
9.	Anas platyrhynchos	Mallard	26	LC	-	**NMW**
10.	Anas clypeata	Northern Shoveler	52	LC	-	**NMW**
11.	Circus aeruginosus	Marsh Harrier	7	LC	-	**NMW**
12.	Phasianus colchicus	Common Pheasant	2 (voice)	LC	-	**R**
13.	Fulica atra	Common Coot	80	LC	-	**NMW**
14.	Chlamydotis undulata	Houbara Bustard	2	VU	2 (VU:D)	**NM**
15.	Charadrius asiaticus	Caspian Plover	15	LC	-	**NM**

Juru Energy

16.	Himantopus himantopus	Black-Winged Stilt	8	LC	-	**NM**
17.	Tringa glareola	Wood Sandpiper	4	LC	-	**MS**
18.	Phalaropus lobatus	Red-necked Phalarope	37	LC	-	**MS**
19.	Philomachus pugnax	Ruff	6	LC	-	**MS**
20.	Calidris minuta	Little Stint	18	LC	-	**MS**
21.	Glareola pratincola	European Collared Pratincole		LC		**NMW**
22.	Larus ridibundus	Black-Headed Gull	14	LC	-	**NMW**
23.	Larus cachinnans	Yellow-legged (Caspian) Gull	6	LC	-	**NMW**
24.	Larus genei	Slender-Billed Gull	4	LC	-	**NM**
25.	Sterna hirundo	Common Tern	15	LC	-	**NM**
26.	Athene noctua	Little Owl	2	LC	-	**R**
27.	Apus apus	Northern Swift	120	LC	-	**NM**
28.	Coracias garrulus	Eurasian Roller	22		-	**NM**
29.	Merops superciliosus	Blue-cheeked Bee-eater	60	LC	-	**NMW**
30.	Riparia riparia	Sand Martin	80	LC	-	**NM**
31.	Motacilla flava	Yellow Wagtail	4	LC	-	**N**

Juru Energy

32.	Motacilla alba	White Wagtail	5	LC	-	**MW**
33.	Acrocephalus stentoreus	Clamorous Reed Warbler	singing	LC	-	**NM**

On Agitma lake shore we observed Greater Flamingo feeding on the lake in the amount of 27 individuals. Greater Flamingo is included in the Red List of Threatened Species of Uzbekistan. They were on the South side of the lake, further from the anthropogenic pressure.

One of the primary species of Houbara Bustard in the number of two individuals also were seen on that part of the lake. Common coots, little stints, slender-billed gulls, mute swans, ruddy shelducks and other species of birds regularly can be seen on the same shore. On clay cliffs, where the canal flows into the lake, there is a colony of blue-cheeked bee-eaters. From observations, it became clear that following birds regularly visit the lake: greater flamingos, mute swans, great cormorants, small cormorants, sea kentishs, black-winged stilts, ruddy shelducks, marsh harriers, night herons, purple herons, gray herons, common coots, and some other types of ducks. This was also confirmed by residents and local environmental inspectors.

Houbara Bustard

On vantage points of the project territory of the Navoi Bash wind farm, single individuals of Houbara Bustard were discovered only twice in May: on May 02, 2020 near VP 6 point, and on 10 May, 2020 on VP 8 point. This cautious bird is wary of contact with humans and usually lives in sparsely populated steppe areas. When birds noticed bird-watchers, they did not fly, but ran and got lost in the bushes. There was no opportunity to take pictures. The search for eggs and chicks did not yield results.

Juru Energy

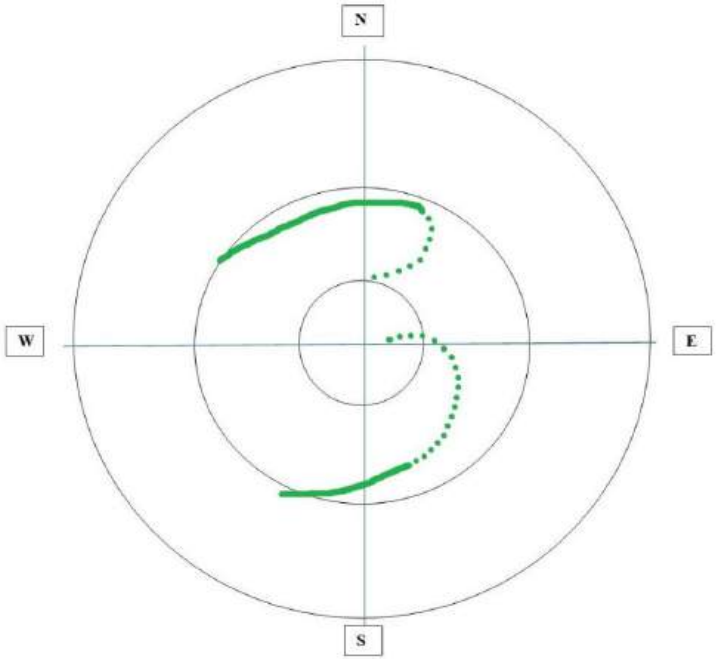


Fig. 8 Houbara Bustard flight path

Our next record of Houbara Bustard was made on May 18, 2020 on the South-West side of the lake during water bird survey of Agitma lake. The first Houbara Bustard was seen from the car. As we stopped, the bird did not immediately take off, but ran about 180-200 meters and only then took off in a westerly direction. The flight height was low, at the highest point about 8-10 meters. After it flew about 1 km, we lost sight of it. And the second Houbara Bustard was noticed a few seconds from the first, it also ran, but in a different direction - towards the lake, rose into the air, turned left and flew back. The flight height of the second Houbara Bustard was even lower, about 6-7 meters.

The flight path represents Houbara Bustards (2) outside the project area; on the project site Houbara Bustards were sitting on the gorund

Chlamydotis macqueenii

Running on the ground

Flight

Juru Energy



Fig. 9 Yellow points - Houbara Bustard observations

According to local shepherds, they do not often see Houbara Bustards, but it is more likely that the birds hide or run away when seeing people. As we were told by the chief of the Nature Protection Inspectorate, Houbara Bustard mainly lives on the relatively sparsely populated Western side of the lake, where there is less anthropogenic pressure.

Juru Energy

SPECIALIZED RAPTOR NEST SURVEY

As noted in the report from the March 14-15, 2020 bird observation visit, the cliffs that border the Lake Agitma basin, that lie immediately west of the NBWEP area, extending from the northern to the southern limits of the area, are the most likely area in which a variety of raptor species, including old world vultures, falcons, and all hawks, eagles, buzzards, kites, and harriers, are likely to nest within the project's larger area of influence. This is the reason [redacted]

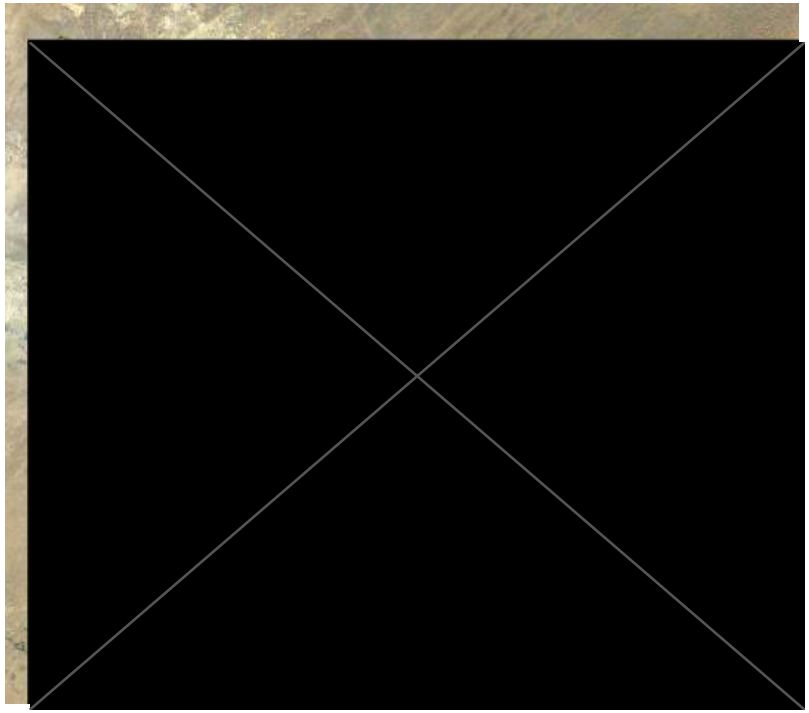


Fig. 10 Route for specialized raptor nest survey on May 21, 2020

Juru Energy

We examined the cliffs and did not find occupied nests (Fig. 15-16). A large bird's nest from the last year was found on one of the cliffs. It should be noted that the cliffs are relatively low. There are several dozens of Northern Swift and one Kestrel were circling around the cliffs.

But it must be noted that in 2011 local ornithologists found Saker Falcon (*Falco cherrug*) and Egyptian Vulture (*Neophron percnopterus*) nesting in this particular cliffs (Fig. 11-14). Those nests were found by ornithologists when they performed survey of the Ayakaghytma lake in order to estimate whether it meets criteria for IBA[3].

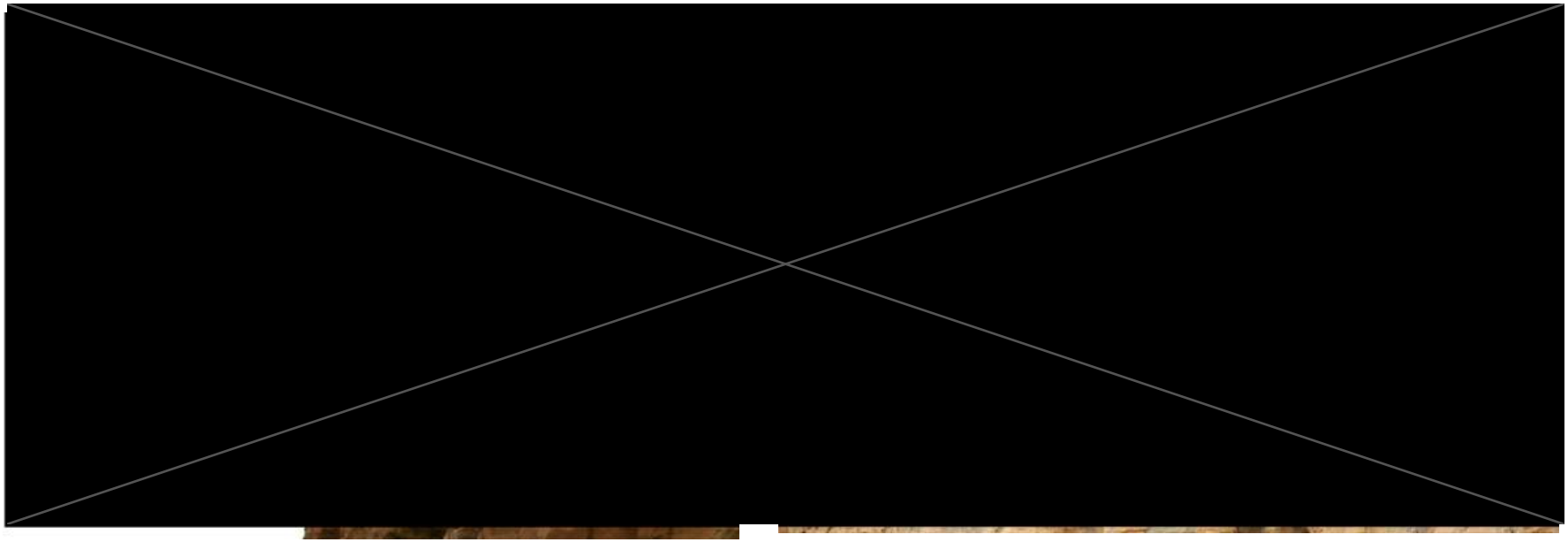


Fig. 11 Saker Falcon (Falco cherrug) in Agitma cliffs in 2011

Fig. 12 Nest of Saker Falcon (*Falco cherrug*) in Agitma cliffs in 2011

[3] Akpetky lakes, Sarykamysh lake, Ayakaghytma lake, and their desert surrounds: three new Important Bird Areas in Uzbekistan ANNA TEN, ROMAN KASHKAROV, GULARA MATEKOVA, ILIA ZHOLDASOVA & MUKHTOR TURAEV Sandgrouse 34 (2012)

Juru Energy

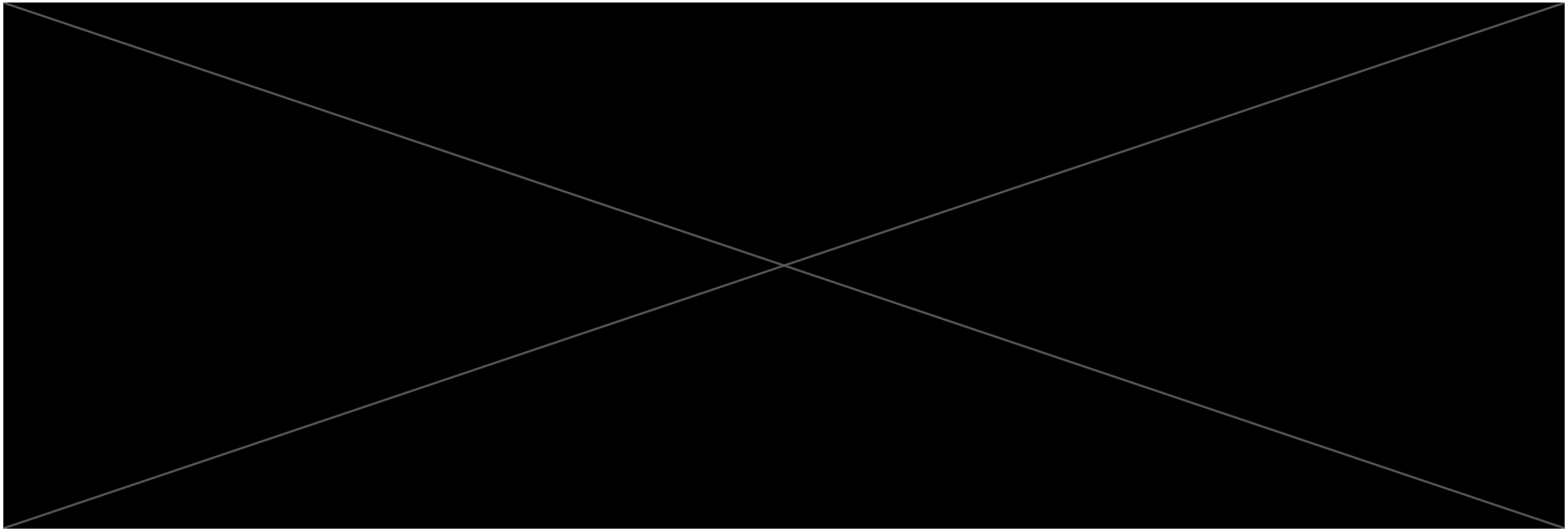
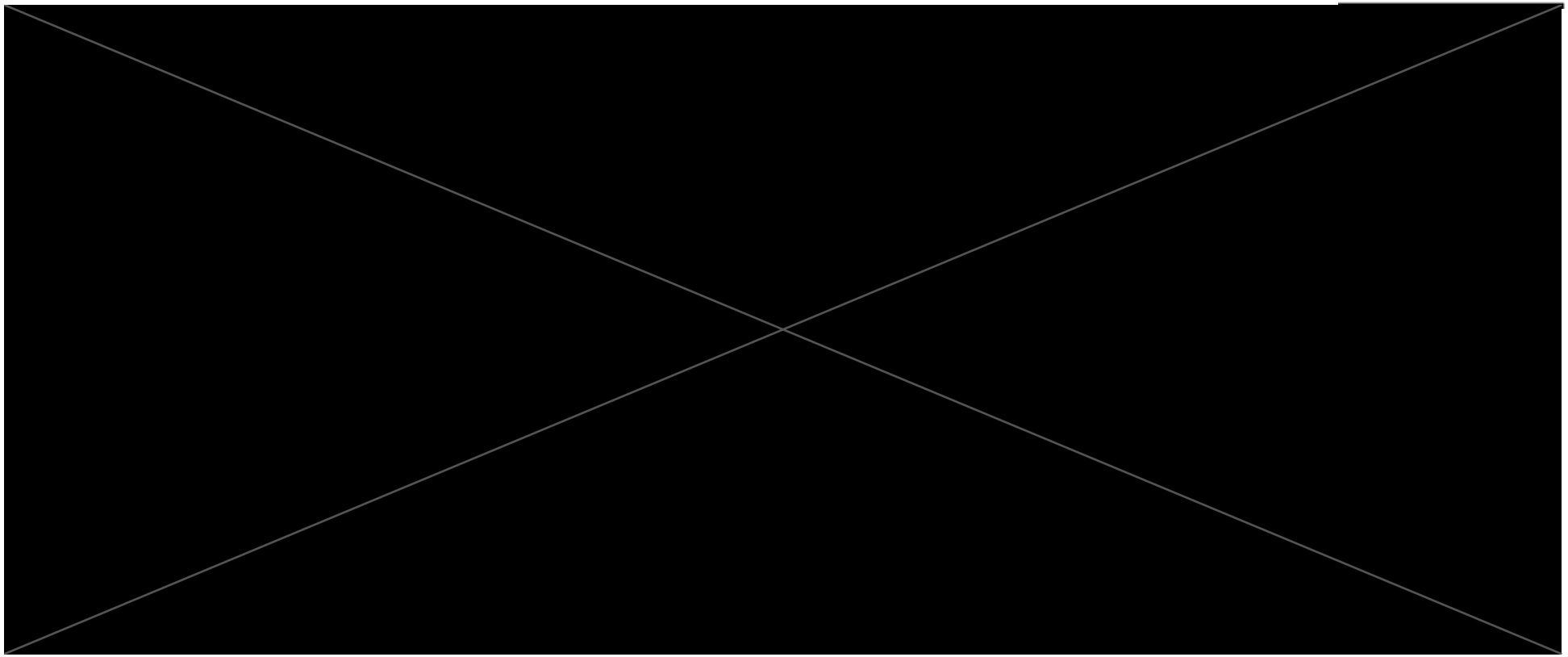


Fig. 13 Egyptian Vulture (Neophron percnopterus) nesting in Agitma cliffs in 2011

Fig. 14 Egyptian Vulture (*Neophron percnopterus*) nesting in Agitma cliffs in 2011

Juru Energy



Juru Energy

CONCLUSIONS AND RECCOMENDATIONS

In March, the migration of birds in the project area was especially active, and birds flew at different altitudes. It is possible that this was due to the aridity of the territory and lack of mountains and hills, where large birds use ascending air currents for a soaring flight. And small migratory birds mostly flied on a wide front and do not concentrate in one area. At the time of observation, insects, turtles and rodents woke up from hibernation. On public roads there were many animals crushed by wheels of cars - hedgehogs, jerboas and especially ground squirrels, which attracted birds of prey as well as yellow gopher abundant in the area. No dead birds were recorded under the power lines or near the railway line during Spring surveys, but this doesn't necessarily mean that no birds die under the power lines, because all dead animals are quickly eaten by other birds of prey, foxes, etc.

At the beginning of April, migratory birds of prey were often found on the area of Bash-Agitma. Among the birds of prey, e.g., Western Marsh Harrier (Circus aeruginosus). Among the target species, Egyptian vulture was often found. Steppe Eagles were detected at the beginning of the month, but they ceased to meet at the end of April. From the side of the lake (Ayakagytma) we met (a couple of times) Grus virgo rising high into the sky. According to local shepherds, large birds of prey in the morning often watch over a flock of sheep and sometimes attack newly born lambs. Towards the end of the month, fledglings (chicks able to fly but not yet independent) of small passerines began to appear.

The anthropogenic influence has an impact in such a remote area: people living in the village are mainly engaged in cattle breeding, small cattle graze here from neighbouring regions, for example, from the Bukhara region, and this in turn negatively affects the species diversity of plants growing here. Due to the lack of food, the livestock often moves from place to place, and the birds' nests laying on the ground are often destroyed.

Juru Energy

One of the primary species (Houbara Bustard) was not met in April. In the middle of the project area, a railway runs from South to North, and a train passes several times a day, providing some noise, maybe this noise might frighten birds like a Houbara bustard.

According to observations during May, we can say that the activity of birds is relatively low when compared with previous months. In May, the migration of birds practically stopped. The majority of mature birds have started the breeding season, and now most birds incubate eggs or feed nestlings. At this period, the birds are most careful. Of the target species, Egyptian Vulture and Booted Eagle were often seen. Among the secondary birds of prey, one can often observe Marsh-Harrier and the Long-legged Buzzard.

Our survey plan included an examination of cliffs in the northeast of the lake and an examination of the lake's surroundings. We examined the cliffs and did not find occupied nests. A large bird's nest from the last year was found on one of the cliffs. It should be noted that the cliffs are relatively low. There are several dozens of Northern Swift and one Kestrel were circling around the cliffs. There were Chukar Partridge on the cliffs. Greater Flamingo that is included in the Red List of Threatened Species of Uzbekistan in the amount of 27 individuals, was feeding on the lake. They were on the South side of the lake, further from the anthropogenic pressure. One of the primary species of Houbara Bustard in the number of two individuals also were seen on that part of the lake. Common coots, little stints, slender-billed gulls, mute swans, ruddy shelducks and other species of birds regularly can be seen on the same shore. On clay cliffs, where the canal flows into the lake, there is a colony of blue-cheeked bee-eaters. From observation, it became clear that birds regularly visit the lake. For example: greater flamingos, mute swans, great cormorants, small cormorants, sea kentishs, black-winged stilts, ruddy shelducks, marsh harriers, night herons, purple herons, gray herons, common coots, and some other types of ducks. This is also confirmed by residents and local environmental inspectors.

Summing up the results of spring bird counts on the project territory we can make a conclusion, that the construction of Navoi Bash Wind Farm near Agitma Lake could pose a threat for bird species safety in the area. There are a number of reasons for this, identified during the monitoring on the territory in Spring 2020:

Juru Energy

- The nearby lake in the middle of the desert attracts primarily waterfowl, most of them are medium-sized and large birds, and among them there are also many species included in the regional and international list of protected species;
- The presence of waterfowl attracts birds of prey, many of which have protection status;
- Cliffs and gorges serve as a resting place and in some places as a place for nesting for raptors;
- Above all, the project area borders with Important bird area (IBA[4]) UZ051 Lake Ayakagytma.

Recommendations:

1. To continue Bird observations especially during the autumn migration period which allow us to estimate the intensity of bird flight in this area and give the final conclusion.
2. To obtain data on bird monitoring on the territory of nearby IBA UZ051 Lake Ayakagytma for previous years from local bird conservation organizations. It will help us see the full picture of bird species distribution and behaviour in the area.

[4] An Important Bird and Biodiversity Area (IBA) is an area identified using an internationally agreed set of criteria as being globally important for the conservation of bird populations.

Juru Energy

Appendix 1. Weather conditions during VP Spring surveys

Table 8 Weather summary table for March

	VP 1	VP 2	VP 3	VP 4	VP 5	VP 6	VP 7	VP 8	VP 9
14 March	changeable weather, 6-8 m/s	changeable weather, 6-8 m/s			changeable weather, 6-8 m/s				
23 March		cloudy, 10-13 m/s	cloudy, 10-13 m/s						
26 March				sunny, 4-6m/s	sunny, 4-6m/s	sunny, 4-6m/s			
29 March							clear, 5-7m/s	sunny, 5-7m/s	

Juru Energy

Table 9 Weather summary table for April

	VP 1	VP 2	VP 3	VP 4	VP 5	VP 6	VP 7	VP 8	VP 9
3 April	sunny, 2-4 m/s			sunny, 3-6 m/s	sunny, 6-8 m/s				
4 April			sunny, 6-8 m/s	sunny, 8-12 m/s			sunny, 4-6 m/s		
5 April							cloudy, 10-15 m/s	cloudy, 8-10 m/s	cloudy, ws 6-8 m/s
6 April	changeable weather, 6-8 m/s	sunny, 6-8 m/s		sunny, 5-6 m/s					
7 April			sunny, 8-10 m/s	sunny, 10-12 m/s	sunny, 6-8 m/s				
10 April						cloudy, 12-18 m/s	cloudy, 10-12 m/s	cloudy, 8-10 m/s	
11 April							sunny, 6-8 m/s	sunny, 10-12 m/s	sunny, ws 6-8 m/s
12 April	sunny, 9-10 m/s	sunny, 5-7 m/s	sunny, 6-8 m/s						
14 April				cloudy, 12-15 m/s	cloudy, 9-12 m/s		cloudy, 12-15 m/s		
15 April	sunny, 10-12 m/s	sunny, 6-8 m/s	sunny, 7-10 m/s						
16 April			sunny, 6-8 m/s	sunny, 8-10 m/s	sunny, 8-12 m/s				
19 April				cloudy, 7-10 m/s	changeable weather, 8-10 m/s	changeable weather, 6-8 m/s			
20 April		cloudy, 5-8 m/s						cloudy, 6-8 m/s	cloudy, ws 3-6 m/s

Juru Energy

21 April	cloudy, 6-8 m/s							cloudy, 6-8 m/s	cloudy, ws 3-5 m/s
23 April			cloudy, 5-7 m/s						
24 April			cloudy, 5-7 m/s			changeable weather 5-7- m/s			
26 April					cloudy, 5-7 m/s	cloudy, 6-8 m/s			
27 April						cloudy, 4-6 m/s	cloudy, 5-8 m/s		cloudy, 8-12 m/s
28 April	cloudy, 6-8 m/s	cloudy, 5-7 m/s			cloudy, 6-8 m/s				
30 April					cloudy, 8-10 m/s	cloudy, 6-8 m/s		cloudy, 4-6 m/s	

Juru Energy

Table 10 Weather summary table for May

	VP 1	VP 2	VP 3	VP 4	VP 5	VP 6	VP 7	VP 8	VP 9
1 May	changeable weather, 2-4 m/s	changeable weather, 3-5 m/s	changeable weather, 1-3 m/s						
2 May				sunny, 2-5 m/s	sunny, 2-3 m/s	sunny, 3-5 m/s			
3 May							cloudy, 1-3 m/s	sunny, 3-5 m/s	sunny, 4-6 m/s
4 May				sunny, 5-7 m/s	sunny, 3-5 m/s				sunny, 4-6 m/s
5 May	sunny, 2-4 m/s	sunny, 3-5 m/s	sunny, 2-4 m/s						
6 May				sunny, 2-4 m/s	sunny, 2-5 m/s	sunny, 2-4 m/s			
7 May	sunny, 2-4 m/s	sunny, 3-5 m/s	sunny, 3-5 m/s						
10 May							changeable weather, 5-7m/s	sunny, 5-7 m/s	sunny, 3-5 m/s
11May	sunny, 3-5 m/s	sunny, 5-7 m/s	sunny, 3-5 m/s						
14 May				sunny, 3-5 m/s	sunny, 3-5 m/s	sunny, 3-5 m/s			

Juru Energy

Appendix 2. Vantage Point Data Logs

VP survey results in March

VP 1

Date: 14.03.2020 Start and end time of observations: 9:23 - 12:23

Weather:

The air temperature is about 16-18°C, changeable weather, 6-8 m/s. No precipitation

Primary species not found

Table 11. **Secondary and Other species (VP 1),** 14.03.2020.

№	Latin names	English names	Amount	Flight altitude
Secondary species not found				
Other species				
1.	*Galerida cristata*	Crested lark	28	0-15
2.	*Oenanthe finschii*	Black-necked wheatear	2	0-10
3.	*Calandrella rufescens*	Lesser short-toed lark	10	0-15
4.	*Rhodospiza obsoleta*	Desert finch	16	0-10
5.	*Passer hispaniolensis*	Spanish sparrow	80	0-30
6.	*Scotocerca inquieta*	Streaked scrub warbler	6	0-15
7.	*Oenanthe pleschanka*	Pied wheatear	1	0-10
8.	*Oenanthe isabellina*	Isabelline wheatear	4	0-10

Juru Energy

VP 2

Date: 14.03.2020 Start and end time of observations: 12:38 - 15:38

Weather:

The air temperature is about 18-20°C, changeable weather, 6-8 m/s. No precipitation

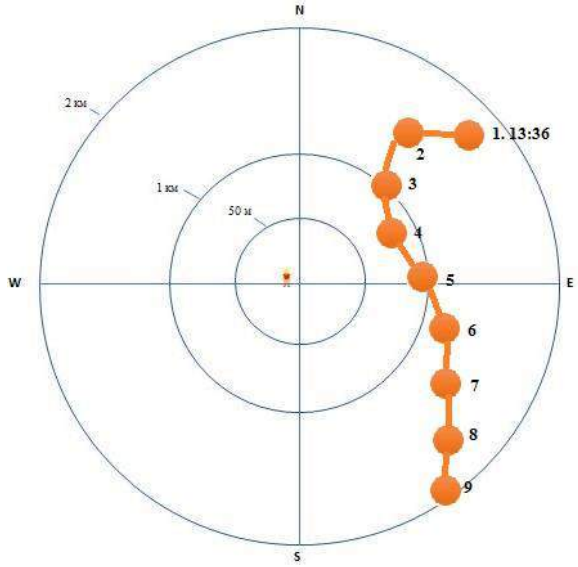


Fig. 17. Flight path (VP 2), 14.03.2020

Table 12. Target species log (VP 2), 14.03.2020

	Neophron percnopterus	1 55 m	2 55 m	3 55 m	4 55 m	5 55 m	6 50 m	7 50 m	8 55 m	9 55 m

Juru Energy

Table 13. **Secondary and Other species (VP 2),** 14.03.2020.

№	Latin names	English names	Amount	Flight altitude
Secondary species				
1.	*Athene noctua*	Little owl	1	0-1
Other species				
1.	*Pterocles orientalis*	Black-bellied sandgrouse	8	25
2.	*Galerida cristata*	Crested lark	20	0-15
3.	*Oenanthe finschii*	Black-necked wheatear	1	0-10
4.	*Calandrella rufescens*	Lesser short-toed lark	6	0-15
5.	*Rhodospiza obsoleta*	Desert finch	60	0-10
6.	*Passer hispaniolensis*	Spanish sparrow	16	0-30
7.	*Scotocerca inquieta*	Streaked scrub warbler	8	0-15
8.	*Oenanthe pleschanka*	Pied wheatear	2	0-10
9.	*Oenanthe isabellina*	Isabelline wheatear	8	0-10
10.	*Melanocorypha bimaculata*	Bimaculated lark	8	0-15

Juru Energy

VP 5

Date: 14.03.2020 Start and end time: 15:49 – 18:49

Weather:

The air temperature is about 18-20 °C, changeable weather, 6-8 m/s No precipitation.

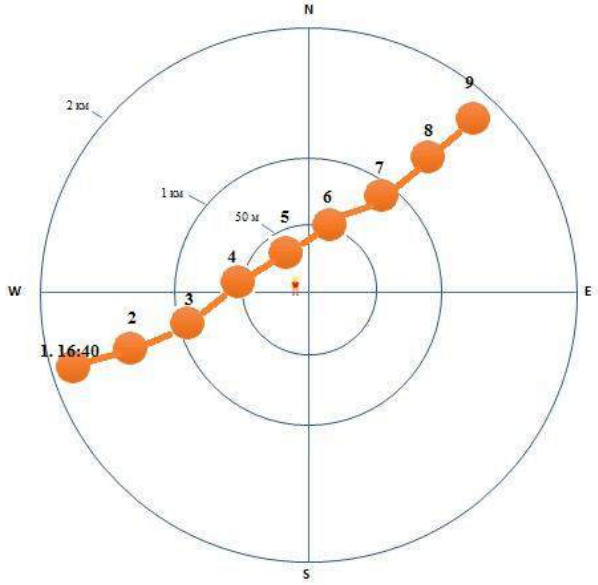


Fig. 18 Flight path (VP 5), 14.03.2020

Table 14 Target species log (VP 5), 14.03.2020

	Neophron percnopterus	1 45 m	2 45 m	3 45 m	4 45 m	5 45 m	6 40 m	7 40 m	8 45 m	9 45 m

Juru Energy

Table 15. **Secondary and Other species (VP 5),** 14.03.2020.

№	Latin names	English names	Amount	Flight altitude
Secondary species not found				
Other species				
1.	*Rhodospiza obsoleta*	Desert finch	10	0-10
2.	*Scotocerca inquieta*	Streaked scrub warbler	3	0-15
3.	*Oenanthe isabellina*	Isabelline wheatear	5	0-10

Juru Energy

VP 2

Date: 23.03.2020 Start and end time: 9:15 – 12:15

Weather:

The air temperature is about 10-13 °C, cloudy, cold weather, 10-15 m/s. No precipitation.

Primary species not found

Table 16. **Secondary and Other species (VP 2**), 23.03.2020

№	Latin names	English names	Amount	Flight altitude
Secondary species not found				
Other species				
1.	*Galerida cristata*	Crested lark	11	0-15
2.	*Scotocerca inquieta*	Streaked scrub warbler	2	0-15
3.	*Oenanthe isabellina*	Isabelline wheatear	8	0-10
4.	*Melanocorypha bimaculata*	Bimaculated lark	4	0-15

Juru Energy

VP 3

Date: 23.03.2020 Start and end time: 12:25 – 15:25

Weather:

The air temperature is about 10-13 °C, cloudy, cold weather, 10-15 m/s No precipitation.

Primary species not found

Table 17. **Secondary and Other species (VP 3**), 23.03.2020.

№	Latin names	English names	Amount	Flight altitude
Secondary species not found				
Other species				
1.	*Falco naumanni*	Lesser kestrel	1	8-10
2.	*Galerida cristata*	Crested lark	4	0-15
3.	*Scotocerca inquieta*	Streaked scrub warbler	2	0-15
4.	*Oenanthe isabellina*	Isabelline wheatear	2	0-10

Juru Energy

VP 4

Date: 26.03.2020 Start and end time of observations: 10:26 - 13:26

Weather:

The air temperature is about 18-20, sunny. Wind speed approx. (4-6 ms) No precipitation

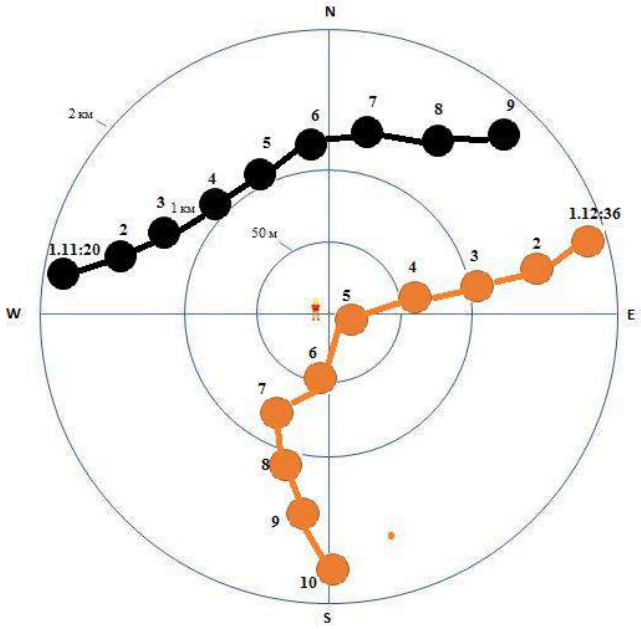


Fig. 19 Flight path (VP 4), 26.03.2020

Table 18 Target species log (VP 4), 26.03.2020

●	***Aquila nipalensis***	1 75 m	2 70 m	3 75 m	4 75 m	5 75 m	6 70 m	7 70 m	8 75 m	9 75 m	
●	***Neophron percnopterus***	1 65 m	2 65 m	3 65 m	4 65 m	5 65 m	6 60 m	7 60 m	8 65 m	9 65 m	10 65 m

Juru Energy

Table 19. **Secondary and Other species (VP 4**), 26.03.2020.

№	Latin names	English names	Amount	Flight altitude
Secondary species				
1.	*Circus aeruginosus*	Marsh harrier	1	25
2.	*Circus cyaneus*	Hen Harrier	1	35-40
3.	*Buteo rufinus*	Long-legged buzzard	2	80
4.	*Accipiter nisus*	Eurasian Sparrowhawk	1	40
Other species				
1.	*Apus apus*	Common swift	22	50
2.	*Upupa epops*	Hoopoe	2	0-10
3.	*Oenanthe pleschanka*	Pied wheatear	4	0-10
4.	*Oenanthe isabellina*	Isabelline wheatear	6	0-10

VP 5

Date: 26.03.2020 Start and end time: 13:36 – 16:36

Weather:

The air temperature is about 18-22, sunny, Wind speed approx. (4-6 ms) No precipitation.

Juru Energy

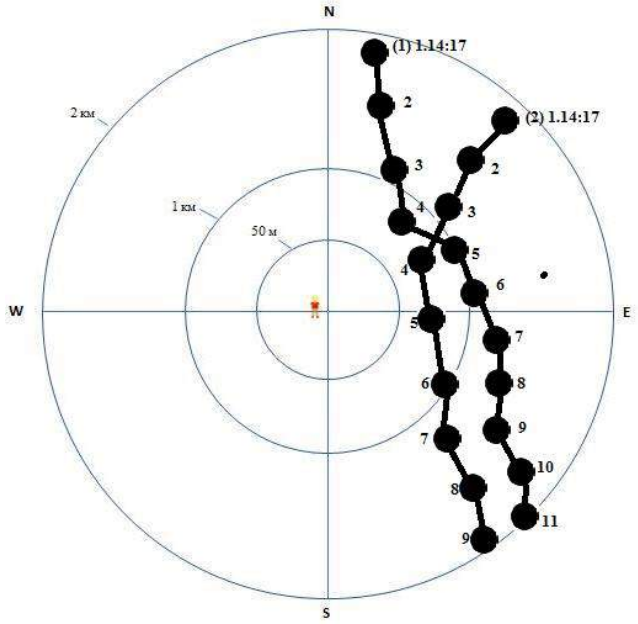


Fig. 20 Flight path (VP 5), 26.03.2020

Table 20. Target species log (VP 5), 26.03.2020

●	***Aquila nipalensis(1)***	1 65 m	2 60 m	3 65 m	4 65 m	5 65 m	6 60 m	7 60 m	8 65 m	9 65 m		
●	***Aquila nipalensis(2)***	1 65 m	2 65 m	3 65 m	4 65 m	5 65 m	6 60 m	7 60 m	8 65 m	9 65 m	10 65 m	11 65 m

Juru Energy

Table 21. **Secondary and Other species (VP 5**), 26.03.2020.

№	Latin names	English names	Amount	Flight altitude
Secondary species				
1.	*Circus aeruginosus*	Marsh harrier	1	25
2.	*Circus cyaneus*	Hen Harrier	1	35-40
Other species				
1.	*Oenanthe pleschanka*	Pied wheatear	1	0-10
2.	*Oenanthe isabellina*	Isabelline wheatear	6	0-10

Juru Energy

VP 6

Date: 26.03.2020 Start and end time: 16:42 – 19:42

Weather:

The air temperature is about 18-20°C, sunny, Wind speed approx. (4-6 m/s) No precipitation.

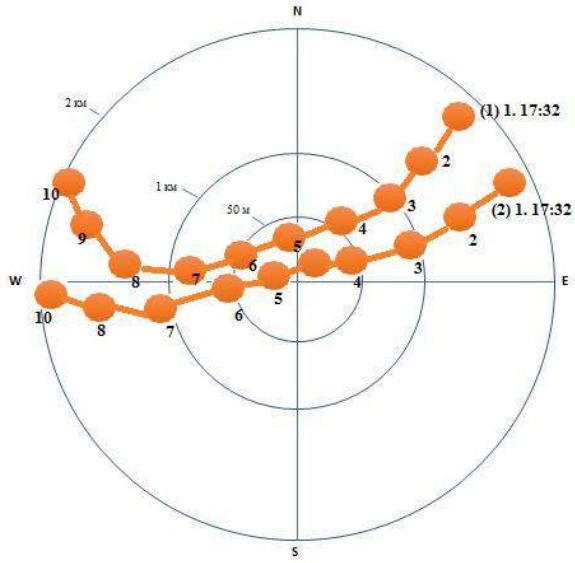


Fig. 21 Flight path (VP 6), 26.03.2020

Juru Energy

Table 22 Target species log VP 6, 26.03.2020

	Neophron percnopterus (1)	1 55 m	2 50 m	3 55 m	4 55 m	5 55 m	6 50 m	7 50 m	8 55 m	9 55 m	10 55 m
	Neophron percnopterus (2)	1 55 m	2 55 m	3 55 m	4 55 m	5 55 m	6 50 m	7 50 m	8 55 m	9 55 m	10 55 m

Table 23. **Secondary and Other species (VP 6**), 26.03.2020.

№	Latin names	English names	Amount	Flight altitude
Secondary species				
1.	*Buteo rufinus*	Long-legged buzzard	2	60
Other species				
1.	*Oenanthe pleschanka*	Pied wheatear	2	0-10
2.	*Oenanthe isabellina*	Isabelline wheatear	3	0-10
3.	*Galerida cristata*	Crested lark	6	0-15

Juru Energy

VP 7

Date: 29.03.2020 Start and end time: 11:38 – 13:45

Weather:

The air temperature around 22-24°C is clear, hot. Wind speed approx. (5-7 ms) No precipitation

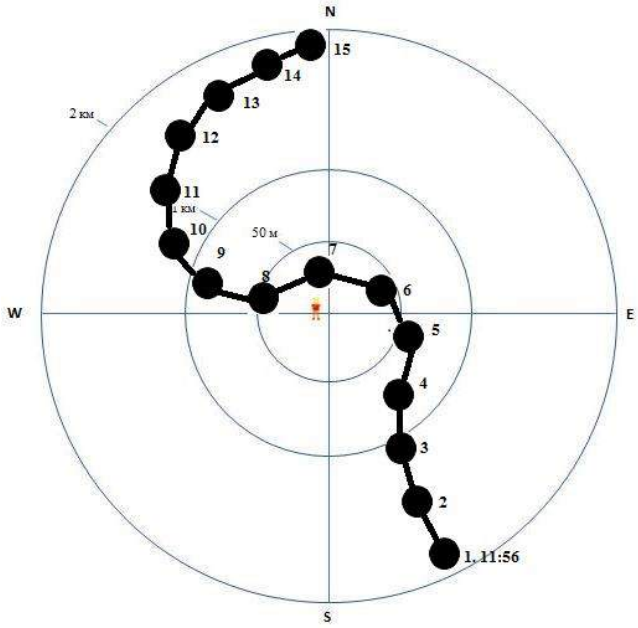


Fig. 22 Flight path VP 7, 29.03.2020

Table 24 Target species log VP 7, 29.03.2020

●	***Neophron percnopterus***	1 65 m	2 65 m	3 65 m	4 65 m	5 65 m	6 60 m	7 60 m	8 65 m	9 65 m	10 65 m	11 65 m	12 65 m	13 65 m	14 65 m	15 65 m

Juru Energy

Table 25. **Secondary and Other species (VP 7**), 29.03.2020

№	Latin names	English names	Amount	Flight altitude
Secondary species				
1.	*Circus aeruginosus*	Marsh harrier	1	25
2.	*Circus cyaneus*	Hen Harrier	1	35-40
3.	*Accipiter nisus*	Eurasian Sparrowhawk	1	30
Other species				
1.	*Upupa epops*	Hoopoe	2	0-3
2.	*Galerida cristata*	Crested lark	15	0-15
3.	*Oenanthe pleschanka*	Pied wheatear	4	0-10
4.	*Oenanthe isabellina*	Isabelline wheatear	6	0-10
5.	*Lanius excubitor*	Great Gray Shrike	1	2-10
6.	*Parus bocharensis*	Bokhara great tit	30	0-10

Juru Energy

VP 8

Date: 29.03.2020 Start and end time: 14:10 – 17:20

Weather:

The temperature is about 22-24 °C, sunny, hot. Wind speed approx. (5-7 m/s) No precipitation.

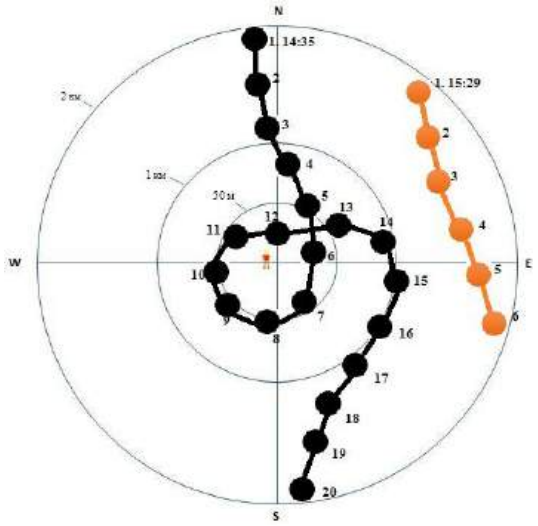


Fig. 23 Flight path (VP 8), 29.03.2020

Table 26 Target species log (VP 8), 29.03.2020

●	***Aquila nipalensis***	1 65 m	2 65 m	3 65 m	4 65 m	5 65 m	6 60 m	7 60 m	8 65 m	9 65 m	10 65 m	11 65 m	12 65 m	13 65 m	14 65 m	15 65 m	16 60 m	17 60 m	18 65 m	19 65 m	20 65 m
●	***Neophron percnopterus***	1 75 m	2 75 m	3 75 m	4 75 m	5 75 m	6 70 m														

Juru Energy

Table 27. **Secondary and Other species (VP 8**), 29.03.2020.

№	Latin names	English names	Amount	Flight altitude
Secondary species				
1.	*Circus cyaneus*	Hen Harrier	1	35-40
2.	*Falco tinnunculus*	Kestrel	1	26
Other species				
1.	*Oenanthe pleschanka*	Pied wheatear	2	0-10
2.	*Oenanthe isabellina*	Isabelline wheatear	3	0-10
3.	*Lanius minor*	Lesser gray shrike	1	2-10

Juru Energy

VP survey results in April

VP. 5

Date: 03.04.2020.
VP survey time: 8:12 – 11:12
Weather:
The air temperature around 16-18°C, clear visibility, hot.
Wind speed approx. (6-8 m/s) No precipitation.

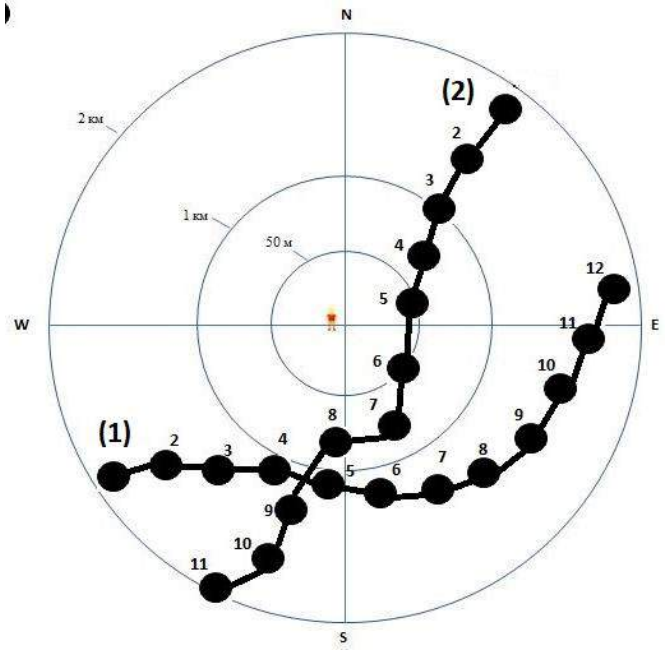


Fig. 24 Flight path VP 5, 03.04.2020

Table 28 Target species log (VP 5), 03.04.2020

●	*Aquila nipalensis (1)*	1 75 m	2 70 m	3 75 m	4 75 m	5 75 m	6 70 m	7 70 m	8 75 m	9 70 m	10 75 m	11 75 m	12 75 m
●	*Aquila nipalensis (2)*	1	2	3	4	5	6	7	8 75 m	9 70 m	10 75 m	11 75 m	

Juru Energy

		75 m	70 m	75 m	75 m	75 m	70 m	70 m				

Table 29 Secondary species log (VP 5), 03.04.2020

No.	Latin names	English names	Amount	Altitude (m)
1.	*Buteo rufinus*	Long-legged Buzzard	1	12
2.	*Circus cyaneus*	Hen (Northern) Harrier	1	14
3.	*Oenanthe pleschanka*	Pied Wheatear	2	4
4.	*Oenanthe oenanthe*	Northern Wheatear	3	3
5.	*Galerida cristata*	Crested Lark	12	4
6.	*Corvus corax*	Northern Raven	2	8
7.	*Apus apus*	Northern Swift	4	5
8.	*Lanius exubitor*	Great (Gray) Shrike	2	5

Juru Energy

VP. 1

Date: 03.04.2020.
VP survey time: 11:32 – 14:32
Weather:
The air temperature around 18-20°C, clear visibility, hot.
Wind speed approx. (2-4 m/s) No precipitation.

Primary species not found

Table 30 Secondary species log (VP 1), 03.04.2020

No.	Latin names	English names	Amount	Altitude (m)
1.	*Circus cyaneus*	Hen (Northern) Harrier	1	12
2.	*Oenanthe pleschanka*	Pied Wheatear	2	4
3.	*Oenanthe oenanthe*	Northern Wheatear	3	3
4.	*Galerida cristata*	Crested Lark	12	4
5.	*Corvus corax*	Northern Raven	2	8
6.	*Apus apus*	Northern Swift	4	5
7.	*Lanius exubitor*	Great (Gray) Shrike	2	5

Juru Energy

VP. 4

Date: 03.04.2020.
VP survey time: 14:50 – 17:50
Weather:
The air temperature around 18-20°C, clear visibility, hot.
Wind speed approx. (3-6 m/s) No precipitation.

Primary species not found

Table 31 Secondary species log (VP 4), 03.04.2020

No.	Latin names	English names	Amount	Altitude (m)
1.	*Oenanthe pleschanka*	Pied Wheatear	1	4
2.	*Oenanthe oenanthe*	Northern Wheatear	2	3
3.	*Galerida cristata*	Crested Lark	14	4
4.	*Corvus corax*	Northern Raven	2	8
5.	*Apus apus*	Northern Swift	3	5
6.	*Lanius exubitor*	Great (Gray) Shrike	1	5

VP.2

Date: 04.04.2020.
VP survey time: 8:15 – 11:15
Weather:
The air temperature around 16-18°C, clear visibility, hot.

Juru Energy

Wind speed approx. (6-8 m/s) No precipitation.

Primary species not found

Table 32 Secondary species log (VP 2), 04.04.2020

No.	Latin names	English names	Amount	Altitude (m)
1.	*Oenanthe pleschanka*	Pied Wheatear	3	1
2.	*Oenanthe oenanthe*	Northern Wheatear	2	2
3.	*Galerida cristata*	Crested Lark	5	3

Juru Energy

VP № 4

Date: 04.04.2020

VP survey time: 11^{30} - 14^{30}
Weather: temperature: 18-20 °C, sunny, wind speed (8-12 m/s)

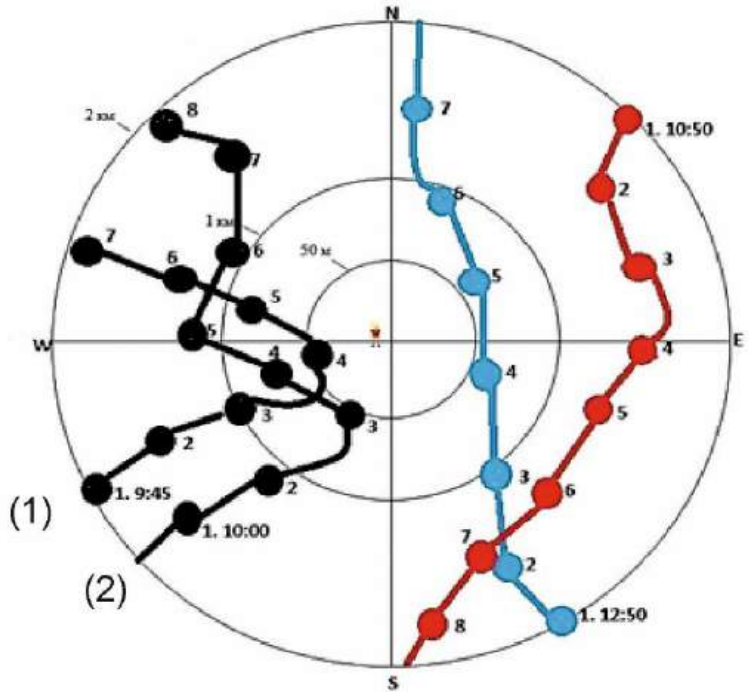


Fig. 25 Flight path for VP 4. 04.04.2020

Juru Energy

Table 33 Target species log (VP 4), 04.04.2020

●	*Aquila chrysaetos* - Golden eagle (1)	*1-70 m*	*2-70 m*	*3-65m*	*4-65 m*	*5-65 m*	*6-70 m*	*7-70 m*	
●	*Aquila chrysaetos* - Golden eagle (2)	*1-70 m*	*2-70 m*	*3-65m*	*4-65 m*	*5-65 m*	*6-70 m*	*7-70 m*	*8-70 m*
●	*Aquila nipalensis* - Steppe eagle	*1-90 m*	*2-90 m*	*3-90m*	*4-85 m*	*5-85 m*	*6-80 m*	*7-80 m*	*8-80 m*
●	*Neophron percnopterus* - Egyptian vulture	*1-60 m*	*2-60 m*	*3-65m*	*4-60 m*	*5-65 m*	*6-60 m*	*7-65 m*	

Table 34 Secondary species log (VP 4), 04.04.2020

№	Latin name	English name	Number of individuals	Altitude (m)
1.	*Circus cyaneus*	Hen harrier	1	11
2.	*Accipiter nisus*	Eurasian sparrowhawk	1	20
3.	*Buteo rufinus*	Long-legged buzzard	2	30
4.	*Circus aeruginosus*	Western marsh harrier	1	12
5.	*Upupa epops*	Eurasian hoopoe	2	6
6.	*Oenanthe isabellina*	Isabelline wheatear	6	3
7.	*Lanius minor*	Lesser grey shrike	2	5

Juru Energy

VP № 7

Date: 04.04.2020
VP survey time: 14^{50} - 17^{50}
Weather: temperature: 18-20 °C, sunny, wind speed (4-6 m/s)

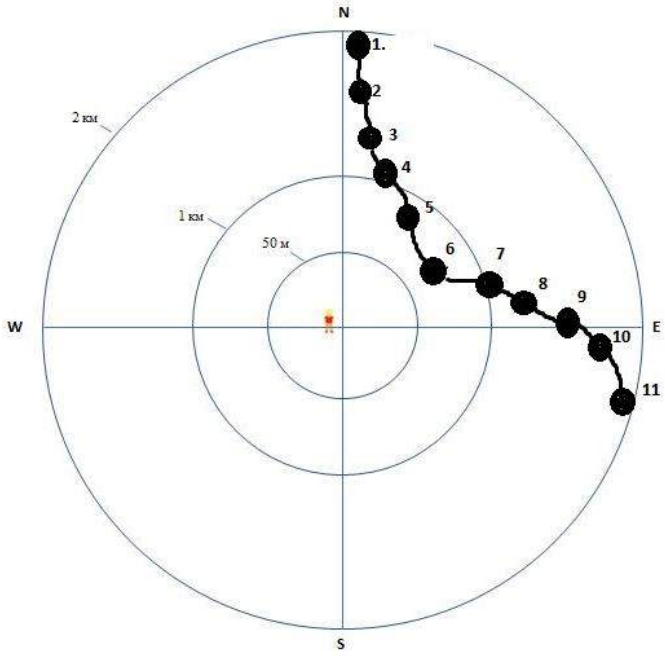


Fig. 26 Flight path for VP 7. 04.04.2020

Juru Energy

Table 35 Target species log (VP 4), 04.04.2020

●	*Aquila chrysaetos* - Golden eagle	*1-70 m*	*2-70 m*	*3-65m*	*4-65 m*	*5-65 m*	*6-70 m*	*7-70 m*	*8-70 m*	*9-70 m*	*10-65m*	*11-65 m*

Table 36 Secondary species log (VP 7), 04.04.2020

№	Latin name	English name	Number of individuals	Altitude (m)
1	*Circus cyaneus*	Hen harrier	2	11
2	*Buteo rufinus*	Long-legged buzzard	1	30
3	*Circus aeruginosus*	Western marsh harrier	1	12
4	*Upupa epops*	Eurasian hoopoe	2	6

Juru Energy

VP № 8

Date: 05.04.2020

VP survey time: 8 ^{30} -11 ^{30}

Weather: The air temperature around 16-18°C, cloudy, good visibility wind speed (8-10 m/s) without precipitation

Primary species not found

Table 37 Secondary species log (VP 8), 05.04.2020

№	Latin name	English name	Number of individuals	Altitude (m)
1.	*Buteo rufinus*	Long-legged buzzard	1	16
2.	*Circus aeruginosus*	Western marsh harrier	1	13
3.	*Oenanthe isabellina*	Isabelline wheatear	6	3

Juru Energy

VP № 7

Date: 05.04.2020
VP survey time: 11^{56} -14^{56}
Weather: The air temperature around 18-22°C, cloudy, good visibility wind speed (10-15 m/s) without precipitation

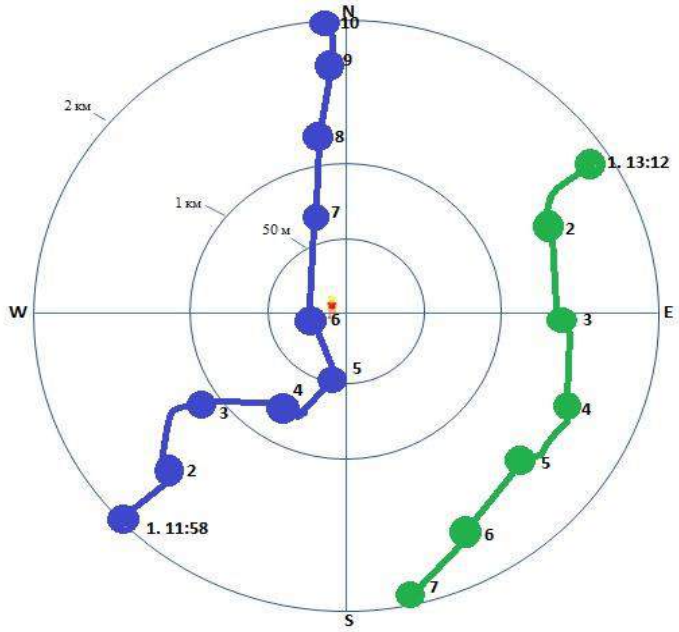


Fig. 27 Flight path for VP 7, 05.04.2020

Juru Energy

Table 38 Target species (VP 7), 05.04.2020

	Aquila chrysaetos	1-90 m	2-90 m	3-90 m	4-90 m	5-85 m	6-85 m	7-85 m	8-85 m	9-90 m	10-90 m
	Aquila nipalensis	1-65 m	2-65 m	3-65 m	4-70 m	5-75 m	6-75 m	7-75 m			

Table 39 Secondary species log (VP 7), 05.04.2020

№	Latin name	English name	Number of individuals	Altitude (m)
1.	*Circus cyaneus*	Hen harrier	1	10
2.	*Accipiter badius*	Shikra	1	15
3.	*Buteo rufinus*	Long-legged buzzard	1	20
4.	*Circus aeruginosus*	Western marsh harrier	1	12
5.	*Upupa epops*	Eurasian hoopoe	2	3
6.	*Oenanthe isabellina*	Isabelline wheatear	6	3
7.	*Lanius minor*	Lesser grey shrike	2	3
8.	*Anthropoides virgo*	Anthropoides virgo	86	120
9.	*Galerida cristata*	Crested lark	20	5

Juru Energy

VP № 9

Date: 05.04.2020
VP survey time: 15^{13} -18^{13}
Weather: The air temperature around 18-20°C, cloudy, good visibility wind speed (6-8 m/s) without precipitation

Primary species not found

Table 40 Secondary species log (VP 9), 05.04.2020

№	Latin name	English name	Number of individuals	Altitude (m)
1.	*Lanius minor*	Lesser grey shrike	2	3
2.	*Galerida cristata*	Crested lark	5	5
3.	*Oenanthe isabellina*	Isabelline Wheatear	2	3

Juru Energy

VP. 1

Date: 06.04.2020. Start and end time: 8:12 – 11:12
Weather:
The air temperature around 12-14°C is changeable weather,
Wind speed approx. (6-8 m/s) No precipitation.

Primary species not found

Table 41 Secondary species log (VP 1), 06.04.2020

No.	Latin names	English names	Amount	Altitude (m)
1.	*Buteo rufinus*	Long-legged Buzzard	1	20
2.	*Circus cyaneus*	Hen (Northern) Harrier	1	15
3.	*Oenanthe pleschanka*	Pied Wheatear	3	3
4.	*Oenanthe oenanthe*	Northern Wheatear	2	3

Juru Energy

VP. 2

Date: 06.04.2020. Start and end time: 11:35 – 14:35

Weather:

The air temperature around 18-20°C is sunny, . Wind speed approx. (6-8 m/s) No precipitation.

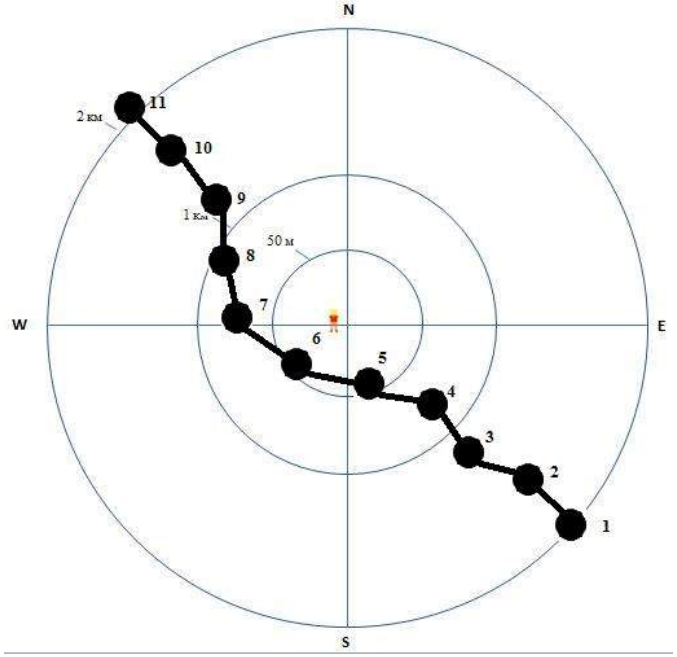


Fig. 28 Flight path for VP 2 06.04.2020

Table 42 Target species (VP 2), 06.04.2020

●	*Aquila nipalensis*	1-60 m	2-60 m	3-65 m	4-60 m	5-65 m	6-65 m	7-65 m	8-60 m	9-60 m	10-65 m	11-60 m

Juru Energy

Table 43 Secondary species log (VP 2), 06.04.2020

No.	Latin names	English names	Amount	Altitude (m)
1.	*Oenanthe pleschanka*	Pied Wheatear	1	2
2.	*Oenanthe oenanthe*	Northern Wheatear	3	3
3.	*Galerida cristata*	Crested Lark	10	5
4.	*Corvus corax*	Northern Raven	3	14
5.	*Coracias garrulus*	Eurasian Roller	3	13

Juru Energy

VP. 4

Date: 06.04.2020. Start and end time: 14:57 – 17:57

Weather:

The air temperature around 18-20°C is clear visibility, hot. Wind speed approx. (6-8 m/s) No precipitation.

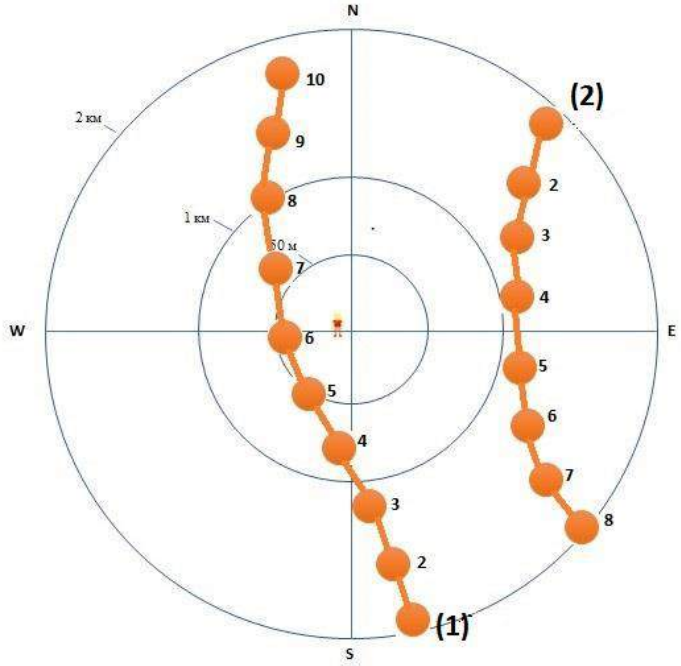


Fig. 29 Flight path for VP 4 06.04.2020

Table 44 Target species (VP 4), 06.04.2020

●	*Neophron percnopterus (2)*	1 75 m	2 70 m	3 75 m	4 75 m	5 75 m	6 70 m	7 70 m	8 70 m		
●	*Neophron percnopterus (1)*	1 85 m	2 80 m	3 85 m	4 85 m	5 85 m	6 80 m	7 80 m	8 80 m	9 80 m	10 80 m

Juru Energy

Table 45 Secondary species log (VP 4), 06.04.2020

No.	Latin names	English names	Amount	Altitude (m)
1.	*Buteo rufinus*	Long-legged Buzzard	2	18
2.	*Circus cyaneus*	Hen (Northern) Harrier	1	16
3.	*Oenanthe pleschanka*	Pied Wheatear	2	2
4.	*Oenanthe oenanthe*	Northern Wheatear	1	3
5.	*Galerida cristata*	Crested Lark	12	6
6.	*Corvus corax*	Northern Raven	2	15
7.	*Lanius exubitor*	Great (Gray) Shrike	2	11
8.	*Coracias garrulus*	Eurasian Roller	3	15

Juru Energy

VP. 3

Date: 7.04.2020. VP survey time: 8:16 – 11:23

Weather:

The air temperature around 14-16°C; clear visibility,. Wind speed approx. (8-10 m/s) No precipitation

Primary species not found

Table 46 Secondary species log (VP 3), 7.04.2020

No.	Latin names	English names	Amount	Altitude (m)
1.	*Oenanthe pleschanka*	Pied Wheatear	2	3
2.	*Oenanthe oenanthe*	Northern Wheatear	1	2
3.	*Galerida cristata*	Crested Lark	3	5
4.	*Muscicapa striata*	Spotted Flycatcher	2	2
5.	*Luscinia svecica*	Bluethroat	4	3
6.	*Melanocorypha bimaculata*	Bimaculated Lark	15	4

Juru Energy

VP. 4

Date: 7.04.2020. VP survey time: 11:46 – 14:46

Weather:

The air temperature around 16-18°C; clear visibility,. Wind speed approx. (10-12 m/s) No precipitation

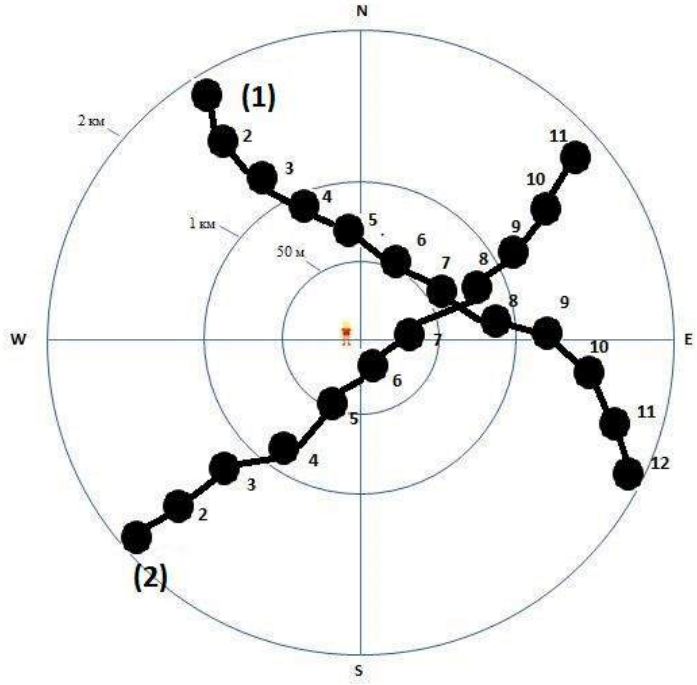


Fig. 30 Flight path for VP 4, 7.04.2020

Table 47 Target species log (VP 4), 7.04.2020

●	*Neophron percnopterus (2)*	1 90 m	2 90 m	3 85 m	4 85 m	5 85 m	6 90 m	7 90 m	8 90 m	9 90 m	10 90 m	11 90 m	
●	*Neophron percnopterus (1)*	1 90 m	2 90 m	3 85 m	4 80 m	5 80 m	6 80 m	7 90 m	8 90 m	9 90 m	10 90 m	11 90 m	12 90 m

Juru Energy

Table 48 Secondary species log (VP 4), 7.04.2020

No.	Latin names	English names	Amount	Altitude (m)
1	*Oenanthe pleschanka*	Pied Wheatear	4	3
2	*Oenanthe oenanthe*	Northern Wheatear	1	2
3	*Galerida cristata*	Crested Lark	5	5
4	*Muscicapa striata*	Spotted Flycatcher	2	2
5	*Luscinia svecica*	Bluethroat	2	3
6	*Melanocorypha bimaculata*	Bimaculated Lark	20	4

Juru Energy

VP. 5

Date: 7.04.2020. VP survey time: 14:57– 17:57

Weather:

The air temperature around 16-18°C; clear visibility,. Wind speed approx. (6-8 m/s) No precipitation

Primary species not found

Table 49 Secondary species log (VP 5), 7.04.2020

No.	Latin names	English names	Amount	Altitude (m)
1.	*Oenanthe pleschanka*	Pied Wheatear	4	3
2.	*Oenanthe oenanthe*	Northern Wheatear	1	2
3.	*Muscicapa striata*	Spotted Flycatcher	2	2
4.	*Luscinia svecica*	Bluethroat	2	3
5.	*Melanocorypha bimaculata*	Bimaculated Lark	20	4

Juru Energy

VP № 7

Date: 10.04.2020
VP survey time: 8^{25} - 11^{25}
Weather: cloudy, good visibility, wind speed (10-12 m/s), without precipitation

Primary species not found

Table 50 Secondary species (VP 7), 10.04.2020

№	Latin name	English name	Number of individuals	Altitude (m)
1.	*Circus cyaneus*	Hen harrier	1	12
2.	*Buteo rufinus*	Long-legged buzzard	1	23
3.	*Circus aeruginosus*	Western marsh harrier	1	12
4.	*Upupa epops*	Eurasian hoopoe	2	3
5.	*Oenanthe isabellina*	Isabelline wheatear	2	2
6.	*Oenanthe oenanthe*	Northern wheatear	6	3

Juru Energy

VP № 6

Date: 10.04.2020
VP survey time: 11^{48} - 14^{48}
Weather: cloudy, good visibility, wind speed (12-18 m/s), without precipitation

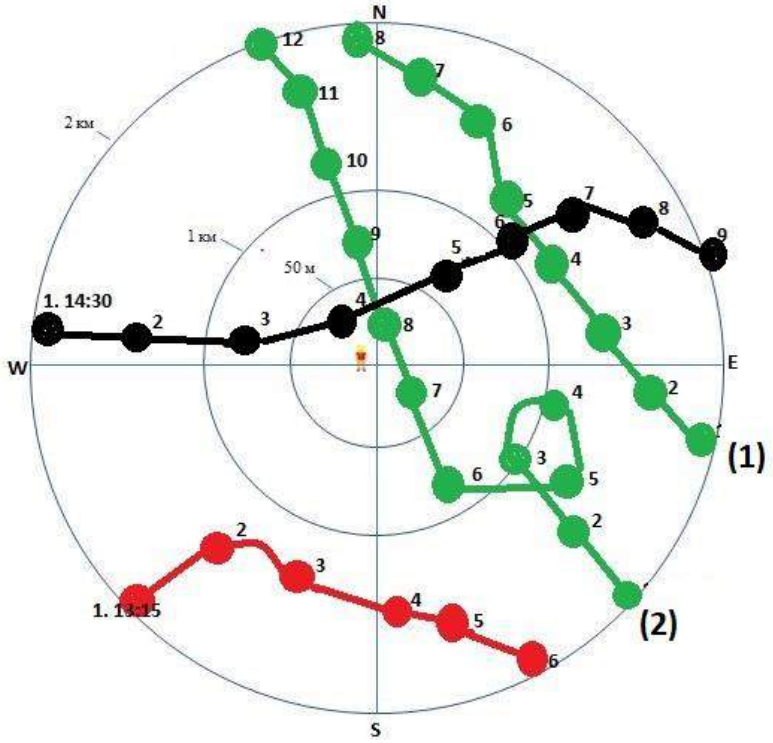


Fig. 31 Flight path for VP 6, 10.04.2020

Juru Energy

Table 51 Target species (VP 6), 10.04.2020

	Aquila chrysaetos (2)	1 65 m	2 65 m	3 70 m	4 70 m	5 65 m	6 65 m	7 70 m	8 70 m	9 70 m	10 70 m	11 70 m	12 70 m
	Aquila chrysaetos (1)	1 65 m	2 65 m	3 70 m	4 70 m	5 65 m	6 65 m	7 70 m	8 70 m				
	Neophron percnopterus	1 75 m	2 75 m	3 75 m	4 75 m	5 75 m	6 75 m						
	Aquila nipalensis	1 65 m	2 65 m	3 70 m	4 70 m	5 65 m	6 65 m	7 70 m	8 70 m	9 70 m			

Table 52 Secondary species (VP 6), 10.04.2020

№	Latin name	English name	Number of individuals	Altitude (m)
1.	*Circus cyaneus*	Hen harrier	1	13
2.	*Buteo rufinus*	Long-legged buzzard	1	21
3.	*Circus aeruginosus*	Western marsh harrier	1	14
4.	*Upupa epops*	Eurasian hoopoe	2	3
5.	*Oenanthe isabellina*	Isabelline wheatear	2	2
6.	Oenanthe oenanthe	Northern wheatear	6	3
7.	*Lanius pallidirostris*	Steppe Grey Shrike	2	5
8.	*Anthropoides virgo*	Anthropoides virgo	More than 150	150
9.	*Lanius minor*	Lesser grey shrike	20	5

Juru Energy

VP № 8

Date: 10.04.2020

VP survey time: 15^{05} - 18^{05}
Weather: The air temperature around 16-18°C, cloudy, good visibility, wind speed (8-10 m/s), without precipitation

Primary species not found

Table 53 Secondary species (VP 8), 10.04.2020

№	Latin name	English name	Number of individuals	Altitude (m)
1.	*Circus aeruginosus*	Eurasian Marsh-Harrier	1	12
2.	*Upupa epops*	Eurasian hoopoe	2	3
3.	*Oenanthe isabellina*	Isabelline wheatear	2	2
4.	*Oenanthe oenanthe*	Northern wheatear	6	3

Juru Energy

VP № 9

Date: 11.04.2020

VP survey time: 9^{05} - 12^{05}
Weather: The air temperature around 16-18°C, cloudy, good visibility, wind speed (6-8 m/s), without precipitation

Primary species not found

Table 54 Secondary species (VP 9), 11.04.2020

№	Latin name	English name	Number of individuals	Altitude (m)
1.	*Upupa epops*	Eurasian hoopoe	2	2
2.	*Oenanthe isabellina*	Isabelline wheatear	2	3
3.	*Oenanthe oenanthe*	Northern wheatear	6	3
4.	*Accipiter nisus*	Eurasian Sparrowhawk	1	15

Juru Energy

VP 7

Date: 11.04.2020. VP survey time: 12:28 – 15:28

Weather:

The air temperature around 14-16°; clear visibility,. Wind speed approx. (6-8 m/s) No precipitation

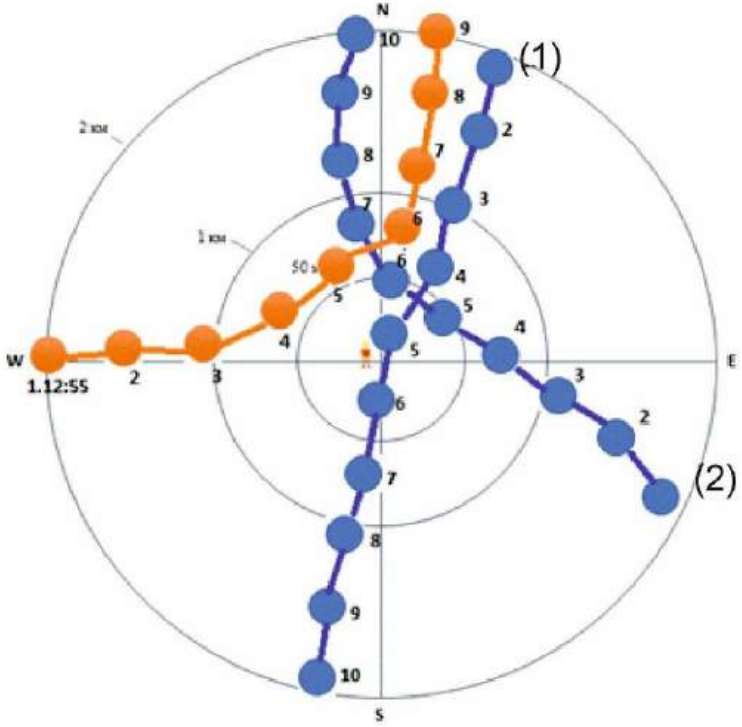


Fig. 32 Flight path for VP 7, 11.04.2020

Table 55 Target species log (VP 7), 11.04.2020

	Aquila nipalensis	1 70 m	2 70 m	3 65 m	4 65 m	5 65 m	6 70 m	7 70 m	8 70 m	9 70 m	10 70 m

Juru Energy

	Aquila nipalensis	1 70 m	2 70 m	3 65 m	4 65 m	5 65 m	6 70 m	7 70 m	8 70 m	9 70 m	10 70 m
	Neophron percnopterus	1 60 m	2 60 m	3 65 m	4 65 m	5 65 m	6 60 m	7 60 m	8 60 m	9 60 m	

Table 56 Secondary species log (VP 7), 11.04.2020

No.	Latin names	English names	Amount	Altitude (m)
1.	*Circus cyaneus*	Hen (Northern) Harrier	2	9
2.	*Alectoris chukar*	Chukar Partridge	4	2
3.	*Oenanthe pleschanka*	Pied Wheatear	4	3
4.	*Oenanthe oenanthe*	Northern Wheatear	2	2
5.	*Phoenicurus phoenicurus*	Eurasian Redstart	1	3

Juru Energy

VP. 8

Date: 11.04.2020. VP survey time: 15:47 – 18:47

Weather:

The air temperature around 14-16°C ; clear visibility,. Wind speed approx. (10-12 m/s) No precipitation

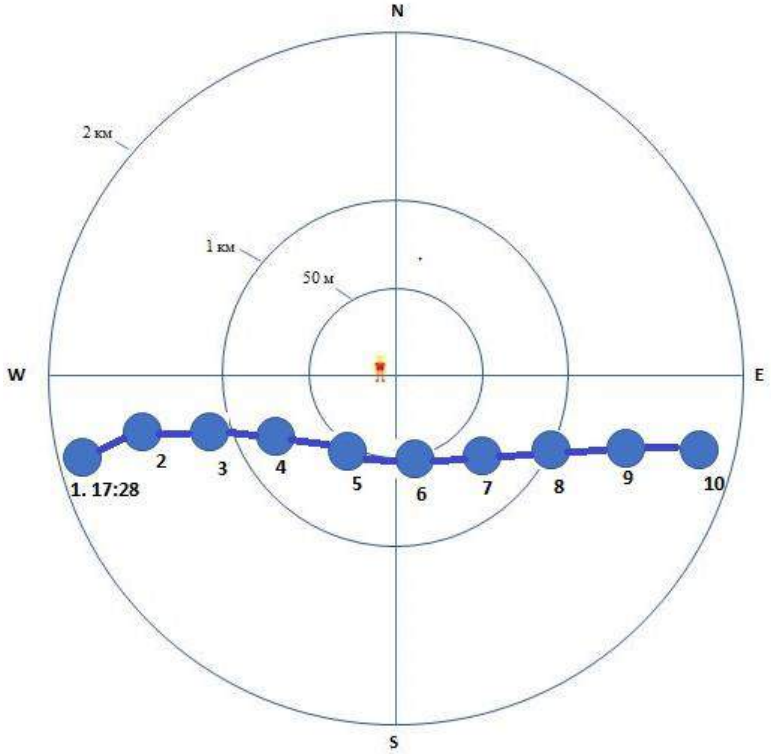


Fig. 33 Flight path for VP 8, 11.04.2020

Table 57 Target species (VP 8), 11.04.2020

	Neophron percnopterus	1 70 m	2 70 m	3 75 m	4 75 m	5 75 m	6 70 m	7 70 m	8 70 m	9 75 m	10 75 m

Juru Energy

Table 58 Secondary species log (VP 8), 11.04.2020

No.	Latin names	English names	Amount	Altitude (m)
1.	*Buteo rufinus*	Long-legged Buzzard	1	25
2.	*Oenanthe pleschanka*	Pied Wheatear	1	3
3.	*Oenanthe oenanthe*	Northern Wheatear	3	4
4.	*Galerida cristata*	Crested Lark	6	4
5.	*Muscicapa striata*	Spotted Flycatcher	2	1
6.	*Luscinia svecica*	Bluethroat	2	2
7.	*Melanocorypha bimaculata*	Bimaculated Lark	16	4

Juru Energy

VP 2

Date: 12.04.2020. VP survey time: 8:06 – 11:06

***Weather*:**

The air temperature around 18-20°C; clear visibility, hot. Wind speed approx. (5-7 m/s) No precipitation

Primary species not found

Table 59 Secondary species log (VP 2), 12.04.2020

No.	Latin names	English names	Amount	Altitude (m)
1.	*Buteo rufinus*	Long-legged Buzzard	1	12
2.	*Oenanthe pleschanka*	Pied Wheatear	2	2
3.	*Oenanthe oenanthe*	Northern Wheatear	3	2
4.	*Galerida cristata*	Crested Lark	13	3

Juru Energy

VP 1

Date: 12.04.2020. VP survey time: 12:26 – 15:26

***Weather*:**

The air temperature around 18-20°C ; clear visibility, hot. Wind speed approx. (9-10 m/s) No precipitation

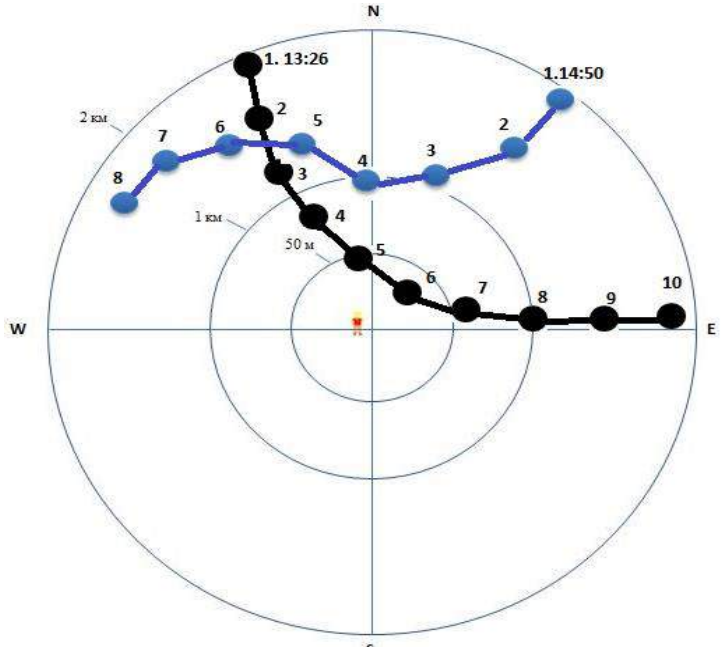


Fig. 34. Flight path for VP 1, 12.04.2020

Table 60 Target species (VP 1), 12.04.2020

●	*Aquila chrysaetos*	1 90 m	2 90 m	3 95m	4 95 m	5 95 m	6 90 m	7 90 m	8 90 m	9 90 m	10 90 m
●	*Neophron percnopterus*	1 80 m	2 80 m	3 85m	4 85 m	5 80 m	6 80 m	7 80 m	8 80 m		

Juru Energy

Table 61 Secondary species log (VP 1), 12.04.2020

No.	Latin names	English names	Amount	Altitude (m)
1	*Buteo rufinus*	Long-legged Buzzard	1	12
2	*Circus cyaneus*	Hen (Northern) Harrier	1	19
3	*Oenanthe pleschanka*	Pied Wheatear	5	5
4	*Oenanthe oenanthe*	Northern Wheatear	3	2
5	*Galerida cristata*	Crested Lark	17	3
7	*Lanius exubitor*	Great (Gray) Shrike	2	4
8	*Phoenicurus phoenicurus*	Eurasian Redstart	2	3

Juru Energy

VP 3

Date: 12.04.2020. VP survey time: 15:36 – 18:36
***Weather*:**
The air temperature around 17-19°C ; clear visibility, hot. Wind speed approx. (6-8 m/s) No precipitation

Primary species not found

Table 62 Secondary species log (VP 3), 12.04.2020

No.	Latin names	English names	Amount	Altitude (m)
1.	*Oenanthe pleschanka*	Pied Wheatear	3	3
2.	*Oenanthe oenanthe*	Northern Wheatear	2	1
3.	*Galerida cristata*	Crested Lark	6	5
4.	*Lanius exubitor*	Great (Gray) Shrike	2	3
5.	*Phoenicurus phoenicurus*	Eurasian Redstart	2	2

Juru Energy

VP № 5

Date: 14.04.2020
VP survey time: 8^{22} - 11^{22}
Weather: The air temperature around 16-18°C, cloudy, good visibility, wind speed (9-12 m/s), without precipitation

Table 63 Secondary species log (VP 5), 14.04.2020

№	Latin name	English name	Number of individuals	Altitude (m)
1.	*Circus aeruginosus*	Western marsh harrier	1	20
2.	*Falco tinnunculus*	Common kestrel	1	16
3.	*Oenanthe pleschanka*	Pied wheatear	2	3

Juru Energy

VP № 4

Date: 14.04.2020
VP survey time: 11^{46} - 14^{46}
Weather: The air temperature around 16-20 C, cloudy, good visibility, wind speed (12-15 m/s), without precipitation

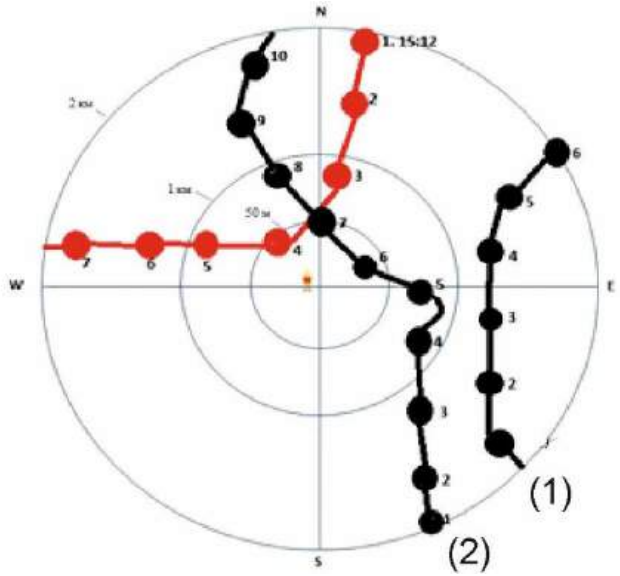


Fig. 35 Flight path for VP 4, 14.04.2020

Table 64 Target species log (VP 4), 14.04.2020

●	***Aquila chrysaetos (2)***	1 90 m	2 90 m	3 85 m	4 85 m	5 85 m	6 90 m	7 90 m	8 90 m	9 90 m	10 90 m
●	***Aquila chrysaetos (1)***	1 90 m	2 90 m	3 85 m	4 80 m	5 80 m	6 80 m				
●	***Neophron percnopterus***	1 65 m	2 60 m	3 65 m	4 65 m	5 65 m	6 60 m	7 60 m			

Juru Energy

Table 65 Secondary species log (VP 4), 14.04.2020

№	Latin name	English name	Number of individuals	Altitude (m)
1	*Circus cyaneus*	Hen harrier	2	14
2	*Circus aeruginosus*	Western marsh harrier	1	11
3	*Buteo rufinus*	Long-legged buzzard	1	16
4	*Falco tinnunculus*	Common kestrel	1	12
5	*Oenanthe pleschanka*	Pied wheatear	4	3
6	*Oenanthe isabellina*	Isabelline wheatear	1	2
7	*Galerida cristata*	Crested lark	30	4

Juru Energy

VP 7

Date: 14.04.2020. VP survey time: 15:06 – 18:06

***Weather*:**

The air temperature around 14-16°; good visibility. Wind speed approx. (12-15 m/s) No precipitation

Primary species not found

Table 66 Secondary species (VP 9), 14.04.2020

No.	Latin names	English names	Amount	Altitude (m)
1.	*Alectoris chukar*	Chukar Partridge	4	4
2.	*Oenanthe pleschanka*	Pied Wheatear	3	3
3.	*Alectoris chukar*	Chuckar partridge	3	4
4.	*Oenanthe oenanthe*	Northern Wheatear	1	3
5.	*Galerida cristata*	Crested Lark	20	3
6.	*Athene noctua*	Little owl	1	3
7.	*Corvus corax*	Northern Raven	1	16
8.	*Gyps fulvus*	Eurasian Griffon	1	80

Juru Energy

VP № 1

Date: 15.04.2020 ,
VP survey time: 8^{14} - 11 ^{14}
Weather: temperature 18-20^{0}C, clear visibility wind speed (10-12 m/s), without precipitation.

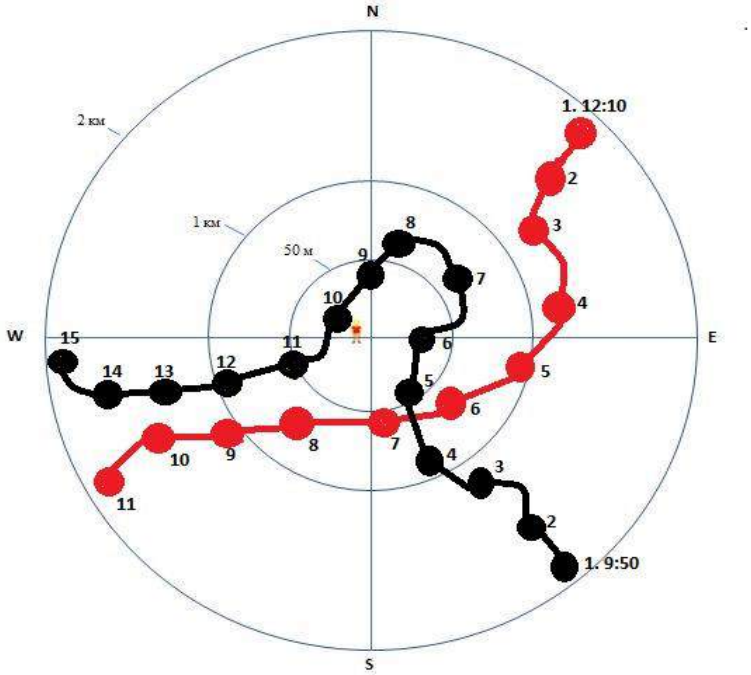


Fig. 36. Flight path for VP 4, 15.04.2020

Juru Energy

Table 67 Target species log (VP 1), 15.04.2020

●	Aquila chrysaetos	1 70m	2 70m	3 65m	4 65m	5 65m	6 70m	7 70m	8 70m	9 70m	10 70 m	11 65m	12 65 m	13 65 m	14 65m	15 65 m
●	Aquila nipalensis	1 80m	2 80m	3 85m	4 85m	5 80m	6 80m	7 80m	8 80m	9 80m	10 80 m	11 85m				

Table 68 Secondary species log (VP 1), 15.04.2020

№	Latin name	English name	Number of individuals	Altitude (m)
1.	*Circus cyaneus*	Hen harrier	2	16
2.	*Accipiter nisus*	Eurasian sparrowhawk	1	14
3.	*Buteo rufinus*	Long-legged buzzard	2	21
4.	*Circus aeruginosus*	Western marsh harrier	1	12
5.	*Alectoris chukar*	Chukar partridge	2	4
6.	*Oenanthe isabellina*	Isabelline wheatear	2	3
7.	*Lanius minor*	Lesser grey shrike	1	12

Juru Energy

VP № 2

Date: 15.04.2020
VP survey time: 11^{31} - 14^{31}
Weather: temperature 16-18 °C, clear visibility, wind speed (6-8 m/s), without precipitation.

Primary species not found

Table 69 Secondary species log (VP 2), 15.04.2020

№	Latin name	English name	Number of individuals	Altitude (m)
1.	*Accipiter nisus*	Eurasian sparrowhawk	1	16
2.	*Buteo rufinus*	Long-legged buzzard	2	23
3.	*Oenanthe isabellina*	Isabelline wheatear	2	3

Juru Energy

VP № 3

Date: 15.04.2020
VP survey time: 14^{52} - 17^{52}
Weather: temperature 16-18 °C, clear visibility, wind speed (7-10 m/s), without precipitation.

Primary species not found

Table 70 Secondary species log (VP 3), 15.04.2020

№	Latin name	English name	Number of individuals	Altitude (m)
1.	*Accipiter nisus*	Eurasian sparrowhawk	1	16
2.	*Turdus atrogularis*	Black-throated Thrush	2	5
3.	*Luscinia svecica*	Bluethroat	1	2
4.	*Scotocerca inguieta*	Streaked Scrub Warbler	2	
5.	*Oenanthe isabellina*	Isabelline wheatear	2	3

Juru Energy

VP № 5

Date: 16.04.2020
VP survey time: 8^{12} - 11^{12}
Weather: temperature 16-18 °C, clear visibility, wind speed (8-12 m/s), without precipitation.

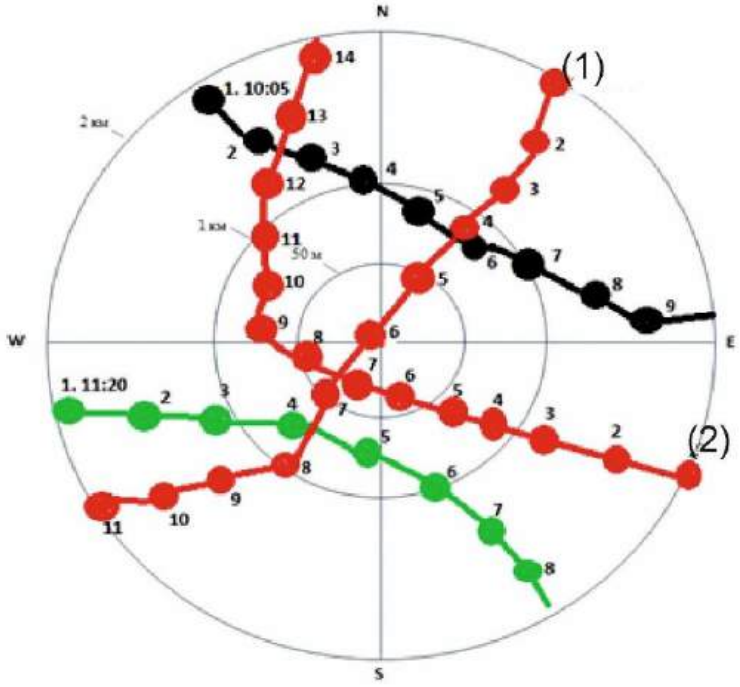


Fig. 37. Flight path for VP 5, 16.04.2020

Juru Energy

Table 71 Target species log (VP 5), 16.04.2020

●	*Neophron percnopterus*	1 90 m	2 90 m	3 85 m	4 85 m	5 85 m	6 90m	7 90 m	8 90 m	9 90 m	10 90 m	11 90 m	12 90 m	13 85 m
●	*Aquila nipalensis*	1 70 m	2 70 m	3 75 m	4 75 m	5 75 m	6 70m	7 70 m	8 70 m					
●	*Aquila chrysaetos (1)*	1 90 m	2 90 m	3 85 m	4 85 m	5 85 m	6 90 m	7 90 m	8 90 m	9 90 m	10 90 m	11 90 m		
●	*Aquila chrysaetos (2)*	1 90 m	2 90 m	3 85 m	4 85 m	5 85 m	6 90m	7 90 m	8 90 m	9 90 m	10 90 m	11 90 m	12 90 m	13 85 m	14 85 m

Table 72 Secondary species log (VP 5), 16.04.2020

№	Latin name	English name	Number of individuals	Altitude (m)
1.	*Circus cyaneus*	Hen harrier	1	13
2.	*Circus aeruginosus*	Western marsh harrier	2	16
3.	*Buteo rufinus*	Long-legged buzzard	2	23
4.	*Falco tinnunculus*	Common kestrel	1	17
5.	*Oenanthe pleschanka*	Pied wheatear	4	3
6.	*Oenanthe isabellina*	Isabelline wheatear	1	4
7.	*Galerida cristata*	Crested lark	30	5

Juru Energy

VP № 4

Date: 16.04.2020
VP survey time: 11^{32} - 14^{32}
Weather: The air temperature around 18-22 °C, cloudy, clear visibility, wind speed (8-10 m/s), without precipitation.

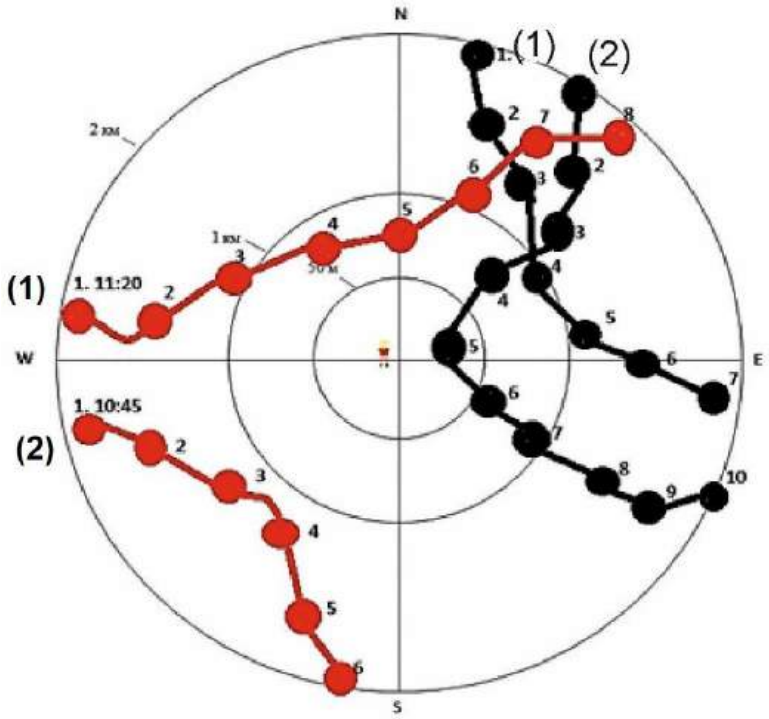


Fig. 38. Flight path for VP 4, 16.04.2020

Table 73 Target species log (VP 4), 16.04.2020

●	*Aquila chrysaetos (2)*	1 90 m	2 90 m	3 85 m	4 85 m	5 85 m	6 90 m	7 90 m	8 90 m	9 90 m	10 90 m
●	*Aquila chrysaetos (1)*	1	2	3	4	5	6				

Juru Energy

		90 m	90 m	85 m	80 m	80 m	80 m				
	Neophron percnopterus (1)	1 65 m	2 60 m	3 65 m	4 65 m	5 65 m	6 60 m	7 60 m	8 60 m		
	Neophron percnopterus (2)	1 65 m	2 70 m	3 65 m	4 60 m	5 60 m	6 60 m				

Table 74 Secondary species log (VP 4), 16.04.2020

№	Latin name	English name	Number of individuals	Altitude (m)
1	*Circus cyaneus*	Hen harrier	2	12
2	*Circus aeruginosus*	Western marsh harrier	1	16
3	*Buteo rufinus*	Long-legged buzzard	1	25
4	*Falco tinnunculus*	Common kestrel	1	13
5	*Oenanthe pleschanka*	Pied wheatear	4	5
6	*Oenanthe isabellina*	Isabelline wheatear	1	3
7	*Galerida cristata*	Crested lark	30	4

Juru Energy

VP № 3

Date: 16.04.2020
VP survey time: 14^{52} - 17^{52}
Weather: cloudy, clear visibility, wind speed (6-8 m/s), without precipitation.

Primary species not found

Table 75 Secondary species log (VP 3), 16.04.2020

№	Latin name	English name	Number of individuals	Altitude (m)
1.	*Oenanthe pleschanka*	Pied wheatear	3	2
2.	*Oenanthe isabellina*	Isabelline wheatear	2	2
3.	*Galerida cristata*	Crested lark	9	3

Juru Energy

VP № 4

Date: 19.04.2020
VP survey time: 8^{25} - 11 ^{25}
Weather*:* The air temperature around 16-18°C, cloudy, good visibility, wind speed (7-10 m/s), without precipitation.

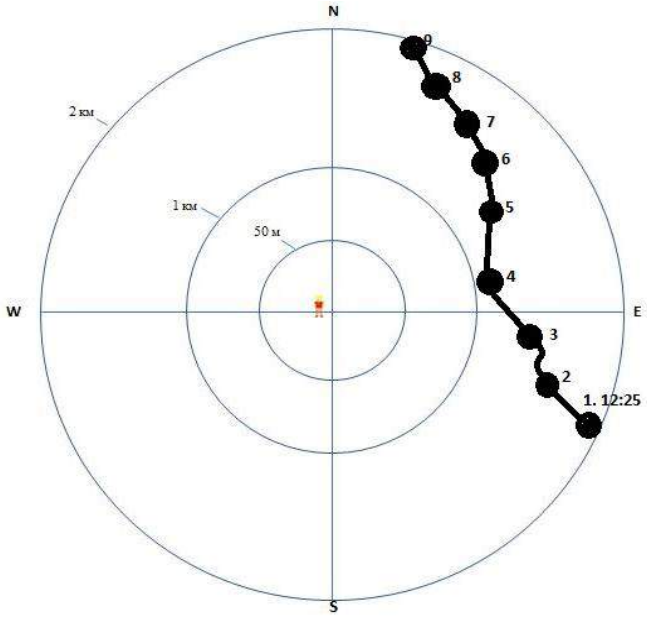


Fig. 39. Flight path VP 4, 19.04.2020

Juru Energy

Table 76 Target species log (VP 4), 19.04.2020

●	***Aquila chrysaetos***	1 90 m	2 90 m	3 85 m	4 85 m	5 85 m	6 90 m	7 90 m	8 90 m	9 90 m

Table 77 Secondary species log (VP 4), 19.04.2020

№	Latin name	English name	Number of individuals	Altitude (m)
1.	*Buteo rufinus*	Long-legged buzzard	1	16
2.	*Calandrella brachydactyla*	Greater short-toed lark	23	5
3.	*Oenanthe pleschanka*	Pied wheatear	4	4
4.	*Oenanthe isabellina*	Isabelline wheatear	1	3
5.	*Lanius minor*	Lesser grey shrike	2	5
6.	*Galerida cristata*	Crested lark	20	5

Juru Energy

VP № 5

Date: 19.04.2020
VP survey time: 11^{46} - 14^{46}
Weather*:* cloudy, good visibility, wind speed (8-10 m/s), without precipitation.

Primary species not found

Table 78 Secondary species log (VP 5), 19.04.2020

№	Latin name	English name	Number of individuals	Altitude (m)
1.	*Calandrella brachydactyla*	Greater short-toed lark	11	6
2.	*Oenanthe pleschanka*	Pied wheatear	2	3
3.	*Oenanthe isabellina*	Isabelline wheatear	2	1
4.	*Galerida cristata*	Crested lark	12	4

Juru Energy

VP № 6

Date: 19.04.2020

VP survey time: 15^{06} - 18^{06}
Weather*:* The air temperature around 16-18°C, cloudy, good visibility, wind speed (8-12 m/s), without precipitation.

Primary species not found

Table 79 Secondary species log (VP 6), 19.04.2020

№	Latin name	English name	Number of individuals	Altitude (m)
1.	*Oenanthe pleschanka*	Pied wheatear	2	2
2.	*Oenanthe isabellina*	Isabelline wheatear	2	2
3.	*Lanius minor*	Lesser grey shrike	1	4
4.	*Galerida cristata*	Crested lark	6	3

Juru Energy

VP № 8

Date: 20.04.2020
VP survey time: 8^{00} - 11^{00}
Weather: The air temperature around 18-20°C, cloudy, good visibility, wind speed (6-8 m/s), without precipitation.

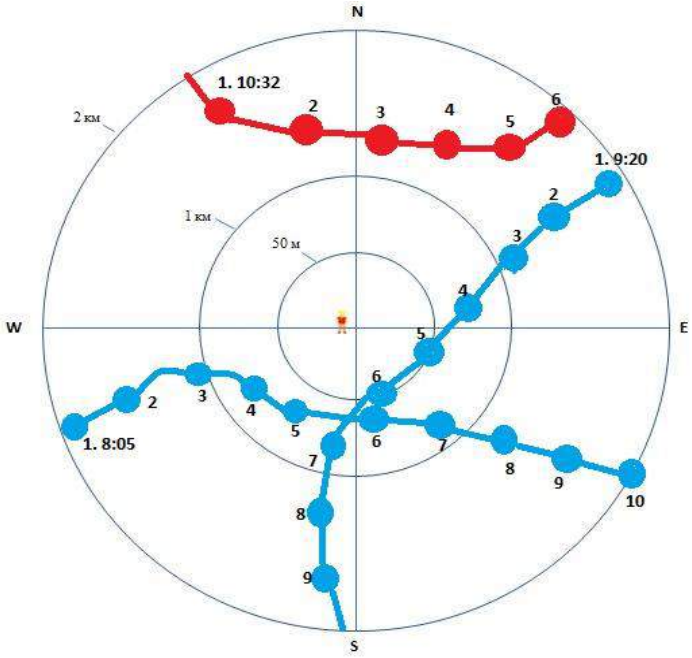


Fig. 40. Flight path for VP 8, 20.04.2020

Table 80 Target species log (VP 8), 20.04.2020

●	*Aquila chrysaetos*	1 90 m	2 90 m	3 85 m	4 85 m	5 85 m	6 90 m				
●	*Neophron percnopterus*	1 70 m	2 70 m	3 75 m	4 75 m	5 75 m	6 70 m	7 70 m	8 70 m	9 70 m	10 70 m

Juru Energy

	Neophron percnopterus	1 75 m	2 70 m	3 75 m	4 75 m	5 75 m	6 70 m	7 70 m	8 70 m	9 70 m

Table 81 Secondary species log (VP 8), 20.04.2020

№	Latin name	English name	Number of individuals	Altitude (m)
1.	*Circus cyaneus*	Hen harrier	2	11
2.	*Falco tinnunculus*	Common kestrel	1	16
3.	*Alectoris chukar*	Chukar partridge	4	5
4.	*Oenanthe pleschanka*	Pied wheatear	4	3
5.	*Oenanthe isabellina*	Isabelline wheatear	1	4
6.	*Galerida cristata*	Crested lark	30	4

Juru Energy

VP № 9

Date: 20.04.2020
VP survey time: 11^{23} - 14^{23}
Weather: The air temperature around 16-18°C, cloudy, good visibility, wind speed (6-8 m/s), without precipitation.

Primary species not found

Table 82 Secondary species log (VP 9), 20.04.2020

№	Latin name	English name	Number of individuals	Altitude (m)
1	*Oenanthe pleschanka*	Pied wheatear	3	2
2	*Oenanthe isabellina*	Isabelline wheatear	1	4
3	*Galerida cristata*	Crested lark	16	3

Juru Energy

VP № 2

Date: 20.04.2020
VP survey time: 14^{40}- 17^{40}
Weather: The air temperature around 16-18°C, cloudy, good visibility, wind speed (5-8 m/s), without precipitation.

Primary species not found

Table 83 Secondary species log (VP2), 20.04.2020

№	Latin name	English name	Number of individuals	Altitude (m)
1	*Alectoris chukar*	Chukar partridge	2	4
2	*Oenanthe pleschanka*	Pied wheatear	2	3
3	*Oenanthe isabellina*	Isabelline wheatear	3	2
4	*Galerida cristata*	Crested lark	16	3

Juru Energy

VP № 1

Date: 21.04.2020
VP survey time: 8^{17} - 11^{17}
Weather: The air temperature around 16-20°C, cloudy, good visibility, wind speed (6-8 m/s), without precipitation

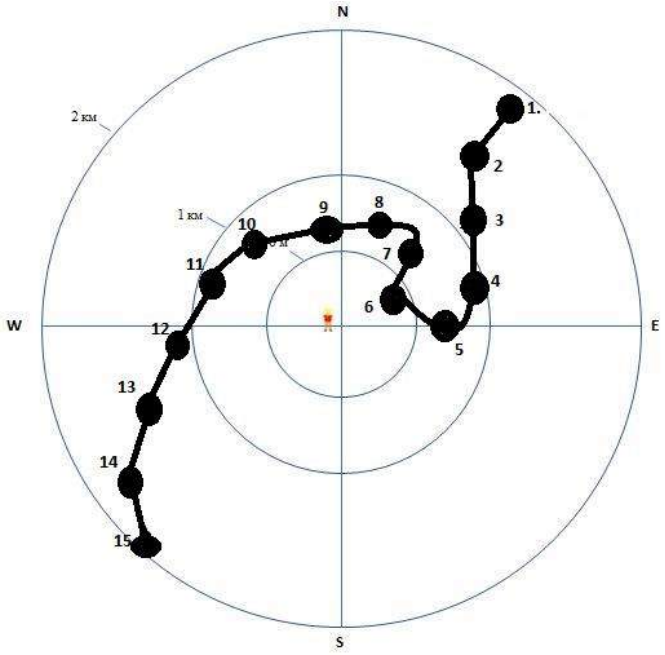


Fig. 41. Flight path for VP 1, 21.04.2020

Table 84 Target species log (VP 1), 21.04.2020

●	*Neophron percnopterus*	1 75 m	2 70 m	3 75 m	4 75 m	5 75 m	6 70 m	7 70 m	8 75 m	9 75 m	10 75 m	11 70 m	12 70 m	13 75 m	14 75 m	15 75 m

Juru Energy

Table 85 Secondary species log (VP 1), 21.04.2020

№	Latin name	English name	Number of individuals	Altitude (m)
1.	*Circus cyaneus*	Hen harrier	2	12
2.	*Oenanthe pleschanka*	Pied wheatear	4	3
3.	*Oenanthe isabellina*	Isabelline wheatear	1	5
4.	*Galerida cristata*	Crested lark	10	3

Juru Energy

VP № 9

Date: 21.04.2020
VP survey time: 11^{35} - 14^{35}
Weather: The air temperature around 16-18°C, cloudy, good visibility, wind speed (3-6 m/s), without precipitation

Table 86 Secondary species log (VP 9), 21.04.2020

№	Latin name	English name	Number of individuals	Altitude (m)
1.	*Oenanthe pleschanka*	Pied wheatear	3	2
2.	*Oenanthe isabellina*	Isabelline wheatear	2	2
3.	*Galerida cristata*	Crested lark	9	5

Juru Energy

VP № 8

Date: 21.04.2020
VP survey time: 14^{58} - 17^{58}
Weather: The air temperature around 16-18°C, cloudy, good visibility, wind speed (6-8 m/s), without precipitation

Primary species not found

Table 87 Secondary species log (VP 8), 21.04.2020

№	Latin name	English name	Number of individuals	Altitude (m)
1.	*Circus cyaneus*	Hen harrier	1	15
2.	*Oenanthe pleschanka*	Pied wheatear	4	3
3.	*Oenanthe isabellina*	Isabelline wheatear	3	3
4.	*Galerida cristata*	Crested lark	5	5

Juru Energy

VP № 3

Date: 23.04.2020
VP survey time: 08^{30} – 14^{30}
Weather: The air temperature around 18-20 °C, cloudy, good visibility, wind speed (5-7 m/s), without precipitation.

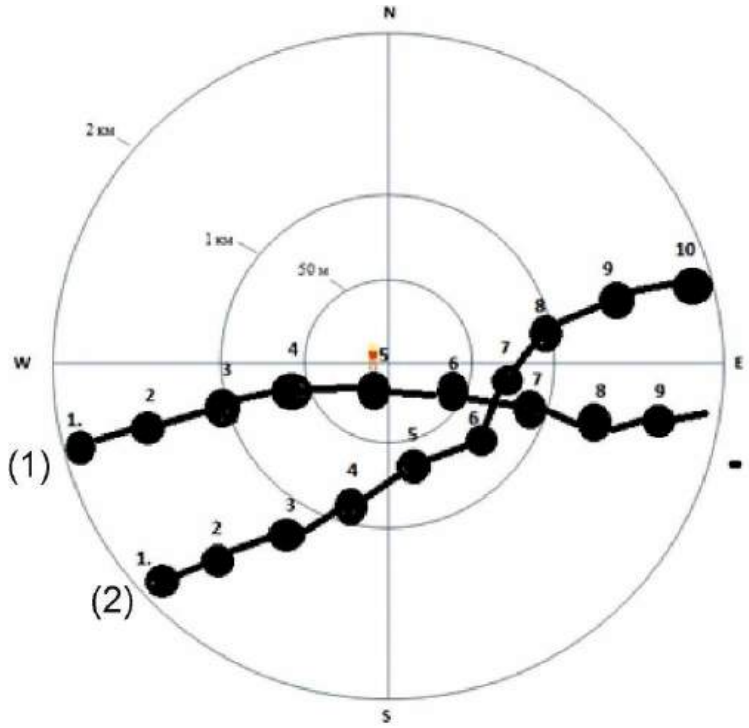


Fig. 42. Flight path for VP 3, 23.04.2020

Juru Energy

Table 88 Target species log (VP 3), 23.04.2020

●	*Aquila chrysaetos (1)*	1 90 m	2 90 m	3 85 m	4 85 m	5 90 m	6 90 m	7 85 m	8 85 m	9 85 m	10 85 m
●	*Aquila chrysaetos (2)*	1 90 m	2 90 m	3 85 m	4 85 m	5 90 m	6 90 m	7 85 m	8 85 m	9 85 m	

Table 89 Target species log (VP 3), 23.04.2020

№	Latin name	English name	Number of individuals	Altitude (m)
1	*Falco tinnunculus*	Common kestrel	1	23
2	*Athene noctua*	Little owl	1	4
3	*Oenanthe pleschanka*	Pied wheatear	4	3
4	*Oenanthe isabellina*	Isabelline wheatear	1	3
6	*Galerida cristata*	Crested lark	20	5

Juru Energy

VP № 6

Date: 24.04.2020
VP survey time: 8^{36} - 11^{36}
Weather: The air temperature around 16-18°C, good visibility, wind speed (5-7 m/s), without precipitation.

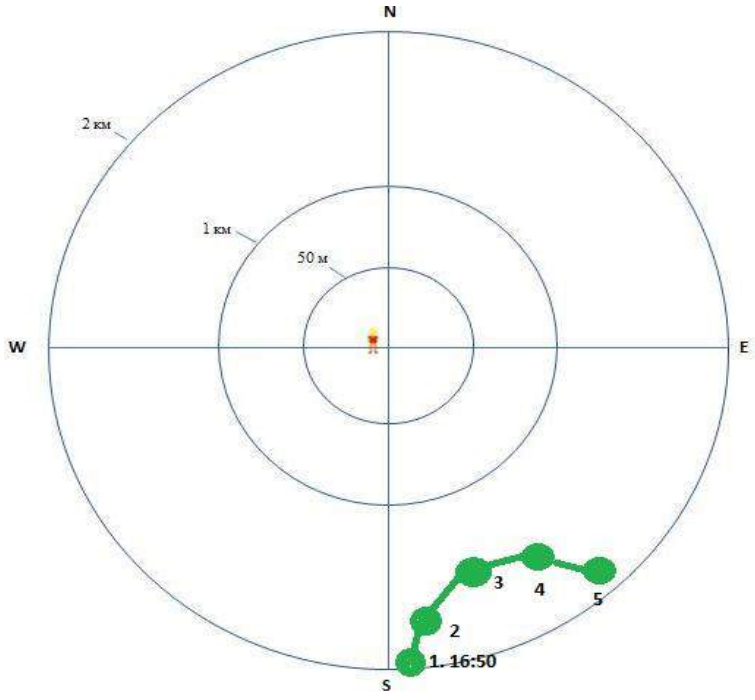


Fig. 43. Flight path for VP 6, 24.04.2020

Juru Energy

Table 90 Target species log (VP 6), 24.04.2020

	Neophron percnopterus	1 90 m	2 90 m	3 85 m	4 85 m	5 85 m

Table 91 Secondary species log (VP 6), 24.04.2020

№	Latin name	English name	Number of individuals	Altitude (m)
1.	*Falco tinnunculus*	Common kestrel	1	19
2.	*Athene noctua*	Little owl	1	5
3.	*Oenanthe pleschanka*	Pied wheatear	4	3
4.	*Oenanthe isabellina*	Isabelline wheatear	1	4
5.	*Galerida cristata*	Crested lark	40	4

Juru Energy

VP № 7

Date: 24.04.2020
VP survey time: 11^{30} - 14^{03}
Weather: The air temperature around 16-18°C, cloudy, good visibility, wind speed (5-7 m/s), without precipitation.

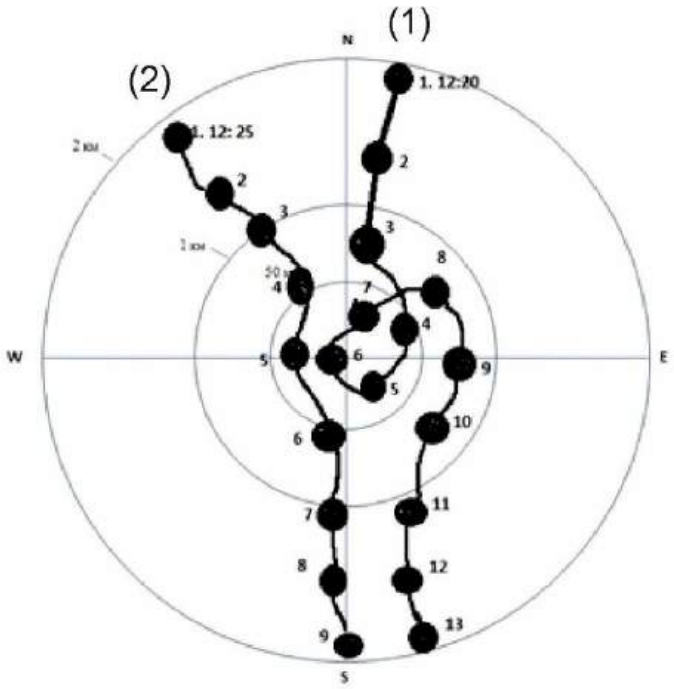


Fig. 44. Flight path for VP 3, 24.04.2020

Table 92 Target species log (VP 3), 23.04.2020

●	*Neophron percnopterus (1)*	1 90 m	2 90 m	3 85 m	4 85 m	5 90 m	6 90 m	7 85 m	8 85 m	9 85 m	10 85 m	11 85 m	12 85 m	13 85 m

Juru Energy

●	*Neophron percnopterus (2)*	1 90 m	2 90 m	3 85 m	4 85 m	5 90 m	6 90 m	7 85 m	8 85 m	9 85 m

Table 93 Target species log (VP 3), 23.04.2020

№	Latin name	English name	Number of individuals	Altitude (m)
1.	*Falco tinnunculus*	Common kestrel	1	21
2.	*Oenanthe pleschanka*	Pied wheatear	4	3
3.	*Oenanthe isabellina*	Isabelline wheatear	1	2
4.	*Galerida cristata*	Crested lark	30	5

Juru Energy

VP № 5

Date: 26.04.2020
VP survey time: 9^{13} - 12^{13}
Weather:
The air temperature around 16-20 °C, cloudy, good visibility, wind speed (5-7 m/s), without precipitation.

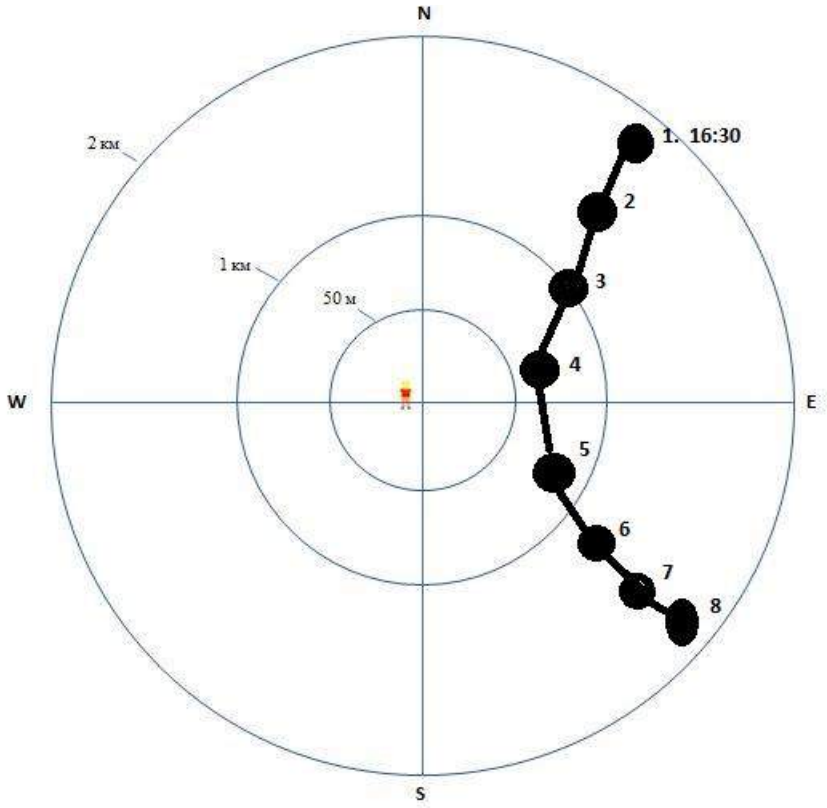


Fig. 45. Flight path for VP 5, 26.04.2020

Juru Energy

Table 94 Target species log (VP 5), 26.04.2020

●	*Neophron percnopterus*	1 90 m	2 90 m	3 85 m	4 85 m	5 85 m

Table 95 Secondary species log (VP 5), 26.04.2020

№	Latin name	English name	Number of individuals	Altitude (m)
1.	*Athene noctua*	Little owl	1	5
2.	*Oenanthe pleschanka*	Pied wheatear	3	3
3.	*Oenanthe isabellina*	Isabelline wheatear	2	2
4.	*Galerida cristata*	Crested lark	30	3
5.	*Hirundo rustica*	Barn swallow	12	5
6.	*Acridotheres tristis*	Common myna	2	9

Juru Energy

VP № 6

Date: 26.04.2020
VP survey time: 12^{32} - 15^{32}
Weather:
Temperature: cloudy, good visibility, wind speed (6-8 m/s), without precipitation.

Primary species not found

Table 96 Secondary species log (VP 6), 26.04.2020

№	Latin name	English name	Number of individuals	Altitude (m)
1	*Athene noctua*	Little owl	1	4
2	*Oenanthe pleschanka*	Pied wheatear	1	3
3	*Oenanthe isabellina*	Isabelline wheatear	2	2
4	*Galerida cristata*	Crested lark	8	3
5	*Hirundo rustica*	Barn swallow	10	5
6	*Acridotheres tristis*	Common myna	3	10

Juru Energy

VP № 7

Date: 27.04.2020
VP survey time: 8[12] - 11 [12]
Weather: temperature: 16-18 °C cloudy, good visibility, wind speed (5-8 m/s), without precipitation.

Primary species not found

Table 97 Secondary species log (VP 7), 27.04.2020

№	Latin name	English name	Number of individuals	Altitude (m)
1.	*Falco tinnunculus*	Common kestrel	1	10
2.	*Oenanthe pleschanka*	Pied wheatear	1	2
3.	*Oenanthe isabellina*	Isabelline wheatear	2	2
4.	*Galerida cristata*	Crested lark	11	3

Juru Energy

VP № 9

Date: 27.04.2020
VP survey time: 11^{32} - 14^{32}
Weather: temperature: 18-22 °C cloudy, good visibility, wind speed (8-12 m/s), without precipitation.

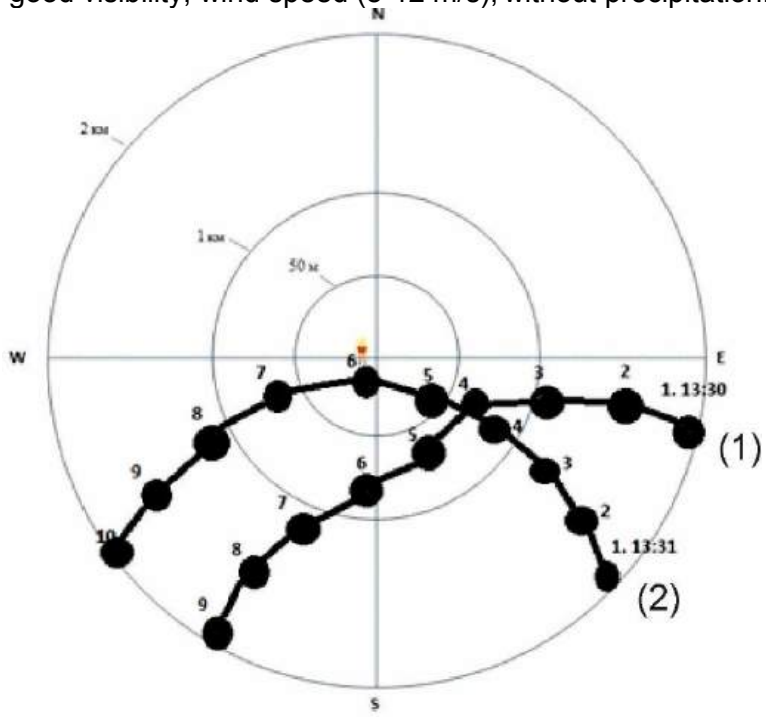


Fig. 46. Flight path for VP 9, 27.04.2020

Table 98 Target species log (VP 9), 27.04.2020

●	*Aquila chrysaetos (2)*	1 75 m	2 70 m	3 75 m	4 75 m	5 75 m	6 70 m	7 70 m	8 75 m	9 75 m	10 75 m
●	*Aquila chrysaetos (1)*	1 75 m	2 70 m	3 75 m	4 75 m	5 75 m	6 70 m	7 70 m	8 75 m	9 75 m	

Juru Energy

Table 99 Secondary species log (VP 9), 27.04.2020

№	Latin name	English name	Number of individuals	Altitude (m)
1.	*Falco tinnunculus*	Common kestrel	1	12
2.	*Merops persicus*	Blue-cheeked bee-eater	15	9
3.	*Oenanthe pleschanka*	Pied wheatear	2	3
4.	*Oenanthe isabellina*	Isabelline wheatear	5	3
5.	*Galerida cristata*	Crested lark	20	4

Juru Energy

VP № 6

Date: 27.04.2020
VP survey time: 14^{56} - 17^{56}
Weather: temperature: 16-18 °C cloudy, good visibility, wind speed (5-7 m/s), without precipitation.

Primary species not found

Table 100 Secondary species log (VP 6), 27.04.2020

№	Latin name	English name	Number of individuals	Altitude (m)
1.	*Oenanthe pleschanka*	Pied wheatear	1	2
2.	*Oenanthe isabellina*	Isabelline wheatear	2	2
3.	*Galerida cristata*	Crested lark	11	3

VP № 1

Date: 28.04.2020
VP survey time: 8^{03} - 11^{03}
Weather: temperature 16-18 °C, cloudy, good visibility, wind speed (6-8 m/s), without precipitation.

Primary species not found

Table 101 Secondary species log (VP 1), 28.04.2020

№	Latin name	English name	Number of individuals	Altitude (m)
1.	*Oenanthe pleschanka*	Pied wheatear	3	2
2.	*Upupa epops*	Eurasian hoopoe	1	1
3.	*Oenanthe isabellina*	Isabelline wheatear	2	2
4.	*Galerida cristata*	Crested lark	6	4

Juru Energy

VP № 2

Date: 28.04.2020
VP survey time: 11^{23} - 14^{23}
Weather: temperature 18-22 °C, cloudy, good visibility, wind speed (5-7 m/s), without precipitation.

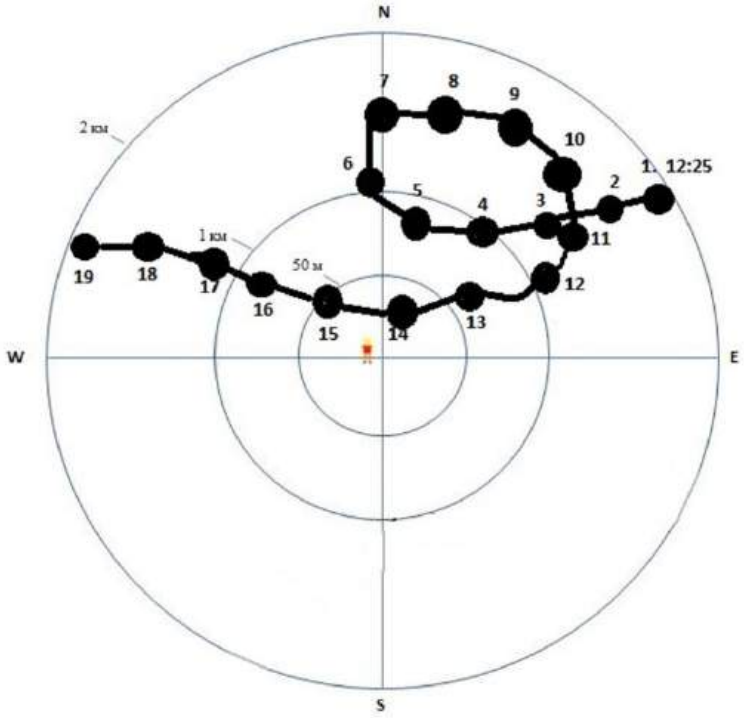


Fig. 47. Flight path for VP 2, 28.04.2020

Table 102 Target species log (VP 2), 28.04.2020

●	***Aquila chrysaetos***	1 75 m	2 70 m	3 75 m	4 75 m	5 75 m	6 70 m	7 70 m	8 75 m	9 75 m	10 75 m	11 75 m	12 70 m	13 75 m	14 75 m	15 75 m	16 75 m	18 75 m	19 75 m

Table 103 Secondary species log (VP 2), 28.04.2020

№	Latin name	English name	Number of individuals	Altitude (m)
1.	*Falco tinnunculus*	Common kestrel	1	13
2.	*Oenanthe pleschanka*	Pied wheatear	2	3
3.	*Upupa epops*	Eurasian hoopoe	2	2
4.	*Oenanthe isabellina*	Isabelline wheatear	5	3
5.	*Galerida cristata*	Crested lark	20	4
6.	*Hieraaetus pennatus*	Booted Eagle	1	90-95

Juru Energy

VP № 5

Date: 28.04.2020
VP survey time: 14^{46} - 17^{46}
Weather: temperature 18-22 °C, cloudy, good visibility, wind speed (6-8 m/s), without precipitation.

Primary species not found

Table 104 Secondary species log (VP 5), 28.04.2020

№	Latin name	English name	Number of individuals	Altitude (m)
1.	*Accipiter nisus*	Eurasian Sparrowhawk	1	16
2.	*Oenanthe pleschanka*	Pied wheatear	2	3
3.	*Upupa epops*	Eurasian hoopoe	2	2
4.	*Oenanthe isabellina*	Isabelline wheatear	5	3
5.	*Galerida cristata*	Crested lark	12	6

Juru Energy

VP № 5

Date: 30.04.2020
VP survey time: 8^{20}- 11 ^{20}
Weather: temperature: 18-20 °C, cloudy, good visibility, wind speed (8-10 m/s), without precipitation.

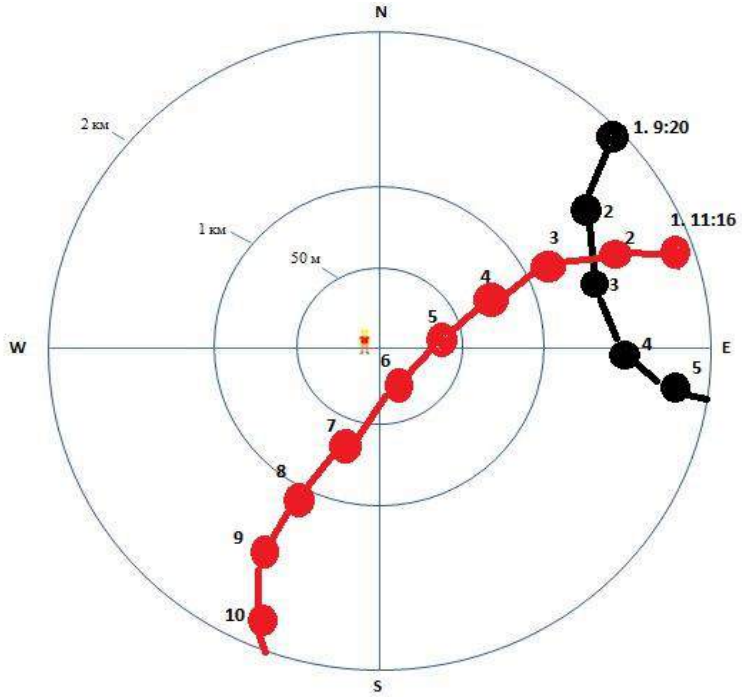


Fig. 48. Flight path for VP 5, 30.04.2020

Juru Energy

Table 105 Target species log (VP 5), 30.04.2020

●	*Aquila chrysaetos*	1 75 m	2 70 m	3 75 m	4 75 m	5 75 m					
●	*Aquila nipalensis*	1 95 m	2 95 m	3 95 m	4 95 m	5 95 m	6 90 m	7 90 m	8 95 m	9 90 m	10 95 m

Table 106 Secondary species log (VP 5), 30.04.2020

№	Latin name	English name	Number of individuals	Altitude (m)
1.	*Athene noctua*	Little owl	1	4
2.	*Oenanthe pleschanka*	Pied wheatear	3	3
3.	*Lanius minor*	Lesser grey shrike	2	4
4.	*Columba livia*	Rock dove	2	6
5.	*Oenanthe isabellina*	Isabelline wheatear	3	3
6.	*Galerida cristata*	Crested lark	30	4

VP № 6

Date: 30.04.2020
VP survey time: 11^{45} - 14^{45}
Weather: temperature: 18-20 °C, cloudy, good visibility, wind speed (6-8 m/s), without precipitation.

Primary species not found

Table 107 Secondary species log (VP 6), 30.04.2020

№	Latin name	English name	Number of individuals	Altitude (m)
1.	*Oenanthe pleschanka*	Pied wheatear	2	3
2.	*Lanius minor*	Lesser grey shrike	3	4
3.	*Oenanthe isabellina*	Isabelline wheatear	1	2
4.	*Galerida cristata*	Crested lark	6	3

VP № 8

Date: 30.04.2020
VP survey time: 15^{03} - 18^{03}
Weather: temperature: 18-20 °C, cloudy, good visibility, wind speed (4-6 m/s), without precipitation.

Table 108 Secondary species log (VP 8), 30.04.2020

№	Latin name	English name	Number of individuals	Altitude (m)
1.	*Athene noctua*	Little owl	1	3
2.	*Oenanthe pleschanka*	Pied wheatear	2	2
3.	*Lanius minor*	Lesser grey shrike	2	4
4.	*Columba livia*	Rock dove	2	6
5.	*Oenanthe isabellina*	Isabelline wheatear	3	3
6.	*Galerida cristata*	Crested lark	12	3

Juru Energy

VP survey results in May

VP. 1

Date: 01.05.2020. Start and end time: 8:36 – 11:40
Weather:
The air temperature around 16-18°C is clear,
Wind speed approx. (2-4 m/s) No precipitation

Primary species not found

01.05.2020 VP 1

Table 109. Secondary species log 01.05.2020 VP 1

No.	Latin names	English names	Amount	Altitude (m)
1.	*Circus aeruginosus*	Marsh Harrier	1	23

Juru Energy

VP. 2

Date: 01.05.2020. Start and end time: 12:45 – 15:45
Weather:
The air temperature around 18-22°C is clear.
Wind speed approx. (3-5 m/s) No precipitation

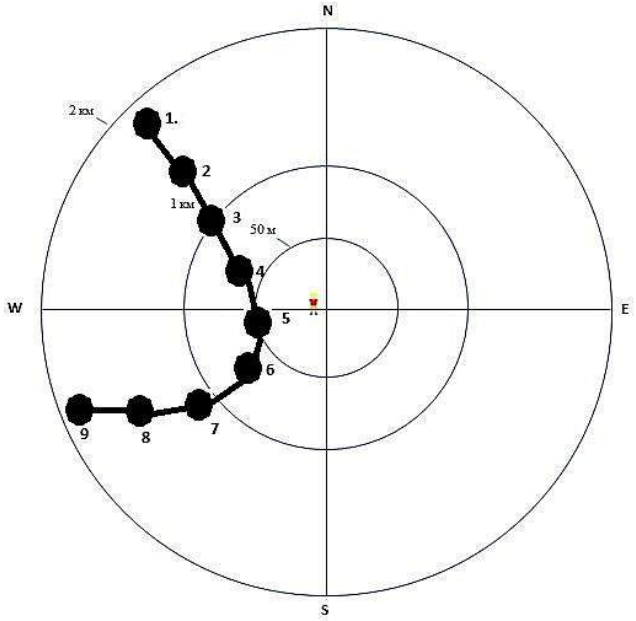


Fig. 49 Flight path VP 2), 1.05.2020

Juru Energy

Table 110 Target species log (VP 2), 1.05.2020

●	*Neophron percnopterus*	1 45 m	2 45 m	3 40 m	4 40 m	5 45 m	6 45 m	7 40 m	8 40 m	9 40 m

Table 111 Secondary species log 01.05.2020 VP 2

No.	Latin names	English names	Amount	Altitude (m)
1	*Circus cyaneus*	Hen Harrier	1	16

Juru Energy

VP. 3

Date: 01.05.2020. Start and end time: 16:20 – 19:20
Weather:
The air temperature around 23-25°C is clear.
Wind speed approx. (1-3 m/s) No precipitation

Primary species not found

Table 112 Secondary species log 01.05.2020 VP 3

No.	Latin names	English names	Amount	Altitude (m)
1	*Buteo rufinus*	Long-legged Buzzard	1	15

Juru Energy

VP. 4

Date: 02.05.2020. Start and end time: 8:15 – 11:15
Weather:
The air temperature around 20-22°C is clear.
Wind speed approx. (2-5 m/s) No precipitation

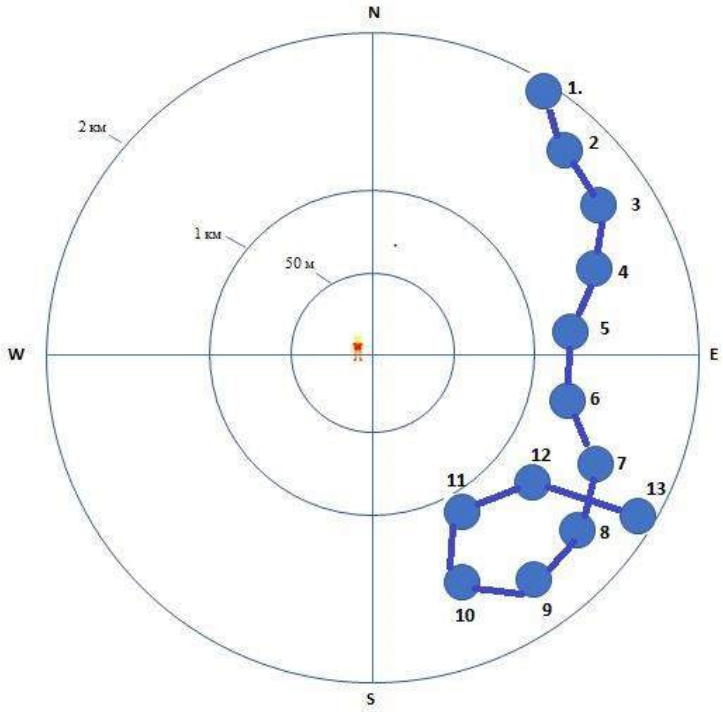


Fig. 50 Flight path (VP 4), 02.05.2020

Table 113 Target species log (VP 4), 02.05.2020

	Neophron percnopterus	1 45m	2 45m	3 40m	4 40m	5 45m	6 45m	7 40m	8 40m	9 40m	10 45m	11 45m	12 40m	13 40m

Table 114 Secondary species log 02.05.2020 VP 4

No.	Latin names	English names	Amount	Altitude (m)
1	*Buteo rufinus*	Long-legged Buzzard	2	25

Juru Energy

VP. 5

Date: 02.05.2020. Start and end time: 12:25 – 15:25

Weather:

The air temperature around 22-25°C is clear, .

Wind speed approx. (2-3 m/s) No precipitation

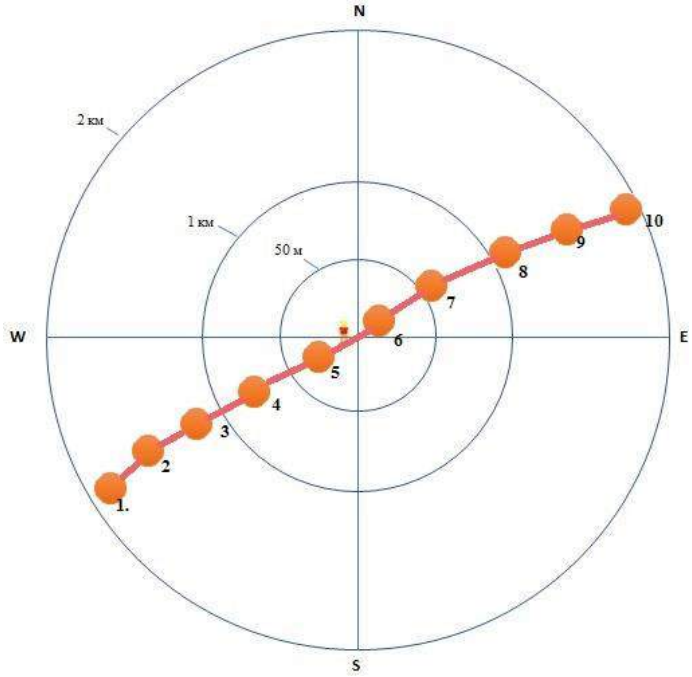


Fig. 51 Flight path (VP 5), 2.05.2020

Table 115. Target species log (VP 5), 02.05.2020

	Aquila nipalensis	1 90 m	2 90 m	3 85m	4 85 m	5 85 m	6 90 m	7 90 m	8 90 m	9 90 m	10 90 m

Table 116 Secondary species log 02.05.2020 VP 5

No.	Latin names	English names	Amount	Altitude (m)
1	*Falco tinnunculus*	Common Kestrel	1	17

Juru Energy

VP.6

Date: 02.05.2020. Start and end time: 15:50 – 18:50
Weather:
The air temperature around 23-25°C is clear.
Wind speed approx. (3-5 m/s) No precipitation
Primary species not found

Table 117 Secondary species log 02.05.2020 VP 6

No.	Latin names	English names	Amount	Altitude (m)
1	*Falco tinnunculus*	Common Kestrel	1	20

Juru Energy

VP. 9

Date: 03.05.2020. Start and end time: 8:00 – 11:00
Weather:
The air temperature around 18-22°C is clear.
Wind speed approx. (4-6 m/s) No precipitation
Primary species not found

Table 118 Secondary species log 03.05.2020 VP 9

No.	Latin names	English names	Amount	Altitude (m)
1	*Circus aeruginosus*	Marsh-Harrier	1	16

Juru Energy

VP. 7

Date: 03.05.2020. Start and end time: 11:50 – 14:50
Weather:
The air temperature around 20-22°C is clear.
Wind speed approx. (1-3 m/s) No precipitation
Primary species not found

Table 119 Secondary species log 03.05.2020 VP 7

No.	Latin names	English names	Amount	Altitude (m)
1	*Buteo rufinus*	Long-legged Buzzard	1	30

Juru Energy

VP. 8

Date: 03.05.2020. Start and end time: 15:25 – 18:35

Weather:

The air temperature around 22-23°C is clear.

Wind speed approx. (3-5 m/s) No precipitation

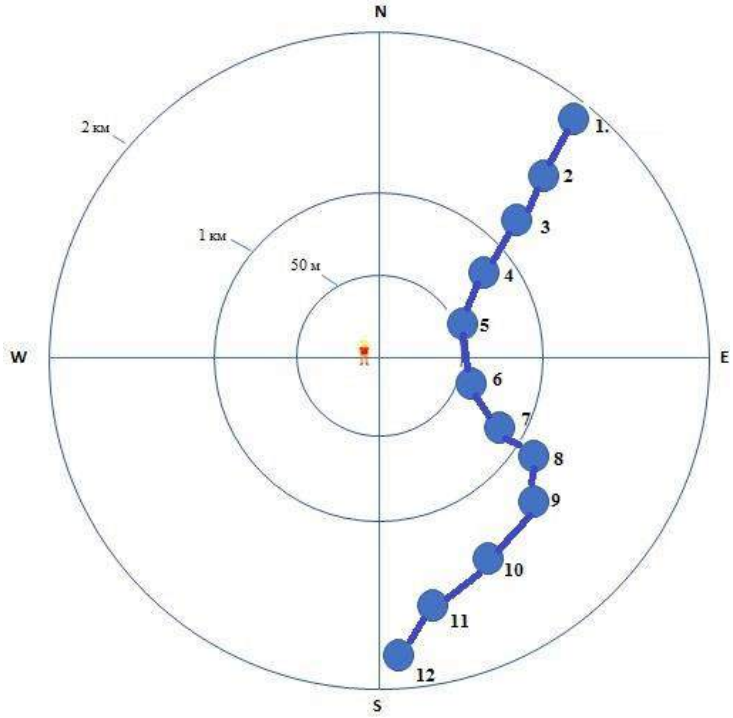


Fig. 52. Flight path (VP 8), 03.05.2020

Juru Energy

Table 120 Target species log

	Hieraaetus pennatus	1 50m	2 50m	3 50m	4 55m	5 55m	6 50m	7 55m	8 55m	9 50m	10 50m	11 50m	12 50m

Table 121 Secondary species log 03.05.2020 VP 8

No.	Latin names	English names	Amount	Altitude (m)
1	*Accipiter nisus*	Eurasian Sparrowhawk	1	11

Juru Energy

VP. 9

Date: 04.05.2020. Start and end time: 8:00 – 11:05
Weather:
The air temperature around 18-20°C is clear.
Wind speed approx. (4-6 m/s) No precipitation

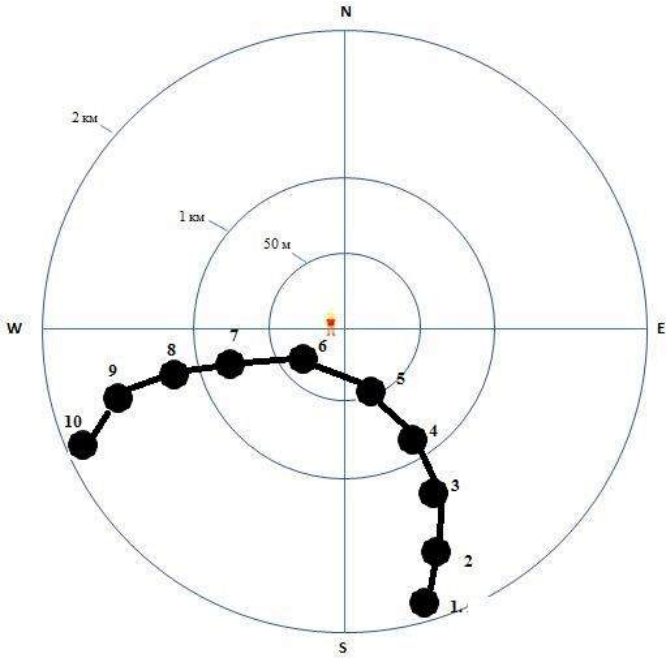


Fig. 53 Flight path (VP 9), 04.05.2020

Juru Energy

Table 122. Target species log (VP 9), 04.05.2020

●	*Neophron percnopterus*	1-40 m	2-40 m	3-40 m	4-40 m	5-45 m	6-45 m	7-45 m	8-40 m	9-45 m	10-45 m

Table 123 Secondary species log 04.05.2020 VP 9

No.	Latin names	English names	Amount	Altitude (m)
1	*Buteo rufinus*	Long-legged Buzzard	1	28

Juru Energy

VP. 4

Date: 04.05.2020. Start and end time: 11:35 – 14:35
Weather:
The air temperature around 20-22°C is clear.
Wind speed approx. (5-7 m/s) No precipitation
Primary species not found

Table 124 Secondary species log 04.05.2020 VP 4

No.	Latin names	English names	Amount	Altitude (m)
1	*Circus aeruginosus*	Marsh-Harrier	1	23

Juru Energy

VP. 1

Date: 05.05.2020. Start and end time: 7:37 – 10:37
Weather:
The air temperature around 18-20°C is clear.
Wind speed approx. (2-4 m/s) No precipitation
Primary species not found

VP.2

Date: 05.05.2020. Start and end time: 11:53 – 14:53
Weather:
The air temperature around 20-23°C is clear.
Wind speed approx. (3-5 m/s) No precipitation

Primary species not found

Juru Energy

VP. 3

Date: 05.05.2020. Start and end time: 15:36 – 18:40
eather:
The air temperature around 22-25°C is clear.
Wind speed approx. (2-4 m/s) No precipitation

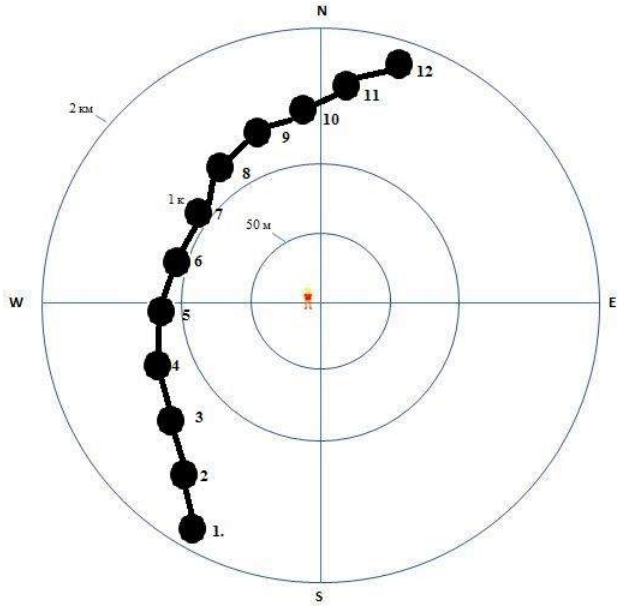


Fig. 54. Flight path (VP 3), 05.05.2020

Juru Energy

Table 125. Target species log (VP 3), 05.05.2020

●	*Neophron percnopterus*	1- 40 m	2- 40 m	3- 45 m	4- 40 m	5- 45 m	6- 45 m	7- 45 m	8- 40 m	9- 40 m	10- 40 m	11- 40 m	12- 45 m

Juru Energy

VP 4

Date: 06.05.2020. Start and end time: 7:46 – 10:46
Weather:
The air temperature around 20-22°C is clear.
Wind speed approx. (2-4 m/s) No precipitation

Primary species not found

Juru Energy

VP. 5

Date: 06.05.2020. Start and end time: 11:17 – 14:27
Weather:
The air temperature around 20-22°C is clear.
Wind speed approx. (2-5 m/s) No precipitation

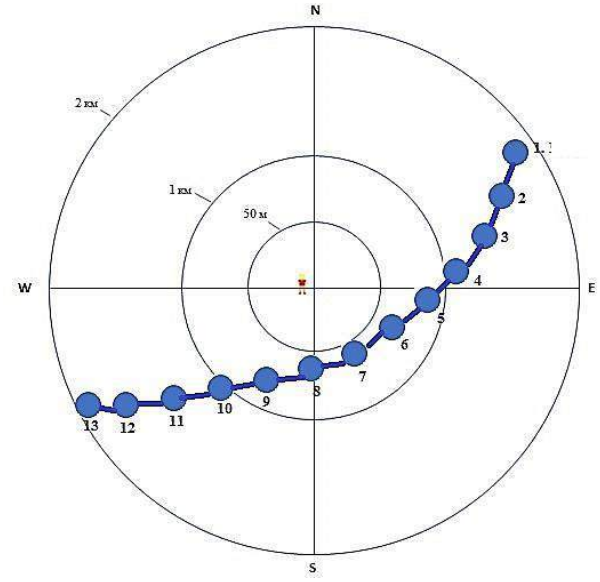


Fig. 55 Flight path (VP 5), 06.05.2020

Table 126. Target species log (VP 5), 06.05.2020

●	*Neophron percnopterus*	1- 40 m	2- 40 m	3- 45 m	4- 40 m	5- 45 m	6- 45 m	7- 45 m	8- 40 m	9- 40 m	10- 45 m	11- 40 m	12- 40 m	13- 40 m

Juru Energy

Juru Energy

VP. 6

Date: 06.05.2020. Start and end time: 15:26 – 18:26
Weather:
The air temperature around 22-24°C is clear.
Wind speed approx. (2-4 m/s) No precipitation

Primary species not found

Table 127 Secondary species log 06.05.2020 VP 6

No.	Latin names	English names	Amount	Altitude (m)
1	*Buteo rufinus*	Long-legged Buzzard	1	26

Juru Energy

VP. 1

Date: 07.05.2020. Start and end time: 9:15 – 12:20
Weather:
The air temperature around 20-22°C is clear.
Wind speed approx. (2-4 m/s) No precipitation

Primary species not found

VP. 2

Date: 07.05.2020. Start and end time: 12:50 – 15:50
Weather:
The air temperature around 23-25°C is clear.
Wind speed approx. (3-5 m/s) No precipitation

Primary species not found

Juru Energy

VP. 3

Date: 07.05.2020. Start and end time: 16:30 – 19:30
Weather:
The air temperature around 23-25°C is clear.
Wind speed approx. (3-5 m/s) No precipitation

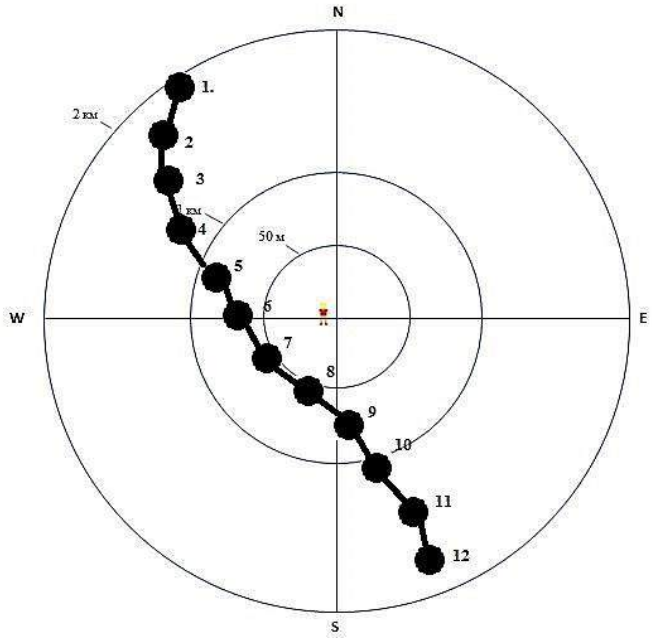


Fig. 56. Flight path (VP 3), 07.05.2020

Juru Energy

Table 128. Target species log (VP 3), 07.05.2020

●	*Hieraaetus pennatus*	1- 60 m	2- 60 m	3- 65 m	4- 60 m	5- 65 m	6- 65 m	7- 65 m	8- 60 m	9- 60 m	10- 65 m	11- 60 m	12- 60 m

Juru Energy

VP. 8

Date: 10.05.2020. Start and end time: 8:32 – 11:32
Weather:
The air temperature around 18-20°C is clear.
Wind speed approx. (5-7 m/s) rainy

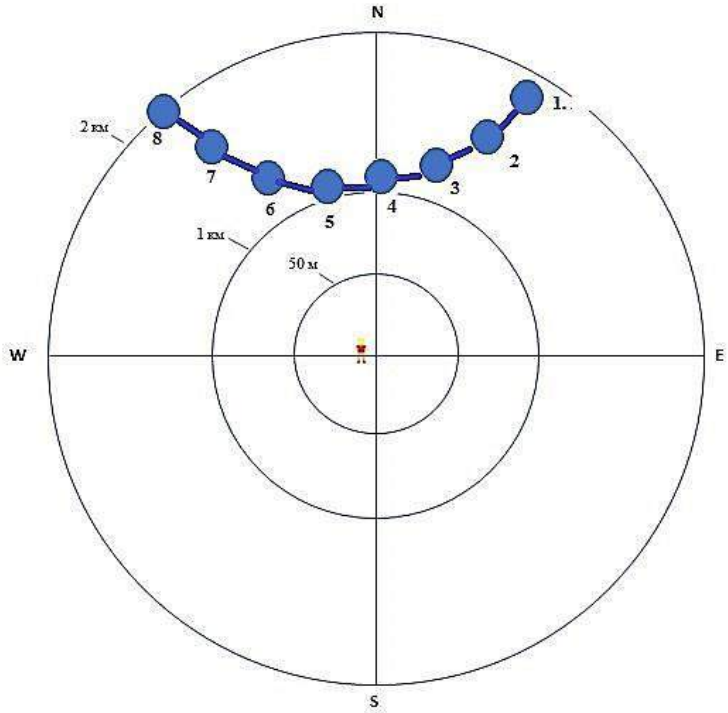


Fig. 57. Flight path (VP 8), 10.05.2020

Juru Energy

Table 129. Target species log (VP 8), 10.05.2020

	Aquila nipalensis	1- 65 m	2- 60 m	3- 60 m	4- 60 m	5- 60 m	6- 60 m	7- 65 m	8- 65 m

Juru Energy

VP. 7

Date: 10.05.2020. Start and end time: 11:53 – 14:55
Weather:
The air temperature around 23-25°C is clear.
Wind speed approx. (5-7 m/s) No precipitation

Primary species not found

Table 130 Secondary species log10.05.2020 VP 7

No.	Latin names	English names	Amount	Altitude (m)
1	*Falco tinnunculus*	Common Kestrel	1	15

Juru Energy

VP. 9

Date: 10.05.2020. Start and end time: 15:30 – 18:30
Weather:
The air temperature around 25-29°C is clear.
Wind speed approx. (3-5 m/s) No precipitation

Primary species not found

Juru Energy

VP. 1

Date: 11.05.2020. Start and end time: 8:18 – 11:18
Weather:
The air temperature around 22-24°C is clear.
Wind speed approx. (3-5 m/s) No precipitation

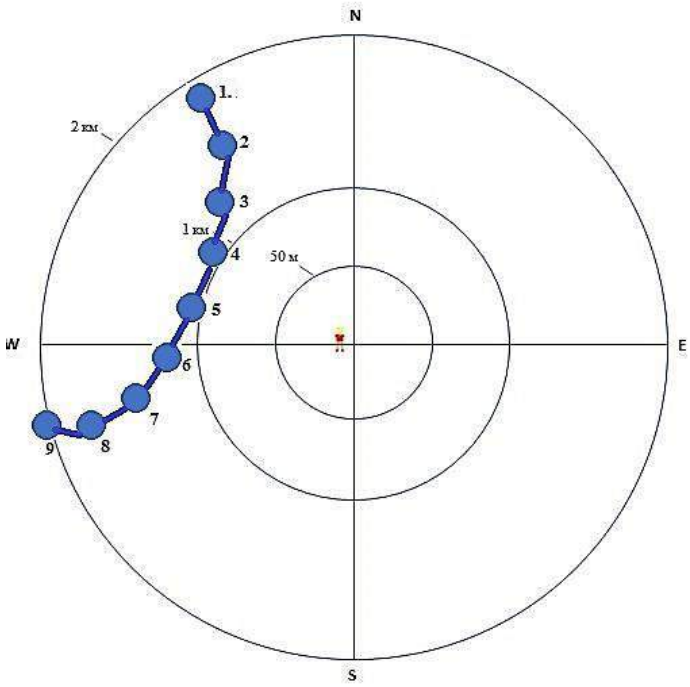


Fig. 58. Flight path (VP 1), 11.05.2020

Juru Energy

Table 131. Target species log (VP 1), 11.05.2020

	Neophron percnopterus	1- 50 m	2- 50 m	3- 50 m	4- 50 m	5- 50 m	6- 50 m	7- 50 m	8- 50 m	9- 50 m

Juru Energy

VP. 2

Date: 11.05.2020. Start and end time: 12:00 – 15:00
Weather:
The air temperature around 23-26°C is clear.
Wind speed approx. (5-7 m/s), No precipitation

Primary species not found

VP. 3

Date:11.05.2020. Start and end time: 15:33 – 18:53
Weather:
The air temperature around 25-27°C is clear.
Wind speed approx. (3-5 m/s) No precipitation

Primary species not found

Juru Energy

VP. 4

Date: 14.05.2020. Start and end time: 8:06 – 11:06
Weather:
The air temperature around 23-26°C is clear.
Wind speed approx. (3-5 m/s) No precipitation

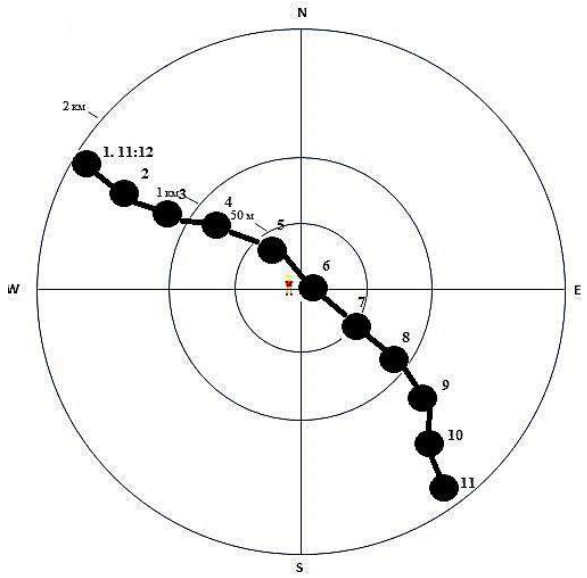


Fig. 59. Flight path (VP 4), 14.05.2020

Juru Energy

Table 132. Target species log (VP 4), 14.05.2020

●	*Hieraaetus pennatus*	1- 60 m	2- 60 m	3- 65 m	4- 60 m	5- 65 m	6- 65 m	7- 65 m	8- 60 m	9- 60 m	10- 65 m	11- 65 m

Table 133 Secondary species log 14.05.2020 VP 4

No.	Latin names	English names	Amount	Altitude (m)
1	*Accipiter nisus*	Eurasian Sparrowhawk	1	11

VP. 5

Date: 14.05.2020. Start and end time: 12:00 – 15:00
Weather:
The air temperature around 28-32°C is clear.
Wind speed approx. (3-5 m/s) No precipitation.

Primary species not found

VP. 6

Date: 14.05.2020. Start and end time: 15:38 – 18:38
Weather:
The air temperature around 26-29°C is clear.
Wind speed approx. (3-5 m/s) No precipitation

Primary species not found

Table 134 Secondary species log 14.05.2020 VP 6

No.	Latin names	English names	Amount	Altitude (m)
1	*Circus cyaneus*	Hen Harrier	1	17

ATTACHMENTS

Photos taken during specialized survey on water birds and Asian houbara (*Chlamydotis macqueenii)* around Agitma lake









Houbara Bustard 40°33'46.13"N, 64°33'27.22"E





Houbara Bustard	Slender-Billed Gull
	
Wood Sandpiper	Black-Winged Stilt

	
Motacilla flava	Tadorna ferruginea

	
Little Stint	Caspian Plover

	
European Collared Pratincole	Merops superciliosus









Phoenicopterus roseus

	
Ruff and Red-necked Phalarope	

	
Circus aeruginosus	Sterna hirundo

	
Pelecanus onocrotalus	





Summer Quarterly Bird monitoring Report

Report Title	Summer Quarterly Bird monitoring Report
Scope	BIRDS VP / BIRDS NESTING / WATERBIRDS
Areas Covered	BASH WF
Seasons Covered	SUMMER 2020
Notes	

SUMMER QUARTERLY BIRD MONITORING REPORT

Bash Wind Farm Site

Client: 5 Capitals

This report is prepared by: Juru Enery Date: _____

CHECKED BY _____ Date: _____

APRROVED BY _____ Date:_____

Contents

INTRODUCTION 4

SURVEY METHODS 4

VANTAGE POINTS 9

BIRD OBSERVATIONS RESULTS 12

SPECIALIZED SURVEY ON WATER BIRDS AND ASIAN HOUBARA *Chlamydotis macqueenii* ON AGITMA LAKE 29

SPECIALIZED RAPTOR NEST SURVEY 37

CONCLUSIONS AND RECCOMENDATIONS 43

Appendix 1. Weather conditions during VP Summer surveys 53

Appendix 2. Vantage Point Data Logs 60

VP survey results in May 60

VP survey results in June 93

VP survey results in July 155

VP survey results in August 180

ATTACHMENTS 225

INTRODUCTION

In the framework of the Bash Wind Farm Project, bird survey was conducted in the project area in Summer 2020. The purpose of ornithological monitoring was to conduct systematic field studies at specific vantage points to assess bird species composition that occur within the project's area of influence, its abundance and territorial distribution, the nature of the stay, and daily activity of birds during spring migration and the beginning of nesting and also to identify birds that are of conservation interest under IUCN and Uzbekistan Redlist.

This report presents the primary materials of field studies in this territory from May 16 to August 31, 2020.

This report is a statement of work made by Juru Enery` local ornitologist Alisher Atakhodjaev and international expert Caleb Gordon. However, it should be noted that help in collecting survey material was also provided by Juru Enery' employees, and expedition members.

SURVEY METHODS

The research methods were based on international best practice recommendations, in particular those set forth in the Scottish Natural Heritage: recommended bird survey methods to justify the assessment of the impact of surface wind farms. The range of detection and identification of large species as golden eagles was up to 2 km, and small passerines 50 m. Directions and flight altitude were taken into account.

The observations were carried out at 9 Vantage points (Table 2). The number and location of Vantage points for stationary observation in the project area have been agreed with the company employees and international expert. The points are located so as to cover the territory as completely as possible (Fig.1).

The duration of one bird count at each Vantage point (VP) was 3 hours. The total duration of all the observations in the territory was 438 hours (Table 3). During observations weather conditions such as wind speed and direction, and air temperature were recorded. Wind speed and air temperature were measured using an anemometer. Whenever

possible, the number of species, approximate flight altitude, speed, and flight direction of each target species were recorded every 15 seconds.

During the observations, photographing and short video shooting of birds were carried out, which is used to confirm the correct determination of species and obtain additional data on the number of individuals. Following equipment was used: binoculars (Viking) with 10x zoom; cameras (Nikon P1000, Canon 550D) with 24x and 50x zoom, with focal length of 550 mm and 1200 mm, respectively; field telescope (Viking).

Target and Secondary Species

Some species are more sensitive than others from a wind farm risk management standpoint. This is generally because they are classified as highly protected species by national and/or international authorities, because they are known or suspected to be highly susceptible to wind farm impacts (especially collision with rotors), or both. In addition, some species may be regarded as sensitive due to their cultural or iconic significance, or based on ecological/demographic factors (e.g. slow reproductive rate, naturally low population density). In present, these different criteria have been integrated and considered together to produce a preliminary list of suggested target species for the NBWEP, to be used to prioritize the Project's biological monitoring and mitigation programs, including the biological baseline studies.

We included Great White Pelican into the list of secondary species for Summer survey, because we found it on Agitma lake in Spring.

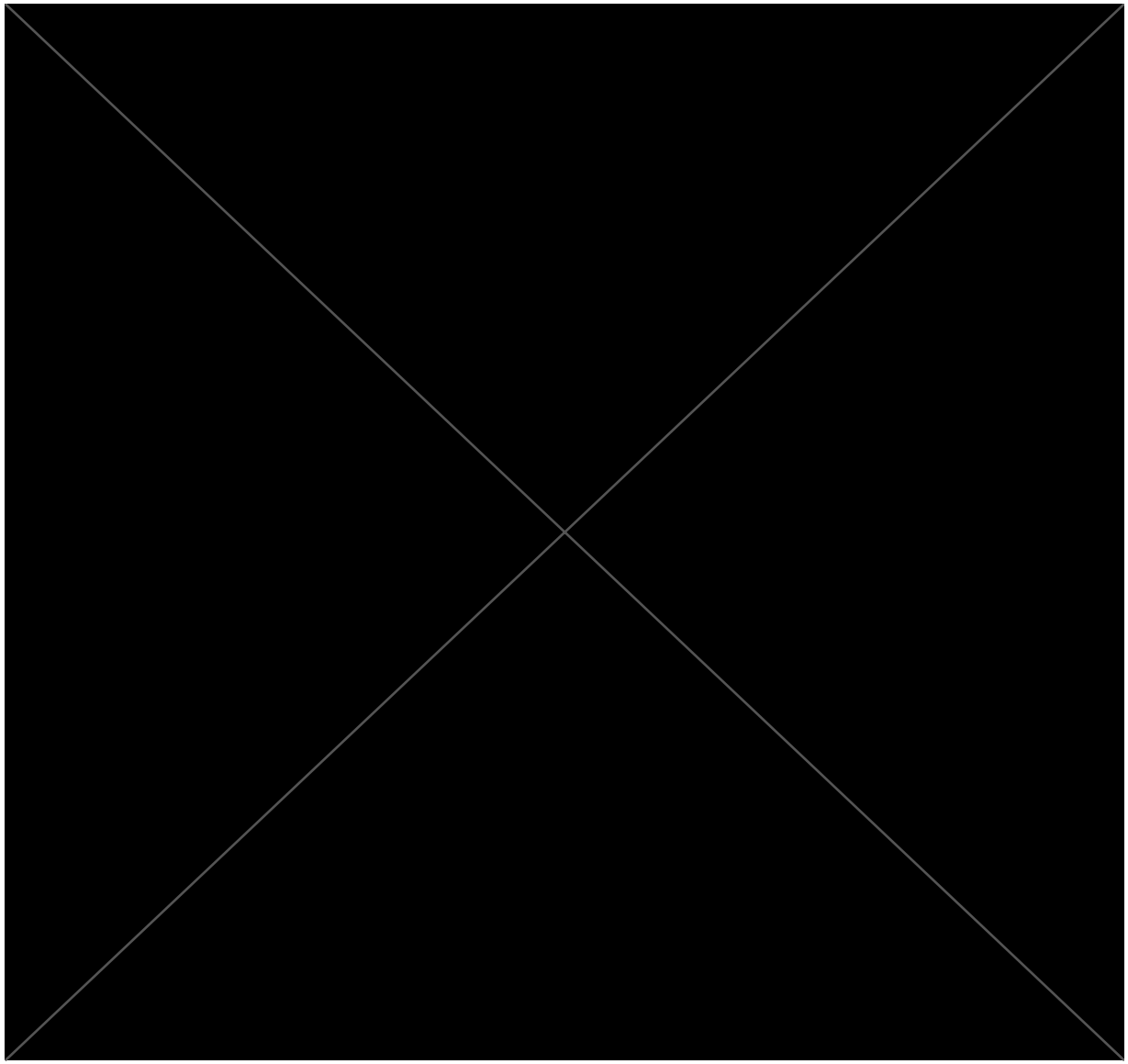
Table 1 below presents a suggested list of sensitive, or "target" bird species for the NBWEP, subdivided into two tiers, reflecting different priority levels (tier 1 is higher sensitivity, higher priority than tier 2).

Table 1 Target and secondary species

Latin name	English name	IUCN status	Uzbek status	Notes on Likely Occurrence/Risk
Tier 1 Target Species (top priority)				
Aquila nipalensis	Steppe Eagle	EN	2 (VU:D)	Common migrant. In March 2018 observed on project area (Ten A)
Aquila chrysaetos	Golden Eagle	LC	listed 2 (VU:R)	Common resident and nests in project area (powerlines) and in cliffs of Ayakagytma depression (Ten, Soldatov 2018)
Aquila heliaca	Imperial Eagle	VU	2 (VU:D)	Common migrant. In March 2018 observed on project area (Ten A)
Neophron percnopterus	Egyptian Vulture	EN	2 (VU:D)	Common nesting species in cliffs of Ayakagytma depression (Ten, Soldatov 2018)
Falco cherrug	Saker Falcon	EN	EN	Common nesting species in cliffs of Ayakagytma depression (Ten, Soldatov 2018)
Chlamydotis macqueenii	Houbara Bustard	VU	2 (V*U:D)	Nesting and migration species in project area (Burnside oral comm., Koshkin 2016)
Vanellus gregarius	Sociable Lapwing	CR	2 (VU:R)	possible rarity, recent eBird photo record in desert habitat ca 75km SW suggests possibility of occurrence. Extremely sensitive species with CR status
Tier 2 Target Species (second priority)				

1. Pelecanus onocrotalus	Great White Pelican	LC	VU:D	Common migrant and rare summering in Ayakagytma lake
2. *Pelecanus crispus*	Dalmatian Pelican	NT	EN	Common migrant and rare summering in Ayakagytma lake
3. Aegypius monachus	Cinereous Vulture	NT	3 (NT)	Resident in region
4. Gyps fulvus	Eurasian Griffon	NT	2 (VU:D)	Resident in region
5. Circaetus gallicus	Short-toed Snake-Eagle	LC	2 (VU:D)	Rare nesting bird in region
6. Hieraaetus pennatus	Booted Eagle	LC	2 (VU:D)	Possible rarity, very rare in region
7. Circus aeruginosus	Eurasian Marsh-Harrier	LC	*not listed*	Fairly common in region
8. Circus cyaneus	Hen Harrier	LC	*not listed*	Fairly common in region
9. Circus macrourus	Pallid Harrier	NT	3 (NT)	Fairly common in region
10. Circus pygargus	Montagu's Harrier	LC	*not listed*	Uncommon in region
11. Accipiter badius	Shikra	LC	*not listed*	Uncommon in region
12. Accipiter nisus	Eurasian Sparrowhawk	LC	*not listed*	Uncommon in region
13. Buteo rufinus	Long-legged Buzzard	LC	*not listed*	Fairly common in region

14. Buteo buteo	Common Buzzard	LC	*not listed*	Fairly common in region
15. Milvus migrans	Black Kite	LC	*not listed*	Uncommon in region
16. Anthropoides virgo	Demoiselle Crane	LC	*not listed*	Uncommon in region
17. Grus grus	Common Crane	LC	*not listed*	Rare migrant. Observed in 2018 in project area (Ten A)
18. Falco naumanni	Lesser Kestrel	LC	NT	Observed at site
19. Falco tinnunculus	Common Kestrel	LC	*not listed*	Numerous in region
20. Oxyura leucocephala	White-headed Duck	EN	1 (EN)	Possible on Lake Agitma
21. Anser erythropus	Lesser White-fronted Goose	VU	2 (VU:R)	Possible on Lake Agitma
22. Branta ruficollis	Red-breasted Goose	VU	2 (VU:R)	Possible on Lake Agitma
23. Marmaronetta angustirostris	Marbled Teal	VU	1 (EN)	Possible on Lake Agitma
24. Aythya ferina	Common Pochard	VU	*not listed*	Possible on Lake Agitma
25. Podiceps auritus	Horned Grebe	VU	*not listed*	Possible on Lake Agitma



The number of Vantage Points was agreed with the Client. Points are located so as to cover the project territory as fully as possible. The coordinates of the Vantage Points of Navoi Bash are shown in Table 2. The radius of a single observation point is 2 km. Time spent at one point is 3 hours' average.

Table 2 Coordinates of the VPs of Navoi Bash

Vantage Points	**Coordinates**
VP 1	[redacted]
VP 2	[redacted]
VP 3	[redacted]
VP 4	[redacted]
VP 5	[redacted]
VP 6	[redacted]
VP 7	[redacted]
VP 8	[redacted]
VP 9	[redacted]
Crossing the railway on the north side of the area	[redacted]

438 total hours (Table 3) of VP survey effort were conducted at the 9 VP survey points in the project area during the reporting period. This is equivalent to an average of 48.7 hours per point for the quarter (summer season), and each of the 9 points received at least 42 hours of VP survey effort during the summer season. This exceeds the recommended effort level (which was a minimum of 36 survey hours per point per season). This is an excellent level of effort, and will provide an excellent source of data for a robust seasonal collision risk modelling effort, and overall interpretation of summer season collision risk for target bird species.

Table 3 Total Number of VP survey hours

	VP 1	**VP 2**	**VP 3**	**VP 4**	**VP 5**	**VP 6**	**VP 7**	**VP 8**	**VP 9**	
Total hours										
May hr	12	12	18	6	6	12	15	15	18	
June hr	15	15	15	18	18	18	15	18	18	
July hr	9	9	9	6	6	6	6	6	6	
August hr	12	12	12	12	12	12	15	12	12	
accounts for Summer	48	48	54	42	42	48	51	51	54	**438**

BIRD OBSERVATIONS RESULTS

Among birds registered during bird survey in from May 16 to August 31, 2020 (Tables 4-7), following bird species belonging to top priority target species were found in the project area: Steppe Eagle (*Aquila nipalensis*), Egyptian Vulture (*Neophron percnopterus*), Golden Eagle (*Aquila chrysaetos*).

Among the secondary species, following bird species were found in the project area: Eurasian Marsh-Harrier (*Circus aeruginosus*), Hen Harrier (*Circus cyaneus*), Eurasian Sparrowhawk (*Accipiter nisus*), Long-legged Buzzard (*Buteo rufinus*), Common Kestrel (*Falco tinnunculus*).

Table 4 Results of bird observations in May

SPECIES			**VANTAGE POINTS**									**IUCN status**	**Uzbekistan Red Book status**	**Nature of stay**
№	**Latin**	**English**	**VP 1**	**VP 2**	**VP 3**	**VP 4**	**VP 5**	**VP 6**	**VP 7**	**VP 8**	**VP 9**			
TARGET SPECIES														
1.	*Aquila nipalensis*	Steppe Eagle							1			EN	2 (VU:D)	**NMW**
2.	*Aquila chrysaetos*	Golden Eagle										LC	listed 2 (VU:R)	**R**
3.	*Aquila heliaca*	Imperial Eagle										VU	2 (VU:D)	**NMS**
4.	*Neophron percnopterus*	Egyptian Vulture	1	1, 1	1, 2, 2			1				EN	2 (VU:D)	**NMW**
5.	*Falco cherrug*	Saker Falcon										EN	1 (NT)	**RW**
6.	*Chlamydotis*	Houbara Bustard										VU	2 (VU:D)	**NM**

	macqueenii													
7.	*Vanellus gregarius*	Sociable Lapwing										CR	2 (VU:R)	**M**
SECONDARY SPECIES														
	Pelecanus onocrotalus	Great White Pelican										LC	VU:D	**NMW**
	Pelecanus crispus	Dalmatian Pelican										NT	EN	**M**
	Aegypius monachus	Cinereous Vulture										NT	3 (NT)	**R**
4.	*Gyps fulvus*	Eurasian Griffon										NT	2 (VU:D)	**R**
5.	*Circaetus gallicus*	Short-toed Snake-Eagle										LC	2 (VU:D)	**NM**
6.	*Circus aeruginosus*	Eurasian Marsh-Harrier		1, 2							1,1	LC	*not listed*	**NMW**
7.	*Hieraaetus pennatus*	Booted Eagle										LC	2 (VU:D)	**NM**
8.	*Circus cyaneus*	Hen Harrier							1		1	LC	*not listed*	**MW**
9.	*Circus macrourus*	Pallid Harrier										NT	3 (NT)	**MS**
10.	*Circus pygargus*	Montagu's Harrier										LC	*not listed*	**NM**
11.	*Accipiter badius*	Shikra										LC	*not listed*	**NM**
12.	*Accipiter nisus*	Eurasian Sparrowhawk										LC	*not listed*	**NMW**
13.	*Buteo rufinus*	Long-legged Buzzard	1						1		1	LC	*not listed*	**NMW**
14.	*Buteo buteo*	Common Buzzard										LC	*not listed*	**MW**

15.	*Milvus migrans*	Black Kite										LC	*not listed*	**NMW**
16.	*Anthropoides virgo*	Demoiselle Crane										LC	*not listed*	**M**
17.	*Grus grus*	Common Crane										LC	*not listed*	**MW**
18.	*Falco naumanni*	Lesser kestrel									1	LC	NT	**NM**
19.	*Falco tinnunculus*	Common Kestrel	1	1	1,1							LC	*not listed*	**NMW**
20.	*Oxyura leucocephala*	White-headed Duck										EN	1 (EN)	**NMW**
21.	*Anser erythropus*	Lesser White-fronted Goose										VU	2 (VU:R)	**M**
22.	*Branta ruficollis*	Red-breasted Goose										VU	2 (VU:R)	**M**
23.	*Marmaronetta angustirostris*	Marbled Teal										VU	1 (EN)	**NM**
24.	*Aythya ferina*	Common Pochard										VU	*not listed*	**NMW**
25.	*Podiceps auritus*	Horned Grebe										VU	*not listed*	**M**
OTHER SPECIES														
	Upupa epops	Hoopoe		1								LC	-	**NMW**
2.	*Oenanthe isabellina*	Isabelline Wheatear	7, 4, 5, 2	2, 4, 4, 6	6, 3, 7, 4, 2	4, 1	8, 1	3, 8, 2, 2	10, 2, 1, 4, 4, 1	8, 3, 2, 2, 2	8, 7, 4, 5, 4	LC	-	**NM**
3.	*Lanius minor*	Lesser Grey Shrike										LC	-	**NM**

4.	*Galerida cristata*	Crested Lark	11, 4, 12, 12	13, 8, 4, 8	5, 12, 13, 9, 5	4, 15	10, 10	2, 5, 3	5, 8, 4, 6, 11, 3	17, 10, 10, 11, 3	14, 13, 10, 7, 10, 19	LC	-	**R**
5.	*Calandrella brachydactyla*	Greater Short-toed Lark										LC	-	**NM**
6.	*Oenanthe pleschanka*	Pied Wheatear										LC	-	**NM**
7.	*Oenanthe oenanthe*	Northern Wheatear										LC	-	**NM**
8.	*Lanius pallidirostris*	Southern grey shrike			1, 2					1		VU	-	**NM**
9.	*Alectoris chukar*	Chukar Partridge					4	2				LC	-	**R**
10.	*Athene noctua*	Little Owl					1			1		LC	-	**R**
11.	*Hirundo rustica*	Barn Swallow	15, 5	15, 15	18, 30, 30, 17			18, 3	3, 5, 15	10, 5	40, 6, 14, 4, 21, 15	LC	-	**NM**
12.	*Acridotheres tristis*	Indian Myna	5, 1	2		4					6	LC	-	**R**
13.	*Merops superciliosus*	Blue-cheeked Bee-eater	6	5, 26, 26					20	20	35, 30	LC		**NM**
14.	*Columba livia*	Pigeon	58	22	28				12		30, 26, 32, 38	LC		**R**
15.	*Pterocles orientalis*	Black-bellied sandgrouse	2		4			6	2, 2			LC		**NMW**
16.	*Nycticorax nycticorax*	Black-crowned night-heron	14		14							LC		**NM**

17.	*Calandrella rufescens*	Lesser Short-toed Lark	18	20			15	30	30, 20	22, 15, 14		LC		**NMW**
18.	*Scotocerca inguieta*	Streaked Scrub Warbler		4, 2	2, 2, 2	2	4	2	3, 2, 2	1, 1	4	LC		
19.	*Phalacrocorax pygmaeus*	Pygmy cormorant										LC		**NMW**
20.	*Coracias garrulus*	Eurasian Roller	7, 2	5, 4	3, 8	4	3	2	3,		8, 3, 8, 4	LC		**NM**
21.	*Muscicapa striata*	Spotted Flycatcher	1		1					2	1, 1	LC		**NM**
22.	*Melanocorypha bimaculata*	Bimaculated lark									14	LC		**NM**
23.	*Hirundo daurica*	Red-rumped swallow	6, 8	6	5	15, 6	6, 5	6	12	4		LC		**NM**
24.	*Rhodospiza obsoleta*	Black-billed Desert Finch	7, 3	8, 3	3	12			7	3	3, 3	LC		**R**
25.	*Apus apus*	Northern Swift	36, 45	6, 15, 45	25, 40, 40, 27	15	5	30	40, 28, 45	40, 4, 15	36, 45	LC		**NM**
26.	*Passer indicus*	Indian House Sparrow	18, 17	22						6		LC		**NM**
27.	*Corvus monedula*	Jackdaw		6	2, 18		5			4		LC		**RMW**
28.	*Streptopelia decaocto*	Collared Turtle Dove									2, 4	LC		**R**
29.	*Emberiza bruniceps*	Red-headed Bunting								1		LC		**NM**
30.	*Corvus ruficollis*	Brown-necked Raven		1		1						LC		**R**
31.	*Himantopus*	Black-Winged Stilt	1, 22									LC		**NM**

	himantopus													

Table 5 Results of bird observations in June

			VANTAGE POINTS									IUCN status	Uzbekistan Red Book status	Nature of stay
№	Latin	English	VP 1	VP 2	VP 3	VP 4	VP 5	VP 6	VP 7	VP 8	VP 9			
TARGET SPECIES														
	Aquila nipalensis	Steppe Eagle	1			2,1						EN	2 (VU:D)	**NMW**
2.	*Aquila chrysaetos*	Golden Eagle					1			1,1		LC	listed 2 (VU:R)	**R**
3.	*Aquila heliaca*	Imperial Eagle										VU	2 (VU:D)	**NMS**
4.	*Neophron percnopterus*	Egyptian Vulture	2	1	2,1,1		2			1		EN	2 (VU:D)	**NMW**
5.	*Falco cherrug*	Saker Falcon										EN	1 (NT)	**RW**
6.	*Chlamydotis macqueenii*	Houbara Bustard										VU	2 (VU:D)	**NM**
7.	*Vanellus gregarius*	Sociable Lapwing										CR	2 (VU:R)	**M**
SECONDARY SPECIES														
	Pelecanus onocrotalus	Great White Pelican										LC	VU:D	**NMW**
2.	*Pelecanus crispus*	Dalmatian Pelican										NT	EN	**M**
3.	*Aegypius monachus*	Cinereous Vulture										NT	3 (NT)	**R**

4.	*Gyps fulvus*	Eurasian Griffon										NT	2 (VU:D)	**R**
5.	*Circaetus gallicus*	Short-toed Snake-Eagle										LC	2 (VU:D)	**NM**
6.	*Hieraaetus pennatus*	Booted Eagle										LC	2 (VU:D)	**NM**
7.	*Circus aeruginosus*	Eurasian Marsh-Harrier	1, 1	1	1				1	1, 1		LC	*not listed*	**NMW**
8.	*Circus cyaneus*	Hen Harrier	1	1	1	1			1, 2	2, 1, 2, 1		LC	*not listed*	**MW**
9.	*Circus macrourus*	Pallid Harrier										NT	3 (NT)	**MS**
10.	*Circus pygargus*	Montagu's Harrier										LC	*not listed*	**NM**
11.	*Accipiter badius*	Shikra										LC	*not listed*	**NM**
12.	*Accipiter nisus*	Eurasian Sparrowhawk							1, 1			LC	*not listed*	**NMW**
13.	*Buteo rufinus*	Long-legged Buzzard			1			1		1,1		LC	*not listed*	**NMW**
14.	*Buteo buteo*	Common Buzzard										LC	*not listed*	**MW**
15.	*Milvus migrans*	Black Kite										LC	*not listed*	**NMW**
16.	*Anthropoides virgo*	Demoiselle Crane										LC	*not listed*	**M**
17.	*Grus grus*	Common Crane										LC	*not listed*	**MW**
18.	*Falco naumanni*	Lesser kestrel					2, 2	2		1	1	LC	NT	**NM**

19.	*Falco tinnunculus*	Common Kestrel		1		1	2, 2			1		LC	*not listed*	**NMW**
20.	*Oxyura leucocephala*	White-headed Duck										EN	1 (EN)	**NMW**
21.	*Anser erythropus*	Lesser White-fronted Goose										VU	2 (VU:R)	**M**
22.	*Branta ruficollis*	Red-breasted Goose										VU	2 (VU:R)	**M**
23.	*Marmaronetta angustirostris*	Marbled Teal										VU	1 (EN)	**NM**
24.	*Aythya ferina*	Common Pochard										VU	*not listed*	**NMW**
25.	*Podiceps auritus*	Horned Grebe										VU	*not listed*	**M**
OTHER SPECIES														
	Upupa epops	Hoopoe		2, 2	2			1, 1	2	1	1	LC	-	**NMW**
2.	*Oenanthe isabellina*	Isabelline Wheatear	6,1, 1, 1, 1	3, 2, 1, 1, 2	1, 2, 3, 2, 1	1, 3	1, 3, 2, 1	2, 1, 2, 3	6, 2	2, 2, 1, 2	2, 2, 2	LC	-	**NM**
3.	*Lanius minor*	Lesser Grey Shrike		1	1, 1				2			LC	-	**NM**
4.	*Galerida cristata*	Crested Lark	6, 5, 5, 5	13, 13, 3, 6	7, 13, 5, 9	12, 9, 6, 12, 8	6, 5, 17, 4, 6, 13, 6	3, 3, 6, 9, 19, 9	7, 9	12, 13, 12, 11	5, 4, 5, 5, 10	LC	-	**R**
5.	*Calandrella brachydactyla*	Greater Short-toed Lark		6								LC	-	**NM**

6.	*Oenanthe pleschanka*	Pied Wheatear	2, 1	1	3, 1	2, 1, 1	2	1	4	2, 1	3, 3, 1	LC	-	**NM**
7.	*Oenanthe oenanthe*	Northern Wheatear	2	6	2, 1	3, 1, 2	2, 1, 3	2, 1, 3	1, 2	1, 3	2, 1, 2	LC	-	**NM**
8.	*Lanius pallidirostris*	Southern grey shrike		2			2		2, 2	1		VU	-	**NM**
9.	*Alectoris chukar*	Chukar Partridge			2				4			LC	-	**R**
10.	*Athene noctua*	Little Owl			1, 1			2	1, 1, 1			LC	-	**R**
11.	*Hirundo rustica*	Barn Swallow				10					12	LC	-	**NM**
12.	*Acridotheres tristis*	Indian Myna		3			4	4			3, 4, 2	LC	-	**R**
13.	*Merops superciliosus*	Blue-cheeked Bee-eaterr										LC		**NM**
14.	*Columba livia*	Pigeon	2								5, 2	LC		**R**

Table 6 Results of bird observations in July

SPECIES			VANTAGE POINTS									IUCN status	Uzb Red Book status	Nature of stay
№	Latin	English	VP 1	VP 2	VP 3	VP 4	VP 5	VP 6	VP 7	VP 8	VP 9			
TARGET SPECIES														
	Aquila nipalensis	Steppe Eagle						1	1			EN	2 (VU:D)	**NMW**
2.	*Aquila chrysaetos*	Golden Eagle										LC	listed 2 (VU:R)	**R**
3.	*Aquila heliaca*	Imperial Eagle										VU	2 (VU:D)	**NMS**
4.	*Neophron percnopterus*	Egyptian Vulture	2		1,1							EN	2 (VU:D)	**NMW**
5.	*Falco cherrug*	Saker Falcon										EN	1 (NT)	**RW**
6.	*Chlamydotis macqueenii*	Houbara Bustard										VU	2 (VU:D)	**NM**
7.	*Vanellus gregarius*	Sociable Lapwing										CR	2 (VU:R)	**M**
SECONDARY SPECIES														
	Pelecanus onocrotalus	Great White Pelican										LC	VU:D	**NMW**
	Pelecanus crispus	Dalmatian Pelican										NT	EN	**M**
	Aegypius monachus	Cinereous Vulture										NT	3 (NT)	**R**
4.	*Gyps fulvus*	Eurasian Griffon										NT	2 (VU:D)	**R**
5.	*Circaetus gallicus*	Short-toed Snake-Eagle										LC	2 (VU:D)	**NM**
6.	*Hieraaetus pennatus*	Booted Eagle										LC	2 (VU:D)	**NM**
7.	*Circus aeruginosus*	Eurasian Marsh-Harrier	1			1						LC	*not listed*	**NMW**
8.	*Circus cyaneus*	Hen Harrier										LC	*not listed*	**MW**
9.	*Circus macrourus*	Pallid Harrier										NT	3 (NT)	**MS**
10.	*Circus pygargus*	Montagu's Harrier										LC	*not listed*	**NM**

11.	*Accipiter badius*	Shikra										LC	*not listed*	**NM**
12.	*Accipiter nisus*	Eurasian Sparrowhawk										LC	*not listed*	**NMW**
13.	*Buteo rufinus*	Long-legged Buzzard		1		3			1			LC	*not listed*	**NMW**
14.	*Buteo buteo*	Common Buzzard										LC	*not listed*	**MW**
15.	*Milvus migrans*	Black Kite										LC	*not listed*	**NMW**
16.	*Anthropoides virgo*	Demoiselle Crane										LC	*not listed*	**M**
17.	*Grus grus*	Common Crane										LC	*not listed*	**MW**
18.	*Falco naumanni*	Lesser kestrel	2	1	1							LC	3 (NT)	**NM**
19.	*Falco tinnunculus*	Common Kestrel					2	4			1,1	LC	*not listed*	**NMW**
20.	*Oxyura leucocephala*	White-headed Duck										EN	1 (EN)	**NMW**
21.	*Anser erythropus*	Lesser White-fronted Goose										VU	2 (VU:R)	**M**
22.	*Branta ruficollis*	Red-breasted Goose										VU	2 (VU:R)	**M**
23.	*Marmaronetta angustirostris*	Marbled Teal										VU	1 (EN)	**NM**
24.	*Aythya ferina*	Common Pochard										VU	*not listed*	**NMW**
25.	*Podiceps auritus*	Horned Grebe										VU	*not listed*	**M**
OTHER SPECIES OF BIRDS														
1.	*Pterocles orientalis*	Black-bellied sandgrouse	2	2,2	4	2	2			2	4	LC	-	**NMW**
2.	*Columba livia*	Rock Dove	16	40	21,30					36	3	LC	-	**R**
3.	*Coracias garrulus*	Eurasian Roller			2					1	1,1	LC	-	**NM**
4.	*Merops superciliosus*	Blue-cheeked Bee-eaterr	2	14,18	4,27		5,3				2,5	LC	-	**NM**
5.	*Apus apus*	Northern Swift	45,15	60,22	52						11	LC	-	**NM**
6.	*Hirundo rustica*	Barn Swallow	12	48	37	3	4	7	6	13	7	LC	-	**NM**
7.	*Galerida cristata*	Crested lark	4,5,3	3,5,3	4,3,3	12	2,6,5	3,2	6	3,6	3,1,4	LC		**R**

8.	*Oenanthe isabellina*	Isabelline wheatear	2,1	1	1,1		1,2	2,1	2,2		2	LC	-	**NM**
9.	*Acridotheres tristis*	Common myna							3		2	LC		**R**
10.	*Upupa epops*	Hoopoe				1						LC		**NMW**
11.	*Muscicapa striata*	Spotted Flycatcher				1						LC		**NM**
12.	*Athene noctua*	Little Owl			1				1			LC	-	**R**

Table 7 Results of bird observations in August

SPECIES			VANTAGE POINTS									IUCN status	Uzbekistan Red Book status	Nature of stay
№	Latin	English	VP 1	VP 2	VP 3	VP 4	VP 5	VP 6	VP 7	VP 8	VP 9			
TARGET SPECIES														
	Aquila nipalensis	Steppe Eagle	1					1	1, 1			EN	2 (VU:D)	**NMW**
2.	*Aquila chrysaetos*	Golden Eagle										LC	listed 2 (VU:R)	**R**
3.	*Aquila heliaca*	Imperial Eagle										VU	2 (VU:D)	**NMS**
4.	*Neophron percnopterus*	Egyptian Vulture	1, 1		1, 2, 1				1			EN	2 (VU:D)	**NMW**
5.	*Falco cherrug*	Saker Falcon										EN	1 (NT)	**RW**
6.	*Chlamydotis macqueenii*	Houbara Bustard										VU	2 (VU:D)	**NM**
7.	*Vanellus gregarius*	Sociable Lapwing										CR	2 (VU:R)	**M**
SECONDARY SPECIES														
	Pelecanus onocrotalus	Great White Pelican										LC	VU:D	**NMW**
	Pelecanus crispus	Dalmatian Pelican										NT	EN	**M**
3.	*Aegypius monachus*	Cinereous Vulture										NT	3 (NT)	**R**

4.	*Gyps fulvus*	Eurasian Griffon										NT	2 (VU:D)	**R**
5.	*Circaetus gallicus*	Short-toed Snake-Eagle										LC	2 (VU:D)	**NM**
6.	*Hieraaetus pennatus*	Booted Eagle										LC	2 (VU:D)	**NM**
7.	*Circus aeruginosus*	Eurasian Marsh-Harrier			1, 1, 1				1	1		LC	*not listed*	**NMW**
8.	*Circus cyaneus*	Hen Harrier					1, 1	1				LC	*not listed*	**MW**
9.	*Circus macrourus*	Pallid Harrier										NT	3 (NT)	**MS**
10.	*Circus pygargus*	Montagu's Harrier										LC	*not listed*	**NM**
11.	*Accipiter badius*	Shikra										LC	*not listed*	**NM**
12.	*Accipiter nisus*	Eurasian Sparrowhawk										LC	*not listed*	**NMW**
13.	*Buteo rufinus*	Long-legged Buzzard					1		1			LC	*not listed*	**NMW**
14.	*Buteo buteo*	Common Buzzard										LC	*not listed*	**MW**
15.	*Milvus migrans*	Black Kite										LC	*not listed*	**NMW**
16.	*Anthropoides virgo*	Demoiselle Crane										LC	*not listed*	**M**
17.	*Grus grus*	Common Crane										LC	*not listed*	**MW**
18.	*Falco naumanni*	Lesser kestrel			2	1		2		1		LC	3 (NT)	**NM**
19.	*Falco tinnunculus*	Common Kestrel	1				1	1, 1	1	2		LC	*not listed*	**NMW**

20.	*Oxyura leucocephala*	White-headed Duck										EN	1 (EN)	**NMW**
21.	*Anser erythropus*	Lesser White-fronted Goose										VU	2 (VU:R)	**M**
22.	*Branta ruficollis*	Red-breasted Goose										VU	2 (VU:R)	**M**
23.	*Marmaronetta angustirostris*	Marbled Teal										VU	1 (EN)	**NM**
24.	*Aythya ferina*	Common Pochard										VU	*not listed*	**NMW**
25.	*Podiceps auritus*	Horned Grebe										VU	*not listed*	**M**
OTHER SPECIES														
	Upupa epops	Hoopoe										LC	-	**NMW**
2.	*Oenanthe isabellina*	Isabelline Wheatear	2, 2, 2, 1	1, 1, 1	1, 3, 2	1, 1	1, 2, 3, 1	2, 1, 2, 3	1, 2, 3, 1	1, 3	2, 2, 3, 2	LC	-	**NM**
3.	*Lanius minor*	Lesser Grey Shrike										LC	-	**NM**
4.	*Galerida cristata*	Crested Lark	6, 6, 13	5, 6, 6, 6	15, 5, 9, 12	14, 9, 12, 6	5, 5, 3, 5	12, 6, 9, 12	9, 8, 13, 9, 15	8, 9, 8, 6, 3	6, 12, 9	LC	-	**R**
5.	*Calandrella brachydactyla*	Greater Short-toed Lark										LC	-	**NM**
6.	*Oenanthe pleschanka*	Pied Wheatear										LC	-	**NM**
7.	*Oenanthe oenanthe*	Northern Wheatear										LC	-	**NM**

8.	*Lanius pallidirostris*	Southern grey shrike				2, 2, 2		2		2		VU	-	**NM**
9.	*Alectoris chukar*	Chukar Partridge										LC	-	**R**
10.	*Athene noctua*	Little Owl		2, 1	1	1	1, 2	1		1		LC	-	**R**
11.	*Hirundo rustica*	Barn Swallow	2, 5, 6	5, 12, 5	18, 2	1	2, 4, 3, 6	3, 4	3, 5, 4	5	3, 4, 6, 5, 5	LC	-	**NM**
12.	*Acridotheres tristis*	Indian Myna	2				3	3		3	3	LC	-	**R**
13.	*Merops superciliosus*	Blue-cheeked Bee-eaterr										LC		**NM**
14.	*Columba livia*	Pigeon							23	2	5	LC		**R**
15.	*Merops supercilios*	Blue-cheeked Bee-eater	5, 5	2, 3, 18		16, 2, 3, 3	16	16, 5	5, 6, 3, 6	5, 18	6, 3, 5, 5	LC		
16.	*Pterocles orientalis*	Black-bellied sandgrouse	4, 5	2	2, 4, 2	2, 2, 2, 2	4, 2	2	4, 4		2, 2, 2	LC		**NMW**
17.	*Nycticorax nycticorax*	Black-crowned night-heron		5						1		LC		**NM**
18.	*Calandrella rufescens*	Lesser Short-toed Lark	8, 22, 8, 12	8	16, 30	7, 12	15, 30	9		6	9, 8	LC		**NMW**
19.	*Scotocerca inguieta*	Streaked Scrub Warbler				1				1	2	LC		
20.	*Phalacrocorax pygmaeus*	Pygmy cormorant		3								LC		
21.	*Coracias garrulus*	Eurasian Roller	1	2					2			LC		**NM**
22.	*Muscicapa striata*	Spotted Flycatcher					1			1		LC		**NM**

SPECIALIZED SURVEY ON WATER BIRDS AND ASIAN HOUBARA *Chlamydotis macqueenii* ON AGITMA LAKE

Agitma Lake located near the project area attracts many water birds. In this regard, a specialized water birds survey around the lake was conducted on August 6-8, 2020. As the only Asian Houbara (*Chlamydotis macqueenii*) was reported on the south-western part of Agitma lake in Spring, also we searched for it while carrying out water birds survey.

The Ayakaghytma depression is situated in the southern part of the Kyzylkum to the southeast of the Kuldjuktau ridge. It is surrounded by cliffs up to 60 m in height. A significant part of the site consists of saline marshlands (solonchak). Ayakaghytma lake formed in the late 1980s as a result of the discharge of collector-drainage waters into the depression. The lake currently covers c11 000 ha. The water level of the lake is unstable and depends on the volume of inflowing water. The shoreline vegetation is poorly developed and consists mainly of reeds and tamarisk thickets but most of the shoreline is devoid of vegetation. The western and southern parts of the site consist of vast saline marshlands and sandy desert with fixed dunes; the eastern part is clayey-rubble desert. Isolated groups of saxaul and sandy acacia Ammodendron conollyioccur throughout. There is a small village, Ayakaghytma, with fifty households, on the shore of the lake.[1]

Driving along the coastline, we carefully watched the open water and the shore. The survey was conducted from the shore using binoculars and a telescope, as well as photo and video shooting. We recorded all the waterfowl and near-water birds.

Weather was partly cloudy with no precipitation, windy; air temperature in the mornings and evenings was 24-28° C, in the afternoon it rised to 36-40° C.

[1] Akpetky lakes, Sarykamysh lake, Ayakaghytma lake, and their desert surrounds: three new Important Bird Areas in Uzbekistan, ANNA TEN, ROMAN KASHKAROV, GULARA MATEKOVA, ILIA ZHOLDASOVA & MUKHTOR TURAEV, Sandgrouse 34 (2012)

The species composition of birds on Agitma lake is constantly changing, since in August the breeding period of the majority of birds had already ended and the autumn migration began. For example, flamingos that were observed during the waterfowl count in the Spring 2020 were not encountered this time.

The largest number of birds is concentrated in the reedy Southern and South-Eastern part of the lake, where water comes from the collecting channel and therefore the water is less salty. In this part of the lake, there were also many birds (a large number of sandpipers) feeding in shallow water. Bays in this part of the lake protect birds from strong winds.

The most common bird species obsereved during our lake survey were: Gadwall, Black-winged Stilt, Northern Shoveler, Ruddy Shelduck, Common Coot, different types of sandpipers. In the center of the lake we observed Mute Swans and Great White Pelicans. There were Yellow and White Wagtails on the beach. We also observed many fledglings of a variety of small passerine birds. (Table 8)

It should also be noted that due to irrigation of agricultural fields, the flow of water into the lake from the collecting channel in summer greatly decreased. In this connection, the water level in the lake was gradually decreasing, which was also confirmed by local fishermen.

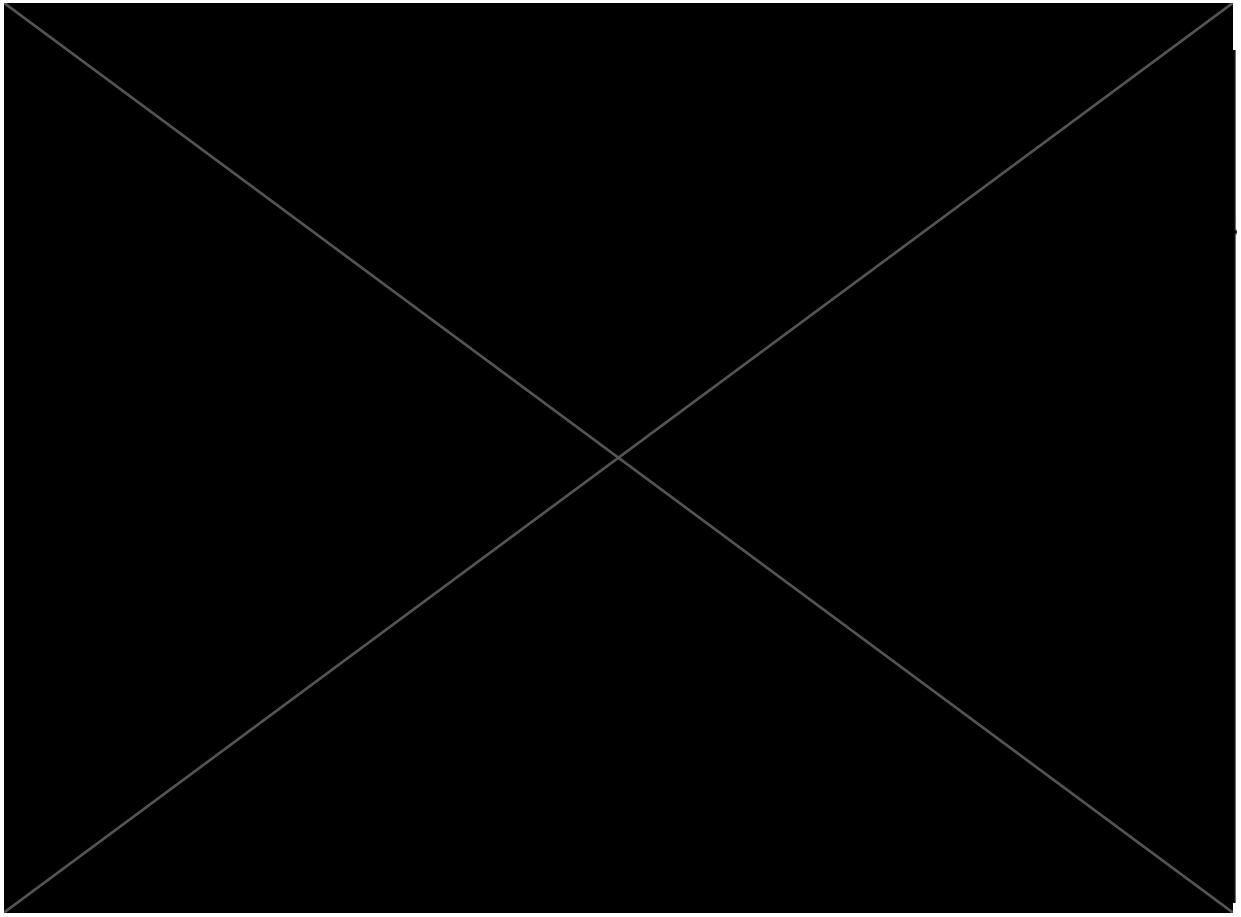


Fig. 2 Water birds survey route around the lake on August 6-8, 2020 (Yellow star - Houbara Bustard observation, N 40029’57,6”, E 064031’28,9”)

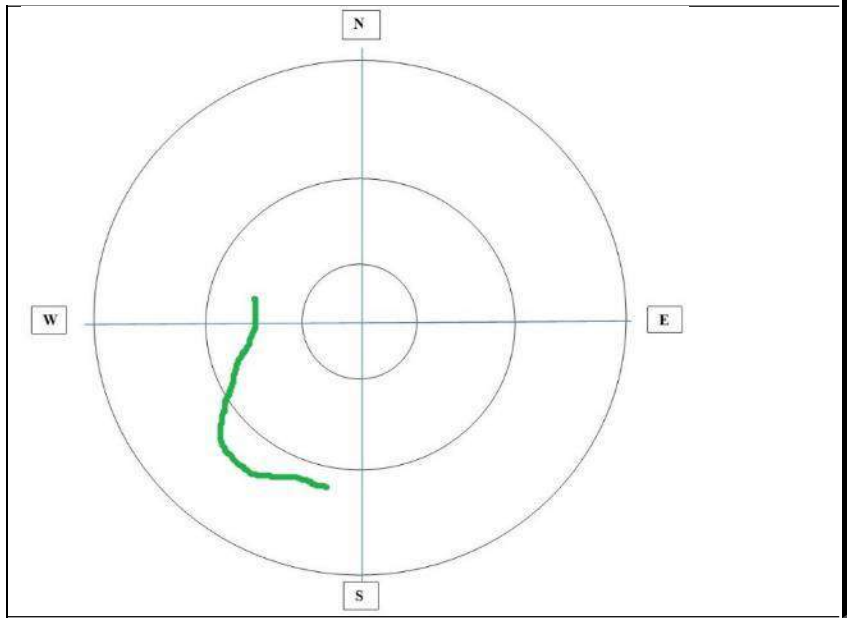
Table 8 Results of water bird observations on Agitma lake shore in August

№	Latin name	English name	Number	IUCN status	Uzbekistan Red Book status	Nature of stay
1.	*Phalacrocorax carbo*	Great Cormorant	4	LC	-	**NMW**
2.	*Phalacrocorax pygmaeus*	Pygmy Cormorant	36	LC	3 (NT)	**NMW**
3.	*Ardea cinerea*	Grey Heron	2	LC	-	**NMW**
4.	*Ardea purpurea*	Purple Heron	5	LC	-	**NM**
5.	*Falco naumanni*	Lesser Kestrel	3	LC	3 (NT)	**NM**
6.	*Neophron percnopterus*	Egyptian Vulture	1	EN	2 (VU:D)	**NMW**
7.	*Haliaeetus albicilla*	White-tailed-Eagle	1	LC	2 (VU:R)	**NMW**
8.	*Circus aeruginosus*	Marsh-Harrier	15	LC	-	**NMW**
9.	*Pelecanus onocrotalus*	Great White Pelican	48	LC	2 (VU:D)	**NMW**
10.	*Tadorna ferruginea*	Ruddy Shelduck	120	LC	-	**NMW**
11.	*Tadorna tadorna*	Common Shelduck	14	LC	-	**NMW**
12.	*Cygnus olor*	Mute Swan	124	LC	3 (NT)	**NMW**
13.	*Anas platyrhynchos*	Mallard	80	LC	-	**NMW**
14.	*Anas clypeata*	Northern Shoveler	360	LC	-	**NMW**
15.	*Anas strepera*	Gadwall	1580	LC	-	**NMW**
16.	*Circus aeruginosus*	Marsh Harrier	18	LC	-	**NMW**
17.	*Phasianus colchicus*	Common Pheasant	2 (voice)	LC	-	**R**
18.	*Fulica atra*	Common Coot	1270	LC	-	**NMW**
19.	*Phalaropus lobatus*	Red-necked Phalarope	60	LC		**MS**
20.	*Philomachus pugnax*	Ruff	12	LC		**MS**
21.	*Calidris minuta*	Little Stint	6	LC		**MS**
22.	*Chlamydotis undulata*	Houbara Bustard	1	VU	2 (VU:D)	**NM**
23.	*Charadrius alexandrinus*	Kentish Plover	80	LC		**NM**
24.	*Charadrius leschenaultii*	Sand Plover	26	LC	-	**NMS**

25.	*Vanellochettusia leucura*	White-tailed Plover	24	LC		**NM**
26.	*Himantopus himantopus*	Black-Winged Stilt	160	LC	-	**NM**
27.	*Tringa glareola*	Wood Sandpiper	2	LC	-	**MS**
28.	*Phalaropus lobatus*	Red-necked Phalarope	32	LC	-	**MS**
29.	*Glareola pratincola*	European Collared Pratincole	32	LC		**NMW**
30.	*Larus ridibundus*	Black-Headed Gull	78	LC	-	**NMW**
31.	*Larus cachinnans*	Yellow-legged (Caspian) Gull	34	LC	-	**NMW**
32.	*Larus genei*	Slender-Billed Gull	5	LC	-	**NM**
33.	*Sterna hirundo*	Common Tern	38	LC	-	**NM**
34.	*Athene noctua*	Little Owl	2	LC	-	**R**
35.	*Apus apus*	Northern Swift	3	LC	-	**NM**
36.	*Coracias garrulus*	Eurasian Roller	6	-	-	**NM**
37.	*Merops superciliosus*	Blue-cheeked Bee-eaterr	240	LC	-	**NMW**
38.	*Riparia riparia*	Sand Martin	28	LC	-	**NM**
39.	*Hirundo rustica*	Barn Swallow	180	LC	-	**NM**
40.	*Galerida cristata*	Crested Lark	46	LC	-	**R**
41.	*Calandrella rufescens*	Lesser Short-toed Lark	120	LC	-	**NMW**
42.	*Motacilla flava*	Yellow Wagtail	8	LC	-	**M**
43.	*Motacilla alba*	White Wagtail	20	LC	-	**MW**

Note: *R – residens, W – wintering, M – migrant, N – Nesting, S – Summer visitor*

All the bird species met on this transect are included in this Table.



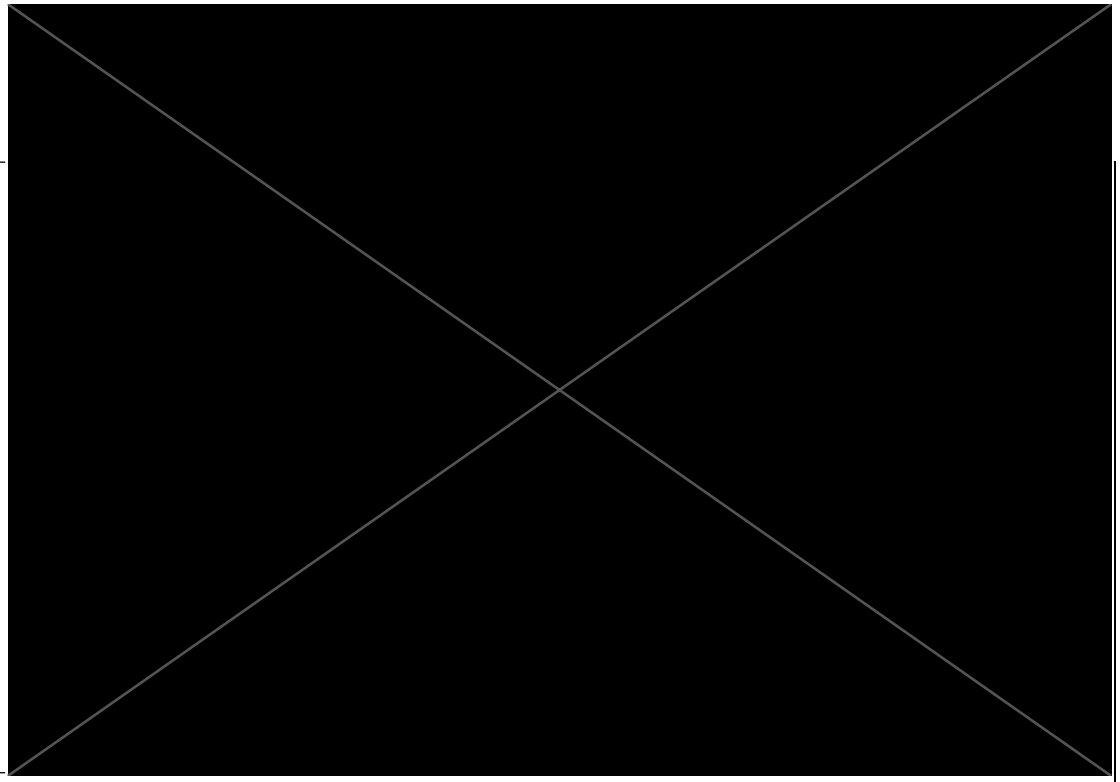


Fig. 3 Houbara Bustard observation, [redacted]

The Houbara Bustard was encountered during a waterfowl survey on the Southwest side of the lake, outside the project territory of planned wind farm. During our spring survey, a pair of bustards were also found on this side of the lake.

We observed Houbara Bustard from our car. At the sight of the car the bird did not fly away, but started to run away from us (Fig. 3). The area was overgrown with camel thorn *(Alhagi pseudoalhagi)* about half a meter high or even higher (Fig. 4-7), so we lost sight of Houbara Bustard after it ran about 300 meters. After the bird was gone we began to look around the area and watch more closely in the hope that we would meet another one, but there wasn't any.

It should be also noted that according to the head of the inspection of this territory, Houbara Bustards live mostly on the western and southwestern sides of the lake, which is less affected by humans.

	
[redacted]	[redacted]

	
[redacted]	[redacted]
[redacted]	

SPECIALIZED RAPTOR NEST SURVEY

The cliffs that border the Lake Agitma basin, that lie immediately west of the NBWEP area, extending from the northern to the southern limits of the area, are the most likely area in which a variety of raptor species are likely to nest within the project's larger area of influence.

The purpose of our specialized raptor nest survey on August 5-6, 2020 was to explore the cliffs in search of nesting sites for birds of prey including old world vultures, falcons, and all hawks, eagles, buzzards, kites, and harriers.

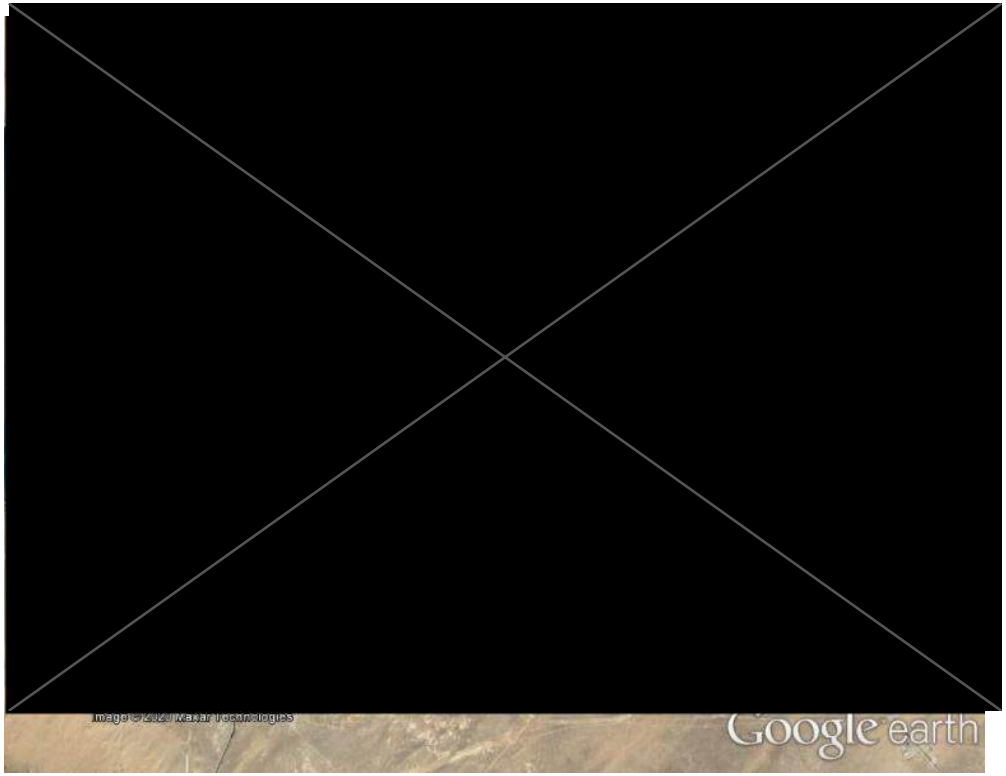


Fig. 8 Raptor nest survey on August 5-6, 2020 transects

The height of the cliffs is about 25-40 meters, so they offer a very good overview of the lake what can be used by raptors for hunting. The cliffs have many indentions and provide a lot of cavities, cracks, and gouges, where birds of prey could nest.

The weather was partly cloudy and windy. The morning temperature was 22-24°C; the afternoon temperature was 32-36 °C.

As a result of a thorough examination of the cliffs we found 4 nests of large birds of prey (Fig. 9-10). By our arrival, all the nests were already empty and no birds or fledglings were found on or near the nests. But there were obvious signs that these nests had been used this breeding season, such as excrements and bones. All the found nests were in excellent condition and located in crevices of the rocks, the gullies and depressions of the cliffs.

In addition to these nests, we obsereved a pair of Northern Eagle Owls flying out of one of the crevices. There is a possibility that they had a nest in the crevice because we noticed many raptors' food debris. Besides, we found a dead Northern Eagle Owls fledgling in one of the crevices nearby (Fig. 11).

We observed a variety of raptors while examining the cliffs, such as Egyptian Vulture, Imperial Eagle, Common Kestrel, Steppe Eagle, Northern Eagle Owl (see Table 9). We also regularly met Little Owls on this territory which probably also nests here (Fig. 12). Marsh-Harrier was also regularly seen near the lake shore.

Near the nesting place of birds of prey, pigeon gatherings (more than 200 individuals) arrive for the night. There is also a colony of Blue-cheeked Bee-eaterrs on the cliffs above the collecting chanal. Pigeons, Blue-cheeked Bee-eaterrs as well as water birds from the lake serve as food for birds of prey.

In the upper part of the plateau there are colonies of rodents such as Great Gerbil, yellow gopher, jerboa, - food base of raptors (Table 10). Besides, birds of prey also hunt reptiles on this territory: turtles, Turkestan and steppe Agamas, geckos, toad-headed Agamas, etc.

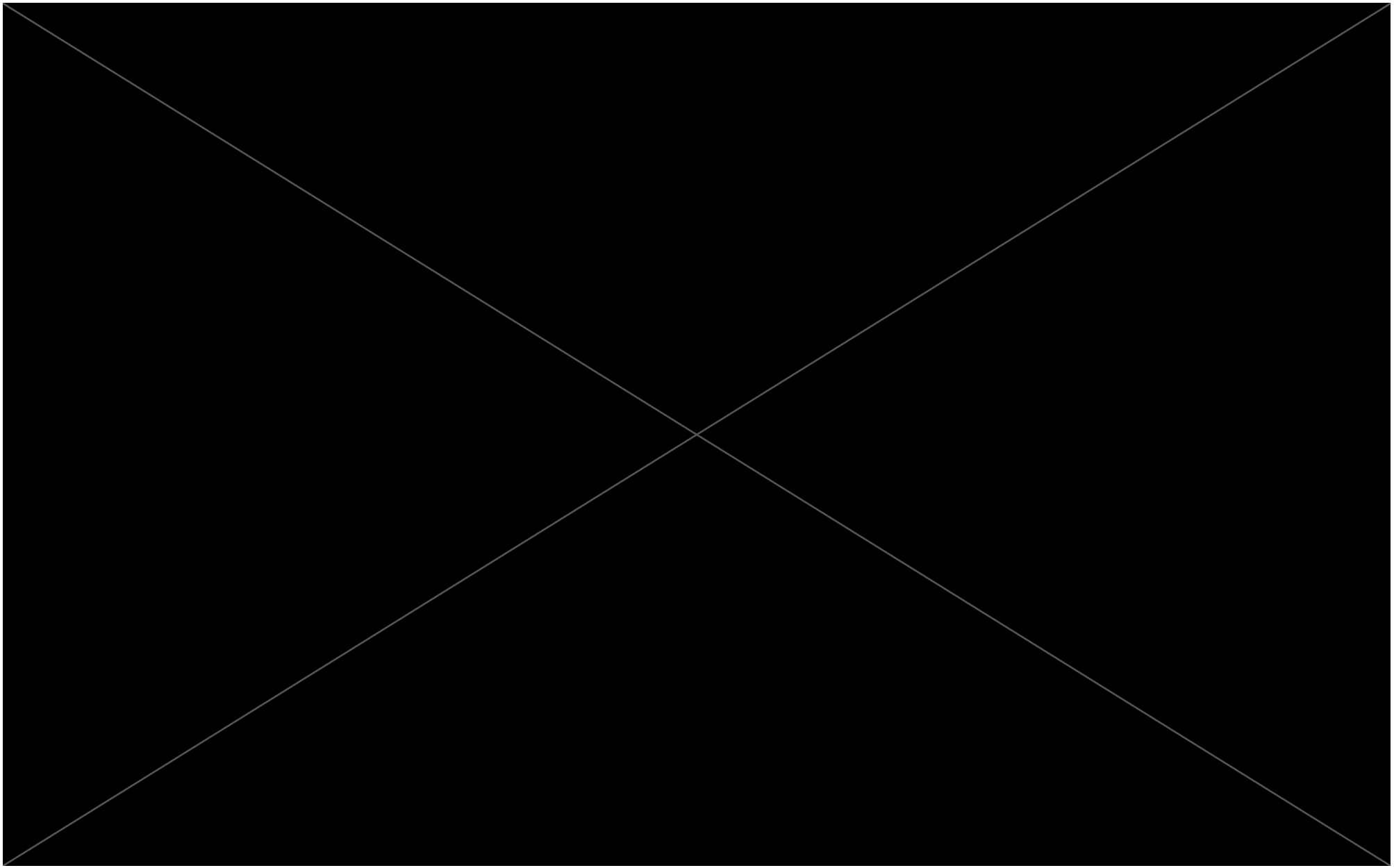
Table 9 List of birds encountered during raptors nests survey on August, 5-6

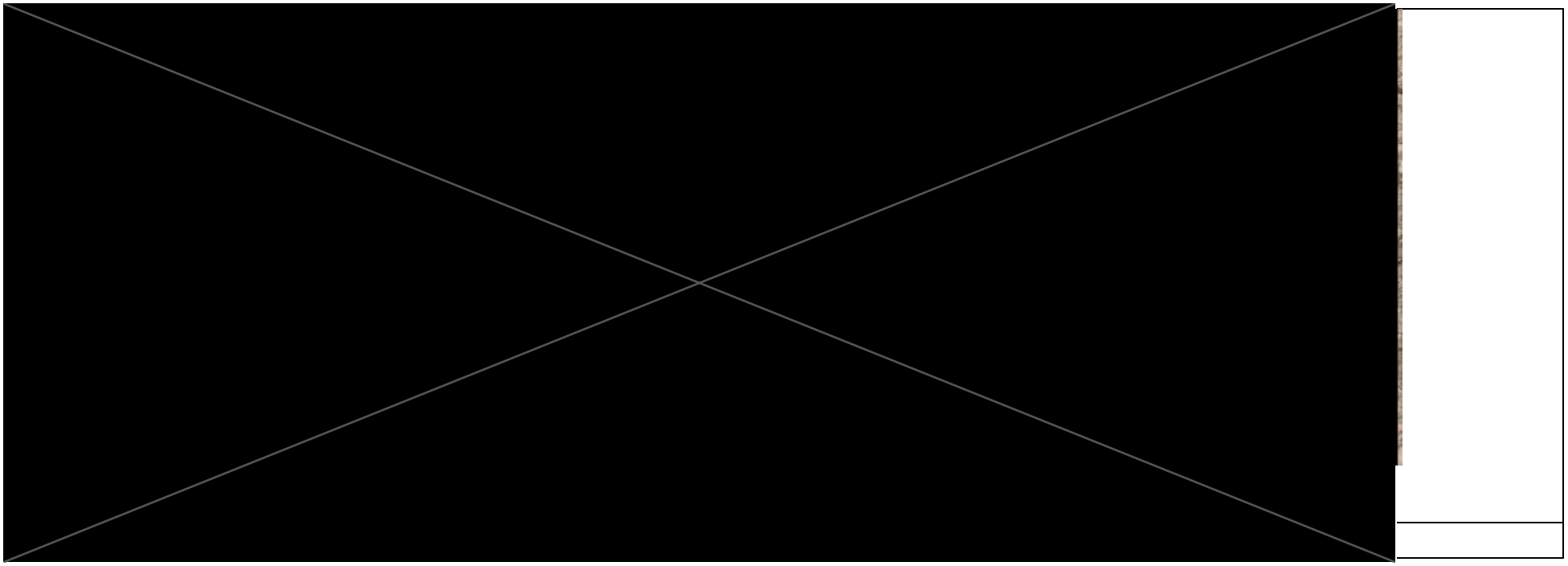
№	Latin name	English name	Number	IUCN status	Uzbekistan Red Book status	Nature of stay
44.	*Aquila heliaca*	Imperial Eagle	1,1	VU	2 (VU:D)	**NMS**
45.	*Aquila nipalensis*	Steppe Eagle	2	EN	2 (VU:D)	**NMW**
46.	*Neophron percnopterus*	Egyptian Vulture	3	EN	2 (VU:D)	**NMW**
47.	*Falco tinnunculus*	Common Kestrel	3	LC	-	**NMW**
48.	*Circus aeruginosus*	Marsh-Harrier	2	LC	-	**NMW**
49.	*Tadorna ferruginea*	Ruddy Shelduck	2	LC	-	**NMW**
50.	*Charadrius alexandrinus*	Kentish Plover	44	LC		**NM**
51.	*Bubo bubo*	Northern Eagle Owl	2 ad + 1 dead fledgling	LC	-	**R**
52.	*Athene noctua*	Little Owl	3	LC	-	**R**
53.	*Columba livia*	Pigeon	80	LC	-	**R**
54.	*Pterocles orientalis*	Black-bellied Sandgrouse	2,13	LC	-	**NMW**
55.	*Merops superciliosus*	Blue-cheeked Bee-eaterr	40	LC	-	**NMW**
56.	*Hirundo rustica*	Barn Swallow	72	LC	-	**NM**
57.	*Galerida cristata*	Crested Lark	24	LC	-	**R**
58.	*Calandrella rufescens*	Lesser Short-toed Lark	87	LC	-	**NMW**
59.	*Oenanthe isabellina*	Isabelline Wheatear	6	LC	-	**NM**

Note: *R – residens, W – wintering, M – migrant, N – Nesting, S – Summer visitor*

Table 10 Mammals encountered during raptors nests survey on August, 5-6

№	Latin name	English name	Number	IUCN status	Uzbekistan Red Book status
1.	*Lepus capensis tolai*	Tolai Hare	2	LC	-
2.	*Rhombomys opimus*	Great Gerbil	11	LC	-
3.	*Vulpes vulpes*	Red Fox	2	LC	-
4.	*Gazella subgutturosa*	Goitered Gazelle	1	VU	2 (VU:D)
5.	*Spermophilopsis Leptodactylus*	Large Souslik, Large-toothed souslik, Yellow ground squirrel	3		-
6.	*Spermophilus fulvus*	Large Souslik, Large-toothed souslik, Yellow ground squirrel	4		-
7.	*Hemiechinus auritus*	Long-eared Hedgehog	2		-
8.	*Ellobius tancrei*	Zaisan Mole Vole	3 colonies		-





CONCLUSIONS AND RECCOMENDATIONS

As there are no wind farms in Uzbekistan yet, it is the first bird survey within the context of wind farm project aimed to determine the risk of bird collision with wind turbines. These observations were carried out to address the possible consequences of the construction of a wind farm, such as collisions and/or death from impacts on the blades or turbine structures, and will determine the extent to which these risks can cause significant negative consequences for birds in the immediate vicinity of wind turbines.

Birds of prey

Considering the risks to birds from wind turbines, cliffs and ledges on the South-Western side of the Agitma lake were examined in search of nests of large birds of prey. This is an area outside the project area. However, birds of prey could fly into the project area while searching for food and for various other reasons, thus they may be at risk of colliding with wind farm structures. The danger is increased by the fact that presence of nests of rare and threatened species near a wind farm means that inexperienced young birds would fly on the project territory.

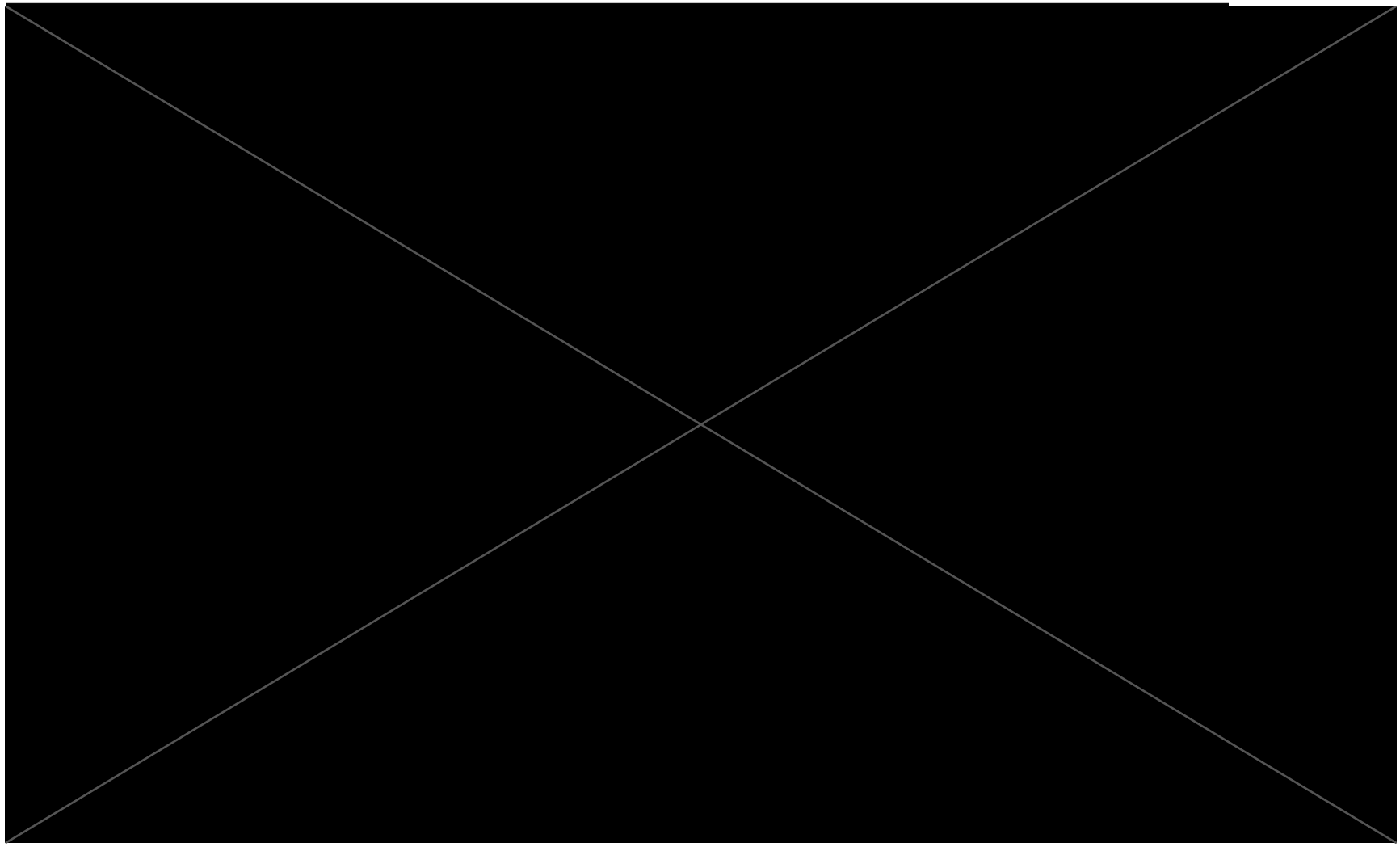
Cliffs suitable for nesting, providing both shelter and safety for large birds of prey such as *Neophron percnopterus, Aquila nipalensis* are located on the cliffs along the “chinks”. There were 4 large predator nests, but by the time of the survey, all the nests were empty, and the birds had probably already bred their offspring. We met a pair of adult Northern Eagle Owls *Bubo bubo* that flew out of a cave, and about 1 km north of this place we found a dead Northern Eagle Owl fledgling. *Bubo bubo* and *Athene noctua* nest in this area, for this there are many crevices and niches among the cliffs and the food supply is quite rich due to the presence of lake. Where adult Northern Eagle Owls flew out of a cave, we found a lot of leftover food.

The species that utilized some of the nests discovered during this survey could not be determined, potentially because the nesting season was already complete. As a result, our understanding of the species and number of active nests of raptors and vulture whose home ranges may overlap the Project area is limited for the 2020 breeding season. These surveys are secondary in importance to the Vantage Surveys for determining the level of collision risk

for target bird species, including raptors and vultures whose breeding home ranges may overlap the Project area. Nonetheless, they provide an important complement to the VP surveys, as breeding populations may be regarded as more sensitive, and exposed to a greater degree of collision risk, than migratory populations. Hence, ***it would be beneficial to repeat the effort in the 2021 breeding season, if possible*.**

It must be taken into account that during a thorough survey of the cliffs near lake Agitma in Spring 2018[2], the nests of the following birds of prey were discovered: Long-Legged Buzzard *Buteo rufinus*; Egyptian Vulture *Neophron percnopterus*; Saker Falcon *Falco cherrug*, Golden Eagle *Aquila chrysaetos (Fig. 13)*.

[2] The Practice of Identifying a Nesting Biotope for Raptors in the Central Part of the Kyzylkum Desert Using the GIS Technology, Ten A.G., Soldatov V.A., Birds of prey and their protection (Pernatyye khishchniki i ikh okhrana) 2019, 39 DOI: 10.19074/1814-8654-2019-39-34-42



[redacted]

Houbara Bustard

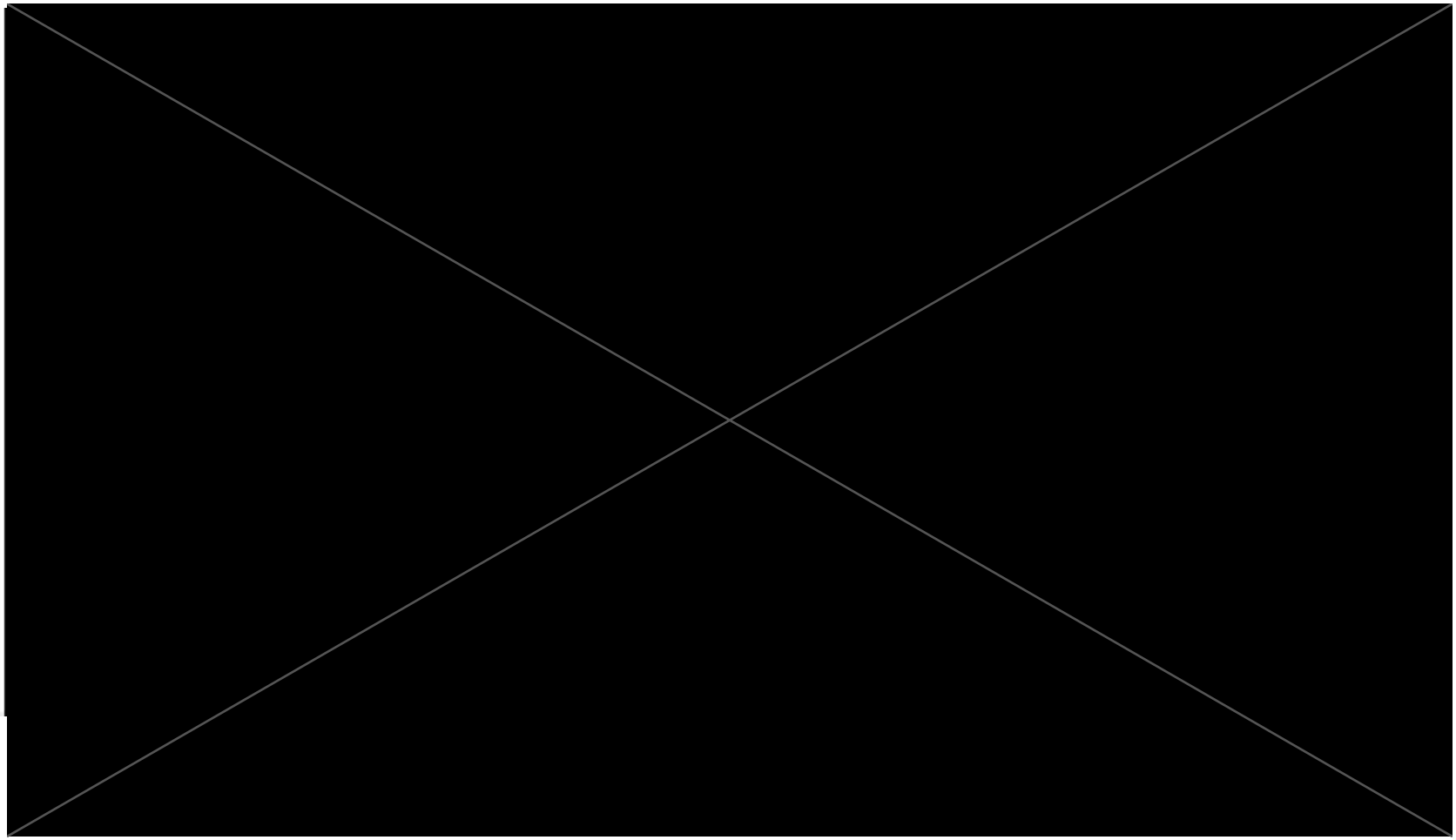
The Navoi Bash is located in the research area of the scientific group of the University of East-Anglia UK (led by dr. John Burnside), which surveys were founded by Ahmed bin Zayed Charitable Foundation. From their survey, it is known that project area of Navoi Bash is important for nesting and migration of Asian Houbara (Burnside et al., 2017, 2020). During the breeding season (mid March– mid May) displaying males are conspicuous and can be apparent from long distances. In summer hovever, Houbara Bustards are very shy and therefore difficult to see.

Although we observed Houbara Bustard only near Agitma lake (not on the project area itself) during summer survey, there are a number of studies that indicate the presence of Houbara Bustard in this region. Houbara Bustard breeding program is being implementing in Uzbekistan by *Emirates Center for the Conservation of Houbara*[4] located in Navoi and Bukhara regions. From two nurseries operating since 2006, 16.32 thousand birds were released into the wild. In August 2020 itself more than 2.3 thousand bustards were released into the wild in Uzbekistan. Agitma lake and our project territory are covered by Houbara Bustard breeding program.

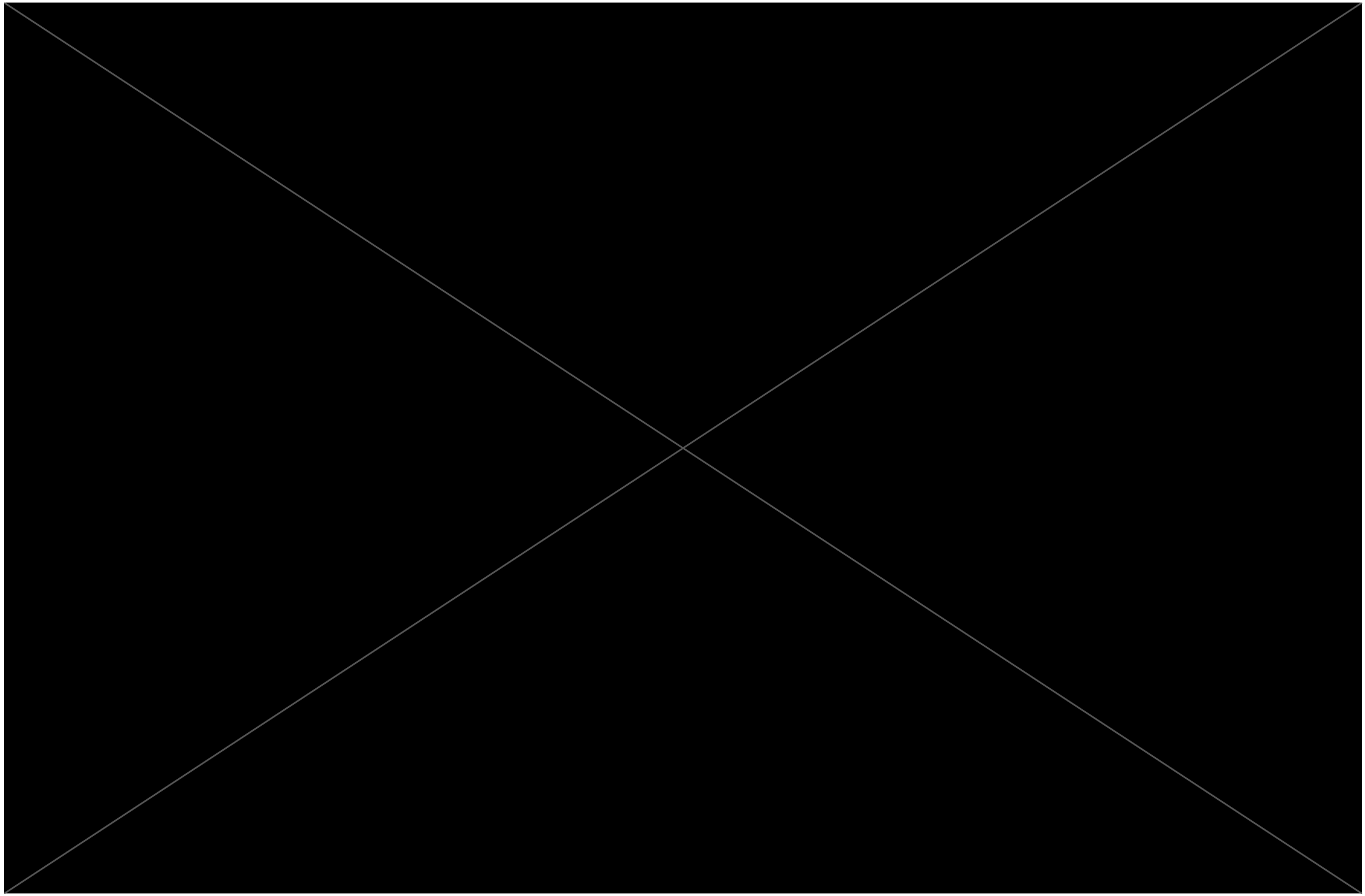
In the research[5] of the powerline mortalities of Houbara Bustards (Robert J. Burnside et al 2015), as it can be seen from the Figure 13, some dead Houbara Bustards was found under power lines on the Navoi Bash WF project territory.

[4] https://www.sustainablehoubaramanagement.org/

[5] Avian powerline mortalities, including Asian Houbaras Chlamydotis macqueenii, on the Central Asian flyway in Uzbekistan, ROBERT J BURNSIDE, NIGEL J COLLAR, MAXIM A KOSHKIN & PAUL M DOLMAN, Sandgrouse 37 (2015)



6 [redacted]



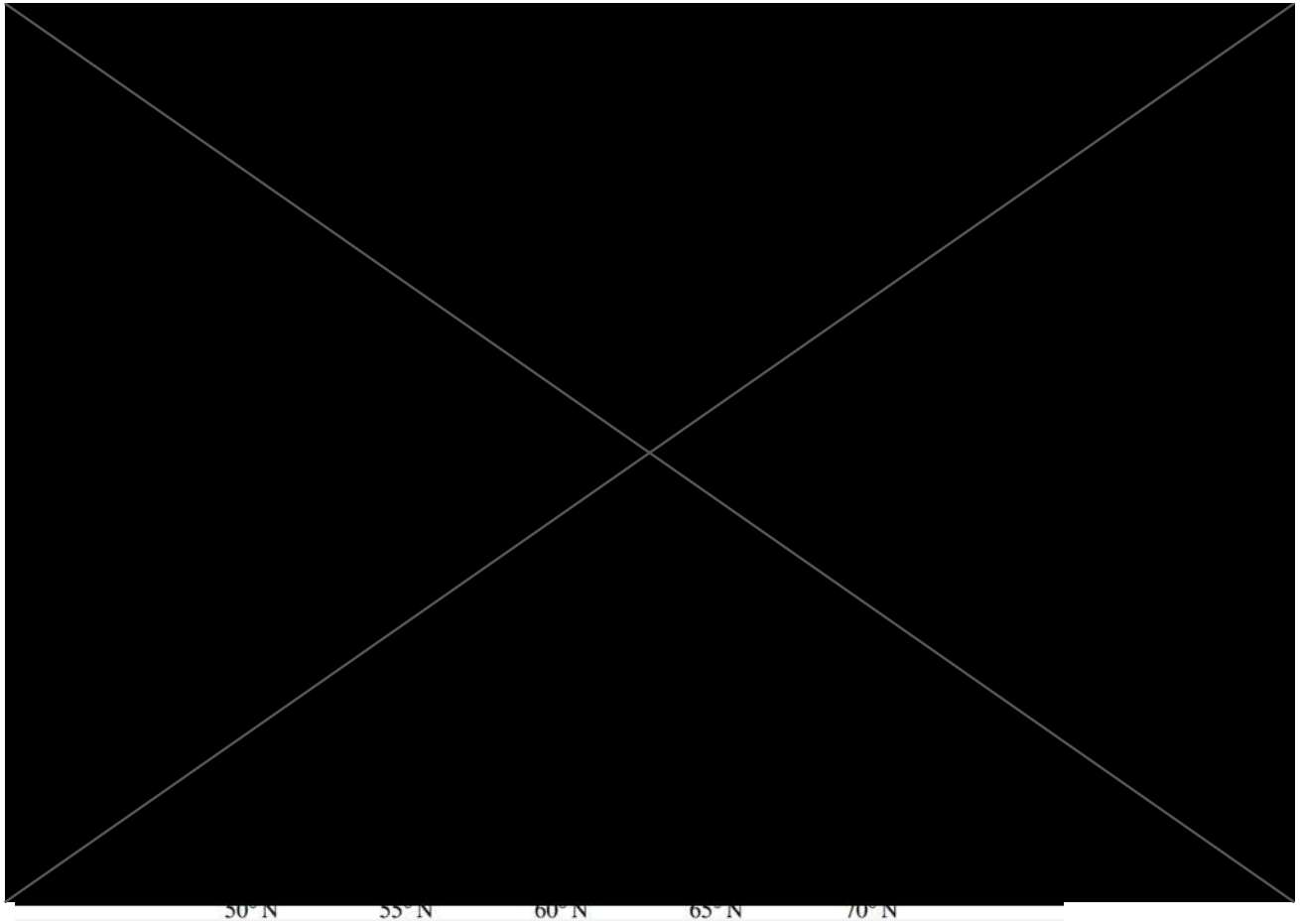


Fig. 16 Migration routes used by wild Asian houbara adults from three different breeding populations in Uzbekistan[10]

[10] Releases of Asian houbara must respect genetic and geographic origin to preserve inherited migration behaviour: evidence from a translocation experiment, Robert J. Burnside, Claire Buchan, Daniel Salliss, Nigel J. Collar and Paul M. Dolman, © 2020 The Authors. Published by the Royal Society under the terms of the Creative Commons Attribution License, 2020

Recomendations

The area where it is planned to build a wind farm in Navoi region is an ecologically important area for resident (local) and migratory birds, because the territory of the proposed project is located within one of the main flyways in Central Asia - **the Central Asian Flyway**. The various studies of diurnal migrations revealed that stops during bird migrations are mainly found on the banks of rivers and lakes, in mountain gorges, in valleys, etc. Ayakagitma lake located near the project area attracts migratory waterfowl and birds of prey.

Lake Ayakagitma is classified as a key ornithological area (IBA[11]) in Uzbekistan and Central Asia, and is included in the international bird database (IBA UZ051 Lake Ayakagytma). As the lake does not freeze and provides rich feeding, it is very important for passage and wintering waterbirds. The aerial inventory by IWC 10 January 2000 recorded 23 231 waterfowl (Atadjanov et al 2001). The vast saline marshlands stretching along the shores of the lake attract wading birds, particularly Whimbrel *Numenius phaeopus*, Eurasian Curlew *N. arquata*, Pied Avocet *Recurvirostra avosetta*, Eurasian Oystercatcher *Haematopus ostralegus* and Glossy Ibis *Plegadis falcinellus*. Breeding species include Western Greylag Goose *Anser a. anser*, Western Marsh Harrier *Circus aeruginosus*, Mute Swan *Cygnus olor*, Grey Heron *Ardea cinerea*, Red-crested Pochard *Netta rufina*, Mallard *Anas platyrhynchos*, Northern Pintail *Anas acuta* and several species of terns, gulls and waders. Macqueen's Bustard *Chlamydotis macqueenii*, Greater Sand Plover *Charadrius leschenaultii* and Caspian Plover *C. asiaticus* nest in the desert. The loess cliffs fringing the Ayakaghytma depression are excellent places for breeding birds of prey, particularly Egyptian Vulture *Neophron percnopterus*, Saker Falcon *Falco cherrug*, Common Kestrel *Falco tinnunculus* and Eagle Owl *Bubo bubo*. During the 2000–2011 studies, 198 bird species were recorded, of which 25 are classified as rare: 11 on the IUCN Red List and 23 in the Red Data Book of Uzbekistan[12].

---

[11] An Important Bird and Biodiversity Area (IBA) is an area identified using an internationally agreed set of criteria as being globally important for the conservation of bird populations.

[12] Akpetky lakes, Sarykamysh lake, Ayakaghytma lake, and their desert surrounds: three new Important Bird Areas in Uzbekistan, ANNA TEN, ROMAN KASHKAROV, GULARA MATEKOVA, ILIA ZHOLDASOVA & MUKHTOR TURAEV, Sandgrouse 34 (2012)

Observations made during water birds survey on Agitma Lake add some value to the baseline study, as the water birds documented in these surveys are occurring within the Project region, and could, potentially occur in the Project area. However, water birds are known to focus their activity almost entirely on the Lake, and shoreline habitats. The Project area is located at least 1.5 km from the Lake shore, a distance considerably greater than the setback of 500m from lakes and waterbodies typically recommended for windfarms by the International Finance Corporation, hence the results of these surveys are not necessarily indicative of bird collision risk for the project.

Birds by the nature of their stay in the area are divided into resident - living all year round in this area, nomadic – moving in search of food, water and nesting sites, and migratory. Migratory birds or migrants are divided into *wintering birds* that come from the North to winter; *summering birds* that can be met in the summer but do not nest; *nesting birds*; and *migrants* that can be seen only during migration. But in reality, the same species may be in different groups listed above. Of the 460 bird species found in various regions of Uzbekistan, the majority (more than 85%) are migratory species that fly through the territory of Uzbekistan in spring and autumn, the remaining 10- 5% are permanent residents. The bulk of the waterfowl are migrating birds, that fly vast distances from breeding grounds to their wintering grounds.

Migration of birds on the territory of Uzbekistan takes place all year round, bird species come and go, sometimes even individuals of the same species come to replace those that have flown away. Spring and autumn are the migration seasons for most waterfowl, but more birds fly in autumn than in spring. This is due to the addition of fledglings to adults' flocks. In this regard, ***we suggest that more observations during the autumn period must be conducted around Ayakagytma lake.***

During migration and flights, birds often fly at night and of course they fly over the project area also, as a result they are not included in the list of birds encountered during day-time observations at VPs. Ducks and geese are known to feed in one place and rest in another, and often fly early in the morning and late in the evening, when observations at VPs on the project area are not carried out. On the lake, birds are sometimes disturbed by fishermen and birds have to move from one place to another and large species such as pelicans, cormorants, geese, swans, and flamingos do not stay long on this reservoir. Therefore, ***we suggest conducting observations on the project territory early in***

the morning and at dusk also, which we did not take into account and missed during the spring and summer surveys. Analysis of the collected information will reveal gaps in the available data that need to be filled with additional observations.

Conclusions

Although the final conclusions and significance of the baseline survey results cannot be addressed until the entire survey effort is complete, some preliminary observations and interpretations regarding the significance of the baseline survey results regarding the nature and intensity of bird risk issues associated with the NBWEP can now be offered, based on the first 6 months of the baseline bird survey effort. These observations are summarized below.

1) Overall, the survey results contain a preliminary indication of a low level of collision risk for target bird species during the summer season. It will be possible to refine the interpretation of summertime collision risk once collision risk modeling is completed. It will also be possible to refine the overall, year-round risk level once the full baseline survey effort is completed and results are analyzed.

2) Water bird risk at the Project appears low during the summer season, reflected by very little water bird flight activity, as recorded during the Vantage Point surveys.

3) There is still no firm basis to interpret the potential level of risk at the Project for Houbara Bustards and Sociable Lapwings, pending the completion of specialized baseline survey elements for these taxa during Autumn migration period.

Appendix 1. Weather conditions during VP Summer surveys

Table 11. Weather conditions and visibility in May[13]

	VP 1	VP 2	VP 3	VP 4	VP 5	VP 6	VP 7	VP 8	VP 9
16 May							sunny, 3-5 m/s	sunny, 3-5 m/s	sunny, 3-5m/s
17 May	sunny, 6-8m/s	sunny, 3-5 m/s	sunny, 3-5 m/s						
18 May			changeable weather, 3-5 m/s				sunny, 5-7 m/s		sunny, 3-5 m/s
22 May						sunny, 3-5 m/s	sunny, 5-7 m/s		changeable weather, 3-5 m/s
23 May			sunny, 3-5 m/s					sunny, 3-5 m/s	sunny, 3-5 m/s
24 May								sunny, 4-6 m/s	sunny, 3-5 m/s
25 May	changeable weather, 3-5 m/s	sunny, 3-5 m/s	sunny, 3-5 m/s						
26May				sunny, 3-5 m/s	sunny, 3-5m/s	changeable weather, 3-5 m/s			
27 May	changeable weather, 3-5 m/s	sunny, 4-6 m/s	sunny, 3-5 m/s						

[13] Green color means good visibility, yellow-average visibility

28 May							**sunny, 3-5 m/s**	**sunny, 3-5 m/s**	**sunny, 3-5 m/s**
29May				**changeable weather, 5-7m/s**	**sunny, 3-5 m/s**	**sunny, 3-6 m/s**			
30 May	**sunny, 3-6 m/s**	**sunny, 3-5 m/s**	**sunny, 3-5 m/s**						
31 May						**sunny, 4-5 m/s**	**sunny, 3-5 m/s**	**sunny, 6-8 m/s**	

Table 12 Weather conditions and visibility in June

	VP 1	VP 2	VP 3	VP 4	VP 5	VP 6	VP 7	VP 8	VP 9
1 June				sunny, 3-4 m/s	sunny, 3-4 m/s	sunny, 3-5m/s			
2 June							sunny, 5-6 m/s	sunny, 2-3 m/s	sunny, 3-5 m/s
3 June	sunny 5-6 m/s	sunny 6-8 m/s	sunny 6-8 m/s						
4 June							sunny 3-4 m/s	sunny, 2-3 m/s	sunny, 3-4 m/s
5 June				sunny, 6-8 m/s	sunny, 3-6 m/s	sunny, 4-5 m/s			
6 June	sunny, 8-10 m/s	sunny, 6-8 m/s	sunny, , 6-8 m/s						
7 June						sunny, 6-4 m/s	sunny, 3-7 m/s		sunny, ws 6-8 m/s
10 June				sunny, 4-5 m/s	sunny, 3-4 m/s			sunny, 5-7 m/s	
11 June	sunny, 9-12 m/s	sunny, 6-8 m/s	sunny, 6-8 m/s						
12 June							sunny, 4-5 m/s	sunny, 4-5 m/s	sunny, 5-6 m/s
13 June				sunny, 6-8 m/s	sunny, 8-10 m/s	sunny, 6-8 m/s			
14 June	cloudy, 3-5 m/s	sunny 8-10 m/s	sunny, 8-12 m/s						
18 June						cloudy, ws 6-8 m/s		cloudy, 6-8 m/s	
19 June				cloudy, 4-5 m/s	cloudy, 2-5 m/s				
20 June							cloudy, 3-6 m/s		cloudy, ws 6-8 m/s
24 June		sunny 3-5	cloudy, 5-7 m/s						
25 June	cloudy, 5-7 m/s								cloudy, 5-7 m/s

26 June				**cloudy, 3-5 m/s**	**cloudy, 3-4 m/s**				
27 June						**cloudy, 8-12 m/s**		**cloudy, 5-7 m/s**	

Table 13 Weather conditions and visibility in July

	VP 1	VP 2	VP 3	VP 4	VP 5	VP 6	VP 7	VP 8	VP 9
1 July	sunny, 2-3 m/s	sunny, 3-5 m/s							
2 July			sunny, 3-5 m/s	sunny, 1-3 m/s	sunny, 2-3 m/s				
3 July						sunny, 3-5 m/s		sunny, 3-4 m/s	
7 July							sunny, 1-3 m/s		sunny, 4-6 m/s
8 July	sunny, 3-5 m/s	sunny, 3-4 m/s							
9July			sunny, 2-4 m/s	sunny, 5-7 m/s					
14 July					sunny, 3-5 m/s	sunny, 2-4 m/s			
15 July								sunny, 2-4 m/s	sunny, 2-5m/s
16 July	sunny, 2-4m/s						sunny, 2-4 m/s		
22 July		sunny, 3-5 m/s	sunny, 3-5 m/s						

Table 14 Weather conditions and visibility in August

	VP 1	VP 2	VP 3	VP 4	VP 5	VP 6	VP 7	VP 8	VP 9
1 August			**sunny, 2-4 m/s**	**sunny, 3-5 m/s**					
2 August							**sunny, 3-5 m/s**	**sunny, 1-3 m/s**	
3 August					**sunny, 5-6 m/s**	**sunny, 3-5 m/s**			
4 August	**sunny, 1-3 m/s**	**sunny, 3-4 m/s**							**sunny, 2-3 m/s**
5 August			**sunny, 3-5 m/s**	**sunny, 3-4 m/s**					
9 August							**sunny, 2-4 m/s**	**sunny, 5-7 m/s**	
10 August					**sunny, 3-5 m/s**	**sunny, 2-4m/s**			
11 August	**sunny, 2-5 m/s**	**sunny, 2-4 m/s**							**sunny, 2-4 m/s**
12 August			**sunny, 2-4 m/s**	**sunny, 3-5 m/s**	**sunny, 3-5 m/s**				
13 August						**sunny, 3-5 m/s**	**sunny, 5-6 m/s**	**sunny, 2-4 m/s**	

14 August	**sunny, 2-5 m/s**	**sunny, 2-4 m/s**							**sunny, 2-4 m/s**
15 August			**sunny, 2-4 m/s**	**sunny, 3-5 m/s**	**sunny, 3-5 m/s**				
16 August						**sunny, 3-5 m/s**	**sunny, 3-5 m/s**	**sunny, 3-5 m/s**	
17 August	**sunny, 3-5 m/s**	**sunny, 2-4 m/s**							**sunny, 5-6 m/s**
18 August							**sunny, 3-5 m/s**		

Appendix 2. Vantage Point Data Logs

VP survey results in May

VP. 9

Date: 16.05.2020 Start and end time: 8:10 – 11:10
Weather:
The air temperature around 20-23°C is clear.
Wind speed approx. (3-5 m/s) No precipitation

Primary species not found
Table 15. Secondary and other species (VP 9), 16.05.2020

№	Latin names	English names	Amount	Flight altitude
OTHER SPECIES				
1.	*Columba livia*	Rock Dove	30	40
2.	*Galerida cristata*	Crested lark	14	0-15
3.	*Merops supercilios*	Blue-cheeked Bee-eater	35	3-30
4.	*Oenanthe isabellina*	Isabelline wheatear	8	0-10
5.	*Melanocorypha bimaculata*	Bimaculated lark	14	0-15
6.	*Hirundo rustica*	Barn Swallow	40	8-30

VP. 7

Date: 16.05.2020 Start and end time: 11:50 – 14:50
Weather:
The air temperature around 25-29°C is clear.
Wind speed approx. (3-5 m/s) No precipitation

Primary species not found
Table 16. Secondary and other species (VP 7), 16.05.2020

№	Latin names	English names	Amount	Flight altitude
OTHER SPECIES				
1.	*Coracias garrulus*	Eurasian Roller	3	20
2.	*Galerida cristata*	Crested lark	5	0-12
3.	*Hirundo daurica*	Red-rumped swallow	12	25

4.	*Oenanthe isabellina*	Isabelline wheatear	10	0-10
5.	*Pterocles orientalis*	Black-bellied sandgrouse	2	8
6.	*Scotocerca inguieta*	Streaked Scrub Warbler	3	3

VP. 8

Date: 16.05.2020 Start and end time: 15:27 – 18:37
Weather:
The air temperature around 25-28°C is clear.
Wind speed approx. (3-5 m/s) No precipitation

Primary species not found
Table 17. Secondary and other species (VP 8), 16.05.2020

№	Latin names	English names	Amount	Flight altitude
OTHER SPECIES				
1.	*Athene noctua*	Little owl	1	0-2
2.	*Galerida cristata*	Crested lark	17	0-15
3.	*Calandrella rufescens*	Lesser Short-toed Lark	22	0-4
4.	*Oenanthe isabellina*	Isabelline wheatear	8	0-10
5.	*Apus apus*	Northern Swift	15	28
6.	*Rhodospiza obsoleta*	Black-billed Desert Finch	3	2
7.	*Muscicapa striata*	Spotted Flycatcher	2	2

VP. 1

Date:17.05.2020 Start and end time: 07:23 – 10:23
Weather:
The air temperature around 18-20°C is clear.
Wind speed approx. (6-8 m/s) No precipitation

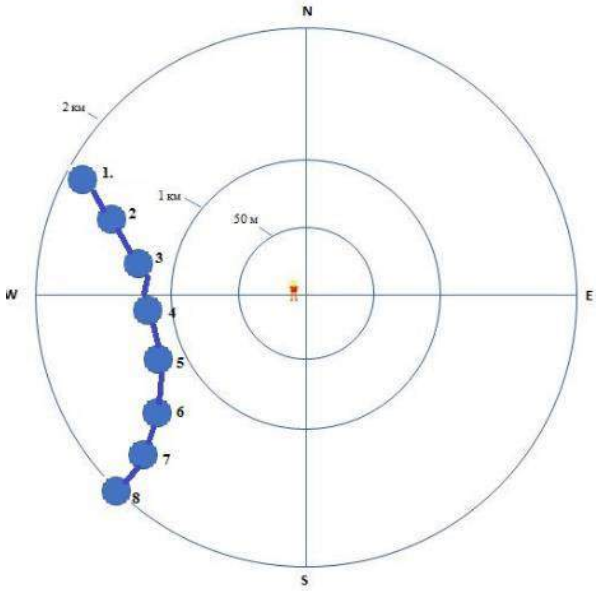


Fig. 17. Flight path (VP 1), 17.05.2020

Table 18. Target species log (VP 1), 17.05.2020

●	*Neophron percnopterus*	1- 50 m	2- 50 m	3- 45 m	4- 50 m	5- 45 m	6- 45 m	7- 45 m	8- 40 m

Table 19. Secondary and other species (VP 1), 17.05.2020

№	Latin names	English names	Amount	Flight altitude
SECONDARY SPECIES				
1.	*Buteo rufinus*	Long-legged Buzzard	1	20
OTHER SPECIES				
2.	*Passer indicus*	Indian House Sparrow	18	0-4
3.	*Galerida cristata*	Crested lark	11	0-15
4.	*Calandrella rufescens*	Lesser Short-toed Lark	18	0-5
5.	*Oenanthe isabellina*	Isabelline wheatear	7	0-10
6.	*Apus apus*	Northern Swift	36	4-15
7.	*Acridotheres tristis*	Indian Myna	5	2-7
8.	*Coracias garrulus*	Eurasian Roller	7	3-15

VP. 2

Date: 17.05.2020 Start and end time: 11:00 – 14:00
Weather:
The air temperature around 25-28°C is clear.
Wind speed approx. (3-5 m/s) No precipitation

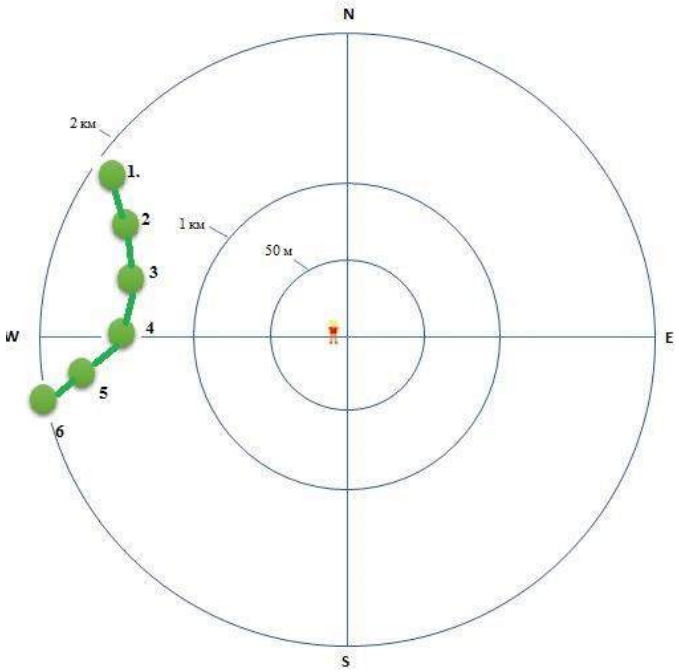


Fig. 18. Flight path (VP 2), 17.05.2020

Table 20 Target species log (VP 2), 17.05.2020

	Neophron percnopterus	1- 90 m	2- 90 m	3- 95 m	4- 90 m	5- 95 m	6- 95 m

Table 21. Secondary and other species (VP 2), 17.05.2020

№	Latin names	English names	Amount	Flight altitude
SECONDARY SPECIES				
1.	*Circus aeruginosus*	Marsh Harrier	1	8
OTHER SPECIES				
2.	*Passer indicus*	Indian House Sparrow	22	0-4
3.	*Merops supercilios*	Blue-cheeked Bee-eater	5	12
4.	*Galerida cristata*	Crested lark	13	0-15
5.	*Oenanthe isabellina*	Isabelline wheatear	2	0-10
6.	*Apus apus*	Northern Swift	6	4-15
7.	*Acridotheres tristis*	Indian Myna	2	2-7
8.	*Coracias garrulus*	Eurasian Roller	5	3-15

VP. 3

Date: 17.05.2020 Start and end time: 14:52 – 17:55
Weather:
The air temperature around 25-28°C is clear.
Wind speed approx. (3-5 m/s) No precipitation

Primary species not found

Table 22. Secondary and other species (VP 9), 17.05.2020

№	Latin names	English names	Amount	Flight altitude
SECONDARY SPECIES				
1.	*Falco tinnunculus*	Kestrel	1	10
OTHER SPECIES				
2.	*Upupa epops*	Hoopoe	1	0-2
3.	*Galerida cristata*	Crested lark	16	0-15
4.	*Calandrella rufescens*	Lesser Short-toed Lark	32	0-5
5.	*Oenanthe isabellina*	Isabelline wheatear	5	0-10
6.	*Apus apus*	Northern Swift	30	4-15
7.	*Acridotheres tristis*	Indian Myna	11	2-7

8.	*Columba livia*	Rock Dove	54	30
9.	*Coracias garrulus*	Eurasian Roller	13	3-15

VP. 7

Date: 18.05.2020 Start and end time: 7:17 – 10:17
Weather:
The air temperature around 28-31°C is clear.
Wind speed approx. (5-7 ms) No precipitation

Primary species not found

Table 23. Secondary and other species (VP 7), 18.05.2020

№	Latin names	English names	Amount	Flight altitude
		SECONDARY SPECIES		
1.	*Buteo rufinus*	Long-legged Buzzard	1	10
		OTHER SPECIES		
2.	*Galerida cristata*	Crested lark	8	0-15
3.	*Oenanthe isabellina*	Isabelline wheatear	2	0-10
4.	*Apus apus*	Northern Swift	40	4-15

VP. 9

Date: 18.05.2020 Start and end time: 11:00 – 14:00
Weather:
The air temperature around 28-32°C is clear.
Wind speed approx. (3-5 m/s) No precipitation

Primary species not found

Table 24. Secondary and other species (VP 9), 18.05.2020

№	Latin names	English names	Amount	Flight altitude
		SECONDARY SPECIES		

1.	*Circus aeruginosus*	Marsh Harrier	1	4
OTHER SPECIES				
2.	*Galerida cristata*	Crested lark	4	0-15
3.	*Columba livia*	Rock Dove	12	12
4.	*Oenanthe isabellina*	Isabelline wheatear	1	0-10

VP. 3

Date: 18.05.2020 Start and end time: 14:52 – 17:55
Weather:
The air temperature around 28-32°C is clear.
Wind speed approx. (3-5 m/s) No precipitation

Primary species not found

Table 25. Secondary and other species (VP 3), 18.05.2020

№	Latin names	English names	Amount	Flight altitude
OTHER SPECIES				
1.	*Rhodospiza obsoleta*	Black-billed Desert Finch	7	3
2.	*Galerida cristata*	Crested lark	5	0-15
3.	*Hirundo rustica*	Barn Swallow	18	5--20
4.	*Oenanthe isabellina*	Isabelline wheatear	6	0-10
5.	*Apus apus*	Northern Swift	25	30
6.	*Corvus monedula*	Jackdaw	2	0-2
7.	*Scotocerca inguieta*	Streaked Scrub Warbler	2	2

VP. 9

Date: 22.05.2020 Start and end time: 7:26 – 10:26
Weather:
The air temperature around 22-25°C is clear.
Wind speed approx. (3-5 m/s) No precipitation

Primary species not found

Table 26. Secondary and other species (VP 9), 22.05.2020

№	Latin names	English names	Amount	Flight altitude
SECONDARY SPECIES				
1.	*Buteo rufinus*	Long-legged Buzzard	1	45
2.	*Falco naumanni* -	Lesser kestrel	1	12
OTHER SPECIES				
3.	*Galerida cristata*	Crested lark	13	0-15
4.	*Oenanthe isabellina*	Isabelline wheatear	7	0-10
5.	*Columba livia*	Rock Dove	26	35
6.	*Hirundo rustica*	Barn Swallow	6	8
7.	*Apus apus*	Northern Swift	36	4-15
8.	*Acridotheres tristis*	Indian Myna	6	2-7
9.	*Coracias garrulus*	Eurasian Roller	8	3-15

VP. 7

Date: 22.05.2020 Start and end time: 11:00 – 14:00
Weather:
The air temperature around 30-32°C is clear.
Wind speed approx. (5-7 m/s) No precipitation

Primary species not found

Table 27. Secondary and other species (VP 7), 22.05.2020

№	Latin names	English names	Amount	Flight altitude
OTHER SPECIES				
1.	*Pterocles orientalis*	Black-bellied sandgrouse	2	5
2.	*Galerida cristata*	Crested lark	6	0-15
3.	*Oenanthe isabellina*	Isabelline wheatear	4	0-10

4.	*Scotocerca inguieta*	Streaked Scrub Warbler	2	2

VP. 6

Date: 22.05.2020 Start and end time: 14:58 – 17:58
Weather:
The air temperature around 30-32°C is clear.
Wind speed approx. (3-5 m/s) No precipitation

Primary species not found

Table 28. Secondary and other species (VP 6), 22.05.2020

№	Latin names	English names	Amount	Flight altitude
		OTHER SPECIES		
1.	*Coracias garrulus*	Eurasian Roller	2	3
2.	*Galerida cristata*	Crested lark	2	0-15
3.	*Hirundo rustica*	Barn Swallow	18	5--20
4.	*Oenanthe isabellina*	Isabelline wheatear	3	0-10
5.	*Apus apus*	Northern Swift	30	30
6.	*Scotocerca inguieta*	Streaked Scrub Warbler	2	2

VP. 9

Date: 23.05.2020 Start and end time: 7:20 – 10:20
Weather:
The air temperature around 23-25°C is clear.
Wind speed approx. (3-5 m/s) No precipitation

Primary species not found

Table 29. Secondary and other species (VP 9), 23.05.2020

№	Latin names	English names	Amount	Flight altitude

OTHER SPECIES				
1.	*Coracias garrulus*	Eurasian Roller	3	5
2.	*Streptopelia decaocto*	Collared Turtle Dove	2	4
3.	*Galerida cristata*	Crested lark	10	0-15
4.	*Hirundo rustica*	Barn Swallow	14	5
5.	*Oenanthe isabellina*	Isabelline wheatear	4	0-10
6.	*Acridotheres tristis*	Indian Myna	4	5
7.	*Scotocerca inguieta*	Streaked Scrub Warbler	4	2

VP. 3

Date: 23.05.2020 Start and end time: 11:00 – 14:00
Weather:
The air temperature around 25-28°C is clear.
Wind speed approx. (3-5 m/s) No precipitation

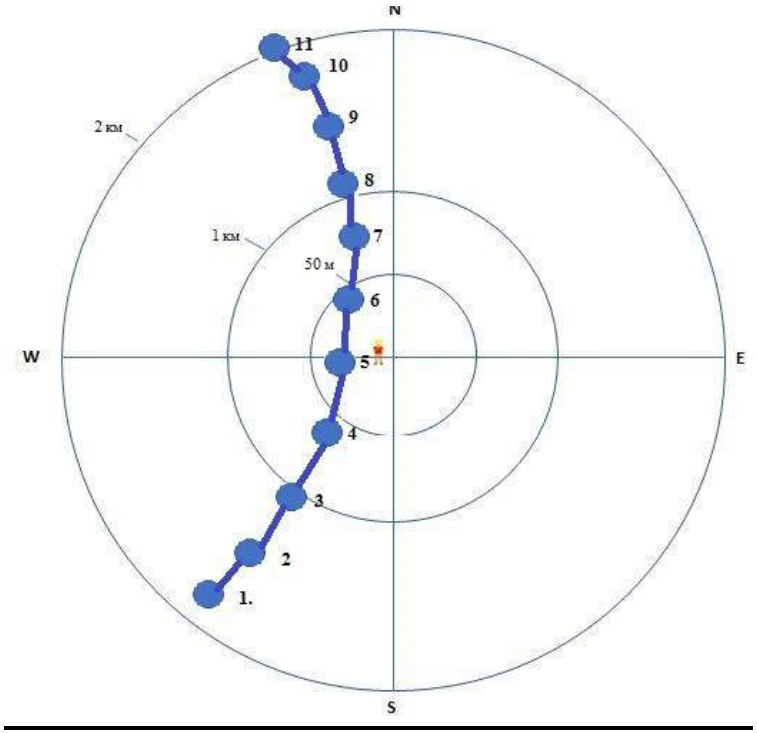


Fig. 19. Flight path (VP 3), 23.05.2020

Table 30. Target species log (VP 3), 23.05.2020

●	*Neophron percnopterus*	1-60 m	2-60 m	3-65 m	4-60 m	5-65 m	6-65 m	7-65 m	8-60 m	9-60 m	10-60 m	11-60 m

Table 31. Secondary and other species (VP 3), 23.05.2020

№	Latin names	English names	Amount	Flight altitude
OTHER SPECIES				
1.	*Coracias garrulus*	Eurasian Roller	3	3
2.	*Galerida cristata*	Crested lark	12	0-15

3.	*Hirundo rustica*	Barn Swallow	30	5--20
4.	*Oenanthe isabellina*	Isabelline wheatear	3	0-10
5.	*Apus apus*	Northern Swift	40	30
6.	*Scotocerca inguieta*	Streaked Scrub Warbler	2	2
7.	*Passer indicus*	Indian House Sparrow	18	2

VP 8

Date: 23/05/2020 Start and end time: 15:52 – 18:52
Weather:
The air temperature around 30-33°C is clear.
Wind speed approx. (3-5 m/s) No precipitation

Primary species not found

Table 32. Secondary and other species (VP 8), 23.05.2020

№	Latin names	English names	Amount	Flight altitude
OTHER SPECIES				
1.	*Lanius pallidirostris*	Southern grey shrike	1	3
2.	*Galerida cristata*	Crested lark	10	0-15
3.	*Hirundo rustica*	Barn Swallow	3	5--20
4.	*Oenanthe isabellina*	Isabelline wheatear	3	0-10
5.	*Apus apus*	Northern Swift	40	30
6.	*Scotocerca inguieta*	Streaked Scrub Warbler	1	2

VP 8

Date: 24/05/2020 Start and end time: 9:23 – 12:23
Weather:
The air temperature around 23-26°C is clear.
Wind speed approx. (4-6 m/s) No precipitation

Primary species not found

Table 33. Secondary and other species (VP 8), 24.05.2020

№	Latin names	English names	Amount	Flight altitude
OTHER SPECIES				
1.	*Galerida cristata*	Crested lark	10	0-15
2.	*Hirundo daurica*	Red-rumped swallow	4	8
3.	*Hirundo rustica*	Barn Swallow	10	5--20
4.	*Oenanthe isabellina*	Isabelline wheatear	2	0-10

VP 9

Date: 24/05/2020 Start and end time: 13:00 – 16:00
Weather:
The air temperature arounччd 30-33°C is clear.
Wind speed approx. (3-5 m/s) No precipitation

Primary species not found

Table 34. Secondary and other species (VP 9), 24.05.2020

№	Latin names	English names	Amount	Flight altitude
SECONDARY SPECIES				
1.	*Circus cyaneus*	Hen (Northern) Harrier	1	6
OTHER SPECIES				
2.	*Galerida cristata*	Crested lark	7	0-15
3.	*Oenanthe isabellina*	Isabelline wheatear	5	0-10
4.	*Columba livia*	Rock Dove	32	35
5.	*Hirundo rustica*	Barn Swallow	21	8
6.	*Coracias garrulus*	Eurasian Roller	8	3-15
7.	*Rhodospiza obsoleta*	Black-billed Desert Finch	3	2
8.	*Muscicapa striata*	Spotted Flycatcher	1	3

9.	*Streptopelia decaocto*	Collared Turtle Dove	4	3

VP. 3

Date: 25.05.2020 Start and end time: 7:56 – 10:56
Weather:
The air temperature around 18-20°C is clear.
Wind speed approx. (3-5 m/s) No precipitation

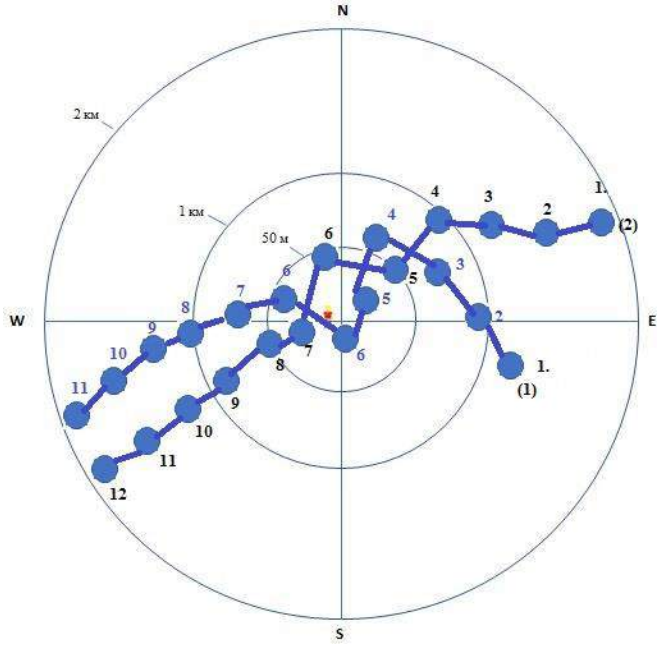


Fig. 20. Flight path (VP 3), 25.05.2020

Table 35. Target species log (VP 3), 25.05.2020

●	*Neophron percnopterus(1)*	1- 0 m	2- 10 m	3- 25 m	4- 30 m	5- 45 m	6- 45 m	7- 45 m	8- 50 m	9- 50 m	10- 45 m	11- 40 m	
●	*Neophron percnopterus(2)*	1- 30 m	2- 30 m	3- 35 m	4- 30 m	5- 45 m	6- 45 m	7- 45 m	8- 50 m	9-50 m	10- 45 m	11- 40 m	12- 45 m

Table 36. Secondary and other species (VP 3), 25.05.2020

№	Latin names	English names	Amount	Flight altitude
SECONDARY SPECIES				
1.	*Falco tinnunculus*	Kestrel	1	15
OTHER SPECIES				
2.	*Galerida cristata*	Crested lark	13	0-15
3.	*Oenanthe isabellina*	Isabelline wheatear	7	0-10
4.	*Columba livia*	Rock Dove	28	35
5.	*Hirundo rustica*	Barn Swallow	30	8
6.	*Apus apus*	Northern Swift	40	4-15
7.	*Nycticorax nycticorax*	Black-crowned night-heron	14	50
8.	*Coracias garrulus*	Eurasian Roller	8	3-15
9.	*Rhodospiza obsoleta*	Black-billed Desert Finch	3	2
10.	*Muscicapa striata*	Spotted Flycatcher	1	3

VP. 1

Date: 25.05.2020 Start and end time: 11:35 – 14:35
Weather:
The air temperature around 22-25°C is clear.
Wind speed approx. (3-5 m/s) No precipitation

Primary species not found

Table 37. Secondary and other species (VP 1), 25.05.2020

№	Latin names	English names	Amount	Flight altitude
OTHER SPECIES				
1.	*Acridotheres tristis*	Indian Myna	5	2
2.	*Galerida cristata*	Crested lark	4	3
3.	*Oenanthe isabellina*	Isabelline wheatear	4	0-10
4.	*Hirundo daurica*	Red-rumped swallow	6	5--15

5.	*Merops supercilios*	Blue-cheeked Bee-eater	6	15

VP. 2

Date: 25.05.2020 Start and end time: 15:03 – 18:03
Weather:
The air temperature around 22-25°C is clear.
Wind speed approx. (3-5 m/s) No precipitation

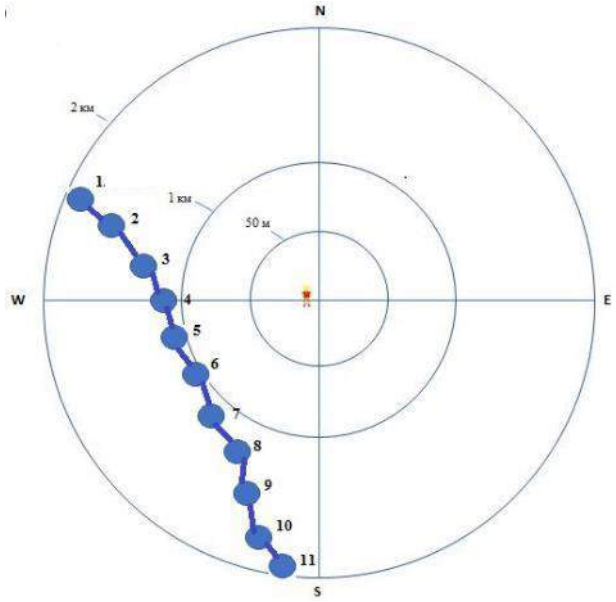


Fig. 21. Flight path (VP 2), 25.05.2020

Table 38. Target species log (VP 2), 25.05.2020

●	*Neophron percnopterus*	1-50m	2-50m	3-50m	4-50m	5-45m	6-45m	7-45m	8-40m	9-40m	10-40m	11-40m

Table 39. Secondary and other species (VP 2), 25.05.2020

№	Latin names	English names	Amount	Flight altitude
		OTHER SPECIES		
6.	*Galerida cristata*	Crested lark	8	0-15
7.	*Oenanthe isabellina*	Isabelline wheatear	4	0-10
8.	*Hirundo daurica*	Red-rumped swallow	6	5--15
9.	*Merops supercilios*	Blue-cheeked Bee-eater	26	15
10.	*Upupa epops*	Hoopoe	1	0-3
11.	*Scotocerca inguieta*	Streaked Scrub Warbler	4	2

VP. 6

Date: 26.05.2020 Start and end time: 8:02 – 11:02
Weather:
The air temperature around 18-23°C is clear.
Wind speed approx. (3-5 m/s) No precipitation

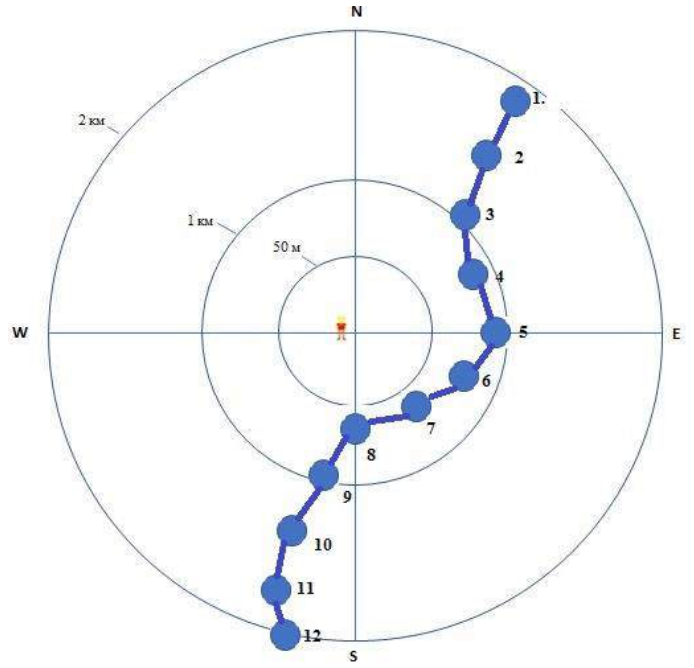


Fig. 22. Flight path (VP 6), 26.05.2020

Table 40. Target species (VP 6), 26.05.2020

●	*Neophron percnopterus*	1-40 m	2-40 m	3-45 m	4-40 m	5-45 m	6-45 m	7-45 m	8-40 m	9-40 m	10-40 m	11-40 m	12-40 m

Table 41. Secondary and other species (VP 6), 26.05.2020

№	Latin names	English names	Amount	Flight altitude
		OTHER SPECIES		
1.	*Rhodospiza obsoleta*	Black-billed Desert Finch	6	3
2.	*Galerida cristata*	Crested lark	10	0-15
3.	*Calandrella rufescens*	Lesser Short-toed Lark	30	4

4.	*Oenanthe isabellina*	Isabelline wheatear	8	0-10

VP. 5

Date: 26.05.2020 Start and end time:11:40 – 14:40
Weather:
The air temperature around 25-28°C is clear.
Wind speed approx. (3-5 m/s) No precipitation

Primary species not found

Table 42. Secondary and other species (VP 5), 26.05.2020

№	Latin names	English names	Amount	Flight altitude
		OTHER SPECIES		
5.	*Alectoris chukar*	Chuckar partridge	4	0
6.	*Galerida cristata*	Crested lark	10	0-15
7.	*Hirundo daurica*	Red-rumped swallow	6	5--15
8.	*Oenanthe isabellina*	Isabelline wheatear	8	0-10
9.	*Corvus monedula*	Jackdaw	5	0-4
10.	*Scotocerca inguieta*	Streaked Scrub Warbler	4	2

VP. 4

Date: 26.05.2020 Start and end time: 15:33 – 18:33
Weather:
The air temperature around 28-32°C is clear.
Wind speed approx. (3-5 m/s) No precipitation

Primary species not found

Table 43. Secondary and other species (VP 4), 26.05.2020

№	Latin names	English names	Amount	Flight altitude
		OTHER SPECIES		

1.	*Rhodospiza obsoleta*	Black-billed Desert Finch	12	3
2.	*Galerida cristata*	Crested lark	4	0-15
3.	*Hirundo daurica*	Red-rumped swallow	15	5--20
4.	*Oenanthe isabellina*	Isabelline wheatear	4	0-10
5.	*Apus apus*	Northern Swift	15	30
6.	*Scotocerca inguieta*	Streaked Scrub Warbler	2	2

VP. 1

Date: 27.05.2020 Start and end time: 7:35 – 10:35
Weather:
The air temperature around 23-25°C is clear.
Wind speed approx. (3-5 m/s) No precipitation

Primary species not found

Table 44. Secondary and other species (VP 1), 27.05.2020

№	Latin names	English names	Amount	Flight altitude
		SECONDARY SPECIES		
1.	*Falco tinnunculus*	Kestrel	1	15
		OTHER SPECIES		
2.	*Hirundo rustica*	Barn Swallow	15	3-16
3.	*Galerida cristata*	Crested lark	12	0-15
4.	*Oenanthe isabellina*	Isabelline wheatear	5	0-10
5.	*Columba livia*	Rock Dove	58	35
6.	*Hirundo rustica*	Barn Swallow	5	8
7.	*Apus apus*	Northern Swift	45	4-15
8.	*Nycticorax nycticorax*	Black-crowned night-heron	14	50
9.	*Coracias garrulus*	Eurasian Roller	2	3-15
10.	*Rhodospiza obsoleta*	Black-billed Desert Finch	3	2
11.	*Muscicapa striata*	Spotted Flycatcher	1	3

VP. 2

Date: 27.05.2020 Start and end time: 11:06 – 14:16
Weather:
The air temperature around 30-32°C is clear.
Wind speed approx. (4-6 ms) No precipitation
Primary species not found

Table 45. Secondary and other species (VP 2), 27.05.2020

№	Latin names	English names	Amount	Flight altitude
		OTHER SPECIES		
8.	*Rhodospiza obsoleta*	Black-billed Desert Finch	8	3
9.	*Galerida cristata*	Crested lark	4	0-15
10.	*Hirundo rustica*	Barn Swallow	15	5--20
11.	*Oenanthe isabellina*	Isabelline wheatear	4	0-10
12.	*Apus apus*	Northern Swift	15	30
13.	*Corvus monedula*	Jackdaw	6	0-2
14.	*Scotocerca inguieta*	Streaked Scrub Warbler	2	2

VP. 3

Date: 27.05.2020 Start and end time: 15:08 – 18:08
Weather:
The air temperature around 30-32°C is clear.
Wind speed approx. (3-5 m/s) No precipitation

Primary species not found

Table 46. Secondary and other species (VP 3), 27.05.2020

№	Latin names	English names	Amount	Flight altitude
		OTHER SPECIES		
5.	*Pterocles orientalis*	Black-bellied sandgrouse	4	8

6.	*Galerida cristata*	Crested lark	9	0-15
7.	*Hirundo rustica*	Barn Swallow	17	5--20
8.	*Oenanthe isabellina*	Isabelline wheatear	4	0-10
9.	*Apus apus*	Northern Swift	27	30
10.	*Lanius pallidirostris*	Southern grey shrike	1	3
11.	*Scotocerca inguieta*	Streaked Scrub Warbler	2	2

VP. 9

Date: 28.05.2020 Start and end time: 8:09 – 11:09
Weather:
The air temperature around 18-20°C is clear.
Wind speed approx. (1-2 m/s) No precipitation

Primary species not found

Table 47. Secondary and other species (VP 9), 28.05.2020

№	Latin names	English names	Amount	Flight altitude
		SECONDARY SPECIES		
1.	*Circus aeruginosus*	Marsh Harrier	1	15
		OTHER SPECIES		
2.	*Galerida cristata*	Crested lark	19	0-15
3.	*Oenanthe isabellina*	Isabelline wheatear	4	0-10
4.	*Merops supercilios*	Blue-cheeked Bee-eaterr	30	20
5.	*Columba livia*	Rock Dove	38	35
6.	*Hirundo rustica*	Barn Swallow	15	8
7.	*Apus apus*	Northern Swift	45	4-15
8.	*Coracias garrulus*	Eurasian Roller	4	3-15
9.	*Rhodospiza obsoleta*	Black-billed Desert Finch	3	2
10.	*Muscicapa striata*	Spotted Flycatcher	1	3

VP. 7

Date: 28.05.2020 Start and end time: 11:56 – 14:56
Weather:
The air temperature around 25-30°C is clear.
Wind speed approx. (3-5 m/s) No precipitation

Primary species not found

Table 48. Secondary and other species (VP 7), 28.05.2020

№	Latin names	English names	Amount	Flight altitude
		OTHER SPECIES		
1.	*Hirundo rustica*	Barn Swallow	5	18
2.	*Galerida cristata*	Crested lark	11	0-15
3.	*Merops supercilios*	Blue-cheeked Bee-eater	20	5--20
4.	*Oenanthe isabellina*	Isabelline wheatear	4	0-10
5.	*Apus apus*	Northern Swift	28	30
6.	*Calandrella rufescens*	Lesser Short-toed Lark	30	0-3
7.	*Scotocerca inguieta*	Streaked Scrub Warbler	2	2

VP. 8

Date: 28.05.2020 Start and end time: 15:30 – 18:30
Weather:
The air temperature around 25-29°C is clear.
Wind speed approx. (3-5 m/s) No precipitation
Primary species not found

Table 49. Secondary and other species (VP 8), 28.05.2020

№	Latin names	English names	Amount	Flight altitude
		OTHER SPECIES		
1.	*Hirundo rustica*	Barn Swallow	5	18
2.	*Galerida cristata*	Crested lark	11	0-15
3.	*Merops supercilios*	Blue-cheeked Bee-eater	20	5--20
4.	*Oenanthe isabellina*	Isabelline wheatear	2	0-10
5.	*Apus apus*	Northern Swift	4	30
6.	*Calandrella rufescens*	Lesser Short-toed Lark	15	0-3
7.	*Scotocerca inguieta*	Streaked Scrub Warbler	1	2
8.	*Emberiza bruniceps*	Red-headed Bunting	1	3

VP. 6

Date: 29.05.2020 Start and end time: 8:17 – 11:17
Weather:
The air temperature around 18-20°C is clear.
Wind speed approx. (3-6 m/s) rainy

Primary species not found
Table 50. Secondary and other species (VP 6), 29.05.2020

№	Latin names	English names	Amount	Flight altitude
		OTHER SPECIES		
1.	*Hirundo rustica*	Barn Swallow	3	20
2.	*Galerida cristata*	Crested lark	5	0-15
3.	*Oenanthe isabellina*	Isabelline wheatear	2	0-10

VP. 5

Date: 29.05.2020 Start and end time: 11:50 – 14:50
Weather:
The air temperature around 18-20°C is clear.
Wind speed approx. (3-5 m/s) No precipitation

Primary species not found
Table 51. Secondary and other species (VP 5), 29.05.2020

№	Latin names	English names	Amount	Flight altitude
		OTHER SPECIES		
1.	*Athene noctua*	Little owl	1	6
2.	*Galerida cristata*	Crested lark	10	0-15
3.	*Hirundo daurica*	Red-rumped swallow	5	10
4.	*Oenanthe isabellina*	Isabelline wheatear	1	0-10
5.	*Coracias garrulus*	Eurasian Roller	3	4
6.	*Calandrella rufescens*	Lesser Short-toed Lark	15	0-3

VP. 4

Date: 29.05.2020 Start and end time: 15:28 – 18:30
Weather:
The air temperature around 23-26°C is clear.
Wind speed approx. (5-7 m/s) No precipitation

Primary species not found

Table 52. Secondary and other species (VP 4), 29.05.2020

№	Latin names	English names	Amount	Flight altitude
		OTHER SPECIES		
1.	*Acridotheres tristis*	Indian Myna	4	5
2.	*Galerida cristata*	Crested lark	15	0-15
3.	*Hirundo daurica*	Red-rumped swallow	6	10
4.	*Oenanthe isabellina*	Isabelline wheatear	1	0-10
5.	*Coracias garrulus*	Eurasian Roller	4	4
6.	*Corvus ruficollis*	Brown-necked Raven	1	0

VP. 1

Date: 30.05.2020 Start and end time: 7:23 – 10:23
Weather:
The air temperature around 18-25°C is clear.
Wind speed approx. (3-6 m/s) No precipitation

Primary species not found
Table 53. Secondary and other species (VP 1), 30.05.2020

№	Latin names	English names	Amount	Flight altitude
		OTHER SPECIES		
1.	*Himantopus himantopus*	Black-Winged Stilt	22	16
2.	*Galerida cristata*	Crested lark	12	0-15
3.	*Hirundo daurica*	Red-rumped swallow	8	10

4.	*Oenanthe isabellina*	Isabelline wheatear	2	0-10
5.	*Passer indicus*	Indian House Sparrow	17	0-4
6.	*Pterocles orientalis*	Black-bellied sandgrouse	2	10

VP. 2

Date: 30.05.2020 Start and end time: 11:00 – 14:00
Weather:
The air temperature around 25-29°C is clear.
Wind speed approx. (3-5 m/s) No precipitation

Primary species not found
Table 54. Secondary and other species (VP 2), 30.05.2020

№	Latin names	English names	Amount	Flight altitude
SECONDARY SPECIES				
1.	*Circus aeruginosus*	Marsh Harrier	2	15
2.	*Falco tinnunculus*	Kestrel	1	25
OTHER SPECIES				
3.	*Galerida cristata*	Crested lark	8	0-15
4.	*Oenanthe isabellina*	Isabelline wheatear	6	0-10
5.	*Merops supercilios*	Blue-cheeked Bee-eater	26	20
6.	*Corvus ruficollis*	Brown-necked Raven	1	4
7.	*Columba livia*	Rock Dove	22	40
8.	*Hirundo rustica*	Barn Swallow	15	8
9.	*Apus apus*	Northern Swift	45	4-15
10.	*Calandrella rufescens*	Lesser Short-toed Lark	20	2
11.	*Coracias garrulus*	Eurasian Roller	4	3-15
12.	*Rhodospiza obsoleta*	Black-billed Desert Finch	3	2

VP. 3

Date: 30.05.2020 Start and end time: 14:52 – 17:55
Weather:
The air temperature around 25-28°C is clear.

Wind speed approx. (3-5 m/s) No precipitation

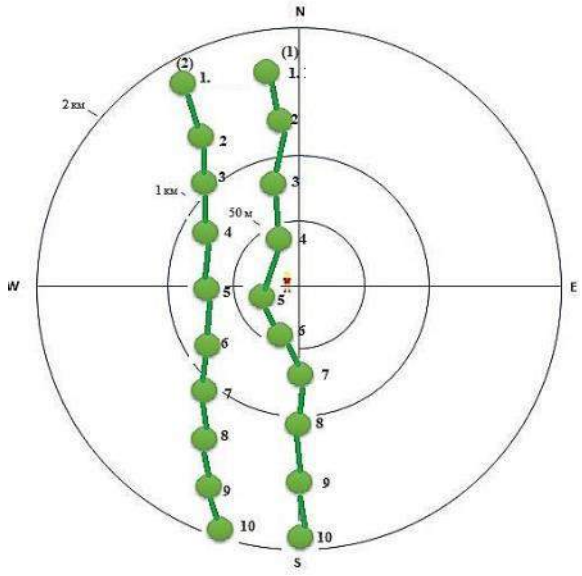


Fig. 23. Flight path (VP 3), 30.05.2020

Table 55. Target species log (VP 3), 30.05.2020

●	*Neophron percnopterus(1)*	1-60 m	2-60 m	3-65 m	4-60 m	5-65 m	6-65 m	7-65 m	8-60 m	9-60 m	10-60 m
●	*Neophron percnopterus(2)*	1-60 m	2-60 m	3-65 m	4-60 m	5-65 m	6-65 m	7-65 m	8-60 m	9-60 m	10-60 m

Table 56. Secondary and other species (VP 3), 30.05.2020

№	Latin names	English names	Amount	Flight altitude
OTHER SPECIES				
1.	*Lanius pallidirostris*	Southern grey shrike	2	2
2.	*Galerida cristata*	Crested lark	5	0-15
3.	*Hirundo daurica*	Red-rumped swallow	5	10

4.	*Oenanthe isabellina*	Isabelline wheatear	2	0-10

VP. 7

Date:31.05.2020 Start and end time: 7:33 – 10:33
Weather:
The air temperature around 18-20°C is clear.
Wind speed approx. (3-5 m/s) No precipitation

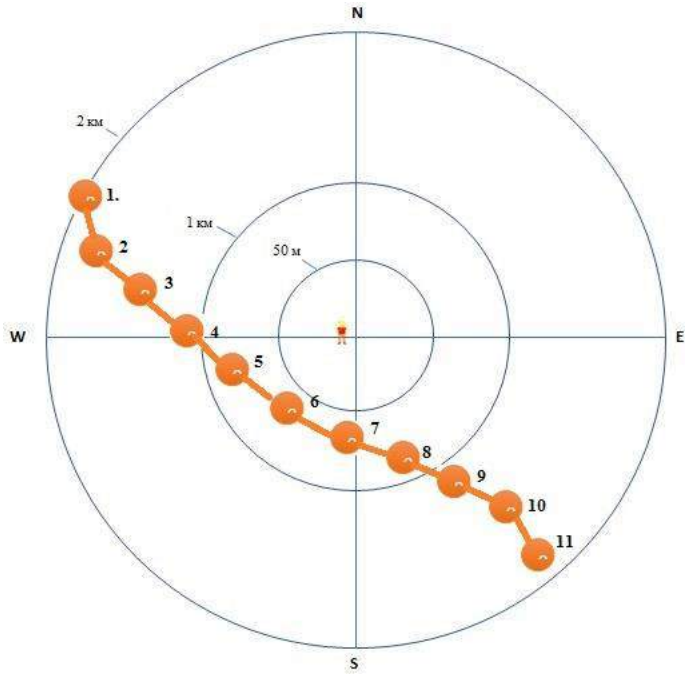


Fig. 24. Flight path (VP 7), 31.05.2020

Table 57. Target species log (VP 7), 31.05.2020

●	*Aquila nipalensis*	1- 60 m	2- 60 m	3- 65 m	4- 60 m	5- 65 m	6- 65 m	7- 65 m	8- 60 m	9- 60 m	10- 65 m	11- 60 m

Table 58. Secondary and other species (VP 7), 31.05.2020

№	Latin names	English names	Amount	Flight altitude
SECONDARY SPECIES				
1.	*Circus cyaneus*	Hen (Northern) Harrier	1	11
OTHER SPECIES				
2.	*Galerida cristata*	Crested lark	3	0-15
3.	*Oenanthe isabellina*	Isabelline wheatear	1	0-10
4.	*Hirundo rustica*	Barn Swallow	15	8
5.	*Apus apus*	Northern Swift	45	4-15
6.	*Calandrella rufescens*	Lesser Short-toed Lark	20	2

VP. 6

Date: 31.05.2020 Start and end time: 11:13 – 14:15
Weather:
The air temperature around 22-23°C is clear.
Wind speed approx. (3-5 m/s) No precipitation

Primary species not found

Table 59. Secondary and OTHER SPECIES (VP 6), 31.05.2020

№	Latin names	English names	Amount	Flight altitude
OTHER SPECIES				
1.	*Alectoris chukar*	Chuckar partridge	2	0
2.	*Columba livia*	Rock Dove	6	15
3.	*Galerida cristata*	Crested lark	3	0-15
4.	*Apus apus*	Northern Swift	5	30
5.	*Oenanthe isabellina*	Isabelline wheatear	2	0-10

VP. 8

Date: 31.05.2020 Start and end time: 14:55 – 17:55
Weather:

The air temperature around 22-25°C is clear.
Wind speed approx. (6-8 m/s) No precipitation

Primary species not found

Table 60. Secondary and other species (VP 8), 31.05.2020

№	Latin names	English names	Amount	Flight altitude
		OTHER SPECIES		
1.	*Calandrella rufescens*	Lesser Short-toed Lark	14	0-2
2.	*Corvus monedula*	Jackdaw	4	0-3
3.	*Galerida cristata*	Crested lark	3	0-15
4.	*Apus apus*	Northern Swift	15	30
5.	*Oenanthe isabellina*	Isabelline wheatear	2	0-10
6.	*Passer indicus*	Indian House Sparrow	6	2

VP survey results in June

VP. 4

Date: 01.06.2020.
VP survey time: 8:12 – 11:12
Weather:
The air temperature around 20-22°C, sunny
Wind speed approx. (3-4 m/s) No precipitation.

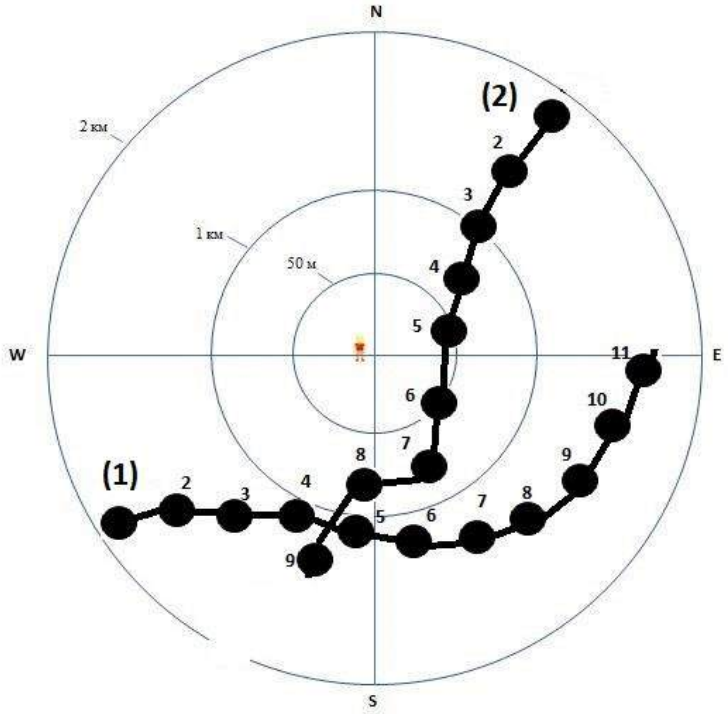


Fig. 25 Flight path VP 4, 01.06.2020

Table 61 Target species log (VP 4), 01.06.2020

●	*Aquila nipalensis (1)*	1 75 m	2 70 m	3 75 m	4 75 m	5 75 m	6 70 m	7 70 m	8 75 m	9 70 m	10 75 m	11 75 m

●	*Aquila nipalensis (2)*	1 75 m	2 70 m	3 75 m	4 75 m	5 75 m	6 70 m	7 70 m	8 75 m	9 70 m		

Table 62. Secondary species log (VP 4), 01.06.2020

No.	Latin names	English names	Amount	Altitude (m)
1.	*Oenanthe pleschanka*	Pied Wheatear	2	4
2.	*Oenanthe oenanthe*	Northern Wheatear	3	3
3.	*Galerida cristata*	Crested Lark	12	4
4.	*Corvus corax*	Northern Raven	2	8
5.	*Apus apus*	Northern Swift	4	5
6.	*Lanius exubitor*	Great (Gray) Shrike	2	5
7.	*Merops supercilios*	Blue-cheeked Bee-eaterr	2	15

VP. 5

Date: 01.06.2020.
VP survey time: 11:43 – 14:43
Weather:
The air temperature around 28-32°C, clear visibility
Wind speed approx. (3-4 m/s) No precipitation.
Primary species not found
Table 63. Secondary species log (VP 5), 01.06.2020.

No.	Latin names	English names	Amount	Altitude (m)
1.	*Falco tinnunculus*	Common Kestrel	2	18
2.	*Oenanthe oenanthe*	Northern Wheatear	2	3
3.	*Galerida cristata*	Crested Lark	6	4
4.	*Corvus corax*	Northern Raven	2	8
5.	*Lanius exubitor*	Great (Gray) Shrike	2	5
6.	*Acridotheres tristis*	Common mayna	4	5
7.	*Muscicapa striata*	Spotted Flycatcher	1	1

VP. 6

Date: 01.06.2020.
VP survey time: 15:16 – 18:16
Weather:
The air temperature around 32-34°C, clear visibility, hot.
Wind speed approx. (3-5 m/s) No precipitation.
Primary species not found
Table 64. Secondary species log (VP 6), 01.06.2020.

No.	Latin names	English names	Amount	Altitude (m)
1.	*Oenanthe oenanthe*	Northern Wheatear	2	3
2.	*Galerida cristata*	Crested Lark	3	4
3.	*Lanius exubitor*	Great (Gray) Shrike	1	5
4.	*Merops supercilios*	Blue-cheeked Bee-eaterr	2	23

VP.9

Date: 02.06.2020
VP survey time: 8:15 – 11:15
Weather:
The air temperature around 20-21°C, clear visibility, hot.
Wind speed approx. (5-6 m/s) No precipitation.
Primary species not found
Table 65. Secondary species log (VP 9), 02.06.2020.

No.	Latin names	English names	Amount	Altitude (m)
1.	*Oenanthe pleschanka*	Pied Wheatear	3	1
2.	*Oenanthe oenanthe*	Northern Wheatear	2	2
3.	*Galerida cristata*	Crested Lark	5	3
4.	*Acridotheres tristis*	Common mayna	3	16
5.	*Streptopelia senegalensis*	Laughing dove	2	12
6.	*Pterocles orientalis*	Black-bellied sandgrouse	2	12
7.	*Upupa epops*	Hoopoe	1	3

VP № 7

Date: 02.06.2020
VP survey time: 11^{46} - 14^{46}
Weather: temperature: 32-34 °C, sunny, wind speed (2-3 m/s)
Primary species not found

Table 66. Secondary species log (VP 7), 02.06.2020

№	Latin name	English name	Number of individuals	Altitude (m)
1.	*Circus cyaneus*	Hen harrier	1	12
2.	*Accipiter nisus*	Eurasian sparrowhawk	1	23
3.	*Circus aeruginosus*	Western marsh harrier	1	10
4.	*Upupa epops*	Eurasian hoopoe	2	6
5.	*Oenanthe isabellina*	Isabelline wheatear	6	3
6.	*Pterocles orientalis*	Black-bellied sandgrouse	2	6
7.	*Lanius minor*	Lesser grey shrike	2	6
8.	*Athene noctua*	Little Owl	1	4

VP № 8

Date: 02.06.2020
VP survey time: 15[17] - 18 [17]
Weather: temperature: 32-33 °C, sunny, wind speed (3-5 m/s)

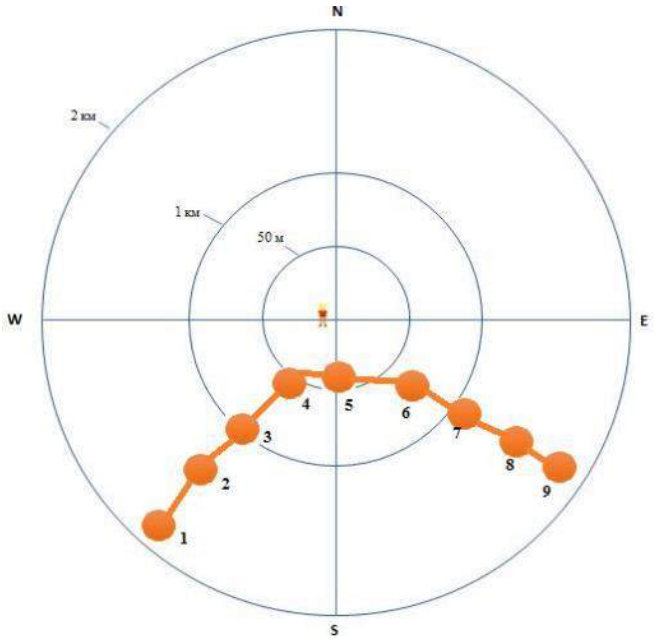


Fig. 26 Flight path for VP 8. 02.06.2020

Table 67. Target species log (VP 8), 02.06.2020

	Neophron percnopterus	*1-70 m*	*2-70 m*	*3-65m*	*4-65 m*	*5-65 m*	*6-70 m*	*7-70 m*	*8-70 m*	*9-70 m*	*10-65m*	*11-65 m*

Table 68. Secondary species log (VP 8), 02.06.2020

№	Latin name	English name	Number of individuals	Altitude (m)
1	*Circus cyaneus*	Hen harrier	2	11
2	*Buteo rufinus*	Long-legged buzzard	1	25
3	*Circus aeruginosus*	Western marsh harrier	1	12
4	*Upupa epops*	Eurasian hoopoe	2	6

VP № 1

Date: 03.06.2020
VP survey time: 8 [30] -11 [30]
Weather: The air temperature around 18-25°C, cloudy, good visibility wind speed (5-6 m/s) without precipitation

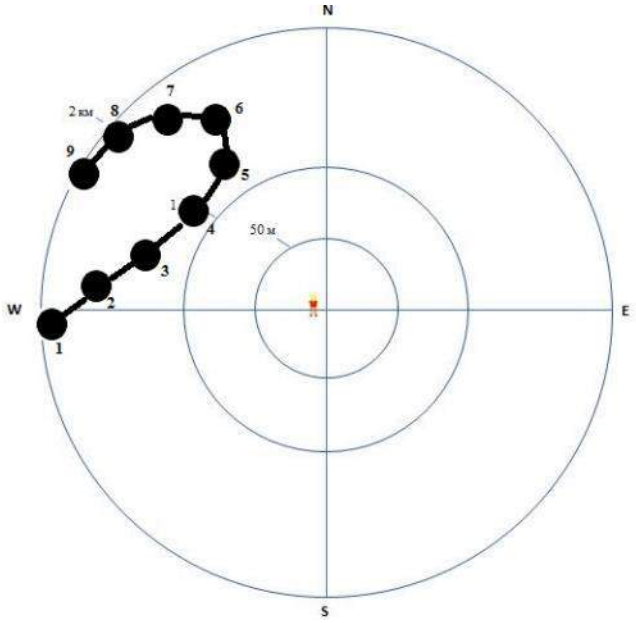


Fig. 27. Flight path for VP 1

Table 69 Target species log (VP 1), 03.06.2020

●	*Aquila nipalensis*	1-90 m	2-90 m	3-95m	4-95 m	5-95 m	6-90 m	7-90 m	8-90 m	9-90 m

Table 70 Secondary species log (VP 1), 03.06.2020

№	Latin name	English name	Number of individuals	Altitude (m)
1.	*Circus cyaneus*	Hen (Northern) Harrier	*1*	23
2.	*Circus aeruginosus*	Western marsh harrier	1	13
3.	*Oenanthe isabellina*	Isabelline wheatear	6	3
4.	*Oenanthe isabellina*	Isabelline Wheatear	1	3
5.	*Galerida cristata*	Crested Lark	6	4

VP № 2

Date: 03.06.2020
VP survey time: 12^{03} -15^{03}
Weather: The air temperature around 28-32°C, cloudy, good visibility wind speed (6-8 m/s) without precipitation

Primary species not found

Table 71 Secondary species log (VP 2), 03.06.20

№	Latin name	English name	Number of individuals	Altitude (m)
1.	*Circus aeruginosus*	Western marsh harrier	1	12
2.	*Upupa epops*	Eurasian hoopoe	2	3
3.	*Oenanthe isabellina*	Isabelline wheatear	3	3
4.	*Lanius minor*	Lesser grey shrike	1	3
5.	*Galerida cristata*	Crested lark	13	5
6.	*Pterocles orientalis*	Black-bellied sandgrouse	2	12

VP № 3

Date: 03.06.2020

VP survey time: 15^{35}-18^{35}

Weather: The air temperature around 32-30°C, cloudy, good visibility wind speed (6-8 m/s) without precipitation

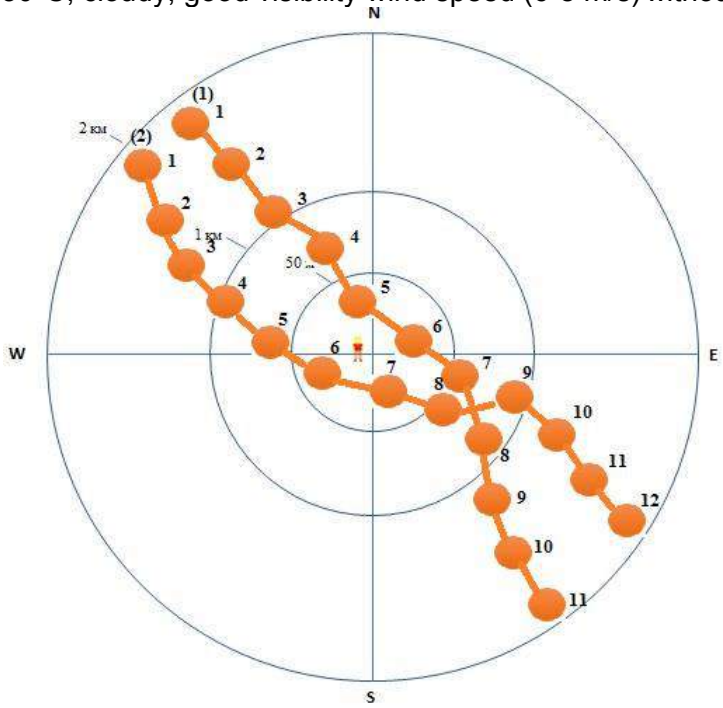


Fig. 28 Flight path for VP 3. 03.06.2020

Table 72 Target species log (VP 3), 03.06.2020

●	*Neophron percnopterus*	1-60 m	2-60 m	3-65m	4-65 m	5-65 m	6-60 m	7-60 m	8-60 m	9-60 m	10-60 m	11-60 m	12-65 m
●	*Neophron percnopterus*	1-60 m	2-60 m	3-65m	4-65 m	5-65 m	6-60 m	7-60 m	8-60 m	9-60 m	10-60 m	11-60 m	

Table 73 Secondary species log (VP 3), 03.06.202

№	Latin name	English name	Number of individuals	Altitude (m)
1.	*Lanius minor*	Lesser grey shrike	1	3
2.	*Galerida cristata*	Crested lark	7	6
3.	*Oenanthe isabellina*	Isabelline Wheatear	1	2
4.	*Coracias garrulus*	Eurasian Roller	1	8
5.	*Tadorna ferruginea*	Roody sheld duck	3	36

VP. 9

Date: 04.06.2020. Start and end time: 7:24 – 11:24

Weather:

The air temperature around 20-25°C is changeable weather, . Wind speed approx. (3-4 m/s) No precipitation.

Primary species not found

Table 74 Secondary species log (VP 9), 04.06.2020.

No.	Latin names	English names	Amount	Altitude (m)
1.	*Oenanthe pleschanka*	Pied Wheatear	3	3
2.	*Falco naumanni*	Lesser Kestrel	1	26
3.	*Oenanthe oenanthe*	Northern Wheatear	2	3
4.	*Charadrius dubius*	Little ringed plover	2	4
5.	*Acridotheres tristis*	Common mayna	4	11

VP. 7

Date: 04.06.2020. Start and end time: 11:46 – 14:46

Weather:

The air temperature around 26-30°C is sunny**,** . Wind speed approx. (3-4 m/s) No precipitation.

Primary species not found

Table 75 Secondary species log (VP 7), 04.06.2020

No.	Latin names	English names	Amount	Altitude (m)
1.	*Oenanthe oenanthe*	Northern Wheatear	1	3
2.	*Galerida cristata*	Crested Lark	7	5
3.	*Corvus corax*	Northern Raven	3	11
4.	*Coracias garrulus*	Eurasian Roller	3	12

VP.8

Date: 04.06.2020. Start and end time: 15:18 – 18:18
Weather: The air temperature around 30-32°C is clear visibility, hot. Wind speed approx. (2-3 m/s) No precipitation.
Primary species not found

Table 76 Secondary species log (VP 8), 04.06.2020

No.	Latin names	English names	Amount	Altitude (m)
1.	*Buteo rufinus*	Long-legged Buzzard	1	18
2.	*Circus cyaneus*	Hen (Northern) Harrier	1	16
3.	*Oenanthe pleschanka*	Pied Wheatear	2	2
4.	*Oenanthe oenanthe*	Northern Wheatear	1	3
5.	*Galerida cristata*	Crested Lark	12	6
6.	*Corvus corax*	Northern Raven	2	15
7.	*Lanius exubitor*	Great (Gray) Shrike	2	11
8.	*Coracias garrulus*	Eurasian Roller	3	15

VP.6

Date: 05.06.2020. VP survey time: 7:32 – 10:32

Weather:

The air temperature around 22-28°C; clear visibility,. Wind speed approx. (4-5 m/s) No precipitation

Primary species not found

Table 77 Secondary species log (VP 6), 05.06.2020

No.	Latin names	English names	Amount	Altitude (m)
1.	*Oenanthe oenanthe*	Northern Wheatear	1	2
2.	*Galerida cristata*	Crested Lark	3	5
3.	*Luscinia svecica*	Bluethroat	4	3
4.	*Melanocorypha bimaculata*	Bimaculated Lark	15	4
5.	*Upupa epops*	Hoopoe	1	3

VP. 5

Date: 05.06.2020. VP survey time: 11:12 – 14:12
Weather: The air temperature around 28-32°C; clear visibility,. Wind speed approx. (3-6 m/s) No precipitation
Primary species not found

Table 78 Secondary species log (VP 5), 05.06.2020

No.	Latin names	English names	Amount	Altitude (m)
1.	*Oenanthe oenanthe*	Northern Wheatear	1	2
2.	*Galerida cristata*	Crested Lark	5	5
3.	*Luscinia svecica*	Bluethroat	2	3
4.	*Falco naumanni*	Lesser Kestrel	2	23

VP. 4

Date: 05.06.2020. VP survey time: 14:57– 17:57

Weather:

The air temperature around 32-28°C; clear visibility,. Wind speed approx. (6-8 m/s) No precipitation

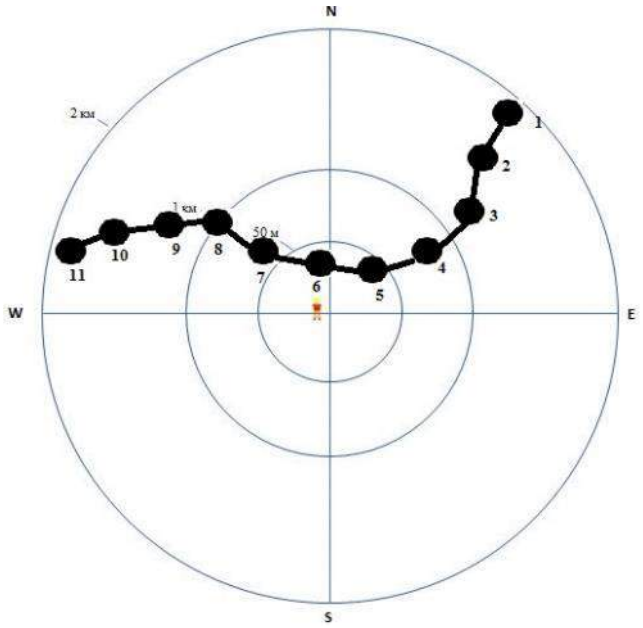


Fig. 29 Flight path for VP 4. 05.06.2020

Table 79 Target species (VP4. 05.06.2020)

●	***Aquila nipalensis***	1 165 m	2 165 m	3 160 m	4 160 m	5 165 m	6 165 m	7 160 m	8 160 m	9 160 m	10 165 m	11 165 m

Table 80 Secondary species log (VP 4), 05.06.2020

No.	Latin names	English names	Amount	Altitude (m)
1.	*Oenanthe pleschanka*	Pied Wheatear	1	3
2.	*Oenanthe oenanthe*	Northern Wheatear	1	2
3.	*Galerida cristata*	Crested Lark	9	4
4.	*Coracias garrulus*	Eurasian Roller	1	16

VP № 3

Date: 06.06.2020

VP survey time: 8^{25} - 11^{25}

Weather: The air temperature around 20-28°C; clear visibility,. Wind speed approx. (6-8 m/s) No precipitation

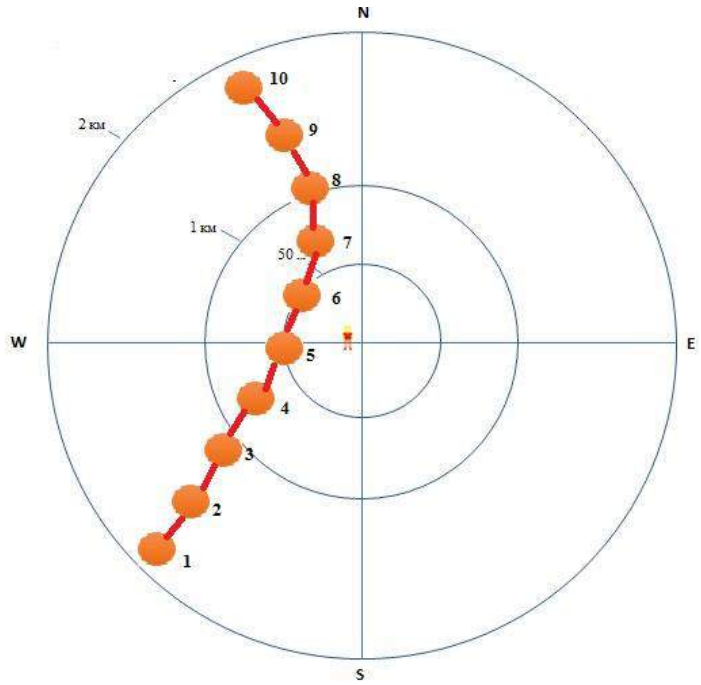


Fig. 30 Flight path for VP 3. 06.06.2020

Table 81 Target species (VP 3), 06.06.2020

●	***Neophron percnopterus***	1 65 m	2 65 m	3 60 m	4 60 m	5 65 m	6 65 m	7 60 m	8 60 m	9 60 m	10 65 m

Table 82 Secondary species (VP 3), 06.06.2020

№	Latin name	English name	Number of individuals	Altitude (m)
1.	*Circus cyaneus*	Hen harrier	1	12
2.	*Buteo rufinus*	Long-legged buzzard	1	23
3.	*Circus aeruginosus*	Western marsh harrier	1	12
4.	*Upupa epops*	Eurasian hoopoe	2	3
5.	*Oenanthe isabellina*	Isabelline wheatear	2	2
6.	*Oenanthe oenanthe*	Northern wheatear	3	3

VP № 2

Date: 06.06.2020
VP survey time: 11^{58} – 14^{58}
Weather:
The air temperature around 28-32°C; clear visibility,. Wind speed approx. (6-8 m/s) No precipitation
Primary species not found

Table 83. Secondary species (VP 2), 06.06.2020

№	Latin name	English name	Number of individuals	Altitude (m)
1.	*Circus cyaneus*	Hen harrier	1	13
2.	*Upupa epops*	Eurasian hoopoe	2	3
3.	*Oenanthe isabellina*	Isabelline wheatear	2	2
4.	*Oenanthe oenanthe*	Northern wheatear	6	3
5.	*Lanius pallidirostris*	Steppe Grey Shrike	2	5

VP № 1

Date: 06.06.2020

VP survey time: 15^{25} – 18^{25}

Weather: The air temperature around 32-28°C, cloudy, good visibility, wind speed (8-10 m/s), without precipitation
Primary species not found

Table 84. Secondary species (VP 1), 06.06.2020

№	Latin name	English name	Number of individuals	Altitude (m)
1.	*Oenanthe isabellina*	Isabelline wheatear	1	2
2.	*Galerida cristata*	Crested Lark	5	3
3.	*Columba livia*	Rock Dove	2	12
4.	*Oenanthe oenanthe*	Northern wheatear	2	3
5.	*Pterocles orientalis*	Black-bellied sandgrouse	2	9

VP № 9

Date: 07.06.2020

VP survey time: 8^{05} - 11^{05}

Weather: The air temperature around 22-26°C, cloudy, good visibility, wind speed (6-8 m/s), without precipitation
Primary species not found

Table 85. Secondary species (VP 9), 07.06.2020

№	Latin name	English name	Number of individuals	Altitude (m)
1.	*Oenanthe isabellina*	Isabelline wheatear	2	3
2.	*Oenanthe oenanthe*	Northern wheatear	2	3
3.	*Galerida cristata*	Crested Lark	4	4
4.	*Columba livia*	Rock Dove	5	15
5.	*Lanius exubitor*	Great (Gray) Shrike	2	10
6.	*Merops supercilios*	Blue-cheeked Bee-eaterr	5	23

VP 7

Date: 07.06.2020. VP survey time: 11:36 – 14:36

Weather:

The air temperature around 28-30°; clear visibility,. Wind speed approx. (3-5 m/s) No precipitation

Primary species not found

Table 86 Secondary species log (VP 7), 07.06.2020

No.	Latin names	English names	Amount	Altitude (m)
1.	*Circus cyaneus*	Hen (Northern) Harrier	2	9
2.	*Alectoris chukar*	Chukar Partridge	4	2
3.	*Oenanthe pleschanka*	Pied Wheatear	4	3
4.	*Oenanthe oenanthe*	Northern Wheatear	2	2
5.	*Phoenicurus phoenicurus*	Eurasian Redstart	1	3
6.	*Athene noctua*	Little Owl	1	5

VP. 6

Date:07.06.2020. VP survey time: 15:07 – 18:07

Weather:

The air temperature around 30-28°C ; clear visibility,. Wind speed approx. (4-6 m/s) No precipitation

Primary species not found

Table 87. Secondary species log (VP 6), 07.06.2020

No.	Latin names	English names	Amount	Altitude (m)
1.	*Buteo rufinus*	Long-legged Buzzard	1	25
2.	*Oenanthe oenanthe*	Northern Wheatear	3	4
3.	*Galerida cristata*	Crested Lark	6	4
4.	*Muscicapa striata*	Spotted Flycatcher	2	1
5.	*Luscinia svecica*	Bluethroat	2	2
6.	*Melanocorypha bimaculata*	Bimaculated Lark	16	4
7.	*Falco naumanni*	Lesser Kestrel	2	26

VP 8

Date: 10.06.2020. VP survey time: 8:06 – 11:06

***Weather*:**

The air temperature around 22-25°C ; clear visibility, hot. Wind speed approx. (5-7 m/s) No precipitation

Primary species not found

Table 88 Secondary species log (VP 8), 10.06.2020

No.	Latin names	English names	Amount	Altitude (m)
1.	*Circus cyaneus*	Hen (Northern) Harrier	2	16
2.	*Oenanthe oenanthe*	Northern Wheatear	3	2
3.	*Galerida cristata*	Crested Lark	13	3
4.	*Falco naumanni*	Lesser Kestrel	1	20
5.	*Pterocles orientalis*	Black-bellied sandgrouse	2	12
6.	*Merops supercilios*	Blue-cheeked Bee-eaterr	5	15

VP 5

Date: 10.06.2020. VP survey time: 11:46 – 14:46

***Weather*:**

The air temperature around 32-34°C ; is clear**,** . Wind speed approx. (3-4 m/s) No precipitation

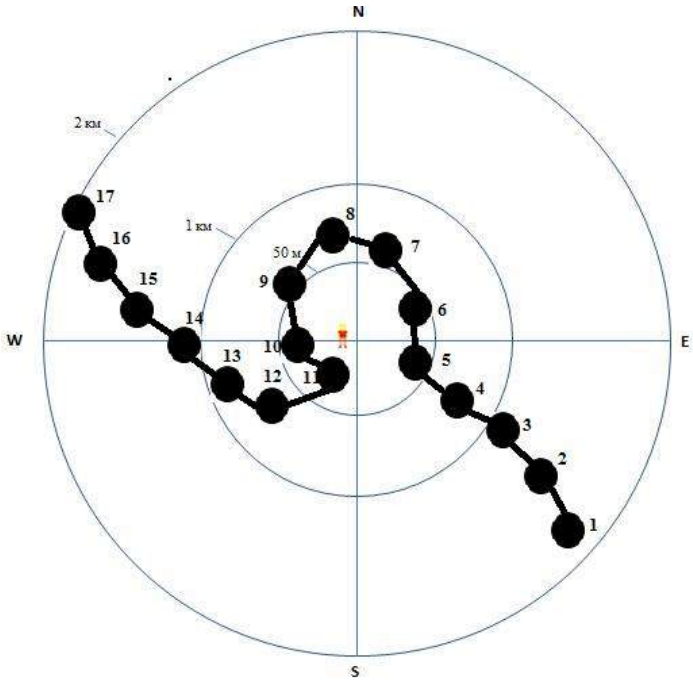


Fig. 31 Flight path for VP 5, 10.06.2020

Table 89 Target species (VP 5), 10.06.2020

●	*Aquila chrysaetos*	1 90 m	2 90 m	3 95 m	4 95 m	5 95 m	6 90 m	7 90 m	8 90 m	9 90 m	10 90 m	1 90 m	2 90 m	3 95 m	4 95 m	5 95 m	6 90 m	7 90 m

Table 90 Secondary species log (VP 5), 10.06.2020

No.	Latin names	English names	Amount	Altitude (m)
1.	*Oenanthe oenanthe*	Northern Wheatear	3	2
2.	*Galerida cristata*	Crested Lark	17	3
3.	*Lanius exubitor*	Great (Gray) Shrike	2	4
4.	*Phoenicurus phoenicurus*	Eurasian Redstart	2	3
5.	*Falco naumanni*	Lesser Kestrel	2	25

VP 4

Date: 10.06.2020. VP survey time: 15:16 – 18:16

***Weather*:**

The air temperature around 30-32°C ; clear visibility, hot. Wind speed approx. (4-5 m/s) No precipitation

Primary species not found

Table 91 Secondary species log (VP 4), 10.06.2020

No.	Latin names	English names	Amount	Altitude (m)
1.	*Oenanthe oenanthe*	Northern Wheatear	2	1
2.	*Galerida cristata*	Crested Lark	6	5
3.	*Lanius exubitor*	Great (Gray) Shrike	2	3
4.	*Phoenicurus phoenicurus*	Eurasian Redstart	2	2
5.	*Muscicapa striata*	Spotted Flycatcher	1	1

VP № 1

Date: 11.06.2020
VP survey time: 8^{22} - 11^{22}
Weather: The air temperature around 20-25°C, cloudy, good visibility, wind speed (9-12 m/s), without precipitation
Primary species not found

Table 92. Secondary species log (VP 1), 11.06.2020

№	Latin name	English name	Number of individuals	Altitude (m)
1.	*Circus aeruginosus*	Western marsh harrier	1	20
2.	*Coracias garrulus*	Eurasian Roller	2	13
3.	*Oenanthe pleschanka*	Pied wheatear	2	3
4.	*Apus affinis*	Little swift	3	3

VP № 2

Date: 11.06.2020

VP survey time: 11^{53} - 14^{53}

Weather: The air temperature around 25-29 C, cloudy, good visibility, wind speed (6-8 m/s), without precipitation

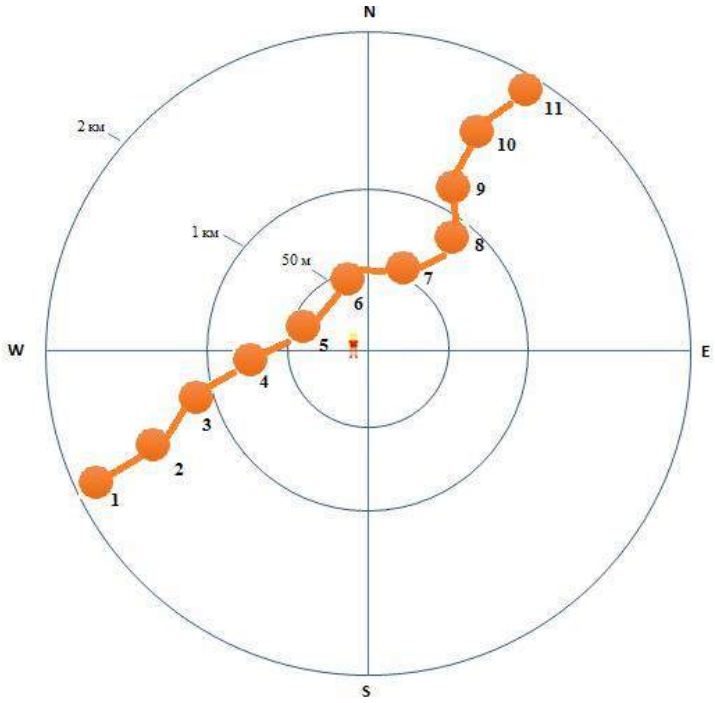


Fig. 32 Flight path for VP 2, 11.06.2020

Table 93. Target species log (VP 2), 11.06.2020

	Neophron percnopterus	1 90 m	2 90 m	3 85 m	4 85 m	5 85 m	6 90 m	7 90 m	8 90 m	9 90 m	10 90 m	11 90

Table 94 Secondary species log (VP 2), 11.06.2020

№	Latin name	English name	Number of individuals	Altitude (m)
1.	*Oenanthe isabellina*	Isabelline wheatear	1	2
2.	*Galerida cristata*	Crested lark	13	4
3.	*Acridotheres tristis*	Common mayna	3	12
4.	*Muscicapa striata*	Spotted Flycatcher	1	1
5.	*Merops supercilios*	Blue-cheeked Bee-eaterr	3	17

VP 3

Date: 11.06.2020. VP survey time: 15:23 – 18:23

***Weather*:**

The air temperature around 32-28C°; good visibility,. Wind speed approx. (6-8 m/s) No precipitation

Table 95 Secondary species (VP 3), 11.06.2020

No.	Latin names	English names	Amount	Altitude (m)
1.	*Alectoris chukar*	Chukar Partridge	2	3
2.	*Oenanthe pleschanka*	Pied Wheatear	3	3
3.	*Oenanthe oenanthe*	Northern Wheatear	1	3
4.	*Galerida cristata*	Crested Lark	13	3
5.	*Athene noctua*	Little owl	1	3
6.	*Corvus corax*	Northern Raven	1	16

VP № 8

Date: 12.06.2020, VP survey time: 8^{14} - 11 ^{14}

Weather: temperature 22-25^{0}C, clear visibility wind speed (4-5 m/s), without precipitation.

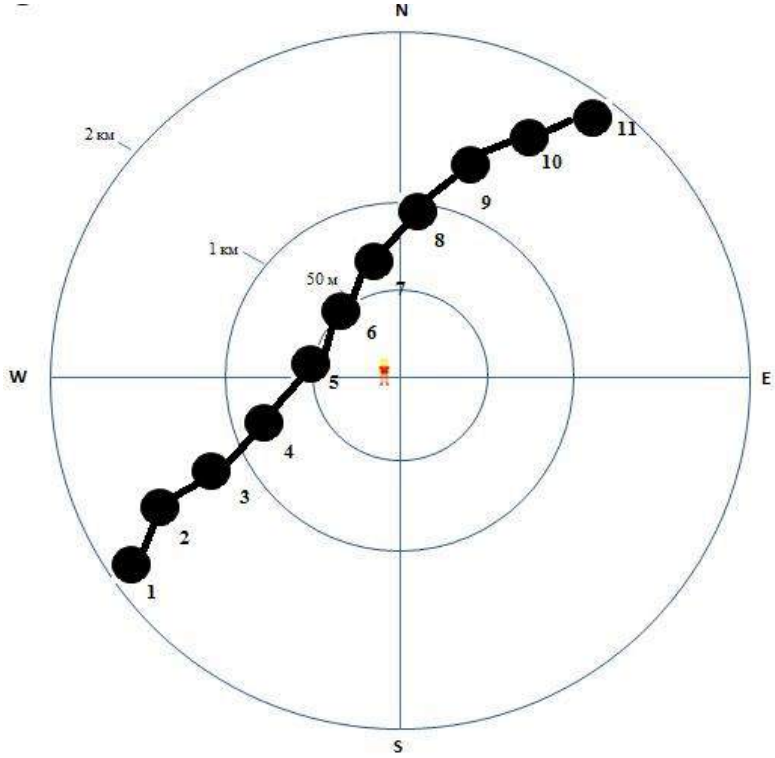


Fig. 33. Flight path for VP 8, 12.06.2020

Table 96. Target species log (VP 8), 12.06.2020

	*Aquila chrysaetos*	1 70 m	2 70 m	3 65 m	4 65 m	5 65 m	6 70 m	7 70 m	8 70 m	9 70 m	10 70 m	11 65 m	12 65 m

Table 97. Secondary species log (VP 8), 12.06.2020

№	Latin name	English name	Number of individuals	Altitude (m)
1.	*Circus cyaneus*	Hen (Northern) Harrier	1	23
2.	*Circus aeruginosus*	Western marsh harrier	1	12
3.	*Oenanthe isabellina*	Isabelline wheatear	2	3
4.	*Lanius pallidirostris*	Southern grey shrike	1	12

VP № 7

Date: 12.06.2020. VP survey time: 11^{56} - 14^{56}
Weather: temperature 28-32 °C, clear visibility, wind speed (4-5 m/s), without precipitation.
Primary species not found

Table 98 Secondary species log (VP 7), 12.06.2020

№	Latin name	English name	Number of individuals	Altitude (m)
1.	*Accipiter nisus*	Eurasian sparrowhawk	1	16
2.	*Oenanthe isabellina*	Isabelline wheatear	2	3
3.	*Athene noctua*	Little Owl	1	3
4.	*Lanius pallidirostris*	Southern grey shrike	2	6

VP № 9

Date: 12.06.2020
VP survey time: 15^{26} - 18^{26}
Primary species not found

Weather: temperature 32-34 °C, clear visibility, wind speed (5-6 m/s), without precipitation.

Table 99. Secondary species log (VP 3), 12.06.2020

№	Latin name	English name	Number of individuals	Altitude (m)
1.	*Galerida cristata*	Crested Lark	5	3
2.	*Columba livia*	Rock Dove	2	15
3.	*Pterocles orientalis*	Black-bellied sandgrouse	2	6
4.	*Oenanthe isabellina*	Isabelline wheatear	2	3

VP № 4

Date: 13.06.2020
VP survey time: 8^{12} - 11^{12}
Weather: temperature 23-26 °C, clear visibility, wind speed (6-8 m/s), without precipitation.
Primary species not found

Table 100 Secondary species log (VP 4), 13.06.2020

№	Latin name	English name	Number of individuals	Altitude (m)
1.	*Circus cyaneus*	Hen harrier	1	13
2.	*Falco tinnunculus*	Common kestrel	1	17
3.	*Oenanthe isabellina*	Isabelline wheatear	1	4
4.	*Galerida cristata*	Crested lark	12	5

VP № 5

Date: 13.06.2020.
VP survey time: 11^{43} - 14^{43}

Weather: The air temperature around 30-34 °C, is clear visibility, wind speed (8-10 m/s), without precipitation.
Primary species not found

Table 101 Secondary species log (VP 5), 13.06.2020

№	Latin name	English name	Number of individuals	Altitude (m)
	Oenanthe isabellina	Isabelline wheatear	1	3
	Galerida cristata	Crested lark	4	4
	Scotocerca inguieta	Streaked Scrub Warbler	1	2
	Cuculus canorus -	Common cuckoo	1	9

VP № 6

Date: 13.06.2020

VP survey time: 15^{12} - 18^{12}

Weather: cloudy, clear visibility, wind speed (6-8 m/s), without precipitation.
Primary species not found

Table 102. Secondary species log (VP 6), 13.06.2020

№	Latin name	English name	Number of individuals	Altitude (m)
1.	*Oenanthe isabellina*	Isabelline wheatear	2	2
2.	*Galerida cristata*	Crested lark	9	3

VP № 1

Date: 14.06.2020

VP survey time: 8^{25} - 11^{25}

Weather*:* The air temperature around 22-26°C, cloudy, good visibility, wind speed (3-5 m/s), without precipitation.

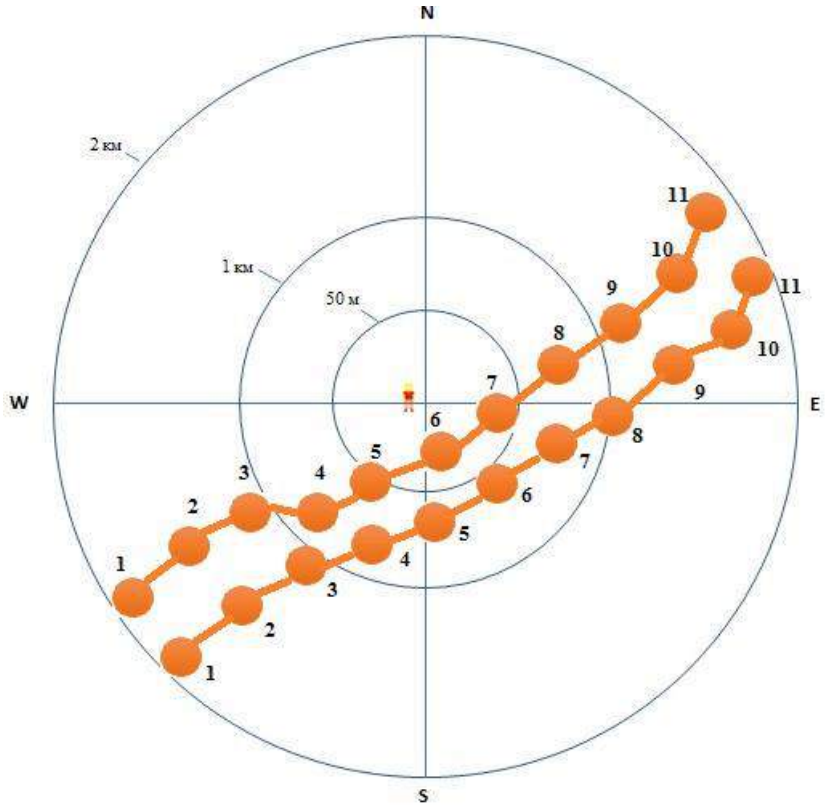


Fig. 34 Flight path VP 1, 14.06.2020

Table 103. Target species log VP 1, 14.06.2020

	Neophron percnopterus(1)	1 90 m	2 90 m	3 85 m	4 85 m	5 85 m	6 90 m	7 90 m	8 90 m	9 90 m	10 90 m	11 90 m	12 85 m
	Neophron percnopterus(2)	1 90 m	2 90 m	3 85 m	4 85 m	5 85 m	6 90 m	7 90 m	8 90 m	9 90 m	10 90 m	11 90 m	12 85 m

Table 104 Secondary species log VP 1, 14.06.2020

№	Latin name	English name	Number of individuals	Altitude (m)
1.	*Oenanthe pleschanka*	Pied wheatear	1	2
2.	*Oenanthe isabellina*	Isabelline wheatear	1	3
3.	*Galerida cristata*	Crested lark	5	5

VP № 2

Date: 14.06.2020
VP survey time: 11^{56} - 14^{56}

Weather*:* The air temperature around 26-34°C cloudy, good visibility, wind speed (8-10 m/s), without precipitation.

Primary species not found

Table 105. Secondary species log (VP 2), 14.06.2020

№	Latin name	English name	Number of individuals	Altitude (m)
1.	*Calandrella brachydactyla*	Greater short-toed lark	6	6
2.	*Oenanthe isabellina*	Isabelline wheatear	1	1
3.	*Galerida cristata*	Crested lark	3	4

VP № 3

Date: 14.06.2020

VP survey time: 15^{23} – 18^{23}

Weather*:* The air temperature around 34-28°C, cloudy, good visibility, wind speed (8-12 m/s), without precipitation.

Primary species not found

Table 106. Secondary species log (VP 3), 14.06.2020

№	Latin name	English name	Number of individuals	Altitude (m)
1.	*Oenanthe isabellina*	Isabelline wheatear	2	2
2.	*Lanius minor*	Lesser grey shrike	1	4
3.	*Galerida cristata*	Crested lark	5	3

VP № 8

Date: 18.06.2020
VP survey time: 8^{14} – 11^{14}

Weather: The air temperature around 22-25°C, cloudy, good visibility, wind speed (6-8 m/s), without precipitation.

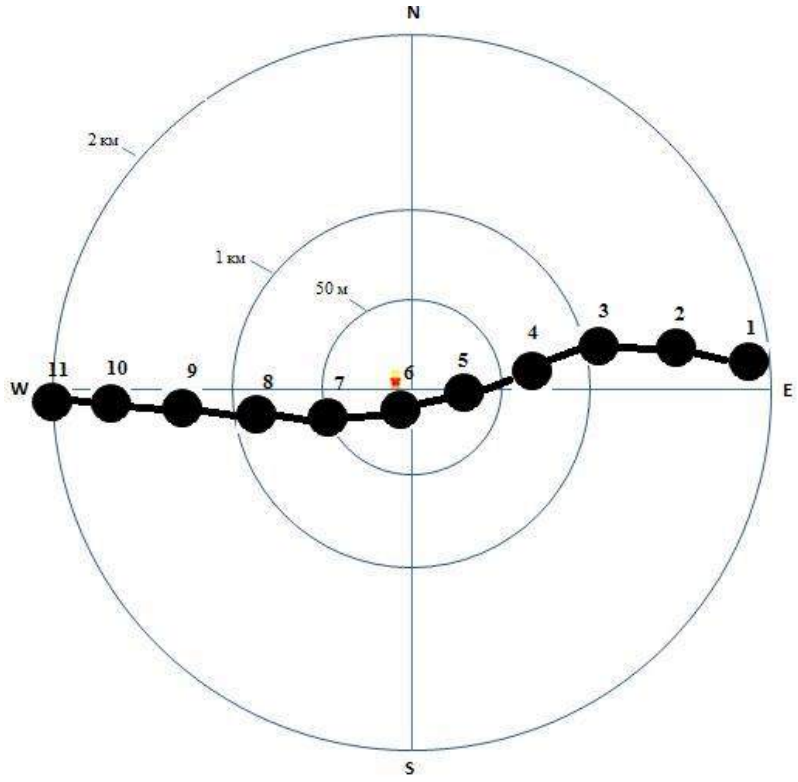


Fig. 35 Flight path for VP 8, 18.06.2020

Table 107. Target species log (VP 8), 18.06.2020

●	*Aquila chrysaetos*	1 120 m	2 120 m	3 125 m	4 125 m	5 125 m	6 120 m	7 120 m	8 120 m	9 120 m	10 120 m	11 120 m

Table 108 Secondary species log (VP 8), 18.06.2020

№	Latin name	English name	Number of individuals	Altitude (m)
1.	*Falco tinnunculus*	Common kestrel	1	16
2.	*Oenanthe isabellina*	Isabelline wheatear	1	4
3.	*Galerida cristata*	Crested lark	12	4

VP № 6

Date: 18.06.2020

VP survey time: 16^{02}- 19^{02}

Weather: The air temperature around 32-26°C, cloudy, good visibility, wind speed (6-8 m/s), without precipitation.
Primary species not found

Table 109 Secondary species log (VP 6), 18.06.2020

№	Latin name	English name	Number of individuals	Altitude (m)
1	*Oenanthe isabellina*	Isabelline wheatear	1	2
2	*Galerida cristata*	Crested lark	19	3
3	*Athene noctua*	Little Owl	2	9
4	*Upupa epops*	Hoopoe	1	3

VP № 5

Date: 19.06.2020

VP survey time: 7^{40}- 10^{40}

Weather: The air temperature around 20-25°C, cloudy, good visibility, wind speed (2-5 m/s), without precipitation.
Primary species not found

Table 110 Secondary species log (VP 5), 19.06.2020

№	Latin name	English name	Number of individuals	Altitude (m)
1	*Oenanthe pleschanka*	Pied wheatear	2	3
2	*Oenanthe isabellina*	Isabelline wheatear	3	2
3	*Galerida cristata*	Crested lark	6	3
4	*Merops supercilios*	Blue-cheeked Bee-eaterr	3	13
5	*Lanius pallidirostris*	Southern grey shrike	2	9
6	*Coracias garrulus*	Eurasian Roller	1	10

VP № 4

Date: 19.06.2020

VP survey time: 16^{17} - 19^{17}

Weather: The air temperature around 32-26°C, cloudy, good visibility, wind speed (4-5 m/s), without precipitation

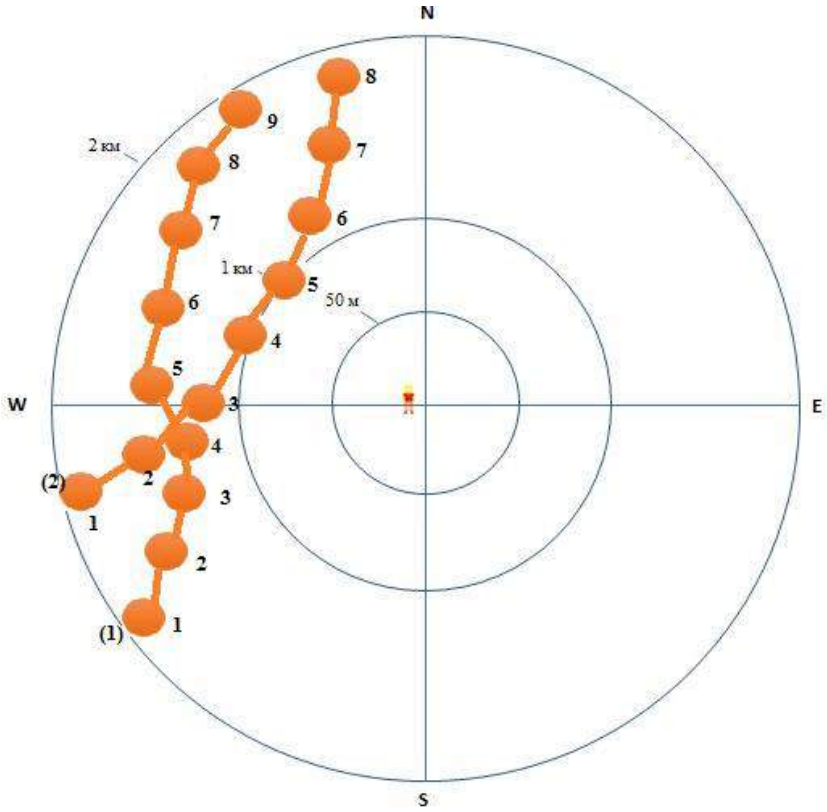


Fig. 36. Flight path for VP 5, 19.06.2020

Table 111 Target species log (VP 5), 19.06.2020

	Neophron percnopterus(1)	1 75 m	2 70 m	3 75 m	4 75 m	5 75 m	6 70 m	7 70 m	8 75 m	9 75 m
	Neophron percnopterus(2)	1 75 m	2 70 m	3 75 m	4 75 m	5 75 m	6 70 m	7 70 m	8 75 m	

Table 112 Secondary species log (VP 5), 19.06.2020

№	Latin name	English name	Number of individuals	Altitude (m)
1.	*Oenanthe isabellina*	Isabelline wheatear	2	5
2.	*Galerida cristata*	Crested lark	13	3
3.	*Pterocles orientalis*	Black-bellied sandgrouse	2	3
4.	*Scotocerca inguieta*	Streaked Scrub Warbler	2	1

VP № 7

Date: 20.06.2020
VP survey time: 9^{35} - 12^{35}
Weather: The air temperature around 22-28°C, cloudy, good visibility, wind speed (3-6 m/s), without precipitation

Primary species not found

Table 113 Secondary species log (VP 7), 20.06.2020

№	Latin name	English name	Number of individuals	Altitude (m)
1.	*Oenanthe isabellina*	Isabelline wheatear	2	2
2.	*Galerida cristata*	Crested lark	9	5
3.	*Lanius pallidirostris*	Southern grey shrike	2	6
4.	*Cuculus canorus*	Common cuckoo	1	12

VP № 9

Date: 20.06.2020

VP survey time: 14^{58} - 17^{58}

Weather: The air temperature around 34-31°C, cloudy, good visibility, wind speed (6-8 m/s), without precipitation
Primary species not found

Table 114 Secondary species log (VP 9), 20.06.2020

№	Latin name	English name	Number of individuals	Altitude (m)
1.	*Oenanthe pleschanka*	Pied wheatear	1	3
2.	*Oenanthe isabellina*	Isabelline wheatear	2	3
3.	*Galerida cristata*	Crested lark	5	5
4.	*Merops apiaster*	European Bee-eaterrr	3	16

VP № 3

Date: 24.06.2020

VP survey time: 08^{30} – 11^{30}

Weather: The air temperature around 20-26 °C, cloudy, good visibility, wind speed (5-7 m/s), without precipitation.

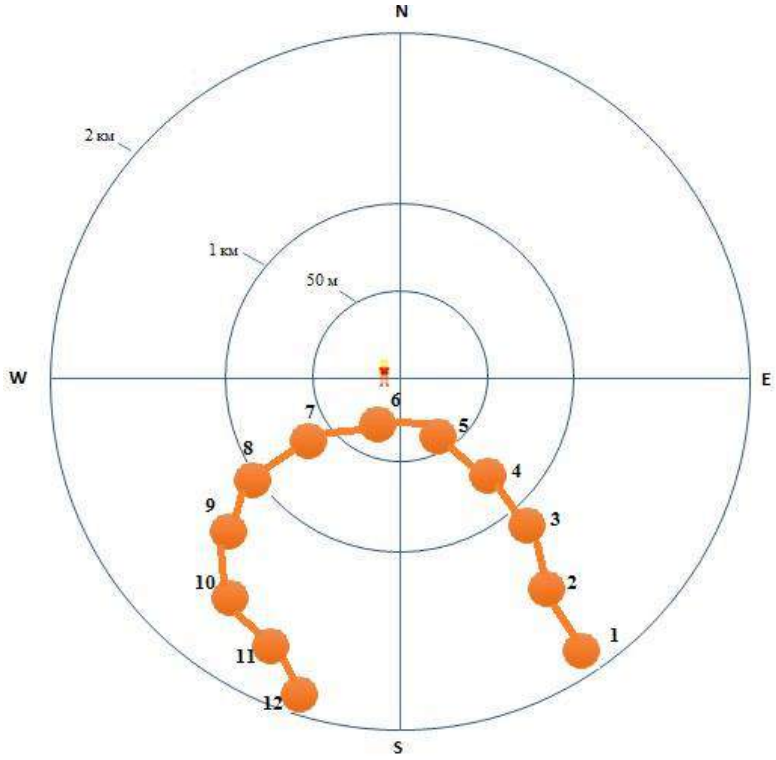


Fig. 37. Flight path for VP 3, 24.06.2020

Table 115 Target species log (VP 3), 24.06.2020

	Neophron percnopterus	1 90 m	2 90 m	3 85 m	4 85 m	5 90 m	6 90 m	7 85 m	8 85 m	9 85 m	10 85 m	11 90 m	12 90 m

Table 116 Target species log (VP 3), 24.06.2020

№	Latin name	English name	Number of individuals	Altitude (m)
1.	*Athene noctua*	Little owl	1	4
2.	*Oenanthe pleschanka*	Pied wheatear	1	3
3.	*Oenanthe isabellina*	Isabelline wheatear	1	3
4.	*Galerida cristata*	Crested lark	9	5

VP № 2

Date: 24.06.2020

VP survey time: 15^{36} - 18^{36}

Weather: The air temperature around 32-34°C, good visibility, wind speed (3-5 m/s), without precipitation.

Primary species not found

Table 117 Secondary species log (VP 2), 24.06.2020

№	Latin name	English name	Number of individuals	Altitude (m)
1.	*Falco tinnunculus*	Common kestrel	1	16
2.	*Oenanthe pleschanka*	Pied wheatear	1	3
3.	*Oenanthe isabellina*	Isabelline wheatear	2	4
4.	*Galerida cristata*	Crested lark	6	4

VP № 1

Date: 25.06.2020

VP survey time: 9^{23} - 12^{23}

Weather: The air temperature around 19-26°C, cloudy, good visibility, wind speed (5-7 m/s), without precipitation.

Primary species not found

Table 118 Target species log (VP 1), 25.06.2020

№	Latin name	English name	Number of individuals	Altitude (m)
1.	*Oenanthe isabellina*	Isabelline wheatear	1	2
2.	*Galerida cristata*	Crested lark	5	5
3.	*Merops supercilios*	Blue-cheeked Bee-eaterr	3	13
4.	*Muscicapa striata*	Spotted Flycatcher	1	5

VP № 9

Date: 25.06.2020
VP survey time: 15^{56} - 18^{56}
Weather:
The air temperature around 32-30 °C, cloudy, good visibility, wind speed (5-7 m/s), without precipitation.

Primary species not found

Table 119 Secondary species log (VP 9), 25.06.2020

№	Latin name	English name	Number of individuals	Altitude (m)
1.	*Oenanthe isabellina*	Isabelline wheatear	2	2
2.	*Galerida cristata*	Crested lark	10	3
3.	*Hirundo rustica*	Barn swallow	12	5
4.	*Acridotheres tristis*	Common myna	2	9

VP № 4

Date: 26.06.2020

VP survey time: 8^{32} - 11^{32}

Weather:
The air temperature around 22-26 °C, cloudy, good visibility, wind speed (3-5 m/s), without precipitation.
Primary species not found

Table 120 Secondary species log (VP 4), 26.06.2020

№	Latin name	English name	Number of individuals	Altitude (m)
1	*Oenanthe pleschanka*	Pied wheatear	1	3
2	*Oenanthe isabellina*	Isabelline wheatear	3	2
3	*Galerida cristata*	Crested lark	8	3
4	*Hirundo rustica*	Barn swallow	10	5

VP № 5

Date: 26.06.2020

VP survey time: 16^{12} - 19^{12}

Weather: : temperature: 35-30 °C cloudy, good visibility, wind speed (3-4 m/s), without precipitation.
Primary species not found

Table 121 Secondary species log (VP 5), 26.06.2020

№	Latin name	English name	Number of individuals	Altitude (m)
1.	*Falco tinnunculus*	Common kestrel	2	10
2.	*Oenanthe isabellina*	Isabelline wheatear	1	2
3.	*Galerida cristata*	Crested lark	6	3

VP № 6

Date: 27.06.2020

VP survey time: 9^{32} - 12^{32}

Weather: temperature: 22-28 °C cloudy, good visibility, wind speed (8-12 m/s), without precipitation.
Primary species not found

Table 122 Secondary species log (VP 6), 27.06.2020

№	Latin name	English name	Number of individuals	Altitude (m)
1.	*Merops persicus*	Blue-cheeked Bee-eaterrr	15	9
2.	*Oenanthe pleschanka*	Pied wheatear	1	3
3.	*Oenanthe isabellina*	Isabelline wheatear	3	3
4.	*Galerida cristata*	Crested lark	9	4
5.	*Acridotheres tristis* -	Common mayna	4	6

VP № 8

Date: 27.06.2020

VP survey time: 14^{56} - 17^{56}

Weather: temperature: 32-34 °C cloudy, good visibility, wind speed (5-7 m/s), without precipitation.
Primary species not found

Table 123. Secondary species log (VP 8), 27.06.2020

№	Latin name	English name	Number of individuals	Altitude (m)
1.	*Oenanthe pleschanka*	Pied wheatear	1	2
2.	*Oenanthe isabellina*	Isabelline wheatear	2	2
3.	*Galerida cristata*	Crested lark	11	3

VP survey results in July

VP. 1

Date: 01.07.2020. Start and end time: 8:36 – 11:40
Weather:
The air temperature around 19-28°C is clear,
Wind speed approx. (2-4m/s) No precipitation

Primary species not found

Table 124 Secondary species log 01.07.2020 VP 1

No.	Latin names	English names	Amount	Altitude (m)
1.	*Circus aeruginosus*	Marsh Harrier	1	20-25
2.	*Oenanthe isabellina*	Isabelline Wheatear	2	0-10
3.	*Galerida cristata*	Crested Lark	4	0-15
4.	*Columba livia*	Rock Dove	16	30
5.	*Apus apus*	Northern Swift	45	30-45
6.	*Hirundo rustica*	Barn Swallow	12	2-15

VP. 2

Date: 01.07.2020. Start and end time: 16:45 – 19:45
Weather:
The air temperature around 34-28°C is clear.
Wind speed approx. (3-5 m/s) No precipitation
Primary species not found

Table 125 Secondary species log 01.07.2020 VP 2

No.	Latin names	English names	Amount	Altitude (m)
1.	*Galerida cristata*	Crested Lark	3	3-10
2.	*Merops supercilios*	Blue-cheeked Bee-eaterr	14	12
3.	*Pterocles orientalis*	Black-bellied sandgrouse	2	10
4.	*Columba livia*	Rock Dove	40	18-20
5.	*Apus apus*	Northern Swift	60	30-40

VP. 3

Date: 02.07.2020. Start and end time: 7:20 – 10:20
Weather:
The air temperature around 23-25°C is clear.
Wind speed approx. (3-5 m/s) No precipitation

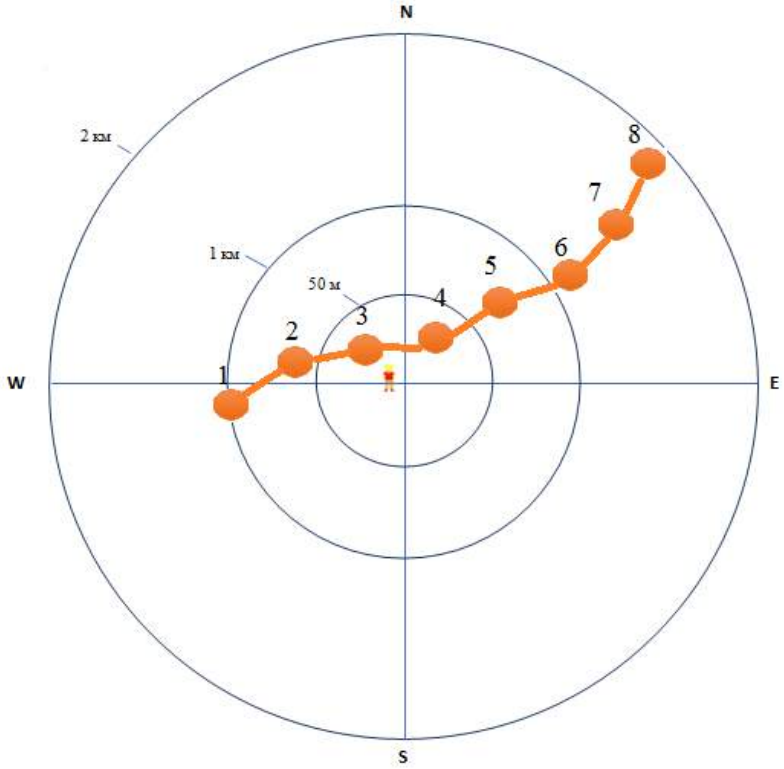


Fig. 38 Flight path (VP 3), 02.07.2020

Table 126 Target species log (VP 3), 02.07.2020

	*Neophron percnopterus*	1 45m	2 45m	3 40m	4 40m	5 45m	6 45m	7 40m	8 40m

Table 127 Secondary species log 01.07.2020 VP 3

No.	Latin names	English names	Amount	Altitude (m)
1.	*Pterocles orientalis*	Black-bellied sandgrouse	4	12
2.	*Coracias garrulus*	Eurasian Roller	2	9-15
3.	*Galerida cristata*	Crested Lark	4	3-10
4.	*Apus apus*	Northern Swift	52	40

VP. 4

Date: 02.07.2020. Start and end time: 10:55 – 13:55
Weather:
The air temperature around 28-34°C is clear.
Wind speed approx. (1-3 m/s) No precipitation

Primary species not found

Table 128 Secondary species log 02.07.2020 VP 4

No.	Latin names	English names	Amount	Altitude (m)
1.	*Galerida cristata*	Crested Lark	12	2-15
2.	*Upupa epops*	Hoopoe	1	3
3.	*Muscicapa striata*	Spotted Flycatcher	1	1-9
4.	*Buteo rufinus*	Long-legged Buzzard	3	3-20
5.	*Hirundo rustica*	Barn Swallow	3	5-30

VP. 5

Date: 02.07.2020. Start and end time: 14:25 – 17:25
Weather:
The air temperature around 37-32°C is clear,
Wind speed approx. (2-3m/s) No precipitation

Primary species not found

Table 129 Secondary species log 02.07.2020 VP 5

No.	Latin names	English names	Amount	Altitude (m)
1.	*Oenanthe isabellina*	Isabelline Wheatear	1	3
2.	*Galerida cristata*	Crested Lark	2	2-10
3.	*Hirundo rustica*	Barn Swallow	4	10-25

VP.6

Date: 03.07.2020. Start and end time: 8:24– 11:24
Weather:
The air temperature around 23-25°C is clear.
Wind speed approx. (3-5 m/s) No precipitation

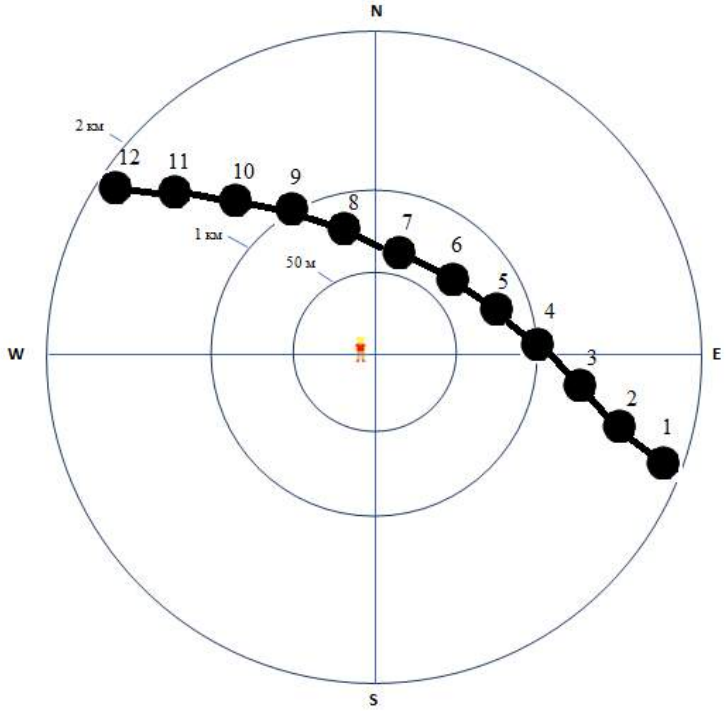


Fig. 39 Flight path (VP 6), 03.07.2020

Table 130 Target species log (VP 6), 03.07.2020

●	*Aquila nipalensis*	1 75 m	2 75 m	3 70 m	4 70 m	5 75 m	6 75 m	7 70 m	8 70 m	9 70 m	10 70 m	11 75 m	12 75 m

Table 131 Secondary species log 03.07.2020 VP 6

No.	Latin names	English names	Amount	Altitude (m)
1.	*Falco tinnunculus*	Kestrel	4	50
2.	*Oenanthe isabellina*	Isabelline Wheatear	2	3
3.	*Galerida cristata*	Crested Lark	3	2-10
4.	*Hirundo rustica*	Barn Swallow	7	10-35

VP. 8

Date: 03.07.2020. Start and end time: 15:14 – 18:14
Weather:
The air temperature around 32-30°C is clear.
Wind speed approx. (3-4m/s) No precipitation
Primary species not found

Table 132 Secondary species log 03.07.2020 VP 8

No.	Latin names	English names	Amount	Altitude (m)
1.	*Galerida cristata*	Crested Lark	3	2-10
2.	*Coracias garrulus*	Eurasian Roller	1	12
3.	*Columba livia*	Rock Dove	36	12
4.	*Hirundo rustica*	Barn Swallow	13	10-30

VP. 9

Date: 07.07.2020. Start and end time: 8:14 – 11:14
Weather:
The air temperature around 19-25°C is clear.
Wind speed approx. (4-6m/s) No precipitation
Primary species not found

Table 133 Secondary species log 07.07.2020 VP 9

No.	Latin names	English names	Amount	Altitude (m)
1.	*Galerida cristata*	Crested Lark	3	2
2.	*Coracias garrulus*	Eurasian Roller	1	12
3.	*Acridotheres tristis*	Common myna	2	8
4.	*Columba livia*	Rock Dove	3	12
5.	*Falco tinnunculus*	Common Kestrel	1	20
6.	*Apus apus*	Northern Swift	11	15
7.	*Hirundo rustica*	Barn Swallow	7	10-25

VP. 7

Date: 07.07.2020. Start and end time: 15:50 – 18:50
Weather:
The air temperature around 20-22°C is clear.
Wind speed approx. (1-3m/s) No precipitation
Primary species not found

Table 134 Secondary species log 07.07.2020 VP7

No.	Latin names	English names	Amount	Altitude (m)
1.	*Athene noctua*	Little Owl	1	2-8
2.	*Oenanthe isabellina*	Isabelline Wheatear	2	3
3.	*Acridotheres tristis*	Commonmayna	3	14
4.	*Buteo rufinus*	Long-legged Buzzard	1	30

VP. 1

Date: 08.07.2020. Start and end time: 8:09 – 11:09

Weather:

The air temperature around 22-26°C is clear.

Wind speed approx. (3-5 m/s) No precipitation

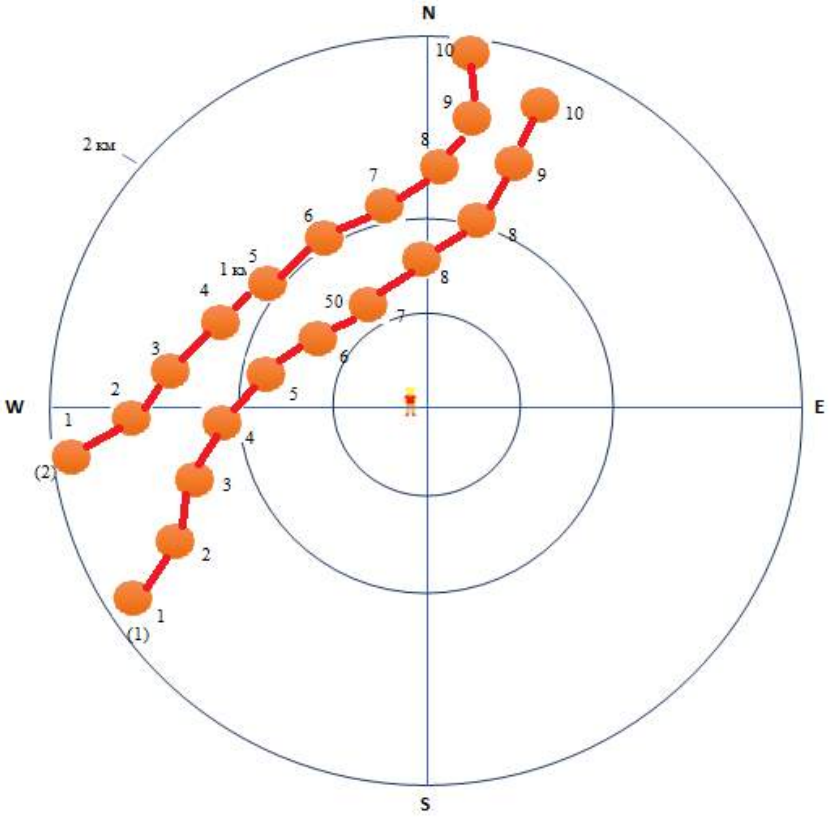


Fig. 40 Flight path (VP 1), 08.07.2020

Table 135 Target species log (VP 1), 08.07.2020

	Neophron percnopterus	1 50m	2 50m	3 50m	4 55m	5 55m	6 50m	7 55m	8 55m	9 50m	10 50m
	Neophron percnopterus	1 50m	2 50m	3 50m	4 55m	5 55m	6 50m	7 55m	8 55m	9 50m	10 50m

Table 136 Secondary species log 08.07.2020 VP1

No.	Latin names	English names	Amount	Altitude (m)
1.	*Falco naumanni*	Lesser Kestrel	2	18
2.	*Galerida cristata*	Crested Lark	5	3
3.	*Pterocles orientalis*	Black-bellied sandgrouse	2	8
4.	*Apus apus*	Northern Swift	15	30

VP. 2

Date: 08.07.2020. Start and end time: 16:16 – 19:16
Weather:
The air temperature around 32-30°C is clear.
Wind speed approx. (3-4 m/s) No precipitation
Primary species not found

Table 137 Secondary species log 08.07.2020 VP2

No.	Latin names	English names	Amount	Altitude (m)
1.	*Galerida cristata*	Crested Lark	5	3
2.	*Pterocles orientalis*	Black-bellied sandgrouse	2	8
3.	*Merops supercilios*	Blue-cheeked Bee-eaterr	18	15
4.	*Buteo rufinus*	Long-legged Buzzard	1	15

VP. 4

Date: 09.07.2020. Start and end time: 8:35 – 11:35
Weather:
The air temperature around 20-28°C is clear.
Wind speed approx. (5-7m/s) No precipitation
Primary species not found

Table 138 Secondary species log 09.07.2020 VP4

No.	Latin names	English names	Amount	Altitude (m)
1.	*Circus aeruginosus*	Marsh-Harrier	1	23
2.	*Merops supercilios*	Blue-cheeked Bee-eaterr	5	10
3.	*Pterocles orientalis*	Black-bellied sandgrouse	2	1
4.	*Galerida cristata*	Crested Lark	6	5

VP.3

Date:09 .07.2020. Start and end time: 15:37 – 18:37
Weather:
The air temperature around 32-34°C is clear.
Wind speed approx. (2-4 m/s) No precipitation
Primary species not found

Table 139 Secondary species log 09.07.2020 VP3

No.	Latin names	English names	Amount	Altitude (m)
1.	*Merops supercilios*	Blue-cheeked Bee-eaterrr	4	10
2.	*Galerida cristata*	Crested Lark	3	5
3.	*Oenanthe isabellina*	Isabelline Wheatear	1	2
4.	*Columba livia*	Rock Dove	21	25

VP.5

Date:14.07.2020. Start and end time: 8:53 – 11:53
Weather:
The air temperature around 22-28°C is clear.
Wind speed approx. (3-5m/s) No precipitation

Primary species not found

Table 140 Secondary species log 14.07.2020 VP5

No.	Latin names	English names	Amount	Altitude (m)
1.	*Merops supercilios*	Blue-cheeked Bee-eaterr	3	12
2.	*Galerida cristata*	Crested Lark	5	3-10
3.	*Oenanthe isabellina*	Isabelline Wheatear	2	1-3
4.	*Falco tinnunculus*	Kestrel	2	16

VP. 6

Date:14.07.2020. Start and end time: 15:36 – 18:40
eather:
The air temperature around 37-32°C is clear.
Wind speed approx. (2-4m/s) No precipitation
Primary species not found

Table 141 Secondary species log 14.07.2020 VP6

No.	Latin names	English names	Amount	Altitude (m)
1.	*Galerida cristata*	Crested Lark	2	3-10
2.	*Oenanthe isabellina*	Isabelline Wheatear	1	1-5

VP 8

Date: 15.07.2020. Start and end time: 7:46 – 10:46
Weather:
The air temperature around 20-26°C is clear.
Wind speed approx. (2-4m/s) No precipitation

Primary species not found

Table 142 Secondary species log 15.07.2020 VP8

No.	Latin names	English names	Amount	Altitude (m)
1.	*Galerida cristata*	Crested Lark	6	2-5
2.	*Oenanthe isabellina*	Isabelline Wheatear	1	2-10
3.	*Pterocles orientalis*	Black-bellied sandgrouse	2	13

VP.9

Date: 15.07.2020. Start and end time: 16:17 – 19:27
Weather:
The air temperature around 30-32°C is clear.
Wind speed approx. (2-5m/s) No precipitation

Primary species not found

Table 143 Secondary species log 15.07.2020 VP9

No.	Latin names	English names	Amount	Altitude (m)
1.	*Galerida cristata*	Crested Lark	4	2
2.	*Oenanthe isabellina*	Isabelline Wheatear	2	2
3.	*Pterocles orientalis*	Black-bellied sandgrouse	4	13
4.	*Merops supercilios*	Blue-cheeked Bee-eaterr	5	18
5.	*Coracias garrulus*	Eurasian Roller	1	12
6.	*Falco tinnunculus*	Common Kestrel	1	25

VP. 1

Date: 16.07.2020. Start and end time: 8:26 – 11:26
Weather:
The air temperature around 22-28°C is clear.
Wind speed approx. (2-4m/s) No precipitation

Primary species not found

Table 144 Secondary species log 16.07.2020 VP1

No.	Latin names	English names	Amount	Altitude (m)
1.	*Galerida cristata*	Crested Lark	3	2-10
2.	*Oenanthe isabellina*	Isabelline Wheatear	1	2-7
3.	*Merops supercilios*	Blue-cheeked Bee-eaterr	2	13

VP. 7

Date: 16.05.2020 Start and end time: 16:15 – 19:20
Weather:
The air temperature around 32-29°C is clear.
Wind speed approx. (2-4m/s) No precipitation

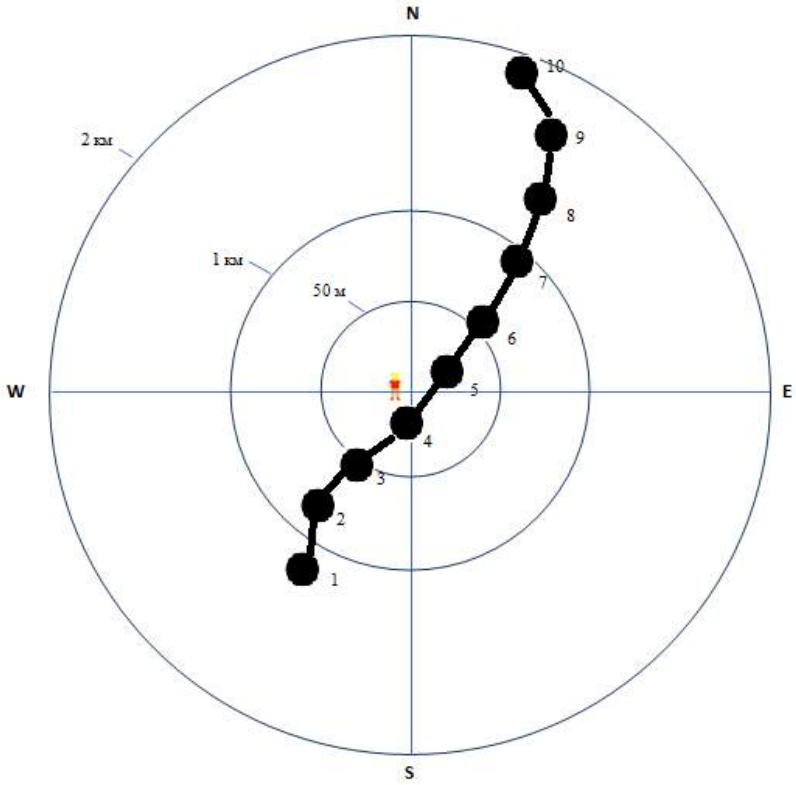


Fig. 41 Flight path(VP 7), 16.07.2020

Table 145 Target species log (VP 7), 16.07.2020

	*Aquila nipalensis*	1 50m	2 50m	3 50m	4 55m	5 55m	6 50m	7 55m	8 55m	9 50m	10 50m

Table 146 Secondary species log 16.07.2020 VP 7

No.	Latin names	English names	Amount	Altitude (m)
1.	*Galerida cristata*	Crested Lark	6	5-12
2.	*Oenanthe isabellina*	Isabelline Wheatear	2	3-10
3.	*Hirundo rustica*	Barn Swallow	6	10-25

VP. 2

Date: 22.07.2020. Start and end time: 8:50 – 11:50
Weather:
The air temperature around 20-25°C is clear.
Wind speed approx. (3-5m/s) No precipitation

Primary species not found

Table 147 Secondary species log 12.07.2020 VP 2

No.	Latin names	English names	Amount	Altitude (m)
1.	*Galerida cristata*	Crested Lark	3	2-8
2.	*Oenanthe isabellina*	Isabelline Wheatear	1	2-8
3.	*Falco naumanni*	Lesser Kestrel	1	16
4.	*Apus apus*	Northern Swift	22	35
5.	*Hirundo rustica*	Barn Swallow	48	12-25

VP. 3

Date: 22.07.2020. Start and end time: 16:23 – 19:23
Weather:
The air temperature around 32-29°C is clear.
Wind speed approx. (3-5m/s) No precipitation

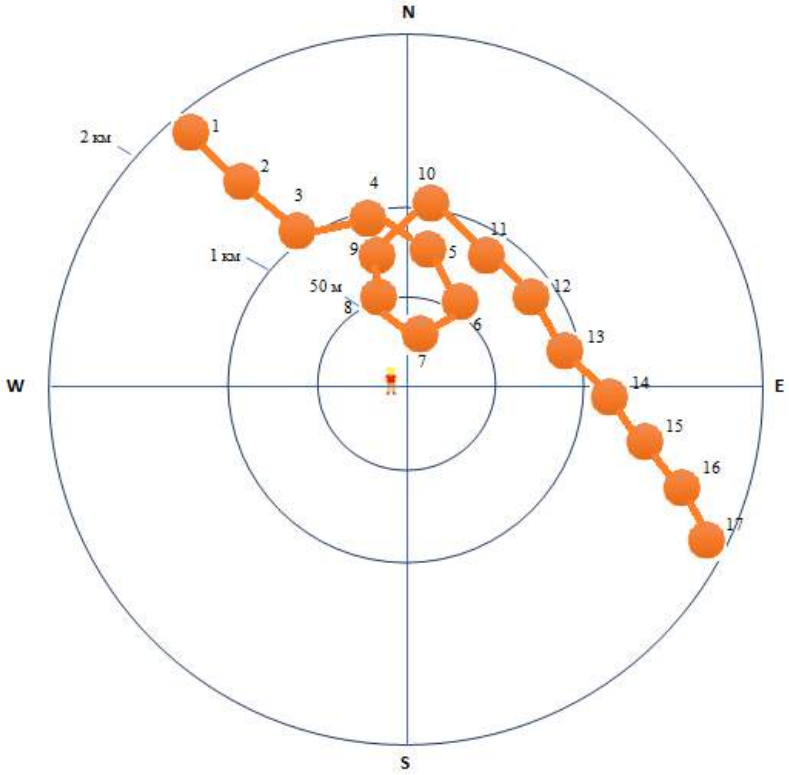


Fig. 42 Flight path (VP 3), 22.07.2020

Table 148 Target species log (VP 3), 22.07.2020

	Neophron percnopterus	1-60 m	2-60 m	3-65 m	4-60 m	5-65 m	6-65 m	7-65 m	8-60 m	9-60 m	10-65 m	11-60 m	12-60 m	13-60 m	14-60 m	15-65 m	16-60 m	17-65 m

Table 149 Secondary species log 22.07.2020 VP 3

No.	Latin names	English names	Amount	Altitude (m)
1.	*Galerida cristata*	Crested Lark	3	2-10
2.	*Oenanthe isabellina*	Isabelline Wheatear	1	2-4
3.	*Falco naumanni*	Lesser Kestrel	1	16-20
4.	*Athene noctua*	Little Owl	1	1
5.	*Columba livia*	Rock Dove	30	20
6.	*Merops superciliosus*	Merops superciliosus	27	1-15
7.	*Hirundo rustica*	Barn Swallow	37	15-25

VP survey results in August

Date: 01.08.2020. Start and end time: 8:36 – 11:40
Weather:
The air temperature around 24-28°C is clear,
Wind speed approx. (2-4 m/s) No precipitation

VP 3

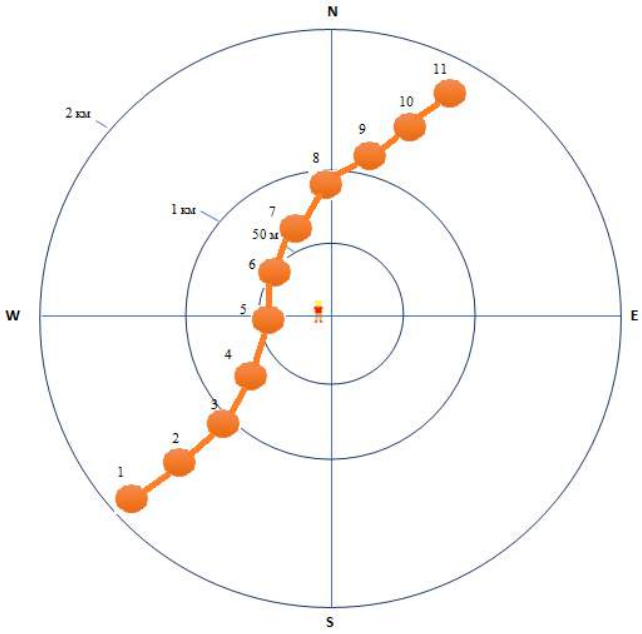


Fig. 43 Flight path (VP 3), 01.08.2020

Table 150 Target species log (VP 3), 01.08.2020

	Neophron percnopterus	1 35 m	2 35 m	3 40 m	4 40 m	5 35 m	6 35 m	7 40 m	8 40 m	9 40 m	10 40 m

Table 151 Secondary species log 01.08.2020 VP 3

No.	Latin names	English names	Amount	Altitude (m)
7.	*Circus aeruginosus*	Marsh Harrier	1	15
8.	*Oenanthe isabellina*	Isabelline Wheatear	1	2
9.	*Galerida cristata*	Crested Lark	15	3
10.	*Hirundo rustica*	Barn Swallow	18	15
11.	*Athene noctua*	Little Owl	1	3

VP 4

Date: 01.08.2020. Start and end time: 16:45 – 19:45
Weather:
The air temperature around 34-38°C is clear.
Wind speed approx. (3-5 m/s) No precipitation
Primary species not found

Table 152 Secondary species log 01.08.2020 VP 4

No.	Latin names	English names	Amount	Altitude (m)
1.	*Galerida cristata*	Crested Lark	14	0-3
2.	*Merops supercilios*	Blue-cheeked Bee-eaterr	16	1-12
3.	*Pterocles orientalis*	Black-bellied sandgrouse	4	10
4.	*Lanius pallidirostris*	Southern grey shrike	2	5

VP 7

Date: 02.08.2020. Start and end time: 7:20 – 10:20
Weather:
The air temperature around 28-32°C is clear.
Wind speed approx. (3-5 m/s) No precipitation

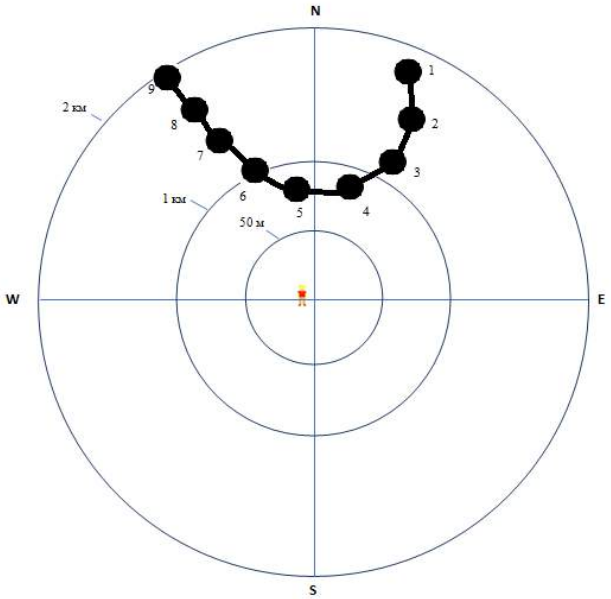


Fig. 44 Flight path (VP 7), 02.08.2020

Table 153 Target species log (VP 7), 02.08.2020

●	*Aquila nipalensis*	1 75 m	2 75 m	3 70 m	4 70 m	5 75 m	6 75 m	7 70 m	8 70 m	9 70 m

Table 154 Secondary species log 02.08.2020 VP 7

No.	Latin names	English names	Amount	Altitude (m)
5.	*Pterocles orientalis*	Black-bellied sandgrouse	4	12
6.	*Hippolais rama*	Southern Booted Warbler	1	2
7.	*Coracias garrulus*	Eurasian Roller	2	9
8.	*Galerida cristata*	Crested Lark	9	3
9.	*Hirundo rustica*	Barn Swallow	3	6
10.	*Columba livia*	Rock Dove	23	12
11.	*Pterocles orientalis*	Black-bellied sandgrouse	2	5

VP 8

Date: 02.08.2020. Start and end time: 15:55 – 18:55
Weather:
The air temperature around 30-34°C is clear.
Wind speed approx. (1-3 m/s) No precipitation

Primary species not found

Table 155 Secondary species log 02.08.2020 VP 8

No.	Latin names	English names	Amount	Altitude (m)
6.	*Galerida cristata*	Crested Lark	8	2
7.	*Muscicapa striata*	Spotted Flycatcher	1	1
8.	*Scotocerca inguieta*	Streaked Scrub Warbler	1	1
9.	*Acridotheres tristis*	Common myna	3	6
10.	*Falco naumanni*	Lesser kestrel	1	16

VP 5

Date: 03.08.2020. Start and end time: 9:25 – 12:25
Weather:
The air temperature around 20-26°C is clear.
Wind speed approx. (5-6 m/s) No precipitation

Primary species not found

Table 156 Secondary species log 03.08.2020 VP 5

No.	Latin names	English names	Amount	Altitude (m)
1.	*Oenanthe isabellina*	Isabelline Wheatear	1	3
2.	*Buteo rufinus*	Long-legged Buzzard	1	40
3.	*Galerida cristata*	Crested Lark	5	3
4.	*Hirundo rustica*	Barn swallow	2	6
5.	*Muscicapa striata*	Spotted Flycatcher	1	1
6.	*Calandrella rufescens*	Lesser Short-toed Lark	15	0-5

VP 6

Date: 03.08.2020. Start and end time: 14:24– 17:28
Weather:
The air temperature around 29-32°C is clear.
Wind speed approx. (3-5 m/s) No precipitation

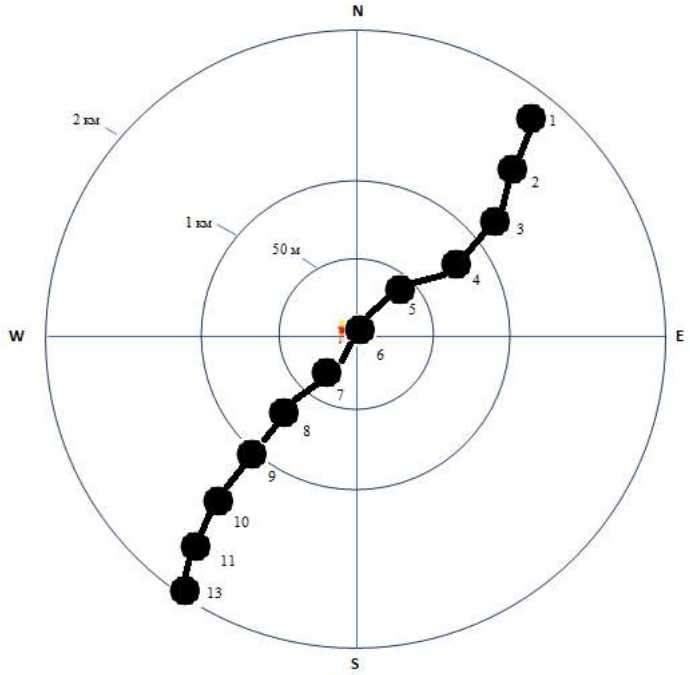


Fig. 45 Flight path (VP 6), 03.08.2020

Table 157 Target species log (VP 6), 03.08.2020

●	*Aquila nipalensis*	1 75 m	2 75 m	3 70 m	4 70 m	5 75 m	6 75 m	7 70 m	8 70 m	9 70 m	10 70 m	11 75 m	12 75 m	13 75 m

Table 158 Secondary species log 03.08.2020 VP 6

No.	Latin names	English names	Amount	Altitude (m)
1.	*Falco tinnunculus*	Kestrel	1	16
2.	*Oenanthe isabellina*	Isabelline Wheatear	2	2
3.	*Galerida cristata*	Crested Lark	12	4
4.	*Circus cyaneus*	Hen (Northern) Harrier	1	14

VP 2

Date: 04.08.2020. Start and end time: 7:34 – 10:35
Weather:
The air temperature around 32-36°C is clear.
Wind speed approx. (3-4 m/s) No precipitation
Primary species not found

Table 159 Secondary species log 04.08.2020 VP 2

No.	Latin names	English names	Amount	Altitude (m)
5.	*Galerida cristata*	Crested Lark	5	2
6.	*Coracias garrulus*	Eurasian Roller	2	2
7.	*Hirundo rustica*	Barn Swallow	5	6
8.	*Pterocles orientalis*	Black-bellied sandgrouse	2	6

VP 1

Date: 04.08.2020. Start and end time: 11:09 – 14:09
Weather:
The air temperature around 28-31°C is clear.
Wind speed approx. (1-3 m/s) No precipitation
Primary species not found

Table 160 Secondary species log 04.08.2020 VP 1

No.	Latin names	English names	Amount	Altitude (m)
1.	*Galerida cristata*	Crested Lark	6	2
2.	*Phalacrocorax pygmaeus*	Pygmy cormorant	3	3
3.	*Hirundo rustica*	Barn Swallow	2	6
4.	*Calandrella rufescens*	Lesser Short-toed Lark	8	0-5
5.	*Oenanthe isabellina*	Isabelline Wheatear	2	3

VP 9

Date: 04.08.2020. Start and end time: 14:46 – 17:46
Weather:
The air temperature around 32-38°C is clear.
Wind speed approx. (2-3 m/s) No precipitation
Primary species not found

Table 161 Secondary species log 04.08.2020 VP 9

No.	Latin names	English names	Amount	Altitude (m)
5.	*Columba livia*	Rock Dove	5	15
6.	*Oenanthe isabellina*	Isabelline Wheatear	2	3
7.	*Calandrella rufescens*	Lesser Short-toed Lark	9	0-5
8.	*Merops supercilios*	Blue-cheeked Bee-eaterr	6	10
9.	*Pterocles orientalis*	Black-bellied sandgrouse	2	6
10.	*Hirundo rustica*	Barn swallow	3	5

VP 3

Date: 05.08.2020. Start and end time: 8:09 – 11:09
Weather:
The air temperature around 32-36°C is clear.
Wind speed approx. (3-5 m/s) No precipitation

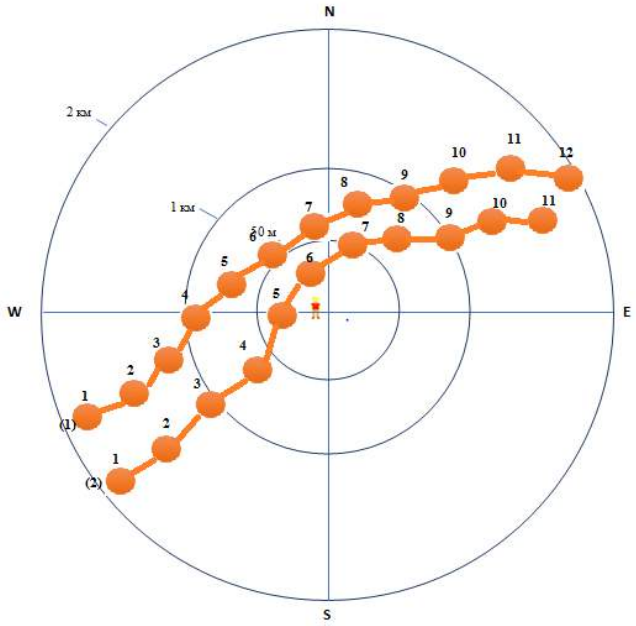


Fig. 46 Flight path(VP 3), 05.08.2020

Table 162 Target species log (VP 3), 05.08.2020

	Neophron percnopterus (1)	1 50 m	2 50 m	3 50 m	4 55 m	5 55 m	6 50 m	7 55 m	8 55 m	9 50 m	10 50 m	11 50 m	12 50 m
	Neophron percnopterus (2)	1 50 m	2 50 m	3 50 m	4 55 m	5 55 m	6 50 m	7 55 m	8 55 m	9 50 m	10 50 m	11 50 m	

Table 163 Secondary species log 05.08.2020 VP 3

No.	Latin names	English names	Amount	Altitude (m)
5.	*Falco naumanni*	Lesser Kestrel	2	18
6.	*Calandrella rufescens*	Lesser Short-toed Lark	16	0-5
7.	*Galerida cristata*	Crested Lark	5	3
8.	*Pterocles orientalis*	Black-bellied sandgrouse	2	8
9.	*Hirundo rustica*	Barn swallow	2	2-5

VP 4

Date: 05.08.2020. Start and end time: 16:16 – 19:16
Weather:
The air temperature around 34-38°C is clear.
Wind speed approx. (3-4 m/s) No precipitation
Primary species not found

Table 164 Secondary species log 05.08.2020 VP 4

No.	Latin names	English names	Amount	Altitude (m)
5.	*Galerida cristata*	Crested Lark	9	3
6.	*Pterocles orientalis*	Black-bellied sandgrouse	2	8
7.	*Merops supercilios*	Blue-cheeked Bee-eaterr	2	15
8.	*Hirundo rustica*	Barn swallow	1	5
9.	*Athene noctua*	Little Owl	1	4

VP 8

Date: 09.08.2020. Start and end time: 8:35 – 11:35
Weather:
The air temperature around 28-32°C is clear.
Wind speed approx. (5-7 m/s) No precipitation
Primary species not found

Table 165 Secondary species log 09.08.2020 VP 8

No.	Latin names	English names	Amount	Altitude (m)
5.	*Circus aeruginosus*	Marsh-Harrier	1	16
6.	*Merops supercilios*	Blue-cheeked Bee-eaterr	5	10
7.	*Falco tinnunculus*	Kestrel	2	14
8.	*Galerida cristata*	Crested Lark	9	5
9.	*Calandrella rufescens*	Lesser Short-toed Lark	6	3-5

VP 7

Date:09.08.2020. Start and end time: 15:37 – 18:37
Weather:
The air temperature around 32-36°C is clear.
Wind speed approx. (2-4 m/s) No precipitation
Primary species not found

Table 166 Secondary species log 09.08.2020 VP 7

No.	Latin names	English names	Amount	Altitude (m)
5.	*Buteo rufinus*	Long-legged Buzzard	1	30
6.	*Galerida cristata*	Crested Lark	8	3
7.	*Oenanthe isabellina*	Isabelline Wheatear	1	2
8.	*Merops supercilios*	Blue-cheeked Bee-eaterr	5	16
9.	*Hirundo rustica*	Barn swallow	5	6

VP 5

Date:10.08.2020. Start and end time: 8:53 – 11:53
Weather:
The air temperature around 29-33°C is clear.
Wind speed approx. (3-5 m/s) No precipitation

Primary species not found

Table 167 Secondary species log 10.08.2020 VP 5

No.	Latin names	English names	Amount	Altitude (m)
5.	*Acridotheres tristis*	Common myna	3	5
6.	*Galerida cristata*	Crested Lark	5	3
7.	*Oenanthe isabellina*	Isabelline Wheatear	2	1
8.	*Falco tinnunculus*	Kestrel	1	20
9.	*Hirundo rustica*	Barn swallow	4	6

VP 6

Date:10.08.2020. Start and end time: 15:36 – 18:40
eather:
The air temperature around 36-39°C is clear.
Wind speed approx. (2-4 m/s) No precipitation
Primary species not found

Table 168 Secondary species log 10.08.2020 VP 6

No.	Latin names	English names	Amount	Altitude (m)
3.	*Galerida cristata*	Crested Lark	6	3
4.	*Oenanthe isabellina*	Isabelline Wheatear	1	1
5.	*Merops supercilios*	Blue-cheeked Bee-eaterr	16	25
6.	*Hirundo rustica*	Barn swallow	3	2-10

VP 9

Date: 11.08.2020. Start and end time: 7:46 – 10:46
Weather:
The air temperature around 34-36°C is clear.
Wind speed approx. (2-4 m/s) No precipitation

Primary species not found

Table 169 Secondary species log 11.08.2020 VP 9

No.	Latin names	English names	Amount	Altitude (m)
4.	*Galerida cristata*	Crested Lark	6	2
5.	*Calandrella rufescens*	Lesser Short-toed Lark	8	0-5
6.	*Merops supercilios*	Blue-cheeked Bee-eaterr	3	16
7.	*Oenanthe isabellina*	Isabelline Wheatear	2	3
8.	*Hirundo rustica*	Barn Swallow	4	4
9.	*Pterocles orientalis*	Black-bellied sandgrouse	2	13

VP 1

Date: 11.08.2020. Start and end time: 11:17 – 14:17
Weather:
The air temperature around 30-32°C is clear.
Wind speed approx. (2-5 m/s) No precipitation

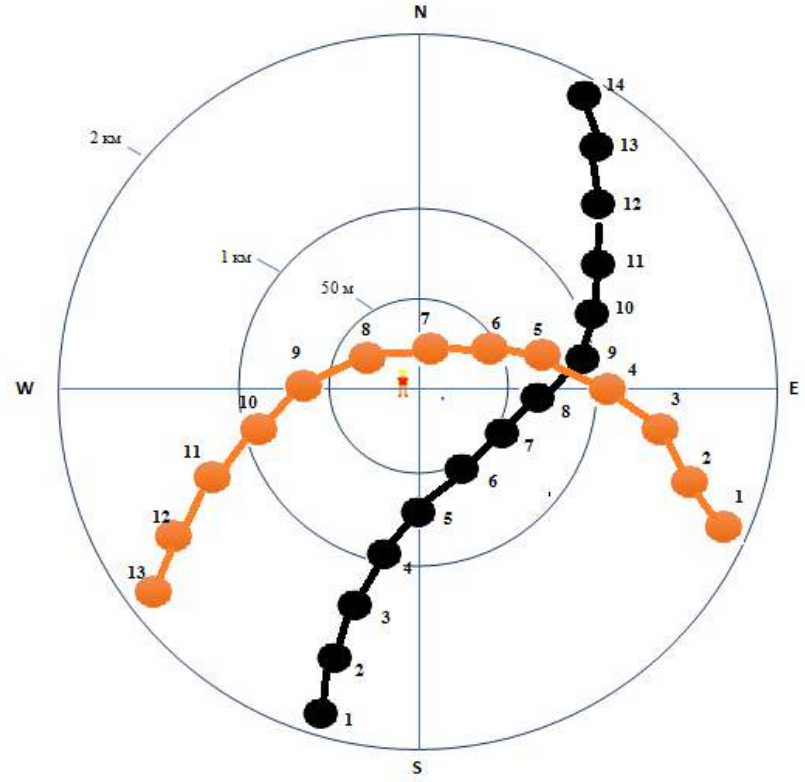


Fig. 47 Flight path(VP 1), 11.08.2020

Table 170 Target species log (VP 1), 11.08.2020

	Aquila nipalensis	1 70 m	2 70 m	3 70 m	4 75 m	5 70 m	6 70 m	7 70 m	8 75 m	9 70 m	10 70 m	11 70 m	12 75 m	13 70 m	14 70 m
	Neophron percnopterus	1 50 m	2 50 m	3 50 m	4 55 m	5 50 m	6 50 m	7 50 m	8 55 m	9 50 m	10 50 m	11 50 m	12 55 m	13 50 m	

Table 171 Secondary species log 11.08.2020 VP 1

No.	Latin names	English names	Amount	Altitude (m)
7.	*Galerida cristata*	Crested Lark	8	5
8.	*Calandrella rufescens*	Lesser Short-toed Lark	22	0-5
9.	*Oenanthe isabellina*	Isabelline Wheatear	2	2
10.	*Pterocles orientalis*	Black-bellied sandgrouse	4	13
11.	*Merops supercilios*	Blue-cheeked Bee-eaterr	5	18
12.	*Coracias garrulus*	Eurasian Roller	1	12

VP 2

Date: 11.08.2020. Start and end time: 14:46 – 17:46
Weather:
The air temperature around 32-36°C is clear.
Wind speed approx. (2-4 m/s) No precipitation

Primary species not found

Table 172 Secondary species log 11.08.2020 VP 2

No.	Latin names	English names	Amount	Altitude (m)
1.	*Galerida cristata*	Crested Lark	6	3
2.	*Oenanthe isabellina*	Isabelline Wheatear	1	2
3.	*Merops supercilios*	Blue-cheeked Bee-eaterr	2	11
4.	*Athene noctua*	Little Owl	2	6
5.	*Calandrella rufescens*	Lesser Short-toed Lark	8	0-8
6.	*Phalacrocorax pygmaeus*	Pygmy cormorant	2	8

VP 3

Date: 12.08.2020. Start and end time: 8:15 – 11:15
Weather:
The air temperature around 30-36°C is clear.
Wind speed approx. (2-4 m/s) No precipitation

Table 173 Target species log (VP 3), 12.08.2020

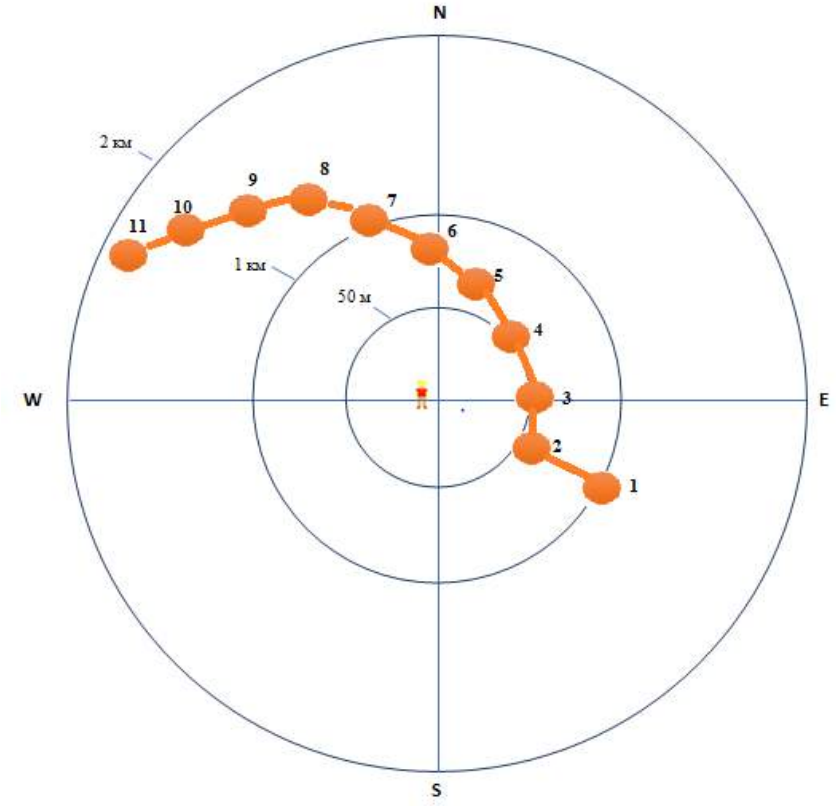


Fig. 48 Flight path (VP 3), 12.08.2020

	Neophron percnopterus	1 0 m	2	3	4	5	6	7	8	9	10	11

			20 m	30 m	35 m	35 m	40 m	45 m	45 m	50 m	50 m	50 m

Table 174 Secondary species log 12.08.2020 VP 3

No.	Latin names	English names	Amount	Altitude (m)
4.	*Galerida cristata*	Crested Lark	9	5
5.	*Oenanthe isabellina*	Isabelline Wheatear	3	3
6.	*Circus aeruginosus*	Marsh Harrier	1	18
7.	*Pterocles orientalis*	Black-bellied sandgrouse	4	5

VP 4

Date: 12.08.2020. Start and end time: 11:50 – 14:50
Weather:
The air temperature around 34-38°C is clear.
Wind speed approx. (3-5 m/s) No precipitation

Primary species not found

Table 175 Secondary species log 12.08.2020 VP 4

No.	Latin names	English names	Amount	Altitude (m)
6.	*Galerida cristata*	Crested Lark	12	5
7.	*Oenanthe isabellina*	Isabelline Wheatear	1	2
8.	*Falco naumanni*	Lesser Kestrel	1	13
9.	*Pterocles orientalis*	Black-bellied sandgrouse	2	4
10.	*Merops supercilios*	Blue-cheeked Bee-eaterr	3	6
11.	*Calandrella rufescens*	Lesser Short-toed Lark	7	0-2
12.	*Lanius pallidirostris*	Southern grey shrike	2	5

VP 5

Date: 12.08.2020. Start and end time: 15:23 – 19:23
Weather:
The air temperature around 32-38°C is clear.
Wind speed approx. (3-5 m/s) No precipitation
Primary species not found

Table 176 Secondary species log 12.08.2020 VP 5

No.	Latin names	English names	Amount	Altitude (m)
8.	*Galerida cristata*	Crested Lark	3	2
9.	*Oenanthe isabellina*	Isabelline Wheatear	3	1
10.	*Athene noctua*	Little Owl	1	3
11.	*Hirundo rustica*	Barn Swallow	3	5
12.	*Circus cyaneus*	Hen (Northern) Harrier	1	9

VP 7

Date:13.08.2020. Start and end time: 7:37 – 10:37
Weather:
The air temperature around 28-32°C is clear.
Wind speed approx. (5-6 m/s) No precipitation
Primary species not found

Table 177 Secondary species log 13.08.2020 VP 7

No.	Latin names	English names	Amount	Altitude (m)
1.	*Merops supercilios*	Blue-cheeked Bee-eaterr	6	8
2.	*Galerida cristata*	Crested Lark	13	5
3.	*Oenanthe isabellina*	Isabelline Wheatear	2	3
4.	*Hirundo rustica*	Barn swallow	4	6
5.	*Falco tinnunculus*	Kestrel	1	18

VP 6

Date:13.08.2020. Start and end time: 11:03 – 14:03
Weather:
The air temperature around 28-32°C is clear.
Wind speed approx. (3-5 m/s) No precipitation

Primary species not found

Table 178 Secondary species log 13.08.2020 VP 6

No.	Latin names	English names	Amount	Altitude (m)
1.	*Acridotheres tristis*	Common myna	3	5
2.	*Galerida cristata*	Crested Lark	9	3
3.	*Calandrella rufescens*	Lesser Short-toed Lark	9	0-5
4.	*Oenanthe isabellina*	Isabelline Wheatear	2	1
5.	*Falco tinnunculus*	Kestrel	1	15
6.	*Hirundo rustica*	Barn swallow	4	6

VP 8

Date:13.08.2020. Start and end time: 14:46 – 17:46
eather:
The air temperature around 32-39°C is clear.
Wind speed approx. (2-4 m/s) No precipitation
Primary species not found

Table 179 Secondary species log 13.08.2020 VP 8

No.	Latin names	English names	Amount	Altitude (m)
1.	*Galerida cristata*	Crested Lark	6	3
2.	*Oenanthe isabellina*	Isabelline Wheatear	1	1
3.	*Merops supercilios*	Blue-cheeked Bee-eaterr	18	23
4.	*Hirundo rustica*	Barn swallow	5	6
5.	*Nycticorax nycticorax*	Black-crowned night-heron	1	25

VP 9

Date: 14.08.2020. Start and end time: 7:46 – 10:46
Weather:
The air temperature around 26-30°C is clear.
Wind speed approx. (2-4 m/s) No precipitation

Primary species not found

Table 180 Secondary species log 14.08.2020 VP 9

No.	Latin names	English names	Amount	Altitude (m)
1.	*Galerida cristata*	Crested Lark	12	3
2.	*Merops supercilios*	Blue-cheeked Bee-eaterr	5	16
3.	*Oenanthe isabellina*	Isabelline Wheatear	3	2
4.	*Hirundo rustica*	Barn Swallow	6	4
5.	*Pterocles orientalis*	Black-bellied sandgrouse	2	13
6.	*Scotocerca inguieta*	Streaked Scrub Warbler	2	2
7.	*Acridotheres tristis*	Common myna	3	9

VP 1

Date: 14.08.2020. Start and end time: 11:17 – 14:17
Weather:
The air temperature around 30-32°C is clear.
Wind speed approx. (2-5 m/s) No precipitation

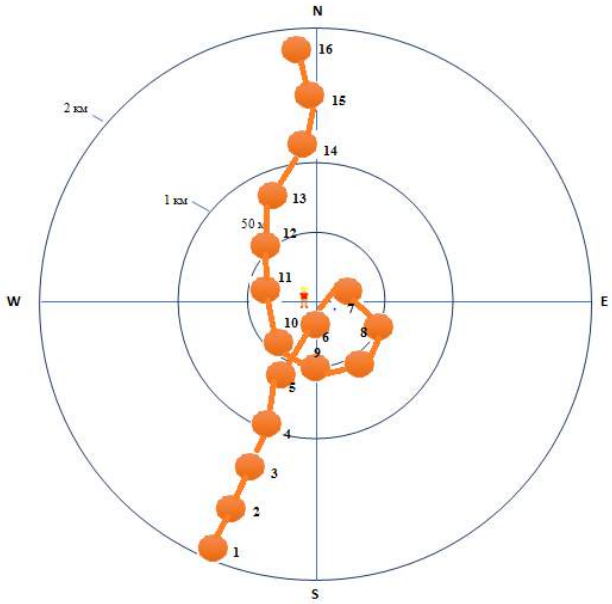


Fig. 49 Flight path (VP 1), 14.08.2020

Table 181 Target species log (VP 1), 14.08.2020

	Neophron percnopterus	1 50 m	2 50 m	3 50 m	4 55 m	5 50 m	6 50 m	7 50 m	8 55 m	9 50 m	10 50 m	11 50 m	12 55 m	13 50 m	14 50 m	15 50 m	16 50 m

Table 182 Secondary species log 14.08.2020 VP 1

No.	Latin names	English names	Amount	Altitude (m)
1.	*Galerida cristata*	Crested Lark	6	4
2.	*Oenanthe isabellina*	Isabelline Wheatear	2	1
3.	*Pterocles orientalis*	Black-bellied sandgrouse	5	12
4.	*Merops supercilios*	Blue-cheeked Bee-eaterr	5	18
5.	*Hirundo rustica*	Barn swallow	5	4
6.	*Calandrella rufescens*	Lesser Short-toed Lark	8	0-5

VP 2

Date: 14.08.2020. Start and end time: 14:46 – 17:46
Weather:
The air temperature around 31-35°C is clear.
Wind speed approx. (2-4 m/s) No precipitation

Primary species not found

Table 183 Secondary species log 14 .08.2020 VP 2

No.	Latin names	English names	Amount	Altitude (m)
1.	*Galerida cristata*	Crested Lark	6	3
2.	*Oenanthe isabellina*	Isabelline Wheatear	1	2
3.	*Merops supercilios*	Blue-cheeked Bee-eaterr	3	5-11
4.	*Athene noctua*	Little Owl	1	1
5.	*Phalacrocorax pygmaeus*	Pygmy cormorant	3	10
6.	*Hirundo rustica*	Barn swallow	12	5

VP 3

Date: 15.08.2020. Start and end time: 8:15 – 11:15
Weather:
The air temperature around 28-36°C is clear.
Wind speed approx. (2-4 m/s) No precipitation

Primary species not found

Table 184 Secondary species log 15.08.2020 VP 3

No.	Latin names	English names	Amount	Altitude (m)
1.	*Galerida cristata*	Crested Lark	12	4
2.	*Calandrella rufescens*	Lesser Short-toed Lark	30	0-3
3.	*Circus aeruginosus*	Marsh Harrier	1	13
4.	*Oenanthe isabellina*	Isabelline Wheatear	2	1
5.	*Pterocles orientalis*	Black-bellied sandgrouse	2	9

VP 4

Date: 15.08.2020. Start and end time: 11:50 – 14:50
Weather:
The air temperature around 29-30°C is clear.
Wind speed approx. (3-5 m/s) No precipitation

Primary species not found

Table 185 Secondary species log 15.08.2020 VP 4

No.	Latin names	English names	Amount	Altitude (m)
1.	*Galerida cristata*	Crested Lark	6	5
2.	*Calandrella rufescens*	Lesser Short-toed Lark	12	0-3
3.	*Oenanthe isabellina*	Isabelline Wheatear	1	2
4.	*Pterocles orientalis*	Black-bellied sandgrouse	2	4
5.	*Merops supercilios*	Blue-cheeked Bee-eaterr	3	6
6.	*Lanius pallidirostris*	Southern grey shrike	2	5
7.	*Scotocerca inguieta*	Streaked Scrub Warbler	1	2

VP 5

Date: 15.08.2020. Start and end time: 15:23 – 19:23
Weather:
The air temperature around 34-38°C is clear.
Wind speed approx. (3-5 m/s) No precipitation
Primary species not found

Table 186 Secondary species log 15.08.2020 VP 5

No.	Latin names	English names	Amount	Altitude (m)
1.	*Galerida cristata*	Crested Lark	5	2
2.	*Calandrella rufescens*	Lesser Short-toed Lark	30	0-3
3.	*Oenanthe isabellina*	Isabelline Wheatear	1	2
4.	*Athene noctua*	Little Owl	2	3
5.	*Merops supercilios*	Blue-cheeked Bee-eaterr	16	12
6.	*Hirundo rustica*	Barn Swallow	6	4
7.	*Circus cyaneus*	Hen (Northern) Harrier	1	9

VP 7

Date: 16.08.2020. Start and end time: 8:12 – 11:12
Weather:
The air temperature around 30-36°C is clear.
Wind speed approx. (3-5 m/s) No precipitation

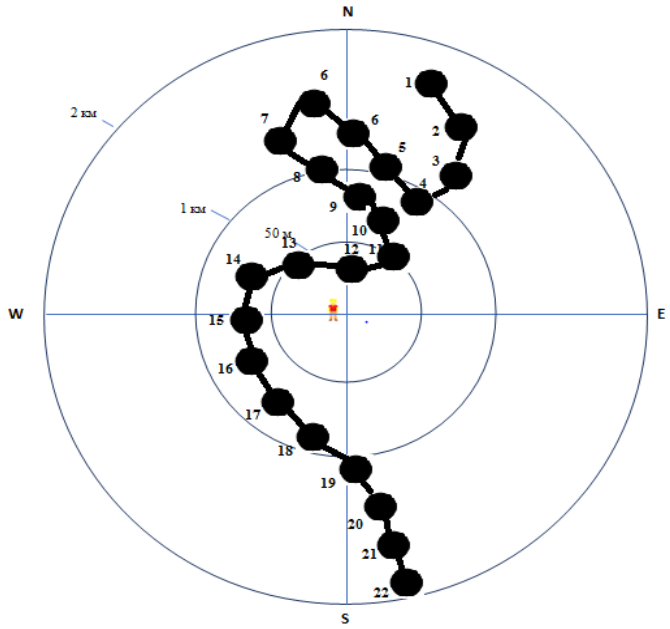


Fig. 50 Flight path (VP 7), 16.08.2020

Table 187 Target species log (VP 7), 16.08.2020

	Aquila nipalensis	1 50 m	2 50 m	3 40 m	4 35 m	5 35 m	6 30 m	7 35 m	8 35 m	9 30 m	10 20 m	11 10 m	12 0 m	13 20 m	14 30 m	15 35 m	16 35 m	17 40 m	18 45 m	19 45 m	20 50 m	21 50 m	22 50 M

Table 188 Secondary species log 16.08.2020 VP 7

No.	Latin names	English names	Amount	Altitude (m)
1.	*Galerida cristata*	Crested Lark	9	5
2.	*Oenanthe isabellina*	Isabelline Wheatear	3	3
3.	*Circus aeruginosus*	Marsh Harrier	1	18
4.	*Pterocles orientalis*	Black-bellied sandgrouse	4	5
5.	*Merops supercilios*	Blue-cheeked Bee-eaterr	3	19

VP 6

Date: 16.08.2020. Start and end time: 11:52 – 14:52
Weather:
The air temperature around 29-32°C is clear.
Wind speed approx. (3-5 m/s) No precipitation

Primary species not found

Table 189 Secondary species log 16.08.2020 VP 6

No.	Latin names	English names	Amount	Altitude (m)
1.	*Galerida cristata*	Crested Lark	12	5
2.	*Athene noctua*	Little Owl	1	6
3.	*Oenanthe isabellina*	Isabelline Wheatear	3	2
4.	*Falco naumanni*	Lesser Kestrel	2	13
5.	*Pterocles orientalis*	Black-bellied sandgrouse	2	4
6.	*Merops supercilios*	Blue-cheeked Bee-eaterr	5	6
7.	*Lanius pallidirostris*	Southern grey shrike	2	4

VP 8

Date: 16.08.2020. Start and end time: 15:23 – 19:23
Weather:
The air temperature around 32-36°C is clear.
Wind speed approx. (3-5 m/s) No precipitation
Primary species not found

Table 190 Secondary species log 16.08.2020 VP 8

No.	Latin names	English names	Amount	Altitude (m)
1.	*Columba livia*	Rock Dove	20	12
2.	*Galerida cristata*	Crested Lark	3	2
3.	*Oenanthe isabellina*	Isabelline Wheatear	3	1
4.	*Athene noctua*	Little Owl	1	3
5.	*Hirundo rustica*	Barn Swallow	5	5
6.	*Lanius pallidirostris*	Southern grey shrike	2	6

VP 9

Date:17.08.2020. Start and end time: 7:37 – 10:37
Weather:
The air temperature around 28-36°C is clear.
Wind speed approx. (5-6 m/s) No precipitation
Primary species not found

Table 191 Secondary species log 17.08.2020 VP 9

No.	Latin names	English names	Amount	Altitude (m)
1.	*Merops supercilios*	Blue-cheeked Bee-eaterr	5	8
2.	*Galerida cristata*	Crested Lark	9	5
3.	*Oenanthe isabellina*	Isabelline Wheatear	2	3
4.	*Hirundo rustica*	Barn swallow	5	6

VP 1

Date:17.08.2020. Start and end time: 11:03 – 14:03
Weather:
The air temperature around 28-32°C is clear.
Wind speed approx. (3-5 m/s) No precipitation

Primary species not found

Table 192 Secondary species log 17.08.2020 VP 1

No.	Latin names	English names	Amount	Altitude (m)
1.	*Acridotheres tristis*	Common myna	2	5
2.	*Galerida cristata*	Crested Lark	13	3
3.	*Oenanthe isabellina*	Isabelline Wheatear	1	1
4.	*Falco tinnunculus*	Kestrel	1	12
5.	*Hirundo rustica*	Barn swallow	6	5
6.	*Calandrella rufescens*	Lesser Short-toed Lark	12	0-3

VP 2

Date:17.08.2020. Start and end time: 14:46 – 17:46
eather:
The air temperature around 32-39°C is clear.
Wind speed approx. (2-4 m/s) No precipitation
Primary species not found

Table 193 Secondary species log 17.08.2020 VP 8

No.	Latin names	English names	Amount	Altitude (m)
1.	*Galerida cristata*	Crested Lark	6	3
2.	*Oenanthe isabellina*	Isabelline Wheatear	1	1
3.	*Merops supercilios*	Blue-cheeked Bee-eaterr	18	23
4.	*Hirundo rustica*	Barn swallow	5	6
5.	*Nycticorax nycticorax*	Black-crowned night-heron	5	25

VP 7

Date: 18.08.2020. Start and end time: 8:12 – 11:12
Weather:
The air temperature around 30-36°C is clear.
Wind speed approx. (3-5 m/s) No precipitation

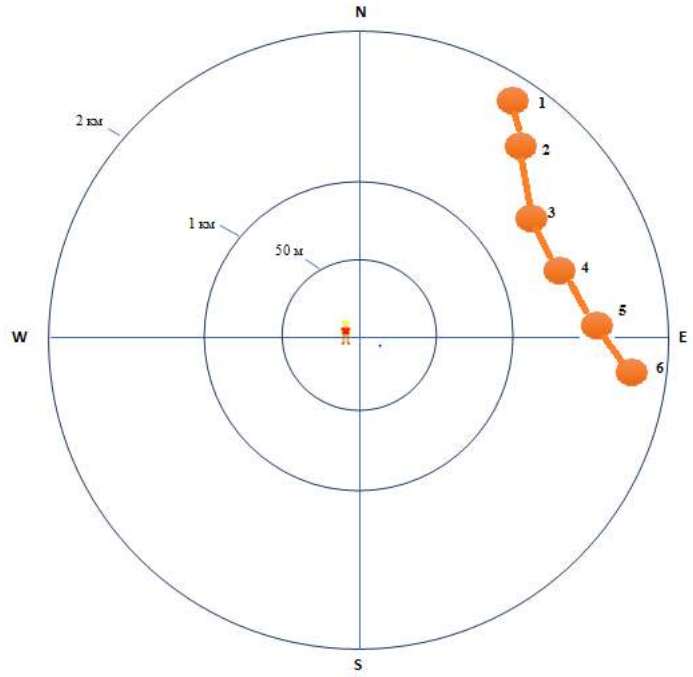


Fig. 51 Flight path (VP 7), 18.08.2020

Table 194 Target species log (VP 7), 18.08.2020

	Neophron percnopterus	1 50 m	2 50 m	3 50 m	4 55 m	5 50 m	6 50 m

Table 195 Secondary species log 18.08.2020 VP 7

No.	Latin names	English names	Amount	Altitude (m)
1.	*Galerida cristata*	Crested Lark	15	4
2.	*Oenanthe isabellina*	Isabelline Wheatear	1	3
3.	*Pterocles orientalis*	Black-bellied sandgrouse	4	5
4.	*Merops supercilios*	Blue-cheeked Bee-eaterr	6	19

ATTACHMENTS

Water birds survey on Agitma lake





Vanelochettusia leucura - White-tailed Plover [redacted]







Himantopus himantopus - Black-Winged Stilt? [redacted]

[redacted]

	
Circus aeruginosus - Marsh-Harrier, [redacted]	Marsh-Harrier 4[redacted]
	
Haliaeetus albicilla - White-tailed-Eagle, [redacted]	*Galerida cristata* - Crested Lark - Everywhere

	
Motacilla flava - Yellow Wagtail, 4[redacted]	*Motacilla alba* - White Wagtail, [redacted]
	
Hirundo rustica - Barn Swallow, [redacted]	*Ardea cinerea* - Grey Heron, [redacted]





Larus cachinnans - Yellow-legged (Caspian) Gull, [redacted]

Larus ridibundus - Black-Headed Gull, [redacted]





Phalaropus lobatus - Red-necked Phalarope, [redacted]





Tringa glareola - Wood Sandpiper, [redacted]





Calidris minuta - Little Stint, [redacted]



Cygnus olor - Mute Swan, [redacted]



Cygnus olor - Mute Swan, [redacted]



Tadorna ferruginea, [redacted]



Tadorna ferruginea - Ruddy Shelduck, [redacted]



Charadrius alexandrinus - Kentish Plover, [redacted]

[redacted]

Ruddy Shelduck

Kentish Plover

[redacted]



Philomachus pugnax – Ruff, [redacted]

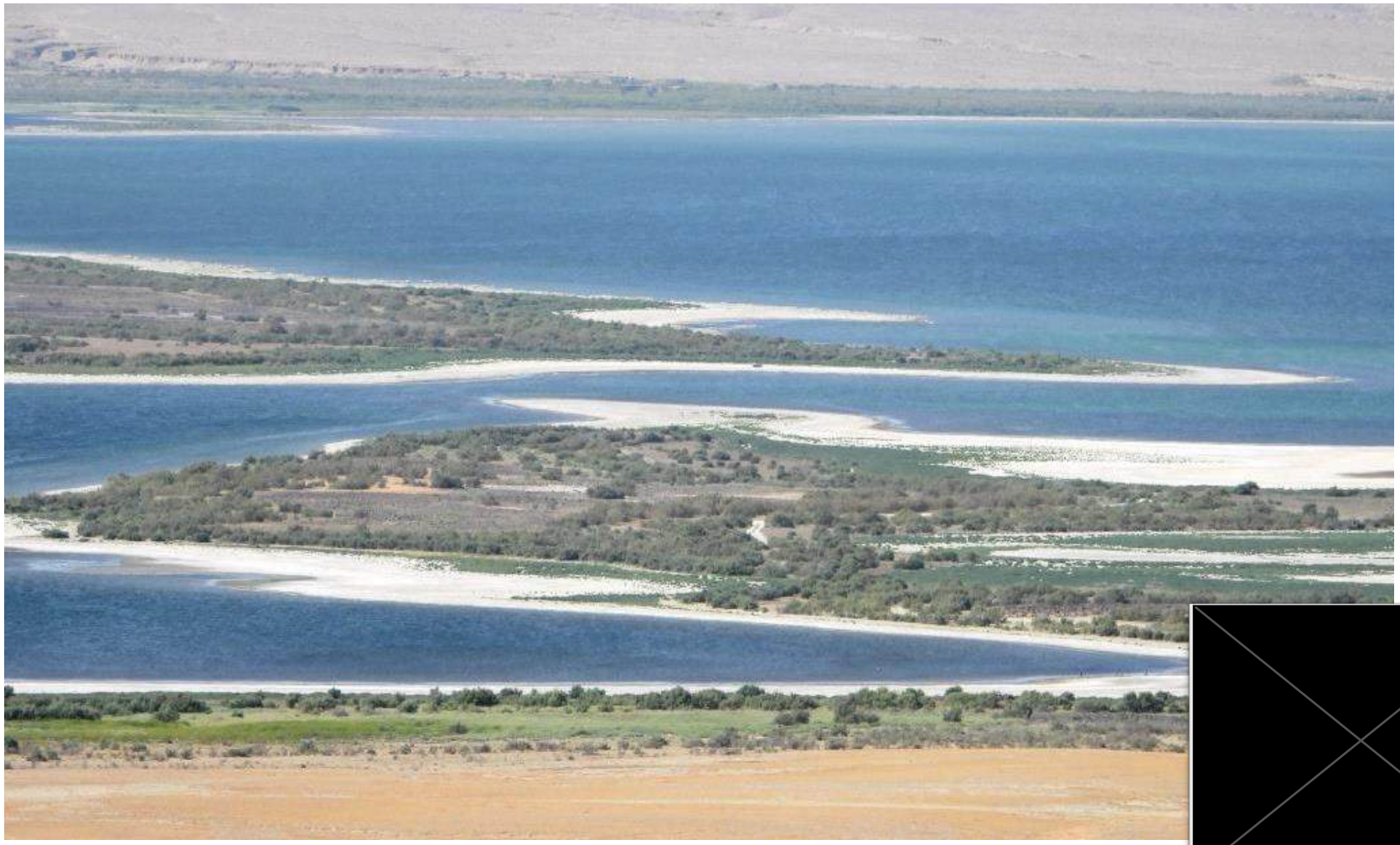








Anas strepera – Gadwall, 4



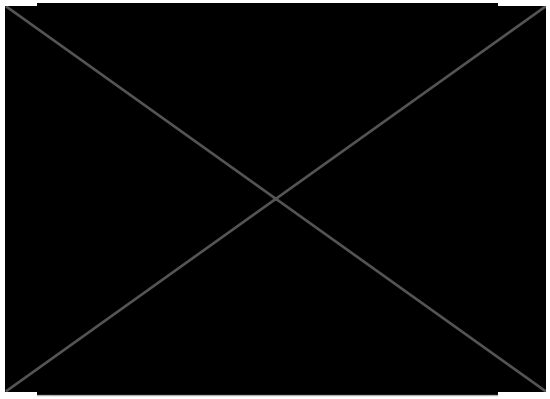


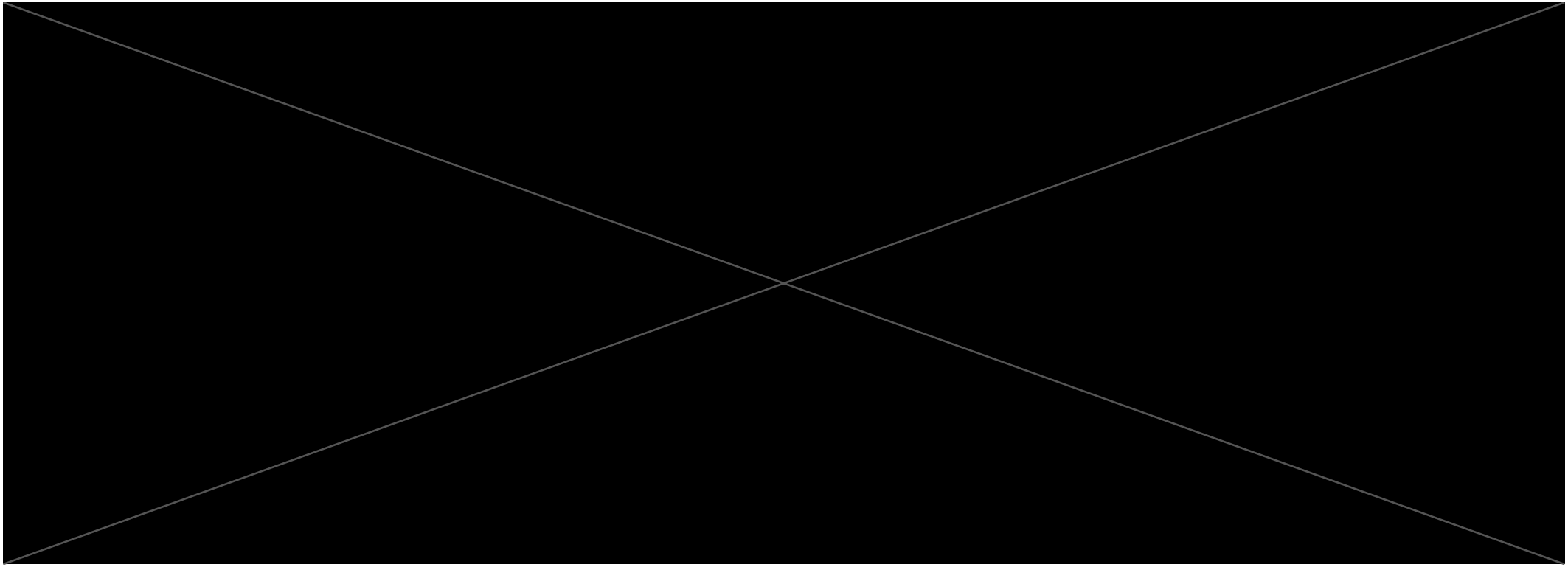






Fulica atra - Common Coot





[redacted]

[redacted]



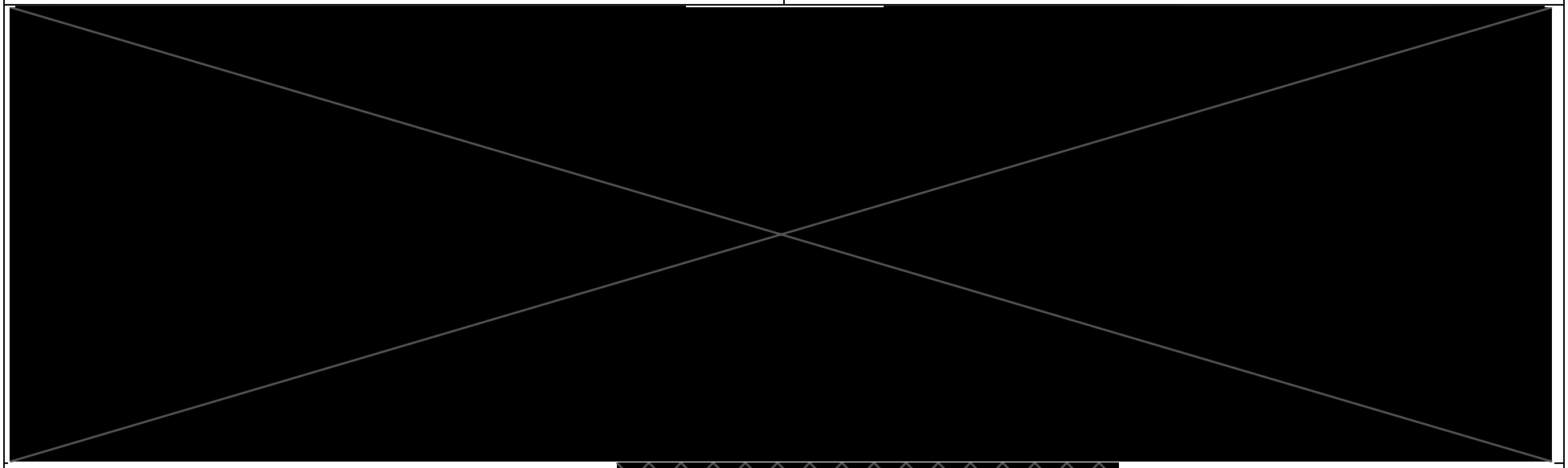
Dead *Bubo bubo* [redacted]



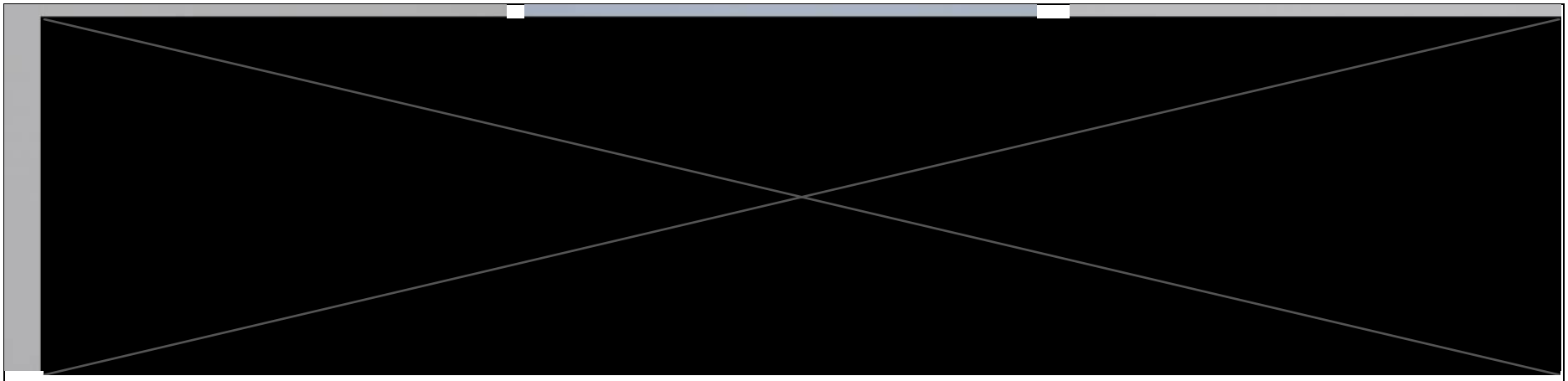
Bubo bubo [redacted]



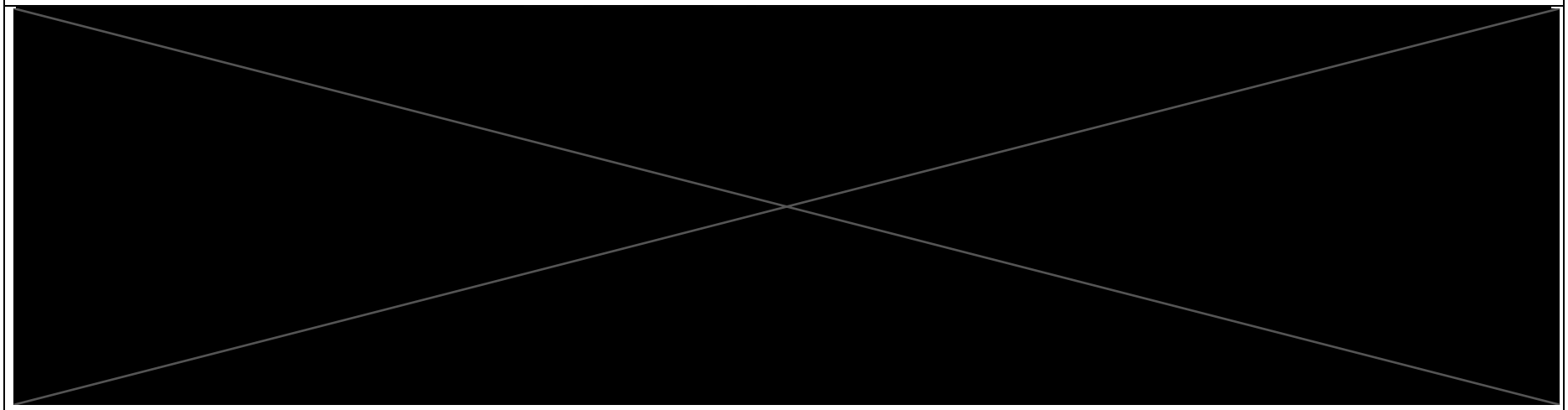




Aquila heliaca

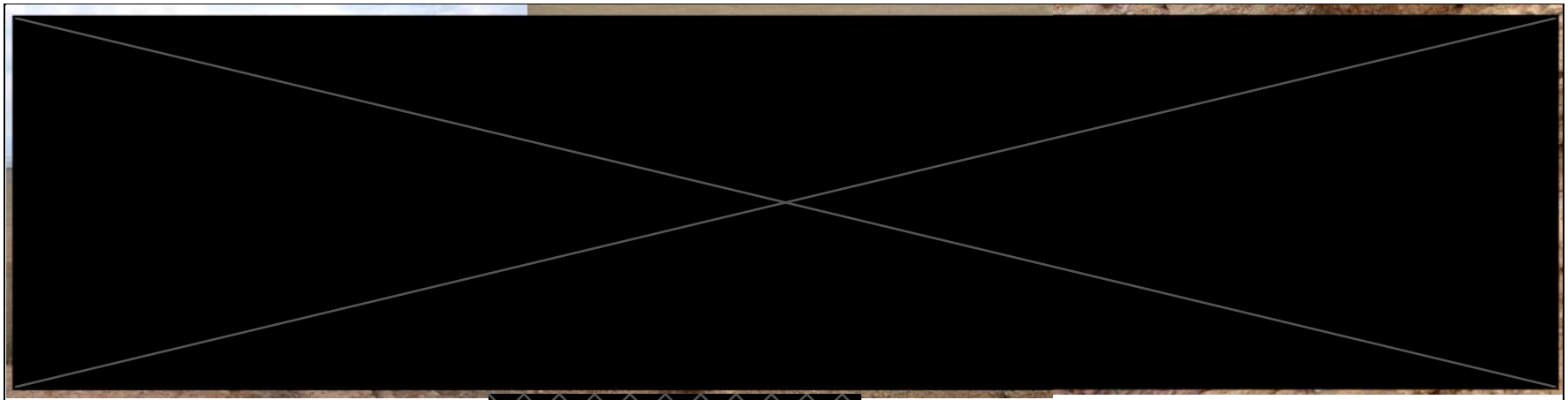


Falco tinnunculus

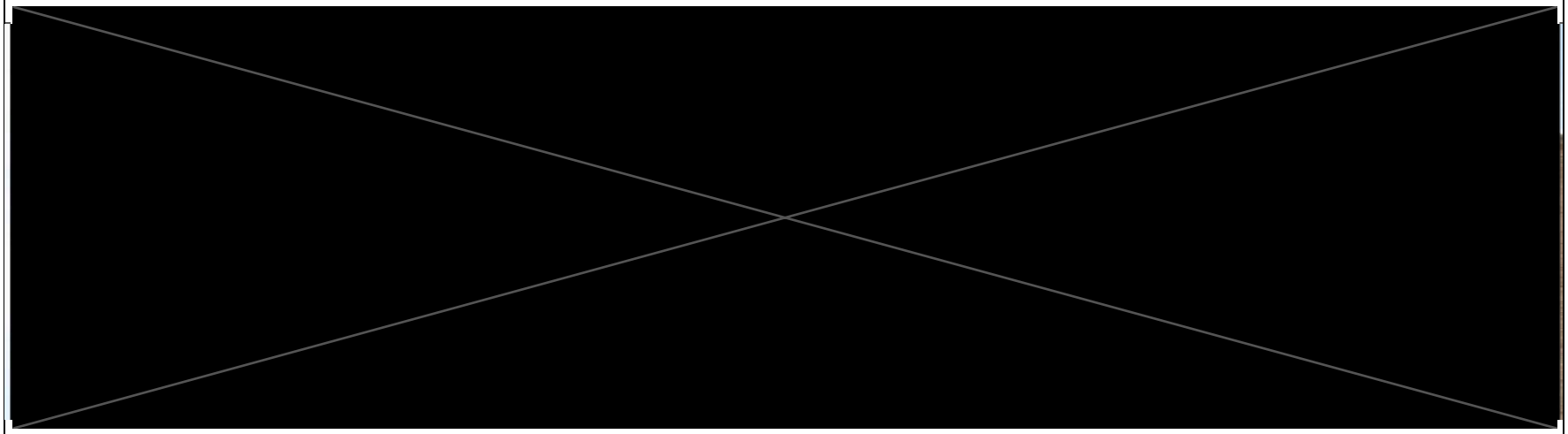


Nest on a cliff: view from a distance (on the left photo), nest itself (on the middle photo), assistant photographs the nest from above (on the right photo)
This nest is too big for a Kestrel, a Kestrel was just hunting there and got into the photo by accident

	
Pterocles orientalis [redacted]	*Pterocles orientalis* [redacted]



Athene noctua is looking for a prey 4 (The photos are all taken from one point from a tripod)



Birds of prey nests





Neophron percnopterus – is a regularly occurring species on the territory and probably one of the nests we found belongs to it.



Land erosion [redacted]



Charadrius alexandrinus [redacted]



Gazella subgutturosa - Goitered Gazelle [redacted]

	
Hemiechinus auritus	*Lepus capensis tolai*
	
Spermophilopsis Leptodactylus	*Cliffs near lake Agitma*





Colony of Blue-cheeked Bee-eaterrs on the cliffs above the collecting chanal



Pigeon gatherings near the nesting place of birds of prey

Summer Quarterly Bird monitoring Report

Report Title	Summer Quarterly Bird monitoring Report
Scope	BIRDS VP
Areas Covered	BASH WF
Seasons Covered	AUTUMN 2020
Notes	

AUTUMN QUARTERLY BIRD MONITORING REPORT

Bash Wind Farm Site

Client: 5 Capitals

This report is prepared by: Juru Enery Date: _____

CHECKED BY _____ Date: _____

APRROVED BY _____ Date:_____

Contents

INTRODUCTION 4

SURVEY METHODS 4

VANTAGE POINTS 9

BIRD OBSERVATIONS RESULTS 12

CONCLUSIONS 28

Appendix 1. Weather conditions during VP Autumn surveys 30

Appendix 2. Vantage Point Data Logs 36

VP survey results in September 36

VP survey results in October 110

VP survey results in November 156

Attachments 181

INTRODUCTION

In the framework of the Bash Wind Farm Project, bird survey was conducted in the project area in Autumn 2020. The purpose of ornithological monitoring was to conduct systematic field studies at specific vantage points to assess bird species composition that occur within the project's area of influence, its abundance and territorial distribution, the nature of the stay, and daily activity of birds during spring migration and the beginning of nesting and also to identify birds that are of conservation interest under IUCN and Uzbekistan Redlist.

This report presents the primary materials of field studies in this territory from September 1 to November 23, 2020.

This report is a statement of work made by Juru Enery` local ornitologist Alisher Atakhodjaev and international expert Caleb Gordon. However, it should be noted that help in collecting survey material was also provided by Juru Enery' employees, and expedition members.

SURVEY METHODS

The research methods were based on international best practice recommendations, in particular those set forth in the Scottish Natural Heritage: recommended bird survey methods to justify the assessment of the impact of surface wind farms. The range of detection and identification of large species as golden eagles was up to 2 km, and small passerines 50 m. Directions and flight altitude were taken into account.

The observations were carried out at 9 Vantage points (Table 2). The number and location of Vantage points for stationary observation in the project area have been agreed with the company employees and international expert. The points are located so as to cover the territory as completely as possible (Fig.1).

The duration of one bird count at each Vantage point (VP) was 3 hours. The total duration of all the observations in the territory was 366 hours (Table 3). During observations weather conditions such as wind speed and direction, and air temperature were recorded. Wind speed and air temperature were measured using an anemometer. Whenever

possible, the number of species, approximate flight altitude, speed, and flight direction of each target species were recorded every 15 seconds.

During the observations, photographing and short video shooting of birds were carried out, which is used to confirm the correct determination of species and obtain additional data on the number of individuals. Following equipment was used: binoculars (Viking) with 10x zoom; cameras (Nikon P1000, Canon 550D) with 24x and 50x zoom, with focal length of 550 mm and 1200 mm, respectively; field telescope (Viking).

Target and Secondary Species

Some species are more sensitive than others from a wind farm risk management standpoint. This is generally because they are classified as highly protected species by national and/or international authorities, because they are known or suspected to be highly susceptible to wind farm impacts (especially collision with rotors), or both. In addition, some species may be regarded as sensitive due to their cultural or iconic significance, or based on ecological/demographic factors (e.g. slow reproductive rate, naturally low population density). In present, these different criteria have been integrated and considered together to produce a preliminary list of suggested target species for the NBWEP, to be used to prioritize the Project's biological monitoring and mitigation programs, including the biological baseline studies.

Table 1 below presents a suggested list of sensitive, or "target" bird species for the NBWEP, subdivided into two tiers, reflecting different priority levels (tier 1 is higher sensitivity, higher priority than tier 2).

Table 1 Target and secondary species

Latin name	English name	IUCN status	Uzbek status	Notes on Likely Occurrence/Risk
Tier 1 Target Species (top priority)				
Aquila nipalensis	Steppe Eagle	EN	2 (VU:D)	Common migrant. In March 2018 observed on project area (Ten A)
Aquila chrysaetos	Golden Eagle	LC	listed 2 (VU:R)	Common resident and nests in project area (powerlines) and in cliffs of Ayakagytma depression (Ten, Soldatov 2018)
Aquila heliaca	Imperial Eagle	VU	2 (VU:D)	Common migrant. In March 2018 observed on project area (Ten A)
Neophron percnopterus	Egyptian Vulture	EN	2 (VU:D)	Common nesting species in cliffs of Ayakagytma depression (Ten, Soldatov 2018)
Falco cherrug	Saker Falcon	EN	EN	Common nesting species in cliffs of Ayakagytma depression (Ten, Soldatov 2018)
Chlamydotis macqueenii	Houbara Bustard	VU	2 (V*U:D)	Nesting and migration species in project area (Burnside oral comm., Koshkin 2016)
Vanellus gregarius	Sociable Lapwing	CR	2 (VU:R)	possible rarity, recent eBird photo record in desert habitat ca 75km SW suggests possibility of occurrence. Extremely sensitive species with CR status
Tier 2 Target Species (second priority)				

1. Pelecanus onocrotalus	Great White Pelican	LC	VU:D	Common migrant and rare autumning in Ayakagytma lake
2. *Pelecanus crispus*	Dalmatian Pelican	NT	EN	Common migrant and rare autumning in Ayakagytma lake
3. Aegypius monachus	Cinereous Vulture	NT	3 (NT)	Resident in region
4. Gyps fulvus	Eurasian Griffon	NT	2 (VU:D)	Resident in region
5. Circaetus gallicus	Short-toed Snake-Eagle	LC	2 (VU:D)	Rare nesting bird in region
6. Hieraaetus pennatus	Booted Eagle	LC	2 (VU:D)	Possible rarity, very rare in region
7. Circus aeruginosus	Eurasian Marsh-Harrier	LC	*not listed*	Fairly common in region
8. Circus cyaneus	Hen Harrier	LC	*not listed*	Fairly common in region
9. Circus macrourus	Pallid Harrier	NT	3 (NT)	Fairly common in region
10. Circus pygargus	Montagu's Harrier	LC	*not listed*	Uncommon in region
11. Accipiter badius	Shikra	LC	*not listed*	Uncommon in region
12. Accipiter nisus	Eurasian Sparrowhawk	LC	*not listed*	Uncommon in region
13. Buteo rufinus	Long-legged Buzzard	LC	*not listed*	Fairly common in region

14. Buteo buteo	Common Buzzard	LC	*not listed*	Fairly common in region
15. Milvus migrans	Black Kite	LC	*not listed*	Uncommon in region
16. Anthropoides virgo	Demoiselle Crane	LC	*not listed*	Uncommon in region
17. Grus grus	Common Crane	LC	*not listed*	Rare migrant. Observed in 2018 in project area (Ten A)
18. Falco naumanni	Lesser Kestrel	LC	NT	Observed at site
19. Falco tinnunculus	Common Kestrel	LC	*not listed*	Numerous in region
20. Oxyura leucocephala	White-headed Duck	EN	1 (EN)	Possible on Lake Agitma
21. Anser erythropus	Lesser White-fronted Goose	VU	2 (VU:R)	Possible on Lake Agitma
22. Branta ruficollis	Red-breasted Goose	VU	2 (VU:R)	Possible on Lake Agitma
23. Marmaronetta angustirostris	Marbled Teal	VU	1 (EN)	Possible on Lake Agitma
24. Aythya ferina	Common Pochard	VU	*not listed*	Possible on Lake Agitma
25. Podiceps auritus	Horned Grebe	VU	*not listed*	Possible on Lake Agitma

VANTAGE POINTS

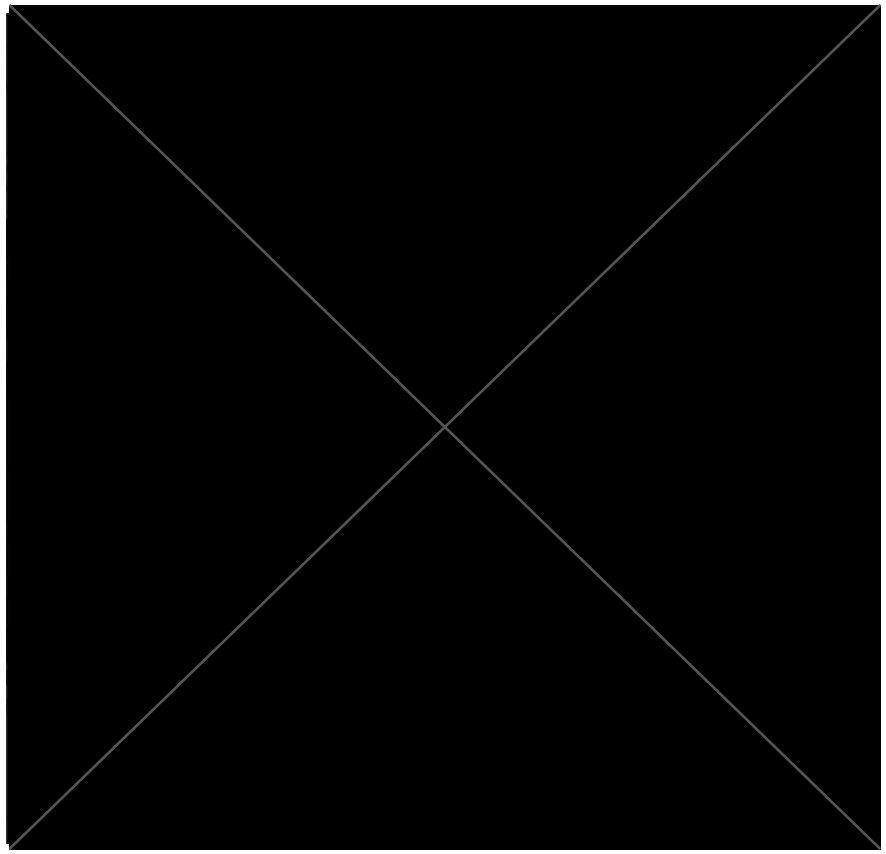


Fig. 1 Vantage Points locations (green line – railway road)

The number of Vantage Points was agreed with the Client. Points are located so as to cover the project territory as fully as possible. The coordinates of the Vantage Points of Navoi Bash are shown in Table 2. The radius of a single observation point is 2 km. Time spent at one point is 3 hours' average.

Table 2 Coordinates of the VPs of Navoi Bash

Vantage Points	**Coordinates**
VP 1	[redacted]
VP 2	[redacted]
VP 3	[redacted]
VP 4	[redacted]
VP 5	[redacted]
VP 6	[redacted]
VP 7	[redacted]
VP 8	[redacted]
VP 9	[redacted]
Crossing the railway on the north side of the area	[redacted]

366 total hours (Table 3) of VP survey effort were conducted at the 9 VP survey points in the project area during the reporting period. This is equivalent to an average of 40.7 hours per point for the quarter (autumn season). This exceeds the recommended effort level (which was a minimum of 36 survey hours per point per season). This is an excellent level of effort, and will provide an excellent source of data for a robust seasonal collision risk modelling effort, and overall interpretation of autumn season collision risk for target bird species.

Table 3 Total Number of VP survey hours

	VP 1	**VP 2**	**VP 3**	**VP 4**	**VP 5**	**VP 6**	**VP 7**	**VP 8**	**VP 9**	
Total hours										
September hr	21	21	21	21	21	18	21	21	21	
October hr	12	12	15	15	15	12	12	12	15	
November hr	6	6	6	6	6	9	9	9	3	
accounts for Autumn	39	39	42	42	42	39	42	42	39	**366**

BIRD OBSERVATIONS RESULTS

Among birds registered during bird survey in from September 1 to November 23, 2020 (Tables 4-6), following bird species belonging to top priority target species were found in the project area: Steppe Eagle (*Aquila nipalensis*), Egyptian Vulture (*Neophron percnopterus*).

Among the secondary species, following bird species were found in the project area: Cinereous Vulture (*Aegypius monachus*), Eurasian Griffon (*Gyps fulvus*), Eurasian Marsh-Harrier (*Circus aeruginosus*), Hen Harrier (*Circus cyaneus*), Long-legged Buzzard (*Buteo rufinus*), Common Buzzard (*Buteo buteo*), Common Crane (*Grus grus*), Common Kestrel (*Falco tinnunculus*), Dalmatian Pelican (*Pelecanus crispus*), Great White Pelican (*Pelecanus onocrotalus*).

Table 4 Results of bird observations in September

SPECIES			**VANTAGE POINTS**									**IUCN status**	**Uzbekistan Red Book status**	**Nature of stay**
№	**Latin**	**English**	**VP 1**	**VP 2**	**VP 3**	**VP 4**	**VP 5**	**VP 6**	**VP 7**	**VP 8**	**VP 9**			
TARGET SPECIES														
1.	*Aquila nipalensis*	Steppe Eagle		2, 1, 1, 2, 1		1, 1	1		2	2	1	EN	2 (VU:D)	**NMW**
2.	*Aquila chrysaetos*	Golden Eagle										LC	listed 2 (VU:R)	**R**
3.	*Aquila heliaca*	Imperial Eagle										VU	2 (VU:D)	**NMS**
4.	*Neophron percnopterus*	Egyptian Vulture	1									EN	2 (VU:D)	**NMW**
5.	*Falco cherrug*	Saker Falcon										EN	1 (NT)	**RW**

6.	*Chlamydotis macqueenii*	Houbara Bustard										VU	2 (VU:D)	**NM**
7.	*Vanellus gregarius*	Sociable Lapwing										CR	2 (VU:R)	**M**
SECONDARY SPECIES														
	Pelecanus onocrotalus	Great White Pelican										LC	VU:D	**NMW**
	Pelecanus crispus	Dalmatian Pelican										NT	EN	**M**
	Aegypius monachus	Cinereous Vulture		1		1, 1			1			NT	3 (NT)	**R**
4.	*Gyps fulvus*	Eurasian Griffon		1								NT	2 (VU:D)	**R**
5.	*Circaetus gallicus*	Short-toed Snake-Eagle										LC	2 (VU:D)	**NM**
6.	*Circus aeruginosus*	Eurasian Marsh-Harrier		1	1, 1, 2, 2, 1			1				LC	*not listed*	**NMW**
7.	*Hieraaetus pennatus*	Booted Eagle										LC	2 (VU:D)	**NM**
8.	*Circus cyaneus*	Hen Harrier	1	1	1, 1, 1, 1	1		1			1	LC	*not listed*	**MW**
9.	*Circus macrourus*	Pallid Harrier										NT	3 (NT)	**MS**
10.	*Circus pygargus*	Montagu's Harrier										LC	*not listed*	**NM**
11.	*Accipiter badius*	Shikra										LC	*not listed*	**NM**
12.	*Accipiter nisus*	Eurasian Sparrowhawk										LC	*not listed*	**NMW**
13.	*Buteo rufinus*	Long-legged Buzzard	1			1					1, 1	LC	*not listed*	**NMW**

14.	*Buteo buteo*	Common Buzzard	1						1		1, 1, 1	LC	*not listed*	**MW**
15.	*Milvus migrans*	Black Kite										LC	*not listed*	**NMW**
16.	*Anthropoides virgo*	Demoiselle Crane										LC	*not listed*	**M**
17.	*Grus grus*	Common Crane	86	73	117, 43		53					LC	*not listed*	**MW**
18.	*Falco naumanni*	Lesser kestrel									1	LC	NT	**NM**
19.	*Falco tinnunculus*	Common Kestrel		2	1, 1, 2	1	1, 2, 1, 2, 2	2			2	LC	*not listed*	**NMW**
20.	*Oxyura leucocephala*	White-headed Duck										EN	1 (EN)	**NMW**
21.	*Anser erythropus*	Lesser White-fronted Goose										VU	2 (VU:R)	**M**
22.	*Branta ruficollis*	Red-breasted Goose										VU	2 (VU:R)	**M**
23.	*Marmaronetta angustirostris*	Marbled Teal										VU	1 (EN)	**NM**
24.	*Aythya ferina*	Common Pochard										VU	*not listed*	**NMW**
25.	*Podiceps auritus*	Horned Grebe										VU	*not listed*	**M**
OTHER SPECIES														
	Upupa epops	Hoopoe			1								-	**NMW**
2.	*Oenanthe isabellina*	Isabelline Wheatear	5, 4, 6, 2, 2, 2, 2	2, 3, 3, 2, 1, 1, 1	5, 3, 3, 2, 3	6, 3, 2, 2, 2, 3, 2	2, 5, 3, 2	3, 3, 2, 2, 1, 2	2, 4, 4, 5, 2	4, 4, 2, 2	2, 7, 3, 3, 1, 3, 1		-	**NM**

3.	*Galerida cristata*	Crested Lark	15, 10, 16, 5, 9, 6, 11	13, 16, 15, 17, 10, 2, 6, 12	12, 8, 8, 16, 8, 12	5, 13, 6, 12, 16, 8, 6	6, 7, 19, 9, 16, 12, 9	4, 15, 12, 9, 5, 5	14, 6, 8, 13, 3, 6, 5	24, 2, 15, 11, 9, 5, 6	14, 18, 13, 15, 3, 9, 6		-	**R**
4.	*Calandrella brachydactyla*	Greater Short-toed Lark							21				-	**NM**
5.	*Oenanthe pleschanka*	Pied Wheatear					1		1				-	**NM**
6.	*Lanius pallidirostris*	Southern grey shrike						2					-	**NM**
7.	*Alectoris chukar*	Chukar Partridge	4						2				-	**R**
8.	*Athene noctua*	Little Owl		1	1	2	1, 1	1, 1, 1	1, 1, 1, 1	1	1, 1		-	**R**
9.	*Hirundo rustica*	Barn Swallow	1		3	3			5		5		-	**NM**
10.	*Acridotheres tristis*	Indian (Common) Myna		2, 5	11						6, 12, 5, 5		-	**R**
11.	*Merops superciliosus*	Blue-cheeked Bee-eater		3					16		2			**NM**
12.	*Columba livia*	Pigeon (Rock Dove)			14, 12	12, 14	15, 5, 38	12	6		12, 27, 12, 32, 15			**R**
13.	*Pterocles orientalis*	Black-bellied sandgrouse	5	5	5, 3, 3	3, 6	5, 2	5, 3	2	3, 4, 5, 3	3			**NMW**
14.	*Nycticorax nycticorax*	Black-crowned night-heron		1	14					1				**NM**

15.	*Calandrella rufescens*	Lesser Short-toed Lark	18, 12, 24, 15	36, 12, 16	32, 25, 31, 25	25, 10	23, 16, 31, 14, 23	9, 12	42, 28, 16, 13	25, 40, 15, 14, 13	32, 25, 18			**NMW**
16.	*Scotocerca inguieta*	Streaked Scrub Warbler	4, 4, 1	2		2, 2			2, 2	2, 1	1			
17.	*Phalacrocorax pygmaeus*	Pygmy cormorant		6							6			**NMW**
18.	*Coracias garrulus*	Eurasian Roller	9, 3	5, 3, 8, 3	13, 2	8	4		3	2	8, 8, 4			**NM**
19.	*Muscicapa striata*	Spotted Flycatcher		1	1					3				**NM**
20.	*Melanocorypha bimaculata*	Bimaculated lark							25		25			**NM**
21.	*Rhodospiza obsoleta*	Black-billed Desert Finch	3		3, 3, 3	7, 8	3, 3, 3			4, 6	3			**R**
22.	*Passer indicus*	Indian House Sparrow		22						6				**NM**
23.	*Corvus monedula*	Jackdaw	5			2, 6				4				**RMW**
24.	*Streptopelia decaocto*	Collared Turtle Dove	2											**R**
25.	*Corvus ruficollis*	Brown-necked Raven					1							**R**
26.	*Corvus corax*	Northern Raven	3	6		4, 15		14		23, 3, 6	6, 2			
27.	*Tadorna ferruginea*	Roodysheld duck	3											
28.	*Streptopelia senegalensis*	Laughing dove									2			

29.	*Columba palumbus*	Wood Pigeon									12			

Table 5 Results of bird observations in October

SPECIES			VANTAGE POINTS									IUCN status	Uzbekistan Red Book status	Nature of stay
№	Latin	English	VP 1	VP 2	VP 3	VP 4	VP 5	VP 6	VP 7	VP 8	VP 9			
TARGET SPECIES														
	Aquila nipalensis	Steppe Eagle		1	1	2	1	1		1		EN	2 (VU:D)	**NMW**
2.	*Aquila chrysaetos*	Golden Eagle										LC	listed 2 (VU:R)	**R**
3.	*Aquila heliaca*	Imperial Eagle										VU	2 (VU:D)	**NMS**
4.	*Neophron percnopterus*	Egyptian Vulture										EN	2 (VU:D)	**NMW**
5.	*Falco cherrug*	Saker Falcon										EN	1 (NT)	**RW**
6.	*Chlamydotis macqueenii*	Houbara Bustard										VU	2 (VU:D)	**NM**
7.	*Vanellus gregarius*	Sociable Lapwing										CR	2 (VU:R)	**M**
SECONDARY SPECIES														
	Pelecanus onocrotalus	Great White Pelican		16								LC	VU:D	**NMW**
	Pelecanus crispus	Dalmatian Pelican										NT	EN	**M**
	Aegypius monachus	Cinereous Vulture	2				2, 1	1			1	NT	3 (NT)	**R**

4.	*Gyps fulvus*	Eurasian Griffon										NT	2 (VU:D)	**R**
5.	*Circaetus gallicus*	Short-toed Snake-Eagle										LC	2 (VU:D)	**NM**
6.	*Circus aeruginosus*	Eurasian Marsh-Harrier			2	1, 1		1				LC	*not listed*	**NMW**
7.	*Hieraaetus pennatus*	Booted Eagle										LC	2 (VU:D)	**NM**
8.	*Circus cyaneus*	Hen Harrier	1				1, 1	1				LC	*not listed*	**MW**
9.	*Circus macrourus*	Pallid Harrier										NT	3 (NT)	**MS**
10.	*Circus pygargus*	Montagu's Harrier										LC	*not listed*	**NM**
11.	*Accipiter badius*	Shikra										LC	*not listed*	**NM**
12.	*Accipiter nisus*	Eurasian Sparrowhawk										LC	*not listed*	**NMW**
13.	*Buteo rufinus*	Long-legged Buzzard	1							1, 1		LC	*not listed*	**NMW**
14.	*Buteo buteo*	Common Buzzard			1	1					2, 1	LC	*not listed*	**MW**
15.	*Milvus migrans*	Black Kite										LC	*not listed*	**NMW**
16.	*Anthropoides virgo*	Demoiselle Crane										LC	*not listed*	**M**
17.	*Grus grus*	Common Crane										LC	*not listed*	**MW**
18.	*Falco naumanni*	Lesser kestrel										LC	NT	**NM**
19.	*Falco tinnunculus*	Common Kestrel				1, 1, 1	2, 2, 2	1	1, 2	1, 1		LC	*not listed*	**NMW**

20.	*Oxyura leucocephala*	White-headed Duck										EN	1 (EN)	**NMW**
21.	*Anser erythropus*	Lesser White-fronted Goose										VU	2 (VU:R)	**M**
22.	*Branta ruficollis*	Red-breasted Goose										VU	2 (VU:R)	**M**
23.	*Marmaronetta angustirostris*	Marbled Teal										VU	1 (EN)	**NM**
24.	*Aythya ferina*	Common Pochard										VU	*not listed*	**NMW**
25.	*Podiceps auritus*	Horned Grebe										VU	*not listed*	**M**
OTHER SPECIES														
	Oenanthe isabellina	Isabelline Wheatear	1, 3, 3, 2	1, 1, 2, 1	2, 3, 4, 2, 3	4, 2, 4, 2, 3	1, 2, 4, 3, 2	2, 1, 3, 3	2, 4, 1	5, 3, 4, 1	2, 4, 1, 2, 1		-	**NM**
2.	*Galerida cristata*	Crested Lark	13, 5, 6, 9	9, 4, 10, 12	26, 10, 15, 5, 12	5, 19, 12, 12, 12	8, 10, 12, 6, 10	6, 9, 8, 9	4, 7, 12, 5	14, 17, 6, 6	6, 9, 19, 9, 8		-	**R**
3.	*Calandrella brachydactyla*	Greater Short-toed Lark	23, 26							26			-	**NM**
4.	*Alectoris chukar*	Chukar Partridge			2, 6, 2								-	**R**
5.	*Athene noctua*	Little Owl	1, 1, 2	1			1		1, 1		1		-	**R**
6.	*Hirundo rustica*	Barn Swallow	4			16		88	12	27			-	**NM**
7.	*Acridotheres tristis*	Indian (Common) Myna				12, 7	3, 5	3		7	6, 6		-	**R**

8.	*Merops supercilios us*	Blue-cheeked Bee-eater					4							**NM**
9.	*Columba livia*	Pigeon (Rock Dove)			6	11, 6		60	5, 24	14, 13	5, 23, 29, 18			**R**
10.	*Pterocles orientalis*	Black-bellied sandgrouse	2	3		3	3, 5	2	5, 5, 2		3			**NMW**
11.	*Nycticorax nycticorax*	Black-crowned night-heron					1							**NM**
12.	*Calandrell a rufescens*	Lesser Short-toed Lark	32, 35, 23	32, 38, 17	62, 32	21, 19, 29	23, 23	12		32, 23	15			**NMW**
13.	*Scotocerc a inguieta*	Streaked Scrub Warbler	2	2, 1	2, 3	2				2	1			
14.	*Phalacroc orax pygmaeus*	Pygmy cormorant		5	3		4							**NMW**
15.	*Coracias garrulus*	Eurasian Roller					1							**NM**
16.	*Melanocor ypha bimaculat a*	Bimaculated lark	25											**NM**
17.	*Rhodospiz a obsoleta*	Black-billed Desert Finch		5	6	3		7	3, 3		2, 4			**R**
18.	*Passer indicus*	Indian House Sparrow				5	12							**NM**
19.	*Corvus monedula*	Jackdaw			4	3		4			2			**RMW**
20.	*Streptopeli a decaocto*	Collared Turtle Dove			2									**R**
21.	*Corvus corax*	Northern Raven		35, 4					4	26	16, 15			
22.	*Tadorna ferruginea*	Roodysheld duck			2, 5, 6				7		9			

23.	*Streptopelia senegalensis*	Laughing dove						2			2			
24.	*Casmerodius albus*	Great egret									1			
25.	*Larus ridibundus*	Black-Headed Gull		7			13							
26.	*Anas strepera*	Gadwall			16	19								
27.	*Anas crecca*	Green-winged teal			6						1			
28.	*Tringa totanus*	Common Redshank			3									
29.	*Caprimulgus aegyptius*	Egyptian Nightjar				1								
30.	*Ardea cinerea*	Gray heron		1										
31.	*Phalacrocorax carbo*	Great Cormorant				26								
32.	*Cygnus olor*	Mute swan							12		8			
33.	*Corvus cornix*	Hooded Crow					7			3				
34.	*Anas platyrhynchos*	Mallard		110	52									
35.	*Aythya fuligula*	Tufted duck		260										
36.	*Pica pica*	Magpie								2				
37.	*Tringa nebularia*	Green shank			5									
38.	*Sturnus vulgaris*	Starling					30							

39.	*Corvus frugilegus*	Eurasian Rook						6						

Table 6 Results of bird observations in November

SPECIES			VANTAGE POINTS									IUCN status	Uzbekistan Red Book status	Nature of stay
№	Latin	English	VP 1	VP 2	VP 3	VP 4	VP 5	VP 6	VP 7	VP 8	VP 9			
TARGET SPECIES														
	Aquila nipalensis	Steppe Eagle			1		1		1	1	1	EN	2 (VU:D)	**NMW**
2.	*Aquila chrysaetos*	Golden Eagle										LC	listed 2 (VU:R)	**R**
3.	*Aquila heliaca*	Imperial Eagle										VU	2 (VU:D)	**NMS**
4.	*Neophron percnopterus*	Egyptian Vulture										EN	2 (VU:D)	**NMW**
5.	*Falco cherrug*	Saker Falcon										EN	1 (NT)	**RW**
6.	*Chlamydotis macqueenii*	Houbara Bustard										VU	2 (VU:D)	**NM**
7.	*Vanellus gregarius*	Sociable Lapwing										CR	2 (VU:R)	**M**
SECONDARY SPECIES														
	Pelecanus onocrotalus	Great White Pelican	7		7							LC	VU:D	**NMW**

	Pelecanus crispus	Dalmatian Pelican										NT	EN	**M**
	Aegypius monachus	Cinereous Vulture				2			1			NT	3 (NT)	**R**
4.	*Gyps fulvus*	Eurasian Griffon										NT	2 (VU:D)	**R**
5.	*Circaetus gallicus*	Short-toed Snake-Eagle										LC	2 (VU:D)	**NM**
6.	*Circus aeruginosus*	Eurasian Marsh-Harrier			1		1		1			LC	*not listed*	**NMW**
7.	*Hieraaetus pennatus*	Booted Eagle										LC	2 (VU:D)	**NM**
8.	*Circus cyaneus*	Hen Harrier								1		LC	*not listed*	**MW**
9.	*Circus macrourus*	Pallid Harrier										NT	3 (NT)	**MS**
10.	*Circus pygargus*	Montagu's Harrier										LC	*not listed*	**NM**
11.	*Accipiter badius*	Shikra										LC	*not listed*	**NM**
12.	*Accipiter nisus*	Eurasian Sparrowhawk										LC	*not listed*	**NMW**
13.	*Buteo rufinus*	Long-legged Buzzard								1		LC	*not listed*	**NMW**
14.	*Buteo buteo*	Common Buzzard	1		1	1	1		1	1		LC	*not listed*	**MW**
15.	*Milvus migrans*	Black Kite										LC	*not listed*	**NMW**
16.	*Anthropoides virgo*	Demoiselle Crane										LC	*not listed*	**M**
17.	*Grus grus*	Common Crane										LC	*not listed*	**MW**
18.	*Falco naumanni*	Lesser kestrel										LC	NT	**NM**

19.	*Falco tinnunculus*	Common Kestrel	2	2	2	2	2	2, 2	2	2, 2		LC	*not listed*	**NMW**
20.	*Oxyura leucocephala*	White-headed Duck										EN	1 (EN)	**NMW**
21.	*Anser erythropus*	Lesser White-fronted Goose										VU	2 (VU:R)	**M**
22.	*Branta ruficollis*	Red-breasted Goose										VU	2 (VU:R)	**M**
23.	*Marmaronetta angustirostris*	Marbled Teal										VU	1 (EN)	**NM**
24.	*Aythya ferina*	Common Pochard										VU	*not listed*	**NMW**
25.	*Podiceps auritus*	Horned Grebe										VU	*not listed*	**M**
OTHER SPECIES														
	Oenanthe isabellina	Isabelline Wheatear	1, 2	21, 2	2, 1	2, 2	2, 2	2, 1, 2	3, 1, 1	3, 2, 2	3		-	**NM**
2.	*Galerida cristata*	Crested Lark	5, 10	6, 12	6, 15	7, 10	12, 12	12, 10, 12	16, 9, 6	8, 17, 12	21		-	**R**
3.	*Alectoris chukar*	Chukar Partridge				6							-	**R**
4.	*Athene noctua*	Little Owl		1		1	2	1, 1	1	1			-	**R**
5.	*Hirundo rustica*	Barn Swallow								5			-	**NM**
6.	*Acridotheres tristis*	Indian (Common) Myna	3, 6		5	6	6	6	4	5, 12	6		-	**R**
7.	*Columba livia*	Pigeon (Rock Dove)						14			56			**R**

8.	*Pterocles orientalis*	Black-bellied sandgrouse					12	5, 3	4	3				**NMW**
9.	*Nycticorax nycticorax*	Black-crowned night-heron		1		1								**NM**
10.	*Calandrella rufescens*	Lesser Short-toed Lark	19	31, 23	18	32, 19	23, 27	32, 12	21, 23, 13	31				**NMW**
11.	*Scotocerca inguieta*	Streaked Scrub Warbler								3	2			
12.	*Corvus monedula*	Jackdaw				16			11					**RMW**
13.	*Streptopelia decaocto*	Collared Turtle Dove									2			**R**
14.	*Corvus ruficollis*	Brown-necked Raven									2			**R**
15.	*Corvus corax*	Northern Raven	28		12			25						
16.	*Tadorna ferruginea*	Roodysheld duck			3									
17.	*Larus ridibundus*	Black-Headed Gull	11	3										
18.	*Anas strepera*	Gadwall		41										
19.	*Cygnus olor*	Mute swan					5, 15		12					
20.	*Corvus cornix*	Hooded Crow	22	7, 5	16, 2	6	19	12, 3	6, 5, 3					
21.	*Anas platyrhynchos*	Mallard		78										
22.	*Pica pica*	Magpie									2			
23.	*Corvus frugilegus*	Eurasian Rook	17	16, 23	15	8, 9		34	24, 21	12	14			

24.	*Larus cachinnans*	Yellow-legged (Caspian) Gull		2										
25.	*Turdus atrogularis*	Black-throated Thrush					30				26			
26.	*Bubo bubo*	Northern Eagle Owl			1									
27.	*Corvus corone*	Eurasian Carrion Crow								2				

CONCLUSIONS

The majority of 460 registered bird species in Uzbekistan (more than 85%) are migratory species; our country is located on the Euro-Asian migration route.

During the year, the composition of the avifauna of the Navoi Bash project territory have been chanching. The richest species diversity we observed in July and September, i.e. after nesting and during the early autumn migration. At this time, there were sandpipers making a reverse migration and swallows making a post-nesting migration.

Lake Agitma, located near the project area, is classified as a key ornithological area (IBA) in Uzbekistan and Central Asia, and is included in the international bird database. The territory where it is planned to create a wind farm in the Navoi region is an ecologically important area for sedentary (local) and migratory birds, because the territory is located within one of the main flyways in Central Asia - the Central Asian Flyway. Located next to the IBA Lake Agitma, is a resting and nesting place for waterfowl such as *Mallard, Greylag Goose, Ruddy Shelduck, Northern Shoveler, Mute Swan*, and for large birds of prey such as *Egyptian Vulture, Steppe Eagle*, and possibly *Golden Eagle*, and naturally they regularly visit the territory where the wind farm is planned.

The research methods were based on international best practice recommendations, in particular those set forth in the Scottish Natural Heritage: recommended bird survey methods to justify the assessment of the impact of surface wind farms. For stationary observations, 9 observation points (VPs) were selected and the minimum observation time at each point was 36 hours per season. For target species, the flight time, altitude, direction, and travel time were recorded in every 15-second interval. All other bird species and other animals (Reptiles and Mammals) were also recorded during observations. Additionally, weather conditions were recorded during observations: cloud cover, precipitation, air temperature, wind speed.

In September, an active migration of Falconiformes was recorded, for example, secondary species as *Common Kestrel, Hen Harrier, Long-legged Buzzard*, and *Common Buzzard* were often found on VP4. *Marsh Harrier* and

Cinereous Vulture were often seen on VP 3. Also on VP1, VP2 and VP3, we observed the passage of waterfowl (due to the proximity to the lake).

Key findings of the autumn bird monitoring:

- The migration corridor is a broad front that includes all of Uzbekistan without narrow corridors.
- The territory of the planned wind farm is located within this wide migration corridor.
- Some large species of waterfowl were recorded flying over the Navoi Bash project territory at different hours of the day, for example, ducks, cranes and swans, and therefore we suggest that the lake attracts waterfowl and other birds during migration.
- There are several species of migratory birds (such as birds of prey, waterfowl, and cranes) included in the IUCN list and in the Red Book of Uzbekistan, which fly over the project territory during Autumn migration.
- These species may be subject to collisions with wind turbines, depending on various conditions.
- The size of the population of bird species registered in the IUCN list and their exposure to collision is very small compared to the size of their population around the globe. Other anthropogenic factors (such as habitat loss, poaching, etc.) are more important factors that cause harm to this recorded migratory population.

Appendix 1. Weather conditions during VP Autumn surveys

Table 7 Weather conditions and visibility in September

	VP 1	VP 2	VP 3	VP 4	VP 5	VP 6	VP 7	VP 8	VP 9
1 September							half cloudy, 3-5 m/s	half cloudy, 3-5 m/s	half cloudy, 3-5 m/s
2 September	half cloudy, 6-8m/s	sunny, 3-5 m/s	half cloudy, 5-7 m/s						
3 September				sunny, 3-5 m/s	sunny, 3-5 m/s	sunny, 3-5 m/s			
4 September							sunny, 5-7 m/s	half cloudy, 3-5 m/s	cloudy, 6-7 m/s
5 September	cloudy, 3-5 m/s	sunny, 3-5 m/s	cloudy, 3-4 m/s						
6 September				half cloudy, 5-6 m/s	cloudy, 3-6 m/s	half cloudy, 4-6 m/s			
7 September							cloudy, 3-4 m/s	sunny, 2-3 m/s	cloudy, 2-5 m/s
10 September	cloudy, 2-5 m/s	partly cloudy, 5-6 m/s	cloudy, 4-6 m/s						
11 September				cloudy, 4-6 m/s	partly cloudy, 3-5 m/s				
12 September							sunny, 6-8 m/s	cloudy, 6-7 m/s	sunny, 2-4 m/s

13 September	half cloudy, 3-6 m/s	sunny, 4-5 m/s	partly cloudy, 5-6 m/s						
14 September				half cloudy, 6-7 m/s	sunny, 5-6 m/s	partly cloudy, 5-6 m/s			
15 September							half cloudy, 3-5 m/s	half cloudy, 6-8 m/s	cloudy, 7-8 m/s
16 September	half cloudy, 3-6 m/s	cloudy, 7-8 m/s	half cloudy, 6-8 m/s						
19 September				half cloudy, 6-8 m/s	cloudy, 7-8 m/s	half cloudy, 5-6 m/s			
20 September							cloudy, 4-5 m/s		partly cloudy, 6-7 m/s
21 September		half cloudy, 6-7 m/s	partly cloudy, 5-7 m/s						
22 September				half cloudy, 6-7 m/s	cloudy, 4-5 m/s				
23 September						half cloudy, 6-7 m/s		cloudy, 6-7 m/s	
25 September	partly cloudy, 5-7 m/s	half cloudy, 4-5 m/s							
26 September			half cloudy, 6-8 m/s	half cloudy, 6-8 m/s					
28 September					sunny, 5-6 m/s	half cloudy, 5-7 m/s			
29 September							half cloudy, 5-6 m/s	half cloudy, 6-7 m/s	

30 September	**cloudy, 6-7 m/s**								**partly cloudy, 5-7 m/s**

Table 8 Weather conditions and visibility in October

	VP 1	VP 2	VP 3	VP 4	VP 5	VP 6	VP 7	VP 8	VP 9
2 October	half cloudy, 6-7 m/s								half cloudy, 6-7 m/s
3 October		half cloudy, 3-5 m/s	partly cloudy, 6-8 m/s						
4 October				sunny, 3-4 m/s	sunny, 4-5 m/s				
5 October						half cloudy, 6-7 m/s	cloudy, 2-5 m/s		
6 October								cloudy, 6-7 m/s	sunny, 3-5 m/s
7 October	sunny, 5-7 m/s	half cloudy 7-8 m/s							
8 October			cloudy, 3-5 m/s	sunny, 4-6 m/s					
11 October					cloudy, 6-8 m/s	half cloudy, 4-6 m/s			
12 October							sunny, 6-8 m/s	half cloudy, 5-6 m/s	
13 October	cloudy, 6-8 m/s								cloudy, 4-6 m/s
14 October		sunny, 5-7 m/s	cloudy, 6-8 m/s						

15 October				**cloudy, 5-8 m/s**	**partly cloudy, 5-6 m/s**				
16 October						**cloudy, 6-8 m/s**	**partly cloudy, 5-6 m/s**		
17 October								**sunny, 6-8 m/s**	**sunny, 4-6 m/s**
22 October		**cloudy, 6-7 m/s**	**half cloudy, 3-6 m/s**						
23 October				**partly cloudy, 5-7 m/s**	**sunny, 4-5 m/s**				
24 October							**half cloudy, 6-7 m/s**	**cloudy, 4-5 m/s**	
25 October	**cloudy, 7-8 m/s**								**partly cloudy, 6-7 m/s**
26 October			**half cloudy, 6-8 m/s**	**half cloudy, 6-8 m/s**					
27 October					**half cloudy, 6-8 m/s**	**half cloudy, 5-7 m/s**			

Table 9 Weather conditions and visibility in November

	VP 1	VP 2	VP 3	VP 4	VP 5	VP 6	VP 7	VP 8	VP 9
1 November	half cloudy, 6-7 m/s	half cloudy, 6-7 m/s							
2 November						half cloudy, 5-6 m/s	partly cloudy. 6-8 m/s		
3 November						cloudy, 4-6 m/s		cloudy, 5-6 m/s	
4 November			half cloudy, 6-7 m/s	half cloudy, 6-7 m/s					
10 November					partly cloudy, 6-8 m/s		half cloudy, 5-6 m/s		
11 November	cloudy, 5-6 m/s	cloudy, 5-6 m/s							
12 November								cloudy, 4-6 m/s	sunny, 4-5 m/s
21 November					half cloudy, 5-6 m/s	half cloudy, 4-6 m/s			
22 November			partly cloudy, 6-8 m/s	cloudy, 5-6 m/s					
23 November							sunny, 4-5 m/s	cloudy, 5-6 m/s	

Appendix 2. Vantage Point Data Logs

VP survey results in September

VP. 9

Date: 01.09.2020. Start and end time: 8:10 – 11:10
Weather:
The air temperature around 18-19°C sky half cloudy.
Wind speed approx. (3-5 m/s) No precipitation

Primary species not found

Table 10. Secondary and other species (VP 9), 01.09.2020

№	Latin names	English names	Amount	Flight altitude
OTHER SPECIES				
1.	*Columba livia*	Rock Dove	12	40
2.	*Galerida cristata*	Crested lark	14	0-15
3.	*Merops supercilios*	Blue-cheeked Bee-eate	2	5-35
4.	*Oenanthe isabellina*	Isabelline Wheatear	2	0-4
5.	*Melanocorypha bimaculata*	Bimaculated lark	25	0-10
6.	*Hirundo rustica*	Barn Swallow	5	3-15
7.	*Acridotheres tristis*	Common myna	6	6-10
8.	*Pterocles orientalis*	Black-bellied sandgrouse	3	0-8
9.	*Corvus corax*	Northern Raven	6	15-25

VP. 7

Date: 01.09.2020. Start and end time: 11:41 – 14:41

Weather:

The air temperature around 20-22°C sky half cloudy.

Wind speed approx. (3-5 m/s) No precipitation

Primary species not found

Table 11. Secondary and other species (VP 7), 01.09.2020

№	Latin names	English names	Amount	Flight altitude
OTHER SPECIES				
1.	*Galerida cristata*	Crested lark	14	0-10
2.	*Oenanthe isabellina*	Isabelline Wheatear	2	0-4
3.	*Melanocorypha bimaculata*	Bimaculated lark	25	0-8
4.	*Hirundo rustica*	Barn Swallow	5	3-15
5.	*Athene noctua*	Little owl	1	0-2

VP. 8

Date: 01.09.2020 Start and end time: 15:27 – 18:37
Weather:
The air temperature around 25-28°C sky half cloudy.
Wind speed approx. (3-5 m/s) No precipitation

Primary species not found

Table 12. Secondary and other species (VP 8), 01.09.2020.

№	Latin names	English names	Amount	Flight altitude
OTHER SPECIES				
1.	*Athene noctua*	Little owl	1	0-5
2.	*Galerida cristata*	Crested lark	24	0-15
3.	*Calandrella rufescens*	Lesser Short-toed Lark	25	0-6
4.	*Oenanthe isabellina*	Isabelline wheatear	4	0-10
5.	*Rhodospiza obsoleta*	Black-billed Desert Finch	4	3
6.	*Muscicapa striata*	Spotted Flycatcher	3	1
7.	*Nycticorax nycticorax*	Black-crowned night-heron	1	85

VP. 1

Date:02.09.2020. Start and end time: 07:23 – 10:23

Weather:

The air temperature around 18-20°C partly cloudy.

Wind speed approx. (6-8 m/s) No precipitation

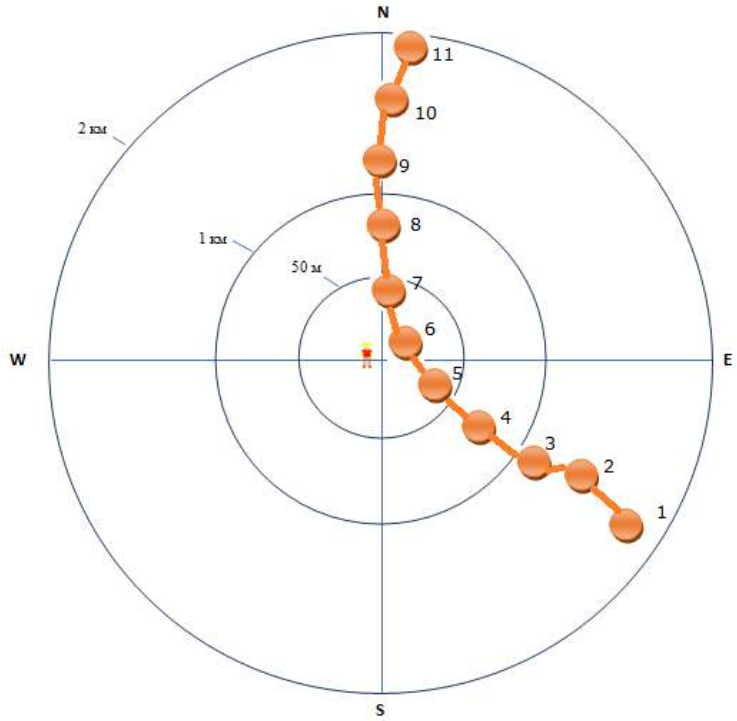


Fig.2 Flight path (VP 1), 02.09.2020

Table 13. Target species log (VP 1), 02.09.2020.

●	*Neophron percnopterus*	1 90 m	2 90 m	3 95 m	4 90 m	5 95 m	6 95 m	7 95 m	8 90 m	9 85 m	10 85 m	11 90 m

Table 14. Secondary and other species (VP 1), 02.09.2020.

№	Latin names	English names	Amount	Flight altitude
SECONDARY SPECIES				
1.	*Buteo rufinus*	Long-legged Buzzard	1	20
2.	*Buteo buteo*	Common Buzzard	1	55
OTHER SPECIES				
1.	*Galerida cristata*	Crested lark	15	0-15
2.	*Calandrella rufescens*	Lesser Short-toed Lark	18	0-5
3.	*Oenanthe isabellina*	Isabelline wheatear	5	0-10
4.	*Coracias garrulus*	Eurasian Roller	9	3-15

VP. 2

Date: 02.09.2020. Start and end time: 11:03 – 14:03

Weather:

The air temperature around 21-24°C is clear.

Wind speed approx. (3-5 m/s) No precipitation

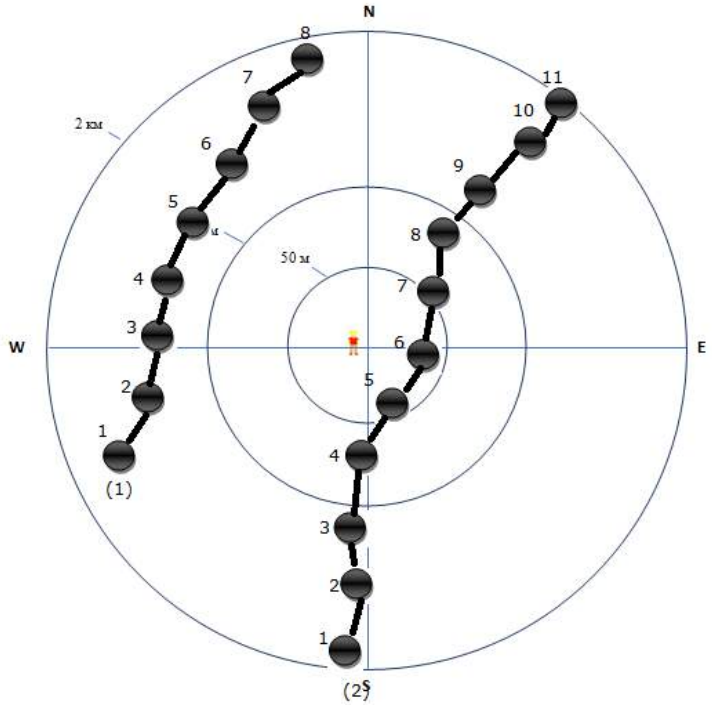


Fig. 3 Flight path (VP 2), 02.09.2020

Table 15 Target species log (VP 2), 02.09.2020.

●	*Aquila nipalensis(1)*	1 90 m	2 90 m	3 95 m	4 90 m	5 95 m	6 95 m	7 90 m	8 90 m			
●	*Aquila nipalensis(2)*	1 90 m	2 90 m	3 95 m	4 90 m	5 95 m	6 95 m	7 90 m	8 90 m	9 95 m	10 90 m	11 95 m

Table 16. Secondary and other species (VP 2), 02.09.2020.

№	Latin names	English names	Amount	Flight altitude
SECONDARY SPECIES				
1.	*Circus aeruginosus*	Marsh Harrier	1	8-25
2.	*Grus grus*	Common Crane	73	230
OTHER SPECIES				
1.	*Passer indicus*	Indian House Sparrow	22	0-4
2.	*Merops supercilios*	Blue-cheeked Bee-eate	3	8-12
3.	*Galerida cristata*	Crested lark	13	0-15
4.	*Oenanthe isabellina*	Isabelline wheatear	2	0-10
5.	*Acridotheres tristis*	Indian Myna	2	2-7
6.	*Coracias garrulus*	Eurasian Roller	5	3-15

VP. 3

Date: 02.09.2020.Start and end time: 14:52 – 17:55
Weather:
The air temperature around 24-21°C is clear.
Wind speed approx. (3-4 m/s) No precipitation

Primary species not found

Table 17. Secondary and other species (VP 3), 02.09.2020.

№	Latin names	English names	Amount	Flight altitude
SECONDARY SPECIES				
1.	*Falco tinnunculus*	Kestrel	1	10-30
2.	*Circus aeruginosus*	Marsh Harrier	1	10-25
OTHER SPECIES				
3.	*Upupa epops*	Hoopoe	1	0-2
4.	*Galerida cristata*	Crested lark	12	0-15
5.	*Calandrella rufescens*	Lesser Short-toed Lark	32	0-5
6.	*Oenanthe isabellina*	Isabelline wheatear	5	0-10
7.	*Acridotheres tristis*	Indian Myna	11	2-7
8.	*Columba livia*	Rock Dove	14	30
9.	*Coracias garrulus*	Eurasian Roller	13	3-15

VP. 6

Date: 03.09.2020. Start and end time: 8:17 – 11:17
Weather:
The air temperature around 18-20°C sky half cloudy
Wind speed approx. (5-7 ms) No precipitation

Primary species not found

Table 18. Secondary and other species (VP 6), 03.09.2020

№	Latin names	English names	Amount	Flight altitude
SECONDARY SPECIES				
1.	*Circus aeruginosus*	Marsh Harrier	1	4-20
OTHER SPECIES				
1.	*Galerida cristata*	Crested lark	4	0-15
2.	*Columba livia*	Rock Dove	12	12
3.	*Oenanthe isabellina*	Isabelline wheatear	3	0-10

VP. 5

Date: 03.09.2020.Start and end time: 11:42 – 14:42
Weather:
The air temperature around 22-24°C is clear.
Wind speed approx. (2-5 m/s) No precipitation

Primary species not found

Table 19. Secondary and other species (VP 5), 03.09.2020

№	Latin names	English names	Amount	Flight altitude
OTHER SPECIES				
1.	*Galerida cristata*	Crested lark	6	0-15
2.	*Columba livia*	Rock Dove	15	12
3.	*Oenanthe isabellina*	Isabelline wheatear	2	0-10

VP.4

Date: 03.09.2020.Start and end time: 15:12 – 18:12

Weather:

The air temperature around 19-23°C is clear.

Wind speed approx. (3-5 m/s) No precipitation

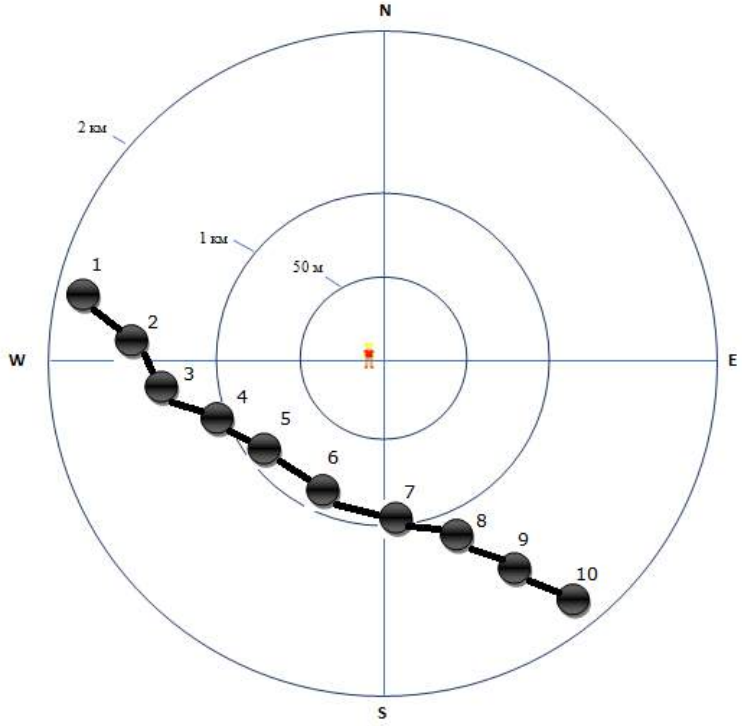


Fig. 4 Flight path (VP 4), 03.09.2020

Table 20 Target species log (VP 4), 03.09.2020.

●	*Aquila nipalensis*	1 120 m	2 120 m	3 125 m	4 120 m	5 125 m	6 125 m	7 120 m	8 120 m	9 125 m	10 120 m

Table 21. Secondary and other species (VP 4), 03.09.2020.

№	Latin names	English names	Amount	Flight altitude
OTHER SPECIES				
1.	*Rhodospiza obsoleta*	Black-billed Desert Finch	7	3
2.	*Galerida cristata*	Crested lark	5	0-15
3.	*Hirundo rustica*	Barn Swallow	3	5-20
4.	*Oenanthe isabellina*	Isabelline wheatear	6	0-10
5.	*Corvus monedula*	Jackdaw	2	0-2
6.	*Scotocerca inguieta*	Streaked Scrub Warbler	2	2

VP. 9

Date: 04.09.2020.Start and end time: 7:34 – 10:34
Weather:
The air temperature around 17-20°C is cloudy.
Wind speed approx. (6-7 m/s) No precipitation

Primary species not found

Table 22. Secondary and other species (VP 9), 04.09.2020.

№	Latin names	English names	Amount	Flight altitude
SECONDARY SPECIES				
1.	*Buteo rufinus*	Long-legged Buzzard	1	20-45
2.	*Falco naumanni*	Lesser kestrel	1	12-25
OTHER SPECIES				
1.	*Galerida cristata*	Crested lark	18	0-15
2.	*Oenanthe isabellina*	Isabelline wheatear	7	0-10
3.	*Columba livia*	Rock Dove	27	35
4.	*Acridotheres tristis*	Indian Myna	6	2-7
5.	*Coracias garrulus*	Eurasian Roller	8	3-15
6.	*Acridotheres tristis*	Common myna	6	6-15

VP. 7

Date: 04.09.2020.Start and end time: 11:06 – 14:06
Weather:
The air temperature around 21-22°C is clear.
Wind speed approx. (5-7 m/s) No precipitation

Primary species not found

Table 23. Secondary and other species (VP 7), 04.09.2020.

№	Latin names	English names	Amount	Flight altitude
OTHER SPECIES				
1.	*Pterocles orientalis*	Black-bellied sandgrouse	2	5
2.	*Galerida cristata*	Crested lark	6	0-15
3.	*Oenanthe isabellina*	Isabelline wheatear	4	0-10
4.	*Scotocerca inguieta*	Streaked Scrub Warbler	2	0-2
5.	*Athene noctua*	Little Owl	1	0-5
6.	*Calandrella brachydactyla*	Short-toed lark	21	0-6

VP. 8

Date: 04.09.2020.Start and end time: 14:38 – 17:38
Weather:
The air temperature around 22-19°C sky half cloudy
Wind speed approx. (3-5 m/s) No precipitation

Primary species not found

Table 24. Secondary and other species (VP 8), 04.09.2020.

№	Latin names	English names	Amount	Flight altitude
OTHER SPECIES				
1.	*Coracias garrulus*	Eurasian Roller	2	3
2.	*Galerida cristata*	Crested lark	2	0-15
3.	*Oenanthe isabellina*	Isabelline wheatear	1	0-10
4.	*Scotocerca inguieta*	Streaked Scrub Warbler	2	2
5.	*Corvus corax*	Northern Raven	23	50-65

VP. 1

Date: 05.09.2020. Start and end time: 8:19 – 11:19
Weather:
The air temperature around 16-18°C cloudy.
Wind speed approx. (3-5 m/s) No precipitation

Primary species not found

Table 25. Secondary and other species (VP 1), 05.09.2020.

№	Latin names	English names	Amount	Flight altitude
OTHER SPECIES				
1.	*Coracias garrulus*	Eurasian Roller	3	5
2.	*Streptopelia decaocto*	Collared Turtle Dove	2	4
3.	*Galerida cristata*	Crested lark	10	0-15
4.	*Hirundo rustica*	Barn Swallow	1	2-5
5.	*Oenanthe isabellina*	Isabelline wheatear	4	0-10
6.	*Scotocerca inguieta*	Streaked Scrub Warbler	4	2

VP. 2

Date: 05.09.2020. Start and end time: 11:56 – 14:56

Weather:

The air temperature around 19-24°C is clear.

Wind speed approx. (4-5 m/s) No precipitation

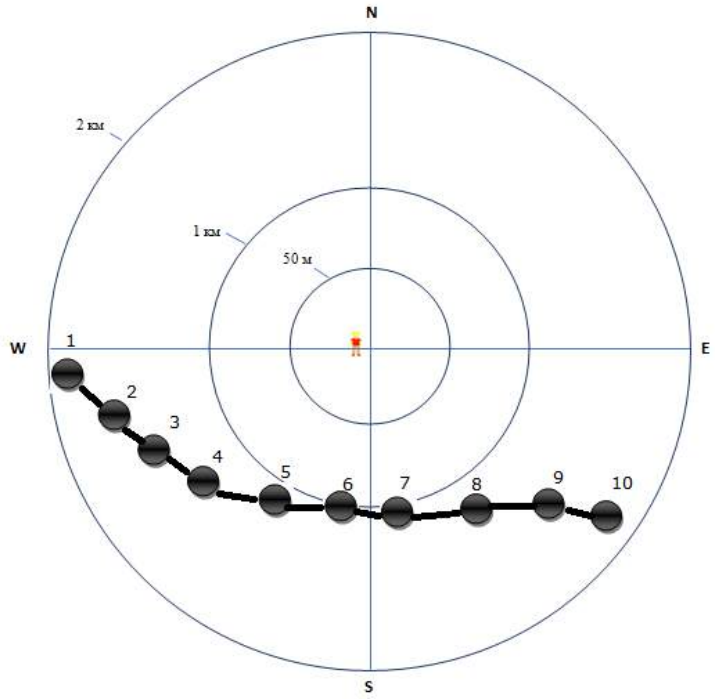


Fig. 5. Flight path (VP 2), 05.09.2020

Table 26. Target species log (VP 2), 05.09.2020

●	*Aquila nipalensis*	1 110 m	2 110 m	3 115 m	4 110 m	5 115 m	6 115 m	7 115 m	8 110 m	9 110 m	10 110 m

Table 27. Secondary and other species (VP 2), 05.09.2020

№	Latin names	English names	Amount	Flight altitude
OTHER SPECIES				
1.	*Coracias garrulus*	Eurasian Roller	3	3
2.	*Galerida cristata*	Crested lark	16	0-13
3.	*Oenanthe isabellina*	Isabelline wheatear	3	0-10
4.	*Scotocerca inguieta*	Streaked Scrub Warbler	2	2
5.	*Acridotheres tristis*	Common myna	5	18

VP 3

Date: 05.09.2020 Start and end time: 15:22 – 18:22
Weather:
The air temperature around 21-18°C is cloudy.
Wind speed approx. (4-3 m/s) No precipitation

Primary species not found

Table 28. Secondary and other species (VP 3), 05.09.2020

№	Latin names	English names	Amount	Flight altitude
SECONDARY SPECIES				
1.	*Circus cyaneus*	Hen (Northern) Harrier	1	5-30
2.	*Falco tinnunculus*	Kestrel	2	15-25
OTHER SPECIES				
3.	*Galerida cristata*	Crested lark	15	0-5
4.	*Oenanthe isabellina*	Isabelline wheatear	3	0-5
5.	*Hirundo rustica*	Barn swallow	3	5-15
6.	*Pterocles orientalis*	Black-bellied sandgrouse	5	0-15
7.	*Athene noctua*	Little Owl	1	0-5

VP 6

Date: 06.09.2020 Start and end time: 7:53 – 10:53
Weather:
The air temperature around 16-19°C sky half cloudy
Wind speed approx. (4-6 m/s) No precipitation

Primary species not found

Table 29. Secondary and other species (VP 6), 06.09.2020

№	Latin names	English names	Amount	Flight altitude
SECONDARY SPECIES				
1.	*Circus cyaneus*	Hen (Northern) Harrier	1	5-30
2.	*Falco tinnunculus*	Kestrel	2	15-25
OTHER SPECIES				
1.	*Galerida cristata*	Crested lark	15	0-5
2.	*Oenanthe isabellina*	Isabelline wheatear	3	0-5
3.	*Pterocles orientalis*	Black-bellied sandgrouse	5	0-15
4.	*Athene noctua*	Little Owl	1	0-5

VP 5

Date: 06.09.2020 Start and end time: 11:18 – 14:18
Weather:
The air temperature arounччd 20-23°C cloudy.
Wind speed approx. (3-6 m/s) No precipitation

Primary species not found

Table 30. Secondary and other species (VP 5), 06.09.2020

№	Latin names	English names	Amount	Flight altitude
SECONDARY SPECIES				
1.	*Falco tinnunculus*	Kestrel	1	6-32
2.	*Grus grus*	Common Crane	53	170
OTHER SPECIES				
1.	*Galerida cristata*	Crested lark	7	0-15
2.	*Columba livia*	Rock Dove	5	35
3.	*Rhodospiza obsoleta*	Black-billed Desert Finch	3	2
4.	*Pterocles orientalis*	Black-bellied sandgrouse	5	35

VP. 4

Date: 06.09.2020. Start and end time: 14:56 – 17:56
Weather:
The air temperature around 18-20°C sky half cloudy.
Wind speed approx. (5-6 m/s) No precipitation

Primary species not found

Table 31. Secondary and other species (VP 4), 06.09.2020.

№	Latin names	English names	Amount	Flight altitude
SECONDARY SPECIES				
1.	*Buteo rufinus*	Long-legged Buzzard	1	45
OTHER SPECIES				
1.	*Galerida cristata*	Crested lark	13	0-15
2.	*Oenanthe isabellina*	Isabelline wheatear	3	0-10
3.	*Columba livia*	Rock Dove	12	35
4.	*Coracias garrulus*	Eurasian Roller	8	3-15

VP. 9

Date: 07.09.2020. Start and end time: 8:15 – 11:15
Weather:
The air temperature around 18-20°C cloudy.
Wind speed approx. (2-5 m/s) No precipitation

Primary species not found

Table 32. Secondary and other species (VP 9), 07.09.2020.

№	Latin names	English names	Amount	Flight altitude
SECONDARY SPECIES				
1.	*Buteo buteo*	Common Buzzard	1	15-45
OTHER SPECIES				
1.	*Galerida cristata*	Crested lark	13	0-15
2.	*Oenanthe isabellina*	Isabelline wheatear	3	0-10
3.	*Columba livia*	Rock Dove	12	35
4.	*Coracias garrulus*	Eurasian Roller	8	3-15
5.	*Corvus corax*	Northern Raven	2	23
6.	*Phalacrocorax pygmaeus*	Pygmy cormorant	6	0-10

VP. 7

Date: 07.09.2020. Start and end time: 11:43 – 14:43
Weather:
The air temperature around 19-22°C cloudy.
Wind speed approx. (3-4 m/s) No precipitation

Primary species not found

Table 33. Secondary and other species (VP 7), 07.09.2020.

№	Latin names	English names	Amount	Flight altitude
OTHER SPECIES				
1.	*Galerida cristata*	Crested lark	8	0-15
2.	*Oenanthe isabellina*	Isabelline wheatear	4	0-10
3.	*Merops supercilios*	Blue-cheeked Bee-eate	16	15

VP.8

Date: 07.09.2020. Start and end time: 15:12 – 18:12

Weather:

The air temperature around 22-18°C is clear.

Wind speed approx. (2-3 m/s) No precipitation

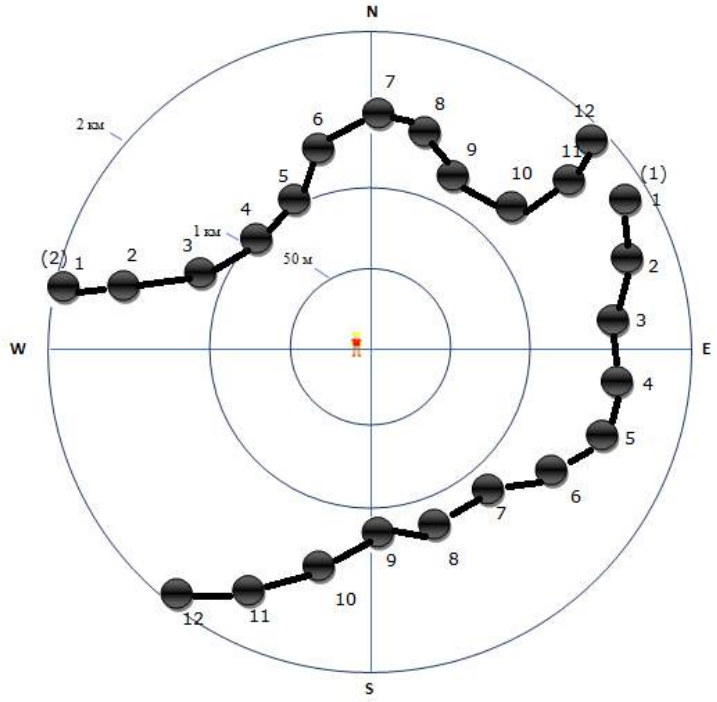


Fig. 6. Flight path (VP 8), 07.09.2020

Table 34. Target species (VP 8), 07.09.2020

●	*Aquila nipalensis(1)*	1-90 m	2-90 m	3-95 m	4-90 m	5-95 m	6-95 m	7-95 m	8-90 m	9-90 m	10-90 m	11-90 m	12-90 m
●	*Aquila nipalensis(2)*	1-90 m	2-90 m	3-95 m	4-90 m	5-95 m	6-95 m	7-95 m	8-90 m	9-90 m	10-90 m	11-90 m	12-40 m

Table 35. Secondary and other species (VP 8), 07.09.2020

№	Latin names	English names	Amount	Flight altitude
OTHER SPECIES				
1.	*Rhodospiza obsolete*	Black-billed Desert Finch	6	3
2.	*Galerida cristata*	Crested lark	15	0-15
3.	*Calandrella rufescens*	Lesser Short-toed Lark	40	0-4
4.	*Oenanthe isabellina*	Isabelline wheatear	4	0-10
5.	*Pterocles orientalis*	Black-bellied sandgrouse	3	6-8

VP. 1

Date: 10.09.2020. Start and end time:7:40 – 10:40
Weather:
The air temperature around 18-19°C cloudy.
Wind speed approx. (2-5 m/s) No precipitation

Primary species not found

Table 36. Secondary and other species (VP 1), 10.09.2020

№	Latin names	English names	Amount	Flight altitude
OTHER SPECIES				
1.	*Alectoris chukar*	Chuckar partridge	4	0
2.	*Galerida cristata*	Crested lark	16	0-15
3.	*Oenanthe isabellina*	Isabelline wheatear	6	0-10
4.	*Corvus monedula*	Jackdaw	5	0-4
5.	*Scotocerca inguieta*	Streaked Scrub Warbler	4	2
6.	*Tadorna ferruginea*	Roodysheld duck	3	45

VP. 2

Date: 10.09.2020. Start and end time: 11:13 – 14:13
Weather:
The air temperature around 19-21°C partly cloudy
Wind speed approx. (5-6 m/s) No precipitation

Primary species not found

Table 37. Secondary and other species (VP 2), 10.09.2020.

№	Latin names	English names	Amount	Flight altitude
SECONDARY SPECIES				
1.	*Circus cyaneus*	Hen (Northern) Harrier	1	15-45
OTHER SPECIES				
1.	*Galerida cristata*	Crested lark	17	0-15
2.	*Oenanthe isabellina*	Isabelline wheatear	2	0-10
3.	*Coracias garrulus*	Eurasian Roller	8	3-15
4.	*Muscicapa striata*	Spotted Flycatcher	1	3
5.	*Phalacrocorax pygmaeus*	Pygmy cormorant	6	0-10

VP. 3

Date: 10.09.2020. Start and end time: 14:55 – 17:45
Weather:
The air temperature around 22-18°C cloudy.
Wind speed approx. (4-6 m/s) No precipitation

Primary species not found

Table 38. Secondary and other species (VP 1), 27.05.2020.

№	Latin names	English names	Amount	Flight altitude
SECONDARY SPECIES				
1.	*Falco tinnunculus*	Kestrel	1	15
2.	*Circus aeruginosus*	Marsh Harrier	1	20-35
3.	*Circus cyaneus*	Hen (Northern) Harrier	1	15-25
OTHER SPECIES				
1.	*Galerida cristata*	Crested lark	8	0-15
2.	*Oenanthe isabellina*	Isabelline wheatear	3	0-10
3.	*Nycticorax nycticorax*	Black-crowned night-heron	14	50
4.	*Coracias garrulus*	Eurasian Roller	2	3-15
5.	*Rhodospiza obsoleta*	Black-billed Desert Finch	3	2
6.	*Muscicapa striata*	Spotted Flycatcher	1	3

VP. 4

Date: 11.09.2020. Start and end time: 11:06 – 14:16

Weather:

The air temperature around 18-20°C cloudy.

Wind speed approx. (4-6 ms) No precipitation

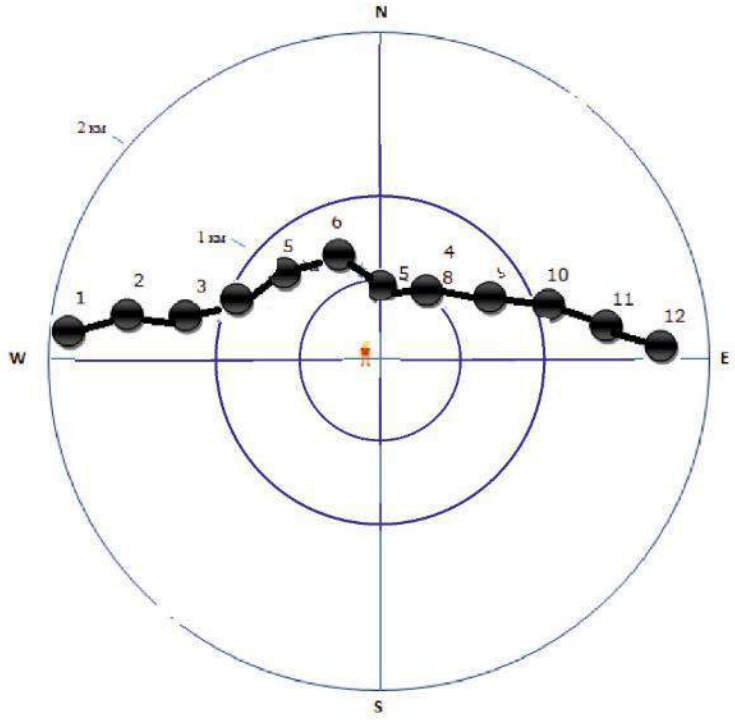


Fig. 7. Flight path (VP 4), 11.09.2020

Table 39. Target species log (VP 4), 11.09.2020

●	*Aquila nipalensis*	1- 120 m	2- 120 m	3- 125 m	4- 120 m	5- 125 m	6- 125 m	7- 125 m	8- 110 m	9- 110 m	10- 110 m	11- 100 m	12- 100 m

Table 40. Secondary and other species (VP 4), 11.09.2020

№	Latin names	English names	Amount	Flight altitude
SECONDARY SPECIES				
1	*Aegypius monachus*	Cinereous Vulture	1	120-160
OTHER SPECIES				
1.	*Rhodospiza obsolete*	Black-billed Desert Finch	8	3
2.	*Galerida cristata*	Crested lark	6	0-15
3.	*Oenanthe isabellina*	Isabelline wheatear	2	0-10
4.	*Pterocles orientalis*	Black-bellied sandgrouse	3	0-15
5.	*Corvus monedula*	Jackdaw	6	0-12
6.	*Scotocerca inguieta*	Streaked Scrub Warbler	2	2

VP. 5

Date: 11.09.2020. Start and end time: 14:48 – 17:48
Weather:
The air temperature around 20-18°C partly cloudy.
Wind speed approx. (3-5 m/s) No precipitation

Primary species not found

Table 41. Secondary and other species (VP 5), 11.09.2020

№	Latin names	English names	Amount	Flight altitude
SECONDARY SPECIES				
1.	*Falco tinnunculus*	Kestrel	2	15-25
OTHER SPECIES				
1.	*Galerida cristata*	Crested lark	19	0-15
2.	*Oenanthe isabellina*	Isabelline wheatear	5	0-10
3.	*Columba livia*	Rock Dove	38	35
4.	*Coracias garrulus*	Eurasian Roller	4	3-15
5.	*Rhodospiza obsolete*	Black-billed Desert Finch	3	2
6.	*Athene noctua*	Little Owl	1	0-5

VP. 9

Date: 12.09.2020. Start and end time: 8:09 – 11:09

Weather:

The air temperature around 18-20°C is clear.

Wind speed approx. (2-4 m/s) No precipitation

Primary species not found

Table 42. Secondary and other species (VP 9), 12.09.2020.

№	Latin names	English names	Amount	Flight altitude
		SECONDARY SPECIES		
1.	*Falco tinnunculus*	Kestrel	2	15-25
2.	*Buteo buteo*	Common Buzzard	1	12-35
		OTHER SPECIES		
1.	*Galerida cristata*	Crested lark	15	0-15
2.	*Oenanthe isabellina*	Isabelline wheatear	3	0-10
3.	*Streptopelia senegalensis*	Laughing dove	2	20
4.	*Columba livia*	Rock Dove	32	35
5.	*Acridotheres tristis*	Common myna	5	23
6.	*Coracias garrulus*	Eurasian Roller	4	3-15
7.	*Rhodospiza obsoleta*	Black-billed Desert Finch	3	2
8.	*Athene noctua*	Little Owl	1	0-3

VP. 7

Date: 12.09.2020. Start and end time: 11:36 – 14:36

Weather:

The air temperature around 20-20°C is clear.

Wind speed approx. (6-8 m/s) No precipitation

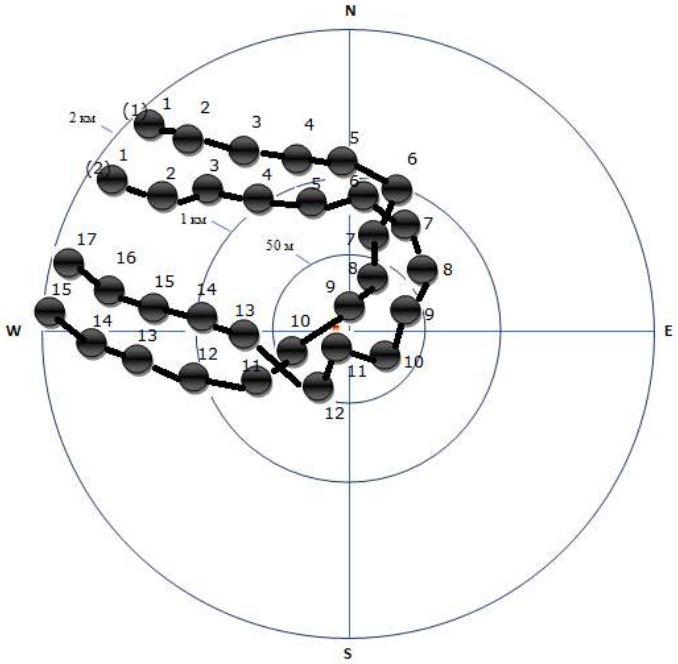


Fig. 8. Flight path (VP 7), 12.09.2020.

Table 43. Target species log (VP 7), 12.09.2020.

●	*Aquila nipalensis(1)*	1-120 m	2-120 m	3-125 m	4-120 m	5-125 m	6-125 m	7-125 m	8-130 m	9-140 m	10-150 m	11-160 m	12-160 m	13-125 m	14-120 m	15-125 m		
●	*Aquila nipalensis(2)*	1-120 m	2-120 m	3-125 m	4-120 m	5-125 m	6-125 m	7-125 m	8-110 m	9-110 m	10-110 m	11-100 m	12-100 m	13-125 m	14-120 m	15-125 m	16-125 m	17-125 m

Table 44. Secondary and other species (VP 7), 12.09.2020

№	Latin names	English names	Amount	Flight altitude
OTHER SPECIES				
1.	*Galerida cristata*	Crested lark	13	0-15
2.	*Oenanthe isabellina*	Isabelline wheatear	5	0-10
3.	*Calandrella rufescens*	Lesser Short-toed Lark	42	0-3
4.	*Scotocerca inguieta*	Streaked Scrub Warbler	2	0-2

VP. 8

Date: 12.09.2020. Start and end time: 14:58 – 17:58
Weather:
The air temperature around 20-18°C cloudy.
Wind speed approx. (6-7 m/s) No precipitation

Primary species not found

Table 45. Secondary and other species (VP 8), 12.09.2020.

№	Latin names	English names	Amount	Flight altitude
OTHER SPECIES				
1.	*Galerida cristata*	Crested lark	11	0-15
2.	*Oenanthe isabellina*	Isabelline wheatear	2	0-10
3.	*Calandrella rufescens*	Lesser Short-toed Lark	15	0-3
4.	*Scotocerca inguieta*	Streaked Scrub Warbler	1	2
5.	*Corvus corax*	Northern Raven	3	50

VP. 1

Date: 13.09.2020. Start and end time: 7:27 – 10:29
Weather:
The air temperature around 14-16°C sky half cloudy
Wind speed approx. (3-6 m/s) rainy

Primary species not found

Table 46. Secondary and other species (VP 1), 13.09.2020.

№	Latin names	English names	Amount	Flight altitude
OTHER SPECIES				
1.	*Galerida cristata*	Crested lark	5	0-15
2.	*Oenanthe isabellina*	Isabelline wheatear	2	0-10
3.	*Pterocles orientalis*	Black-bellied sandgrouse	5	20

VP. 2

Date: 13.09.2020. Start and end time: 10:52 – 13:53

Weather:

The air temperature around 18-20°C is clear.

Wind speed approx. (4-5 m/s) No precipitation

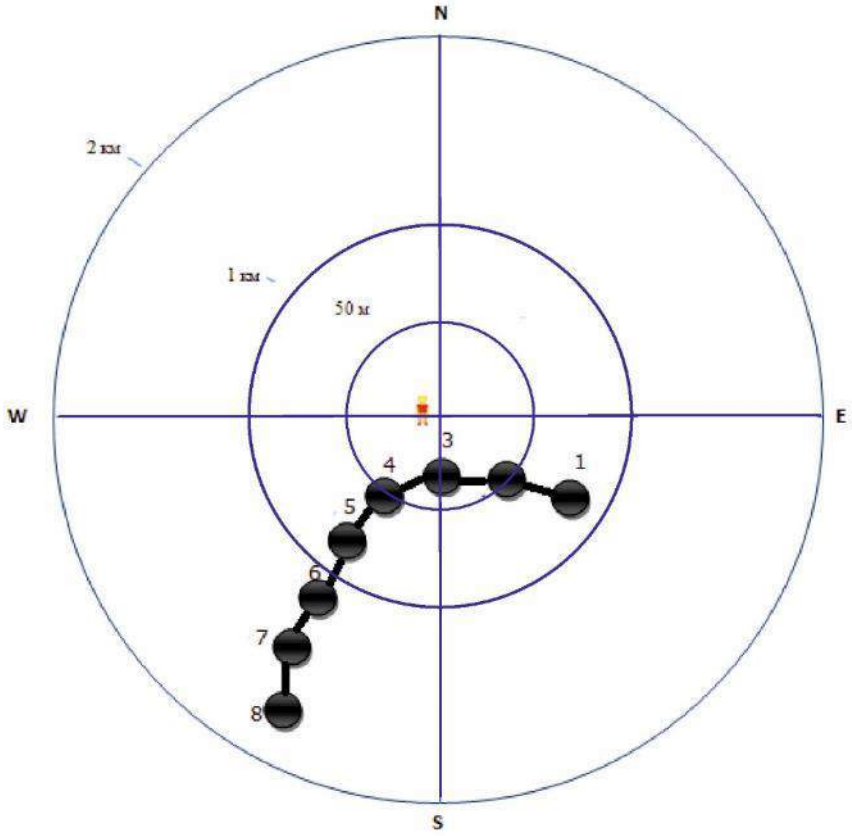


Fig. 9. Flight path (VP 2), 13.09.2020.

Table 47. Target species log (VP 2), 13.09.2020

●	*Aquila nipalensis*	1- 70 m	2- 80 m	3- 95 m	4- 120 m	5- 125 m	6- 125 m	7- 125 m	8- 130 m

Table 48. Secondary and other species (VP 2), 13.09.2020.

№	Latin names	English names	Amount	Flight altitude
SECONDARY SPECIES				
1.	*Aegypius monachus*	Cinereous vulture	1	110-120
OTHER SPECIES				
1.	*Athene noctua*	Little owl	1	0-6
2.	*Galerida cristata*	Crested lark	10	0-15
3.	*Oenanthe isabellina*	Isabelline wheatear	1	0-10
4.	*Coracias garrulus*	Eurasian Roller	3	4
5.	*Calandrella rufescens*	Lesser Short-toed Lark	36	0-3

VP. 3

Date: 13.09.2020. Start and end time: 14:28 – 17:28
Weather:
The air temperature around 21-18°C partly cloudy.
Wind speed approx. (5-7 m/s) No precipitation

Primary species not found

Table 49. Secondary and other species (VP 3), 13.09.2020

№	Latin names	English names	Amount	Flight altitude
SECONDARY SPECIES				
1.	*Circus aeruginosus*	Marsh Harrier	2	15-25
2.	*Falco tinnunculus*	Kestrel	2	16-25
3.	*Grus grus*	Common Crane	117	230
OTHER SPECIES				
1.	*Galerida cristata*	Crested lark	8	0-15
2.	*Oenanthe isabellina*	Isabelline wheatear	3	0-10
3.	*Columba livia*	Rock Dove	12	40
4.	*Calandrella rufescens*	Lesser Short-toed Lark	25	2-6
5.	*Rhodospiza obsoleta*	Black-billed Desert Finch	3	2

VP. 4

Date: 14.09.2020. Start and end time: 7:23 – 10:23
Weather:
The air temperature around 14-16°C sky half cloudy.
Wind speed approx. (6-7 m/s) No precipitation

Primary species not found

Table 50. Secondary and other species (VP 4), 14.09.2020.

№	Latin names	English names	Amount	Flight altitude
OTHER SPECIES				
1.	*Galerida cristata*	Crested lark	12	0-15
2.	*Oenanthe isabellina*	Isabelline wheatear	2	0-10
3.	*Pterocles orientalis*	Black-bellied sandgrouse	6	25
4.	*Corvus corax*	Northern Raven	4	35

VP. 5

Date: 14.09.2020. Start and end time: 10:48 – 13:48
Weather:
The air temperature around 18-20°C is clear.
Wind speed approx. (5-6 m/s) No precipitation

Primary species not found

Table 51. Secondary and other species (VP 5), 14.09.2020

№	Latin names	English names	Amount	Flight altitude
SECONDARY SPECIES				
1.	*Falco tinnunculus*	Kestrel	1	12-25
OTHER SPECIES				
1.	*Galerida cristata*	Crested lark	9	0-15
2.	*Oenanthe isabellina*	Isabelline wheatear	3	0-10
3.	*Corvus ruficollis*	Brown-necked Raven	1	4
4.	*Calandrella rufescens*	Lesser Short-toed Lark	23	2-9

VP. 6

Date: 14.09.2020. Start and end time: 14:12 – 17:15
Weather:
The air temperature around 18-16°C partly cloudy.
Wind speed approx. (6-7 m/s) No precipitation

Primary species not found

Table 52. Secondary and other species (VP 6), 14.09.2020.

№	Latin names	English names	Amount	Flight altitude
OTHER SPECIES				
1.	*Lanius pallidirostris*	Southern grey shrike	2	2
2.	*Galerida cristata*	Crested lark	12	0-15
3.	*Oenanthe isabellina*	Isabelline wheatear	2	0-10
4.	*Athene noctua*	Little Owl	1	0-6

VP. 9

Date:15.09.2020. Start and end time: 7:33 – 10:33

Weather:

The air temperature around 14-16°C cloudy.

Wind speed approx. (7-8 m/s) No precipitation

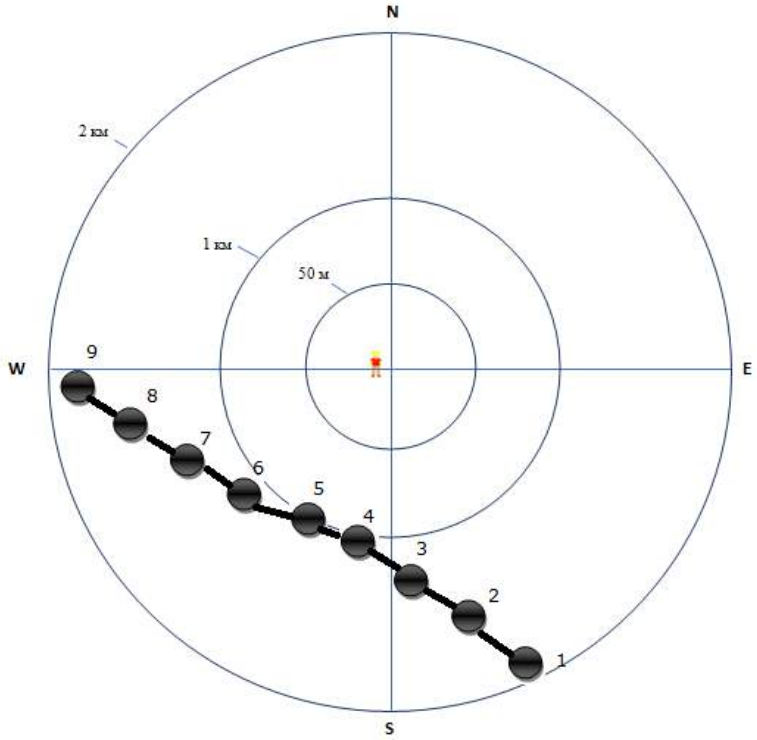


Fig. 10. Flight path (VP 9), 15.09.2020

Table 53. Target species log (VP 9), 15.09.2020

●	*Aquila nipalensis*	1- 60 m	2- 60 m	3- 65 m	4- 60 m	5- 65 m	6- 65 m	7- 65 m	8- 60 m	9- 60 m

Table 54. Secondary and other species (VP 9), 15.09.2020

№	Latin names	English names	Amount	Flight altitude
SECONDARY SPECIES				
	Circus cyaneus	Hen (Northern) Harrier	1	11-20
	Buteo rufinus	Long-legged Buzzard	1	25-30
OTHER SPECIES				
1.	*Galerida cristata*	Crested lark	3	0-15
2.	*Oenanthe isabellina*	Isabelline wheatear	1	0-10
3.	*Calandrella rufescens*	Lesser Short-toed Lark	32	0-6

VP. 7

Date: 15.09.2020.Start and end time: 10:56 – 13:56
Weather:
The air temperature around 16-17°C sky half cloudy
Wind speed approx. (3-5 m/s) No precipitation

Primary species not found

Table 55. Secondary and other species (VP 7), 15.09.2020.

№	Latin names	English names	Amount	Flight altitude
OTHER SPECIES				
1.	*Alectoris chukar*	Chuckar partridge	2	0
2.	*Columba livia*	Rock Dove	6	15
3.	*Galerida cristata*	Crested lark	3	0-15
4.	*Oenanthe isabellina*	Isabelline wheatear	2	0-10
5.	*Calandrella rufescens*	Lesser Short-toed Lark	28	0-12

VP. 8

Date:15.09.2020.Start and end time: 14:15 – 17:15
Weather:
The air temperature around 18-16°C sky half cloudy
Wind speed approx. (6-8 m/s) No precipitation

Primary species not found

Table 56. Secondary and other species (VP 8), 15.09.2020

№	Latin names	English names	Amount	Flight altitude
OTHER SPECIES				
1.	*Calandrella rufescens*	Lesser Short-toed Lark	14	0-2
2.	*Corvus monedula*	Jackdaw	4	0-3
3.	*Galerida cristata*	Crested lark	9	0-15
4.	*Oenanthe isabellina*	Isabelline wheatear	2	0-10
5.	*Passer indicus*	Indian House Sparrow	6	2
6.	*Pterocles orientalis*	Black-bellied sandgrouse	4	0-5

VP. 1

Date: 16.09.2020.Start and end time: 7:56 – 10:56
Weather:
The air temperature around 16-17°C sky half cloudy
Wind speed approx. (3-6 m/s) No precipitation

Primary species not found

Table 57. Secondary and other species (VP 1), 16.09.2020

№	Latin names	English names	Amount	Flight altitude
OTHER SPECIES				
1.	*Galerida cristata*	Crested lark	9	0-15
2.	*Oenanthe isabellina*	Isabelline wheatear	2	0-10
3.	*Calandrella rufescens*	Lesser Short-toed Lark	12	0-12

VP. 2

Date:16.09.2020. Start and end time: 11:13 – 14:13

Weather:

The air temperature around 16-18°C cloudy.

Wind speed approx. (7-8 m/s) No precipitation

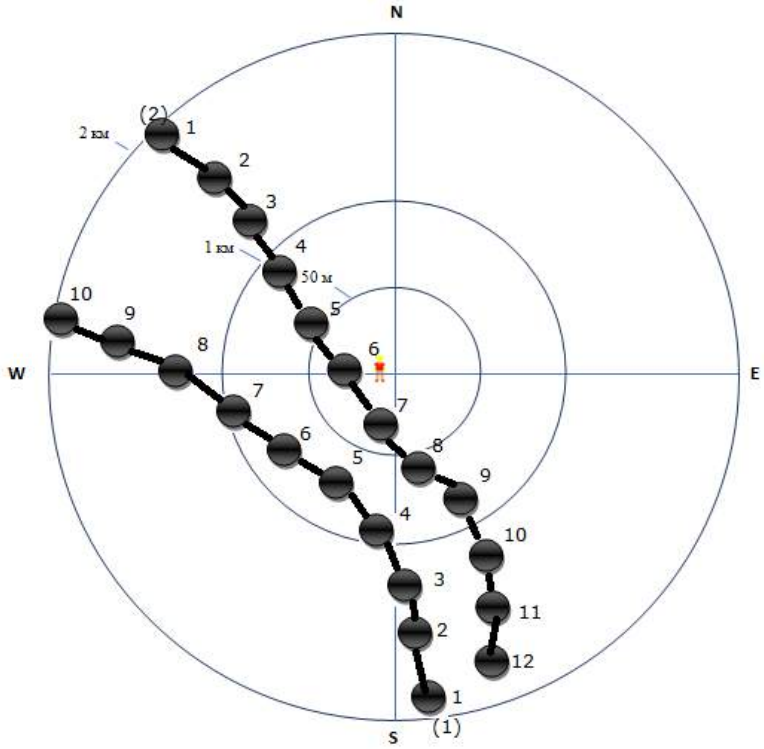


Fig. 11. Flight path (VP 2), 16.09.2020

Table 58. Target species log (VP 2), 16.09.2020.

●	*Aquila nipalensis(1)*	1- 120 m	2- 120 m	3- 125 m	4- 120 m	5- 125 m	6- 115 m	7- 115 m	8- 110 m	9- 110 m	10- 100 m	11- 110 m	12- 110 m
●	*Aquila nipalensis(2)*	1- 90 m	2- 90 m	3- 95 m	4- 90 m	5- 95 m	6- 95 m	7- 95 m	8- 90 m	9- 90 m	10- 90 m		

Table 59. Secondary and other species (VP 2), 16.09.2020.

№	Latin names	English names	Amount	Flight altitude
OTHER SPECIES				
1.	*Galerida cristata*	Crested lark	5	0-15
2.	*Oenanthe isabellina*	Isabelline wheatear	1	0-10
3.	*Calandrella rufescens*	Lesser Short-toed Lark	12	0-6

VP. 3

Date:16.09.2020.Start and end time: 14:32 – 17:32
Weather:
The air temperature around 18-16°C sky half cloudy
Wind speed approx. (6-8 m/s) No precipitation

Primary species not found

Table 60. Secondary and other species (VP 3), 16.09.2020

№	Latin names	English names	Amount	Flight altitude
SECONDARY SPECIES				
1.	*Circus aeruginosus*	Marsh Harrier	2	15-32
2.	*Circus cyaneus*	Hen (Northern) Harrier	1	6-35
3.	*Grus grus*	Common Crane	43	200
OTHER SPECIES				
1.	*Galerida cristata*	Crested lark	16	0-15
2.	*Oenanthe isabellina*	Isabelline wheatear	2	0-10
3.	*Calandrella rufescens*	Lesser Short-toed Lark	31	0-6
4.	*Pterocles orientalis*	Black-bellied sandgrouse	3	0

VP. 6

Date: 19.09.2020.Start and end time: 7:54 – 10:56
Weather:
The air temperature around 16-17°C sky half cloudy
Wind speed approx. (5-6 m/s) No precipitation

Primary species not found

Table 61. Secondary and other species (VP 6), 19.09.2020.

№	Latin names	English names	Amount	Flight altitude
OTHER SPECIES				
1	*Galerida cristata*	Crested lark	9	0-15
2	*Oenanthe isabellina*	Isabelline wheatear	2	0-10
3	*Calandrella rufescens*	Lesser Short-toed Lark	9	0-12

VP. 5

Date:19.09.2020. Start and end time: 11:11 – 14:12
Weather:
The air temperature around 16-18°C cloudy.
Wind speed approx. (7-8 m/s) No precipitation

Primary species not found

Table 62. Secondary and other species (VP 5), 19.09.2020.

№	Latin names	English names	Amount	Flight altitude
SECONDARY SPECIES				
1.	*Falco tinnunculus*	Kestrel	2	10-25
OTHER SPECIES				
1.	*Galerida cristata*	Crested lark	16	0-15
2.	*Oenanthe isabellina*	Isabelline wheatear	2	0-10
3.	*Calandrella rufescens*	Lesser Short-toed Lark	16	0-5
4.	*Pterocles orientalis*	Black-bellied sandgrouse	2	0-6

VP. 4

Date:19.09.2020.Start and end time: 14:28 – 17:28
Weather:
The air temperature around 18-16°C sky half cloudy
Wind speed approx. (6-8 m/s) No precipitation

Primary species not found

Table 63. Secondary and other species (VP 4), 19.09.2020.

№	Latin names	English names	Amount	Flight altitude
SECONDARY SPECIES				
1.	*Circus cyaneus*	Hen (Northern) Harrier	1	6-35
OTHER SPECIES				
1.	*Galerida cristata*	Crested lark	16	0-15
2.	*Oenanthe isabellina*	Isabelline wheatear	2	0-10
3.	*Calandrella rufescens*	Lesser Short-toed Lark	31	0-6

VP. 9

Date: 20.09.2020. Start and end time: 8:28 – 11:32
Weather:
The air temperature around 14-15°C partly cloudy.
Wind speed approx. (6-7 m/s) No precipitation

Primary species not found

Table 64. Secondary and other species (VP 9), 20.09.2020

№	Latin names	English names	Amount	Flight altitude
SECONDARY SPECIES				
1.	*Buteo buteo*	Common Buzzard	1	15-25
OTHER SPECIES				
1.	*Galerida cristata*	Crested lark	9	0-8
2.	*Oenanthe isabellina*	Isabelline wheatear	3	0-10
3.	*Columba livia*	Rock Dove	15	25
4.	*Calandrella rufescens*	Lesser Short-toed Lark	25	2-6
5.	*Columba palumbus*	Wood Pigeon	12	25-35
6.	*Acridotheres tristis*	Common myna	5	20
7.	*Athene noctua*	Little Owl	1	0-3

VP. 7

Date: 20.09.2020. Start and end time: 12:22 – 15:23
Weather:
The air temperature around 16-19°C is cloudy.
Wind speed approx. (4-5 m/s) No precipitation

Table 65. Secondary and other species (VP 7), 20.09.2020

№	Latin names	English names	Amount	Flight altitude
SECONDARY SPECIES				
1.	*Aegypius monachus*	Cinereous vulture	1	110-125
OTHER SPECIES				
1.	*Athene noctua*	Little owl	1	0-6
2.	*Galerida cristata*	Crested lark	6	0-15
3.	*Coracias garrulus*	Eurasian Roller	3	4
4.	*Calandrella rufescens*	Lesser Short-toed Lark	16	0-3

VP. 3

Date: 21.09.2020. Start and end time: 9:27 – 12:29
Weather:
The air temperature around 14-16°C partly cloudy.
Wind speed approx. (5-7 m/s) No precipitation

Primary species not found

Table 66. Secondary and other species (VP 3), 21.09.2020.

№	Latin names	English names	Amount	Flight altitude
SECONDARY SPECIES				
1.	*Circus aeruginosus*	Marsh Harrier	1	15-30
OTHER SPECIES				
1.	*Galerida cristata*	Crested lark	8	0-15
2.	*Oenanthe isabellina*	Isabelline wheatear	3	0-10
3.	*Calandrella rufescens*	Lesser Short-toed Lark	25	2-6
4.	*Rhodospiza obsolete*	Black-billed Desert Finch	3	2

VP. 2

Date: 21.09.2020. Start and end time:13:23 – 16:23
Weather:
The air temperature around 16-18°C sky half cloudy.
Wind speed approx. (6-7 m/s) No precipitation

Primary species not found

Table 67. Secondary and other species (VP 2), 21.09.2020.

№	Latin names	English names	Amount	Flight altitude
OTHER SPECIES				
1.	*Galerida cristata*	Crested lark	6	0-15
2.	*Oenanthe isabellina*	Isabelline wheatear	1	0-10
3.	*Corvus corax*	Northern Raven	6	35
4.	*Nycticorax nycticorax*	Black-crowned night-heron	1	50

VP. 4

Date: 22.09.2020. Start and end time: 9:15 – 12:17
Weather:
The air temperature around 14-16°C sky half cloudy
Wind speed approx. (6-7 m/s) No precipitation

Primary species not found

Table 68. Secondary and other species (VP 4), 22.09.2020.

№	Latin names	English names	Amount	Flight altitude
SECONDARY SPECIES				
1.	*Falco tinnunculus*	Kestrel	1	5-25
OTHER SPECIES				
1.	*Galerida cristata*	Crested lark	8	0-15
2.	*Oenanthe isabellina*	Isabelline wheatear	3	0-10
3.	*Calandrella rufescens*	Lesser Short-toed Lark	25	2-6
4.	*Athene noctua*	Little Owl	2	0-3

VP. 5

Date: 22.09.2020. Start and end time: 13:22 – 13:24

Weather:

The air temperature around 16-19°C is cloudy.

Wind speed approx. (4-5 m/s) No precipitation

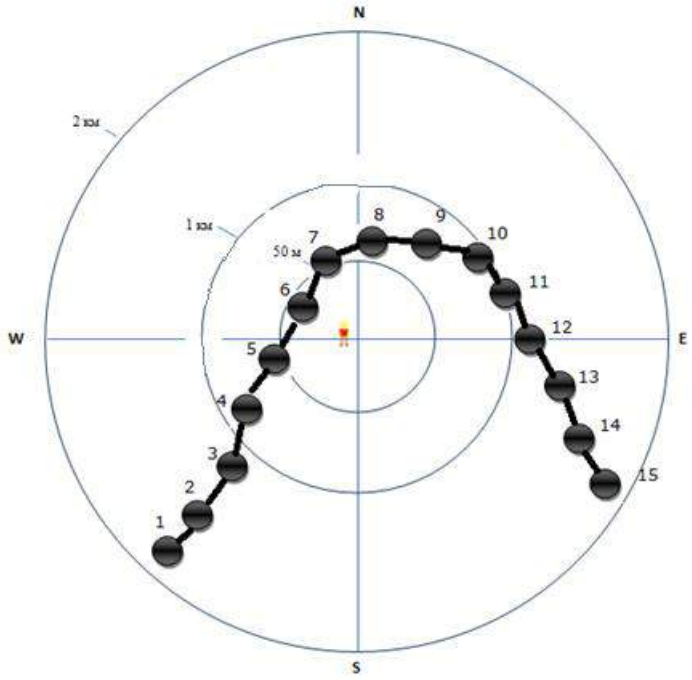


Fig. 12. Flight path (VP 5), 22.09.2020

Table 69. Target species log (VP 5), 22.09.2020.

●	*Aquila nipalensis*	1-120 m	2-120 m	3-125 m	4-120 m	5-125 m	6-125 m	7-125 m	8-110 m	9-110 m	10-110 m	11-120 m	12-120 m	13-125 m	14-120 m	15-125 m

Table 70. Secondary and other species (VP 5), 22.09.2020.

№	Latin names	English names	Amount	Flight altitude
OTHER SPECIES				
1.	*Athene noctua*	Little owl	1	0-6
2.	*Galerida cristata*	Crested lark	12	0-15
3.	*Calandrella rufescens*	Lesser Short-toed Lark	14	0-3

VP. 6

Date: 23.09.2020. Start and end time: 8:54 – 11:56
Weather:
The air temperature around 14-16°C sky half cloudy
Wind speed approx. (6-7 m/s) No precipitation

Primary species not found

Table 71. Secondary and other species (VP 6), 23.09.2020

№	Latin names	English names	Amount	Flight altitude
OTHER SPECIES				
1.	*Galerida cristata*	Crested lark	5	0-15
2.	*Oenanthe isabellina*	Isabelline wheatear	1	0-10
3.	*Calandrella rufescens*	Lesser Short-toed Lark	12	2-6

VP. 8

Date: 23.09.2020. Start and end time: 13:46 – 16:52
Weather:
The air temperature around 18-19°C is cloudy.
Wind speed approx. (6-7 m/s) No precipitation

Primary species not found

Table 72. Secondary and other species (VP 8), 23.09.2020.

№	Latin names	English names	Amount	Flight altitude
OTHER SPECIES				
1.	*Galerida cristata*	Crested lark	5	0-15
2.	*Calandrella rufescens*	Lesser Short-toed Lark	13	0-3
3.	*Pterocles orientalis*	Black-bellied sandgrouse	5	12

VP. 1

Date: 25.09.2020. Start and end time: 8:27 – 11:29
Weather:
The air temperature around 14-16°C partly cloudy.
Wind speed approx. (5-7 m/s) No precipitation

Primary species not found

Table 73. Secondary and other species (VP 1), 25.09.2020.

№	Latin names	English names	Amount	Flight altitude
SECONDARY SPECIES				
1.	*Circus cyaneus*	Hen (Northern) Harrier	1	15-30
2.	*Grus grus*	Common Crane	86	230
OTHER SPECIES				
1.	*Galerida cristata*	Crested lark	6	0-15
2.	*Oenanthe isabellina*	Isabelline wheatear	2	0-10
3.	*Calandrella rufescens*	Lesser Short-toed Lark	24	2-6
4.	*Rhodospiza obsoleta*	Black-billed Desert Finch	3	2

VP. 2

Date: 25.09.2020. Start and end time: 12:24 – 15:28

Weather:

The air temperature around 16-18°C sky half cloudy

Wind speed approx. (4-5 m/s) No precipitation

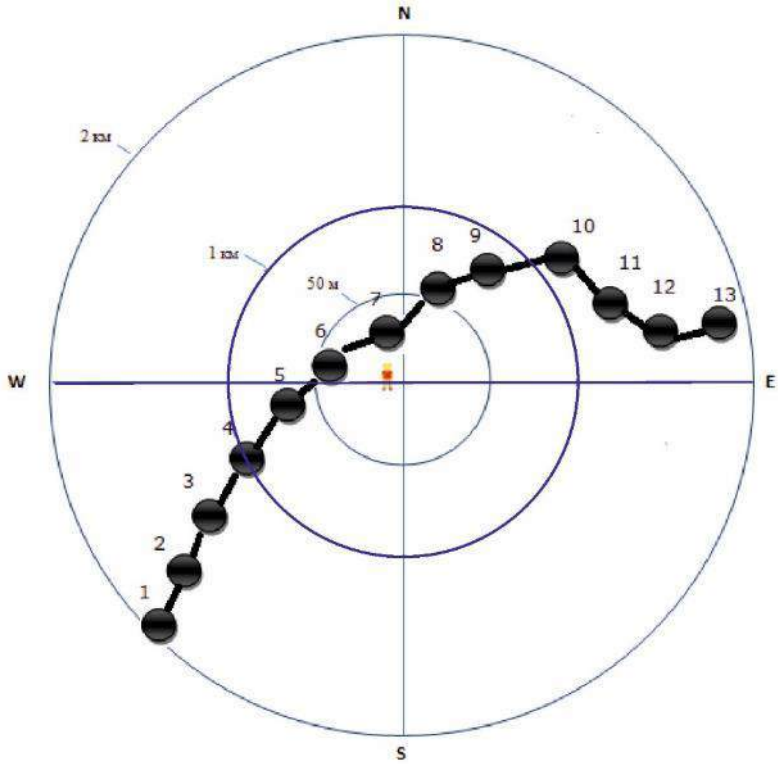


Fig. 13. Flight path (VP 2), 25.09.2020

Table 74. Target species log (VP 2), 25.09.2020

●	*Aquila nipalensis*	1-120 m	2-90 m	3-85 m	4-80 m	5-65 m	6-65 m	7-55 m	8-50 m	9-50 m	10-60 m	11-70 m	12-80 m	13-95 m

Table 75. Secondary and other species (VP 2), 25.09.2020

№	Latin names	English names	Amount	Flight altitude
SECONDARY SPECIES				
1.	*Gyps fulvus*	Griffon Vulture	1	140-145
OTHER SPECIES				
1.	*Galerida cristata*	Crested lark	18	0-15
2.	*Pterocles orientalis*	Black-bellied sandgrouse	5	0-9
3.	*Calandrella rufescens*	Lesser Short-toed Lark	16	0-3

VP. 3

Date: 26.09.2020.Start and end time: 9:32 – 12:32
Weather:
The air temperature around 12-16°C sky half cloudy
Wind speed approx. (6-8 m/s) No precipitation

Primary species not found

Table 76. Secondary and other species (VP 3), 26.09.2020

№	Latin names	English names	Amount	Flight altitude
SECONDARY SPECIES				
1.	*Circus cyaneus*	Hen (Northern) Harrier	1	6-35
OTHER SPECIES				
1.	*Galerida cristata*	Crested lark	5	0-6
2.	*Calandrella rufescens*	Lesser Short-toed Lark	12	0-9
3.	*Pterocles orientalis*	Black-bellied sandgrouse	3	0-3

VP. 4

Date:26.09.2020. Start and end time: 13:13 – 15:13
Weather:
The air temperature around 16-18°C cloudy.
Wind speed approx. (6-8 m/s) No precipitation

Table 77. Secondary and other species (VP 4), 26.09.2020.

№	Latin names	English names	Amount	Flight altitude
SECONDARY SPECIES				
	Aegypius monachus	Cinereous vulture	**1**	**150-155**
OTHER SPECIES				
1.	*Galerida cristata*	Crested lark	6	0-15
2.	*Oenanthe isabellina*	Isabelline wheatear	2	0-10
3.	*Calandrella rufescens*	Lesser Short-toed Lark	10	0-6
4.	*Corvus corax*	Northern Raven	15	35
5.	*Columba livia*	Rock Dove	14	40

VP. 6

Date: 28.09.2020. Start and end time: 8:48 – 11:51

Weather:

The air temperature around 14-16°C sky half cloudy.

Wind speed approx. (5-7 m/s) No precipitation

Primary species not found

Table 78. Secondary and other species (VP 6), 28.09.2020

№	Latin names	English names	Amount	Flight altitude
OTHER SPECIES				
1.	*Galerida cristata*	Crested lark	5	0-15
2.	*Oenanthe isabellina*	Isabelline wheatear	2	0-10
3.	*Pterocles orientalis*	Black-bellied sandgrouse	3	0-5
4.	*Corvus corax*	Northern Raven	14	35
5.	*Athene noctua*	Little Owl	1	0-3

VP. 5

Date: 28.09.2020. Start and end time: 12:38 – 15:42
Weather:
The air temperature around 18-20°C is clear.
Wind speed approx. (5-6 m/s) No precipitation

Primary species not found

Table 79. Secondary and other species (VP 5), 28.09.2020.

№	Latin names	English names	Amount	Flight altitude
SECONDARY SPECIES				
1	*Falco tinnunculus*	Kestrel	2	5-25
OTHER SPECIES				
1.	*Galerida cristata*	Crested lark	9	0-15
2.	*Calandrella rufescens*	Lesser Short-toed Lark	23	2-9
3.	*Rhodospiza obsoleta*	Black-billed Desert Finch	3	2
4.	*Oenanthe pleschanka*	Pied Wheatear	1	0-3

VP. 7

Date: 29.09.2020. Start and end time: 8:38 – 11:43
Weather:
The air temperature around 14-15°C sky half cloudy.
Wind speed approx. (5-6 m/s) No precipitation

Primary species not found

Table 80. Secondary and other species (VP 7), 29.09.2020

№	Latin names	English names	Amount	Flight altitude
SECONDARY SPECIES				
1	*Buteo buteo*	Common Buzzard	1	15-25
OTHER SPECIES				
1.	*Galerida cristata*	Crested lark	5	0-5
2.	*Calandrella rufescens*	Lesser Short-toed Lark	13	0-9
3.	*Oenanthe pleschanka*	Pied Wheatear	1	0-3
4.	*Athene noctua*	Little Owl	1	0-4

VP. 8

Date: 29.09.2020. Start and end time: 2:26 – 15:31
Weather:
The air temperature around 14-16°C sky half cloudy.
Wind speed approx. (6-7 m/s) No precipitation

Primary species not found

Table 81. Secondary and other species (VP 8), 29.09.2020

№	Latin names	English names	Amount	Flight altitude
OTHER SPECIES				
1.	*Galerida cristata*	Crested lark	6	0-15
2.	*Pterocles orientalis*	Black-bellied sandgrouse	3	0-5
3.	*Corvus corax*	Northern Raven	6	35

VP. 9

Date: 30.09.2020. Start and end time: 10:36 – 13:36
Weather:
The air temperature around 14-17°C partly cloudy
Wind speed approx. (5-6 m/s) No precipitation

Primary species not found

Table 82. Secondary and other species (VP 9), 30.09.2020.

№	Latin names	English names	Amount	Flight altitude
OTHER SPECIES				
1.	*Galerida cristata*	Crested lark	6	0-9
2.	*Oenanthe isabellina*	Isabelline wheatear	1	0-3
3.	*Calandrella rufescens*	Lesser Short-toed Lark	18	0-3
4.	*Scotocerca inguieta*	Streaked Scrub Warbler	1	0-2

VP. 1

Date: 30.09.2020. Start and end time: 14:58 – 17:58
Weather:
The air temperature around 17-18°C cloudy.
Wind speed approx. (6-7 m/s) No precipitation

Primary species not found

Table 83. Secondary and other species (VP 1), 30.09.2020.

№	Latin names	English names	Amount	Flight altitude
OTHER SPECIES				
1.	*Galerida cristata*	Crested lark	11	0-15
2.	*Oenanthe isabellina*	Isabelline wheatear	2	0-10
3.	*Calandrella rufescens*	Lesser Short-toed Lark	15	0-3
4.	*Scotocerca inguieta*	Streaked Scrub Warbler	1	2
5.	*Corvus corax*	Northern Raven	3	50

VP survey results in October

VP. 9

Date: 02.10.2020. Start and end time: 9:10 – 12:10

Weather:

The air temperature around 12-14°C sky half cloudy.

Wind speed approx. (6-7 m/s) No precipitation

Primary species not found

Table 84. Secondary and other species (VP 9), 02.10.2020

№	Latin names	English names	Amount	Flight altitude
		OTHER SPECIES		
1.	*Columba livia*	Rock Dove	5	40
2.	*Galerida cristata*	Crested lark	6	0-15
3.	*Oenanthe isabellina*	Isabelline Wheatear	2	0-4
4.	*Acridotheres tristis*	Common myna	6	6-10
5.	*Pterocles orientalis*	Black-bellied sandgrouse	3	0-8
6.	*Corvus corax*	Northern Raven	16	15-25
7.	*Casmerodius albus*	Great egret	1	25

VP. 1

Date: 02.10.2020. Start and end time: 14:23 – 17:23

Weather:

The air temperature around 14-10°C sky half cloudy.

Wind speed approx. (6-7 m/s) No precipitation

Primary species not found

Table 85. Secondary and other species (VP 1), 02.10.2020

№	Latin names	English names	Amount	Flight altitude
OTHER SPECIES				
1.	*Galerida cristata*	Crested lark	13	0-10
2.	*Oenanthe isabellina*	Isabelline Wheatear	1	0-4
3.	*Melanocorypha bimaculata*	Bimaculated lark	25	0-8
4.	*Athene noctua*	Little owl	1	0-2
5.	*Calandrella rufescens*	Lesser Short-toed Lark	32	0-9

VP. 2

Date: 03.10.2020 Start and end time: 9:27 – 12:37

Weather:

The air temperature around 8-12°C sky half cloudy.

Wind speed approx. (3-5 m/s) No precipitation

Primary species not found

Table 86. Secondary and other species (VP 2), 03.10.2020.

№	Latin names	English names	Amount	Flight altitude
OTHER SPECIES				
1.	*Athene noctua*	Little owl	1	0-5
2.	*Galerida cristata*	Crested lark	9	0-15
3.	*Calandrella rufescens*	Lesser Short-toed Lark	32	0-6
4.	*Oenanthe isabellina*	Isabelline wheatear	1	0-6
5.	*Larus ridibundus*	Black-Headed Gull	7	14

VP. 3

Date: 03.10.2020. Start and end time: 13:23 – 15:23

Weather:

The air temperature around 13-10°C partly cloudy.

Wind speed approx. (6-8 m/s) No precipitation

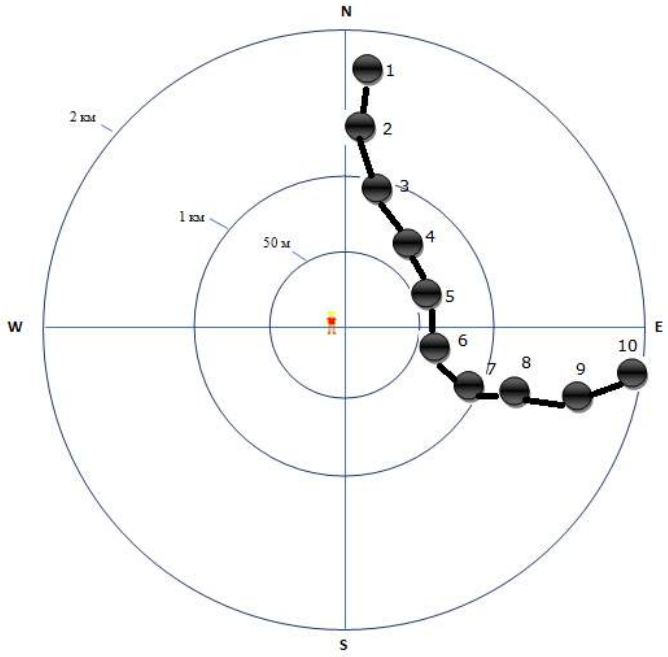


Fig.14 Flight path (VP 3), 03.10.2020

Table 87. Target species log (VP 3), 03.10.2020.

●	*Aquila nipalensis*	1 90 m	2 90 m	3 95 m	4 90 m	5 95 m	6 95 m	7 95 m	8 90 m	9 85 m	10 85 m

Table 88. Secondary and other species (VP 3), 03.10.2020.

№	Latin names	English names	Amount	Flight altitude
SECONDARY SPECIES				
1.	*Circus aeruginosus*	Eurasian Marsh-Harrier	2	10-30
2.	*Buteo buteo*	Common Buzzard	1	45
OTHER SPECIES				
1.	*Galerida cristata*	Crested lark	26	0-15
2.	*Calandrella rufescens*	Lesser Short-toed Lark	62	0-5
3.	*Oenanthe isabellina*	Isabelline wheatear	2	0-3
4.	*Rhodospiza obsoleta*	Black-billed Desert Finch	6	1-3

VP. 5

Date: 04.10.2020. Start and end time: 9:03 – 12:03

Weather:

The air temperature around 10-14°C is clear.

Wind speed approx. (4-5 m/s) No precipitation

Table 89. Secondary and other species (VP 5), 04.10.2020.

№	Latin names	English names	Amount	Flight altitude
SECONDARY SPECIES				
1.	*Falco tinnunculus*	Common Kestrel	2	8-25
2.	*Aegypius monachus*	Cinereous Vulture	2	150
OTHER SPECIES				
1.	*Passer indicus*	Indian House Sparrow	12	0-4
2.	*Merops supercilios*	Blue-cheeked Bee-eate	4	8-12
3.	*Galerida cristata*	Crested lark	8	0-15
4.	*Oenanthe isabellina*	Isabelline wheatear	1	0-10
5.	*Acridotheres tristis*	Indian Myna	3	2-8

VP. 4

Date: 04.10.2020.Start and end time: 12:52 – 15:55

Weather:

The air temperature around 15-12°C is clear.

Wind speed approx. (3-4 m/s) No precipitation

Primary species not found

Table 90. Secondary and other species (VP 4), 04.10.2020.

№	Latin names	English names	Amount	Flight altitude
SECONDARY SPECIES				
1.	*Falco tinnunculus*	Kestrel	1	15-30
2.	*Buteo buteo*	Common Buzzard	1	10-25
OTHER SPECIES				
1.	*Galerida cristata*	Crested lark	5	0-15
2.	*Calandrella rufescens*	Lesser Short-toed Lark	21	0-5
3.	*Oenanthe isabellina*	Isabelline wheatear	4	0-10
4.	*Acridotheres tristis*	Indian Myna	12	2-9
5.	*Anas strepera*	Gadwall	19	45
6.	*Columba livia*	Rock Dove	11	30

VP. 6

Date: 05.10.2020. Start and end time: 9:17 – 12:17

Weather:

The air temperature around 7-12°C sky half cloudy

Wind speed approx. (5-7 ms) No precipitation

Primary species not found

Table 91. Secondary and other species (VP 6), 05.10.2020

№	Latin names	English names	Amount	Flight altitude
SECONDARY SPECIES				
1.	*Circus aeruginosus*	Marsh Harrier	1	5-20
OTHER SPECIES				
1.	*Galerida cristata*	Crested lark	6	0-15
2.	*Columba livia*	Rock Dove	60	25
3.	*Oenanthe isabellina*	Isabelline wheatear	2	0-10

VP. 7

Date: 05.10.2020.Start and end time: 13:02 – 15:16
Weather:
The air temperature around 12-10°C cloudy.
Wind speed approx. (2-5 m/s) No precipitation

Primary species not found

Table 92. Secondary and other species (VP 7), 05.10.2020

№	Latin names	English names	Amount	Flight altitude
OTHER SPECIES				
1.	*Galerida cristata*	Crested lark	4	0-9
2.	*Oenanthe isabellina*	Isabelline wheatear	2	0-10
3.	*Pterocles orientalis*	Black-bellied sandgrouse	5	15
4.	*Hirundo rustica*	Barn Swallow	12	4-30
5.	*Athene noctua*	Little Owl	1	0-12

VP.9

Date: 06.10.2020.Start and end time: 11:12 – 13:12

Weather:

The air temperature around 10-13°C is clear.

Wind speed approx. (3-5 m/s) No precipitation

Table 93. Secondary and other species (VP 9), 06.10.2020.

№	Latin names	English names	Amount	Flight altitude
SECONDARY SPECIES				
1.	*Aegypius monachus*	Cinereous Vulture	1	120-125
OTHER SPECIES				
1.	*Rhodospiza obsoleta*	Black-billed Desert Finch	2	3
2.	*Anas crecca*	Green-winged teal	1	50
3.	*Galerida cristata*	Crested lark	9	0-15
4.	*Oenanthe isabellina*	Isabelline wheatear	4	0-10
5.	*Corvus monedula*	Jackdaw	2	0-2
6.	*Scotocerca inguieta*	Streaked Scrub Warbler	1	2

VP. 8

Date: 06.10.2020.Start and end time: 13:54 – 16:58
Weather:
The air temperature around 10-7°C is cloudy.
Wind speed approx. (6-7 m/s) No precipitation

Primary species not found

Table 94. Secondary and other species (VP 8), 06.10.2020.

№	Latin names	English names	Amount	Flight altitude
SECONDARY SPECIES				
1.	*Buteo rufinus*	Long-legged Buzzard	1	15-45
2.	*Falco tinnunculus*	Kestrel	1	10-25
OTHER SPECIES				
1.	*Galerida cristata*	Crested lark	14	0-15
2.	*Oenanthe isabellina*	Isabelline wheatear	5	0-10
3.	*Columba livia*	Rock Dove	14	35
4.	*Acridotheres tristis*	Indian Myna	7	2-7
5.	*Corvus corax*	Northern Raven	26	25-35

VP. 1

Date: 07.10.2020.Start and end time: 10:06 – 13:09

Weather:

The air temperature around 9-15°C is clear.

Wind speed approx. (5-7 m/s) No precipitation

Primary species not found

Table 95. Secondary and other species (VP 1), 07.10.2020.

№	Latin names	English names	Amount	Flight altitude
OTHER SPECIES				
1.	*Pterocles orientalis*	Black-bellied sandgrouse	2	0-5
2.	*Galerida cristata*	Crested lark	5	0-9
3.	*Oenanthe isabellina*	Isabelline wheatear	3	0-10
4.	*Scotocerca inguieta*	Streaked Scrub Warbler	2	0-2
5.	*Athene noctua*	Little Owl	1	0-5
6.	*Calandrella brachydactyla*	Short-toed lark	23	0-6

VP. 2

Date: 07.10.2020.Start and end time: 14:08 – 17:08
Weather:
The air temperature around 11-7°C sky half cloudy
Wind speed approx. (7-8 m/s) No precipitation

Primary species not found

Table 96. Secondary and other species (VP 2), 07.10.2020.

№	Latin names	English names	Amount	Flight altitude
Secondary Species				
1.	*Pelecanus onocrotalus*	Great White Pelican	16	20
OTHER SPECIES				
1.	*Galerida cristata*	Crested lark	4	0-15
2.	*Oenanthe isabellina*	Isabelline wheatear	1	0-10
3.	*Scotocerca inguieta*	Streaked Scrub Warbler	2	2
4.	*Corvus corax*	Northern Raven	35	50-65

VP. 3

Date: 08.10.2020. Start and end time: 8:19 – 11:19

Weather:

The air temperature around 6-12°C cloudy.

Wind speed approx. (3-5 m/s) No precipitation

Primary species not found

Table 97. Secondary and other species (VP 3), 08.10.2020.

№	Latin names	English names	Amount	Flight altitude
OTHER SPECIES				
1.	*Streptopelia decaocto*	Collared Turtle Dove	2	4
2.	*Galerida cristata*	Crested lark	10	0-15
3.	*Oenanthe isabellina*	Isabelline wheatear	3	0-10
4.	*Scotocerca inguieta*	Streaked Scrub Warbler	2	2
5.	*Tringa totanus*	Common Redshank	3	5
6.	*Alectoris chukar*	Chuckar partridge	2	0

VP. 4

Date: 08.10.2020. Start and end time: 12:16 – 15:18

Weather:

The air temperature around 13-9°C is clear.

Wind speed approx. (4-6 m/s) No precipitation

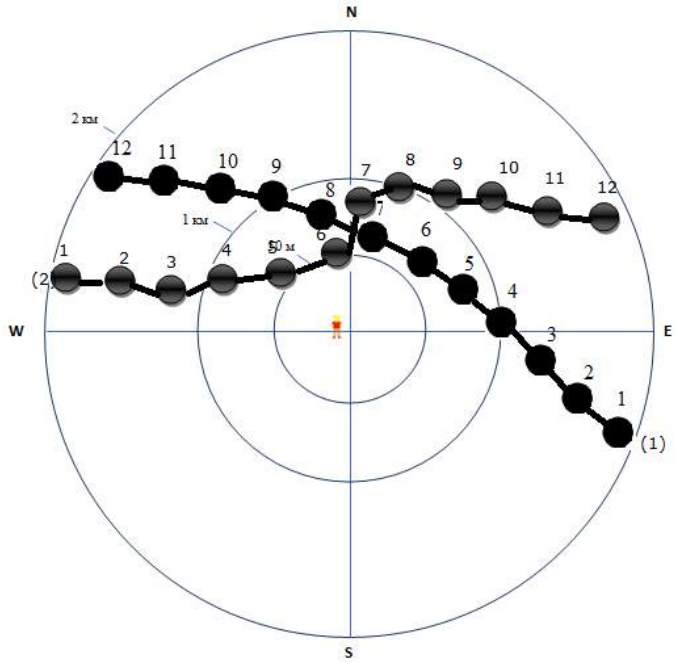


Fig. 15. Flight path (VP 4), 08.10.2020

Table 98. Target species log (VP 4), 08.10.2020

●	*Aquila nipalensis(1)*	1 110 m	2 110 m	3 115 m	4 110 m	5 115 m	6 115 m	7 115 m	8 110 m	9 110 m	10 110 m	11 110 m	12 110 m
●	*Aquila nipalensis(2)*	1 120 m	2 120 m	3 125 m	4 120 m	5 125 m	6 125 m	7 125 m	8 120 m	9 120 m	10 120 m	11 120 m	12 120 m

Table 99. Secondary and other species (VP 4), 08.10.2020

№	Latin names	English names	Amount	Flight altitude
OTHER SPECIES				
1.	*Galerida cristata*	Crested lark	19	0-13
2.	*Hirundo rustica*	Barn Swallow	16	3-15
3.	*Oenanthe isabellina*	Isabelline wheatear	2	0-10
4.	*Scotocerca inguieta*	Streaked Scrub Warbler	2	2
5.	*Acridotheres tristis*	Common myna	7	18
6.	*Caprimulgus aegyptius*	Egyptian Nightjar	1	0-5

VP 5

Date: 11.10.2020 Start and end time: 9:22 – 12:25

Weather:

The air temperature around 6-12°C is cloudy.

Wind speed approx. (6-8 m/s) No precipitation

Primary species not found

Table 100. Secondary and other species (VP 5), 11.10.2020

№	Latin names	English names	Amount	Flight altitude
SECONDARY SPECIES				
1.	*Circus cyaneus*	Hen (Northern) Harrier	1	5-25
2.	*Falco tinnunculus*	Kestrel	2	12-25
OTHER SPECIES				
1.	*Galerida cristata*	Crested lark	10	0-5
2.	*Oenanthe isabellina*	Isabelline wheatear	2	0-5
3.	*Pterocles orientalis*	Black-bellied sandgrouse	3	0-15
4.	*Athene noctua*	Little Owl	1	0-3

VP 6

Date: 11.10.2020 Start and end time: 13:43 – 14:43

Weather:

The air temperature around 12-7°C sky half cloudy

Wind speed approx. (4-6 m/s) No precipitation

Primary species not found

Table 101. Secondary and other species (VP 6), 11.10.2020

№	Latin names	English names	Amount	Flight altitude
SECONDARY SPECIES				
1.	*Circus cyaneus*	Hen (Northern) Harrier	1	5-35
2.	*Falco tinnunculus*	Kestrel	1	15-25
OTHER SPECIES				
1.	*Galerida cristata*	Crested lark	9	0-5
2.	*Oenanthe isabellina*	Isabelline wheatear	1	0-5
3.	*Hirundo rustica*	Barn Swallow	88	10-35

VP 7

Date: 12.10.2020 Start and end time: 9:18 – 11:18

Weather:

The air temperature arounччd 8-11°C cloudy.

Wind speed approx. (3-6 m/s) No precipitation

Primary species not found

Table 102. Secondary and other species (VP 7), 12.10.2020

№	Latin names	English names	Amount	Flight altitude
SECONDARY SPECIES				
1.	*Falco tinnunculus*	Kestrel	1	6-25
OTHER SPECIES				
1.	*Galerida cristata*	Crested lark	7	0-6
2.	*Columba livia*	Rock Dove	5	20
3.	*Rhodospiza obsoleta*	Black-billed Desert Finch	3	0-3
4.	*Pterocles orientalis*	Black-bellied sandgrouse	5	35
5.	*Tadorna ferruginea*	Ruddy Shelduck	7	75

VP. 8

Date: 12.10.2020. Start and end time: 12:14 – 15:16

Weather:

The air temperature around 12-9°C sky half cloudy.

Wind speed approx. (5-6 m/s) No precipitation

Primary species not found

Table 103. Secondary and other species (VP 8), 12.10.2020.

№	Latin names	English names	Amount	Flight altitude
SECONDARY SPECIES				
1.	*Buteo rufinus*	Long-legged Buzzard	1	20-45
OTHER SPECIES				
1.	*Galerida cristata*	Crested lark	17	0-15
2.	*Oenanthe isabellina*	Isabelline wheatear	3	0-10
3.	*Columba livia*	Rock Dove	13	35
4.	*Calandrella brachydactyla*	Short-toed lark	26	0-6
5.	*Hirundo rustica*	Barn Swallow	27	40

VP. 9

Date: 13.10.2020. Start and end time: 8:15 – 11:15

Weather:

The air temperature around 8-12°C cloudy.

Wind speed approx. (4-6 m/s) No precipitation

Primary species not found

Table 104. Secondary and other species (VP 9), 13.10.2020.

№	Latin names	English names	Amount	Flight altitude
SECONDARY SPECIES				
1.	*Buteo buteo*	Common Buzzard	2	25-45
OTHER SPECIES				
1.	*Galerida cristata*	Crested lark	19	0-15
2.	*Oenanthe isabellina*	Isabelline wheatear	1	0-10
3.	*Columba livia*	Rock Dove	23	0-35
4.	*Corvus corax*	Northern Raven	15	23
5.	*Tadorna ferruginea*	Ruddy Shelduck	9	35

VP. 1

Date: 13.10.2020. Start and end time: 12:43 – 15:45

Weather:

The air temperature around 12-9°C cloudy.

Wind speed approx. (6-8 m/s) No precipitation

Primary species not found

Table 105. Secondary and other species (VP 1), 13.10.2020.

№	Latin names	English names	Amount	Flight altitude
OTHER SPECIES				
1.	*Galerida cristata*	Crested lark	6	0-15
2.	*Oenanthe isabellina*	Isabelline wheatear	3	0-10
3.	*Athene noctua*	Little Owl	2	0-3
4.	*Calandrella rufescens*	Lesser Short-toed Lark	35	0-15
5.	*Calandrella brachydactyla*	Short-toed lark	26	0-12
6.	*Hirundo rustica*	Barn Swallow	4	15

VP.2

Date: 14.10.2020. Start and end time: 9:12 – 12:12

Weather:

The air temperature around 8-12°C is clear.

Wind speed approx. (5-7 m/s) No precipitation

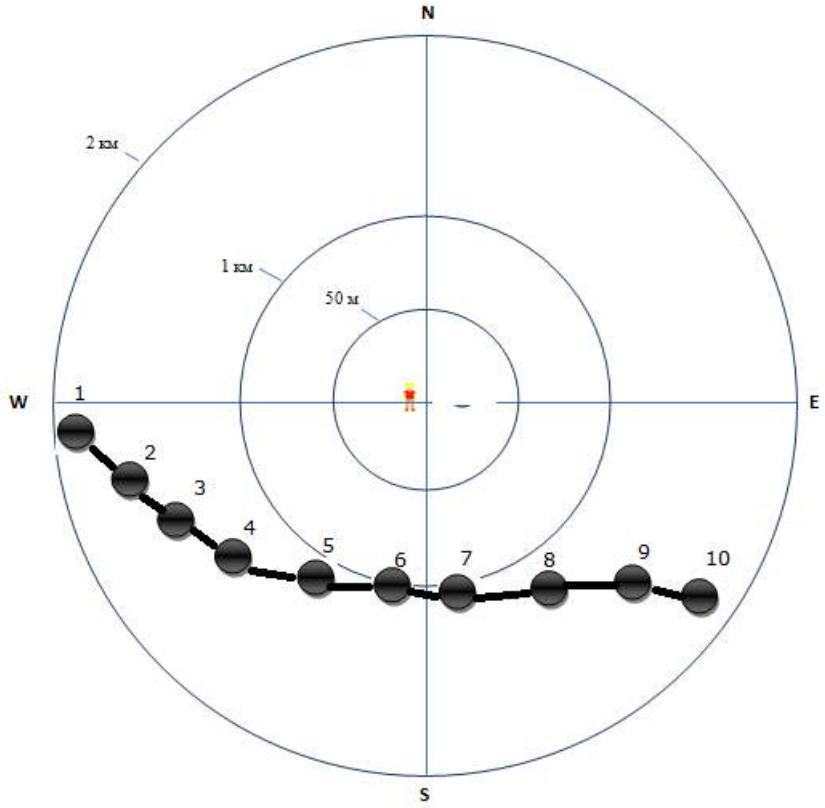


Fig. 16. Flight path (VP 2), 14.10.2020

Table 106. Target species (VP 2), 14.10.2020

	*Aquila nipalensis*	1- 90 m	2- 90 m	3- 95 m	4- 90 m	5- 95 m	6- 95 m	7- 95 m	8- 90 m	9- 90 m	10- 90 m

Table 107. Secondary and other species (VP 2), 14.10.2020

№	Latin names	English names	Amount	Flight altitude
OTHER SPECIES				
1.	*Rhodospiza obsoleta*	Black-billed Desert Finch	5	15
2.	*Galerida cristata*	Crested lark	10	0-15
3.	*Calandrella rufescens*	Lesser Short-toed Lark	38	0-4
4.	*Oenanthe isabellina*	Isabelline wheatear	2	0-10
5.	*Pterocles orientalis*	Black-bellied sandgrouse	3	6-8
6.	*Ardea cinerea*	Gray heron	1	40
7.	*Phalacrocorax pygmaeus*	Pygmy cormorant	5	45

VP. 3

Date: 14.10.2020. Start and end time:13:10 – 15:16

Weather:

The air temperature around 12-8°C cloudy.

Wind speed approx. (6-8 m/s) No precipitation

Primary species not found

Table 108. Secondary and other species (VP 3), 14.10.2020

№	Latin names	English names	Amount	Flight altitude
OTHER SPECIES				
1.	*Alectoris chukar*	Chuckar partridge	6	0-3
2.	*Galerida cristata*	Crested lark	15	0-15
3.	*Oenanthe isabellina*	Isabelline wheatear	4	0-10
4.	*Corvus monedula*	Jackdaw	4	0-4
5.	*Scotocerca inguieta*	Streaked Scrub Warbler	3	2
6.	*Tadorna ferruginea*	Ruddy Shelduck	2	45
7.	*Anas strepera*	Gadwall	16	35

VP.5

Date: 15.10.2020. Start and end time: 10:13 – 13:13

Weather:

The air temperature around 8-13°C partly cloudy

Wind speed approx. (5-6 m/s) No precipitation

Primary species not found

Table 109. Secondary and other species (VP 5), 15.10.2020.

№	Latin names	English names	Amount	Flight altitude
SECONDARY SPECIES				
1.	*Circus cyaneus*	Hen (Northern) Harrier	1	10-45
2.	*Falco tinnunculus*	Kestrel	2	12-25
OTHER SPECIES				
1.	*Galerida cristata*	Crested lark	12	0-15
2.	*Oenanthe isabellina*	Isabelline wheatear	4	0-10
3.	*Coracias garrulus*	Eurasian Roller	1	3-15
4.	*Larus ridibundus*	Black-Headed Gull	13	12
5.	*Phalacrocorax pygmaeus*	Pygmy cormorant	4	0-10

VP. 4

Date: 15.10.2020. Start and end time: 13:56 – 16:56

Weather:

The air temperature around 12-8°C cloudy.

Wind speed approx. (5-8 m/s) No precipitation

Primary species not found

Table 110. Secondary and other species (VP 4), 15.10.2020

№	Latin names	English names	Amount	Flight altitude
SECONDARY SPECIES				
1.	*Falco tinnunculus*	Kestrel	1	15
2.	*Circus aeruginosus*	Marsh Harrier	1	20-35
OTHER SPECIES				
1.	*Galerida cristata*	Crested lark	12	0-15
2.	*Oenanthe isabellina*	Isabelline wheatear	4	0-10
3.	*Phalacrocorax carbo*	Great Cormorant	26	50
4.	*Rhodospiza obsoleta*	Black-billed Desert Finch	3	2

VP. 6

Date: 16.10.2020. Start and end time: 10:06 – 13:16

Weather:

The air temperature around 8-12°C cloudy.

Wind speed approx. (6-8 ms) No precipitation

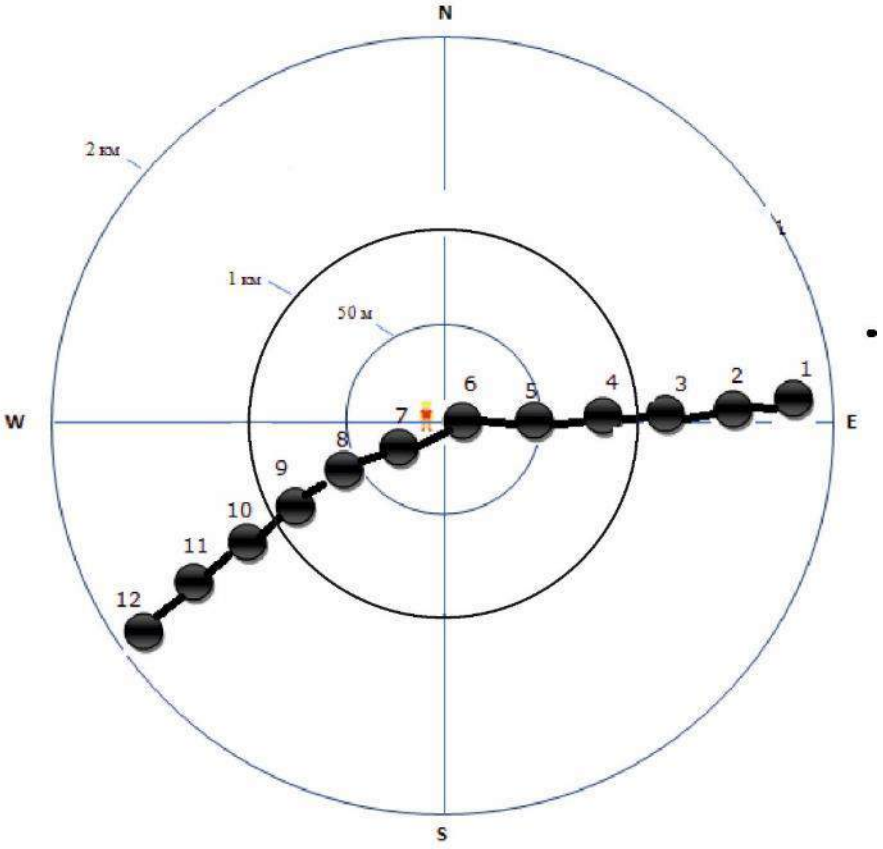


Fig. 17. Flight path (VP 6), 16.10.2020

Table 111. Target species log (VP 6), 16.10.2020

●	*Aquila nipalensis*	1- 120 m	2- 120 m	3- 125 m	4- 120 m	5- 125 m	6- 125 m	7- 125 m	8- 110 m	9- 110 m	10- 110 m	11- 100 m	12- 100 m

Table 112. Secondary and other species (VP 6), 16.10.2020

№	Latin names	English names	Amount	Flight altitude
SECONDARY SPECIES				
1.	*Aegypius monachus*	Cinereous Vulture	1	140-145
OTHER SPECIES				
1.	*Rhodospiza obsoleta*	Black-billed Desert Finch	7	3
2.	*Galerida cristata*	Crested lark	8	0-15
3.	*Oenanthe isabellina*	Isabelline wheatear	3	0-10
4.	*Pterocles orientalis*	Black-bellied sandgrouse	2	0-15
5.	*Corvus monedula*	Jackdaw	4	0-12
6.	*Streptopelia senegalensis*	Laughing dove	2	5-6

VP. 7

Date: 16.10.2020. Start and end time: 13:48 – 15:52
Weather:
The air temperature around 12-8°C partly cloudy.
Wind speed approx. (5-6 m/s) No precipitation

Primary species not found

Table 113. Secondary and other species (VP 7), 16.10.2020

№	Latin names	English names	Amount	Flight altitude
SECONDARY SPECIES				
1.	*Falco tinnunculus*	Kestrel	2	10-25
OTHER SPECIES				
1.	*Galerida cristata*	Crested lark	12	0-15
2.	*Oenanthe isabellina*	Isabelline wheatear	4	0-10
3.	*Columba livia*	Rock Dove	24	35
4.	*Rhodospiza obsoleta*	Black-billed Desert Finch	3	2
5.	*Athene noctua*	Little Owl	1	0-5
6.	*Cygnus olor*	Mute swan	12	35

VP. 9

Date: 17.10.2020. Start and end time: 9:09 – 11:13

Weather:

The air temperature around 8-12°C is clear.

Wind speed approx. (4-6 m/s) No precipitation

Primary species not found

Table 114. Secondary and other species (VP 9), 17.10.2020.

№	Latin names	English names	Amount	Flight altitude
SECONDARY SPECIES				
1.	*Buteo buteo*	Common Buzzard	1	12-35
OTHER SPECIES				
1.	*Galerida cristata*	Crested lark	9	0-15
2.	*Oenanthe isabellina*	Isabelline wheatear	2	0-5
3.	*Streptopelia senegalensis*	Laughing dove	2	20
4.	*Columba livia*	Rock Dove	29	35
5.	*Acridotheres tristis*	Common myna	6	15
6.	*Rhodospiza obsoleta*	Black-billed Desert Finch	4	0-2

VP. 8

Date: 17.10.2020. Start and end time: 11:52 – 14:52

Weather:

The air temperature around 12-14°C is clear.

Wind speed approx. (6-8 m/s) No precipitation

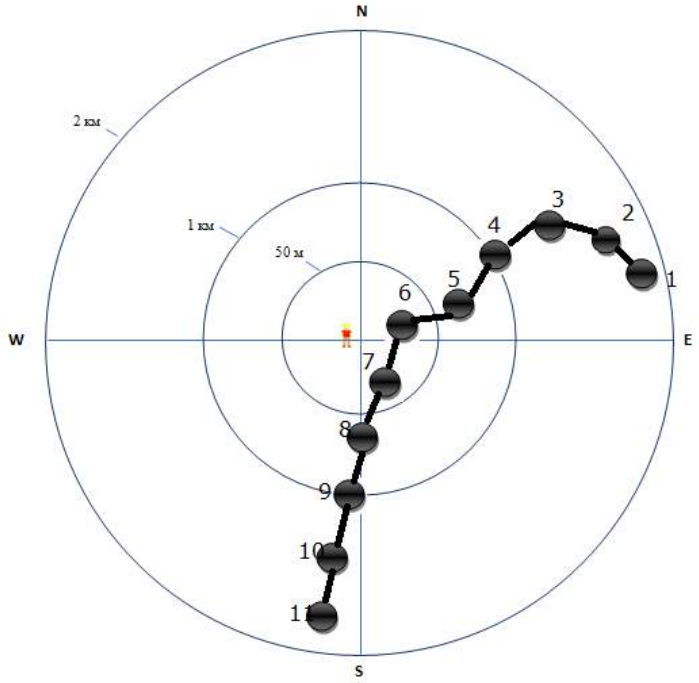


Fig. 18. Flight path (VP 8), 17.10.2020

Table 115. Target species log (VP 8), 17.10.2020

●	*Aquila nipalensis*	1- 120 m	2- 120 m	3- 125 m	4- 120 m	5- 125 m	6- 125 m	7- 125 m	8- 130 m	9- 140 m	10- 150 m	11- 160 m

Table 116. Secondary and other species (VP 8), 17.10.2020

№	Latin names	English names	Amount	Flight altitude
OTHER SPECIES				
1.	*Corvus cornix*	Hooded Crow	3	8
2.	*Galerida cristata*	Crested lark	6	0-15
3.	*Oenanthe isabellina*	Isabelline wheatear	4	0-10
4.	*Calandrella rufescens*	Lesser Short-toed Lark	32	0-3
5.	*Scotocerca inguieta*	Streaked Scrub Warbler	2	0-2

VP. 2

Date: 22.10.2020. Start and end time: 9:58 – 12:59

Weather:

The air temperature around 7-10°C cloudy.

Wind speed approx. (6-7 m/s) No precipitation

Primary species not found

Table 117. Secondary and other species (VP 2), 22.10.2020.

№	Latin names	English names	Amount	Flight altitude
OTHER SPECIES				
1.	*Anas platyrhynchos*	Mallard	110	70
2.	*Aythya fuligula*	Tufted duck	260	90
3.	*Galerida cristata*	Crested lark	12	0-15
4.	*Oenanthe isabellina*	Isabelline wheatear	1	0-10
5.	*Calandrella rufescens*	Lesser Short-toed Lark	17	0-3
6.	*Scotocerca inguieta*	Streaked Scrub Warbler	1	2
7.	*Corvus corax*	Northern Raven	4	50

VP. 3

Date: 22.10.2020. Start and end time: 13:47 – 15:49
Weather:
The air temperature around 10-6°C sky half cloudy
Wind speed approx. (3-6 m/s) No precipitation

Primary species not found

Table 118. Secondary and other species (VP 3), 22.10.2020.

№	Latin names	English names	Amount	Flight altitude
OTHER SPECIES				
1.	*Anas platyrhynchos*	Mallard	52	80
2.	*Galerida cristata*	Crested lark	5	0-15
3.	*Oenanthe isabellina*	Isabelline wheatear	2	0-10
4.	*Tadorna ferruginea*	Ruddy Shelduck	5	25
5.	*Phalacrocorax pygmaeus*	Pygmy cormorant	3	35
6.	*Anas crecca*	Green-winged teal	6	40

VP. 5

Date: 23.10.2020. Start and end time: 9:52 – 12:53

Weather:

The air temperature around 8-12°C is clear.

Wind speed approx. (4-5 m/s) No precipitation

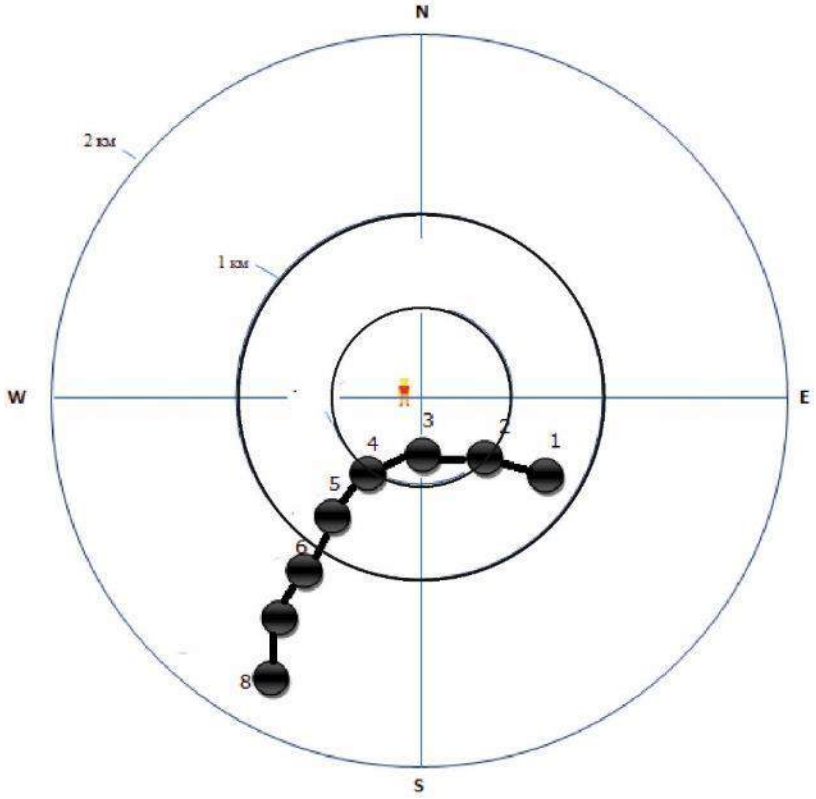


Fig. 19. Flight path (VP 5), 23.10.2020.

Table 119. Target species log (VP 5), 23.10.2020.

●	*Aquila nipalensis*	1- 70 m	2- 80 m	3- 95 m	4- 120 m	5- 125 m	6- 125 m	7- 125 m	8- 130 m	

Table 120. Secondary and other species (VP 5), 23.10.2020.

№	Latin names	English names	Amount	Flight altitude
SECONDARY SPECIES				
1.	*Aegypius monachus*	Cinereous Vulture	1	110-125
OTHER SPECIES				
1.	*Corvus cornix*	Hooded Crow	7	10
2.	*Galerida cristata*	Crested lark	6	0-15
3.	*Oenanthe isabellina*	Isabelline wheatear	3	0-10
4.	*Calandrella rufescens*	Lesser Short-toed Lark	23	0-3
5.	*Pterocles orientalis*	Black-bellied sandgrouse	5	12

VP. 4

Date: 23.10.2020. Start and end time: 13:28 – 15:28

Weather:

The air temperature around 12-7°C partly cloudy.

Wind speed approx. (5-7 m/s) No precipitation

Primary species not found

Table 121. Secondary and other species (VP 4), 23.10.2020

№	Latin names	English names	Amount	Flight altitude
SECONDARY SPECIES				
1.	*Circus aeruginosus*	Marsh Harrier	1	15-25
2.	*Falco tinnunculus*	Kestrel	1	16-25
OTHER SPECIES				
1.	*Galerida cristata*	Crested lark	12	0-15
2.	*Oenanthe isabellina*	Isabelline wheatear	2	0-10
3.	*Columba livia*	Rock Dove	6	35
4.	*Calandrella rufescens*	Lesser Short-toed Lark	19	2-6

VP. 7

Date: 24.10.2020. Start and end time: 9:23 – 12:23

Weather:

The air temperature around 5-8°C sky half cloudy.

Wind speed approx. (6-7 m/s) No precipitation

Primary species not found

Table 122. Secondary and other species (VP 7), 24.10.2020.

№	Latin names	English names	Amount	Flight altitude
OTHER SPECIES				
1.	*Galerida cristata*	Crested lark	5	0-15
2.	*Oenanthe isabellina*	Isabelline wheatear	1	0-10
3.	*Pterocles orientalis*	Black-bellied sandgrouse	2	0
4.	*Corvus corax*	Northern Raven	4	35

VP. 8

Date: 24.10.2020. Start and end time: 13:18 – 16:21

Weather:

The air temperature around 8-9°C sky half cloudy.

Wind speed approx. (5-6 m/s) No precipitation

Primary species not found

Table 123. Secondary and other species (VP 8), 24.10.2020

№	Latin names	English names	Amount	Flight altitude
SECONDARY SPECIES				
1.	*Falco tinnunculus*	Kestrel	1	12-25
OTHER SPECIES				
1.	*Galerida cristata*	Crested lark	6	0-15
2.	*Oenanthe isabellina*	Isabelline wheatear	1	0-10
3.	*Calandrella rufescens*	Lesser Short-toed Lark	23	2-9
4.	*Pica pica*	Magpie	2	3-9

VP. 9

Date: 25.10.2020. Start and end time: 10:12 – 13:15

Weather:

The air temperature around 8-11°C partly cloudy.

Wind speed approx. (6-7 m/s) No precipitation

Primary species not found

Table 124. Secondary and other species (VP 9), 25.10.2020.

№	Latin names	English names	Amount	Flight altitude
OTHER SPECIES				
1.	*Columba livia*	Rock Dove	18	20
2.	*Galerida cristata*	Crested lark	8	0-15
3.	*Oenanthe isabellina*	Isabelline wheatear	1	0-10
4.	*Athene noctua*	Little Owl	1	0-3
5.	*Cygnus olor*	Mute swan	8	50
6.	*Calandrella rufescens*	Lesser Short-toed Lark	15	0-10

VP. 1

Date: 25.10.2020. Start and end time: 14:13 – 17:13

Weather:

The air temperature around 12-6°C cloudy.

Wind speed approx. (7-8 m/s) No precipitation

Table 125. Secondary and other species (VP 1), 25.10.2020

№	Latin names	English names	Amount	Flight altitude
SECONDARY SPECIES				
1.	*Circus cyaneus*	Hen (Northern) Harrier	1	11-20
2.	*Buteo rufinus*	Long-legged Buzzard	1	25-30
3.	*Aegypius monachus*	Cinereous Vulture	2	160-165
OTHER SPECIES				
1.	*Galerida cristata*	Crested lark	9	0-15
2.	*Oenanthe isabellina*	Isabelline wheatear	2	0-10
3.	*Calandrella rufescens*	Lesser Short-toed Lark	23	0-6

VP. 3

Date: 26.10.2020.Start and end time: 9:56 – 12:56
Weather:
The air temperature around 6-11°C sky half cloudy
Wind speed approx. (6-8 m/s) No precipitation

Primary species not found

Table 126. Secondary and other species (VP 3), 26.10.2020.

№	Latin names	English names	Amount	Flight altitude
		OTHER SPECIES		
1.	*Alectoris chukar*	Chuckar partridge	2	0-3
2.	*Columba livia*	Rock Dove	6	15
3.	*Galerida cristata*	Crested lark	12	0-15
4.	*Tadorna ferruginea*	Ruddy Shelduck	6	35
5.	*Oenanthe isabellina*	Isabelline wheatear	3	0-10
6.	*Calandrella rufescens*	Lesser Short-toed Lark	32	0-12
7.	*Tringa nebularia*	Green shank	5	30

VP. 4

Date:26.10.2020.Start and end time: 13:35 – 15:35

Weather:

The air temperature around 11-8°C sky half cloudy

Wind speed approx. (6-8 m/s) No precipitation

Primary species not found

Table 127. Secondary and other species (VP 4), 26.10.2020

№	Latin names	English names	Amount	Flight altitude
OTHER SPECIES				
1.	*Calandrella rufescens*	Lesser Short-toed Lark	29	0-9
2.	*Corvus monedula*	Jackdaw	3	0-3
3.	*Galerida cristata*	Crested lark	12	0-15
4.	*Oenanthe isabellina*	Isabelline wheatear	3	0-10
5.	*Passer indicus*	Indian House Sparrow	5	2
6.	*Pterocles orientalis*	Black-bellied sandgrouse	3	0-5

VP. 5

Date: 27.10.2020.Start and end time: 9:52 – 12:53
Weather:
The air temperature around 6-10°C sky half cloudy
Wind speed approx. (6-8 m/s) No precipitation

Primary species not found

Table 128. Secondary and other species (VP 5), 27.10.2020

№	Latin names	English names	Amount	Flight altitude
OTHER SPECIES				
1.	*Galerida cristata*	Crested lark	10	0-8
2.	*Oenanthe isabellina*	Isabelline wheatear	2	0-10
3.	*Calandrella rufescens*	Lesser Short-toed Lark	23	0-12
4.	*Nycticorax nycticorax*	Black-crowned night-heron	1	35
5.	*Acridotheres tristis*	Indian Myna	5	20
6.	*Sturnus vulgaris*	Starling	30	3-16

VP. 6

Date: 27.10.2020.Start and end time: 13:42 – 15:43
Weather:
The air temperature around 10-8°C sky half cloudy.
Wind speed approx. (5-7 m/s) No precipitation

Primary species not found

Table 129. Secondary and other species (VP 6), 27.10.2020

№	Latin names	English names	Amount	Flight altitude
OTHER SPECIES				
1.	*Galerida cristata*	Crested lark	9	0-8
2.	*Oenanthe isabellina*	Isabelline wheatear	3	0-10
3.	*Calandrella rufescens*	Lesser Short-toed Lark	12	0-12
4.	*Acridotheres tristis*	Indian Myna	3	15
5.	*Corvus frugilegus*	Eurasian Rook	6	3-12

VP survey results in November

VP.1

Date: 01.11.2020. Start and end time: 9:23 – 12:23

Weather:

The air temperature around 6-11°C sky half cloudy.

Wind speed approx. (6-7 m/s) No precipitation

Primary species not found

Table 130. Secondary and other species (VP 1), 01.11.2020

№	Latin names	English names	Amount	Flight altitude
SECONDARY SPECIES				
1.	*Pelecanus onocrotalus*	Great White Pelican	7	50
OTHER SPECIES				
1.	*Galerida cristata*	Crested lark	5	0-8
2.	*Oenanthe isabellina*	Isabelline Wheatear	1	0-4
3.	*Acridotheres tristis*	Common myna	3	6-10
4.	*Corvus corax*	Northern Raven	28	15-25
5.	*Corvus cornix*	Hooded Crow	22	10
6.	*Corvus frugilegus*	Eurasian Rook	17	8

VP. 2

Date: 01.11.2020. Start and end time: 13:33 – 15:36

Weather:

The air temperature around 12-10°C sky half cloudy.

Wind speed approx. (6-7 m/s) No precipitation

Primary species not found

Table 131. Secondary and other species (VP 2), 01.11.2020

№	Latin names	English names	Amount	Flight altitude
OTHER SPECIES				
1.	*Nycticorax nycticorax*	Black-crowned night-heron	1	30
2.	*Anas platyrhynchos*	Mallard	78	80
3.	*Anas strepera*	Gadwall	41	60
4.	*Larus cachinnans*	Yellow-legged (Caspian) Gull	2	22
5.	*Athene noctua*	Little owl	1	0-2
6.	*Galerida cristata*	Crested lark	6	0-10
7.	*Oenanthe isabellina*	Isabelline Wheatear	21	0-4
8.	*Calandrella rufescens*	Lesser Short-toed Lark	31	0-9
9.	*Corvus cornix*	Hooded Crow	7	8
10.	*Corvus frugilegus*	Eurasian Rook	16	7

VP. 6

Date: 02.11.2020 Start and end time: 9:27 – 12:37

Weather:

The air temperature around 8-12°C sky half cloudy.

Wind speed approx. (5-6 m/s) No precipitation

Primary species not found

Table 132. Secondary and other species (VP 6), 02.11.2020.

№	Latin names	English names	Amount	Flight altitude
OTHER SPECIES				
1.	*Athene noctua*	Little owl	1	0-5
2.	*Galerida cristata*	Crested lark	12	0-9
3.	*Calandrella rufescens*	Lesser Short-toed Lark	32	0-6
4.	*Oenanthe isabellina*	Isabelline wheatear	2	0-6
5.	*Acridotheres tristis*	Indian Myna	6	12
6.	*Pterocles orientalis*	Black-bellied sandgrouse	5	25

VP. 7

Date: 02.11.2020. Start and end time: 13:23 – 15:23

Weather:

The air temperature around 13-10°C partly cloudy.

Wind speed approx. (6-8 m/s) No precipitation

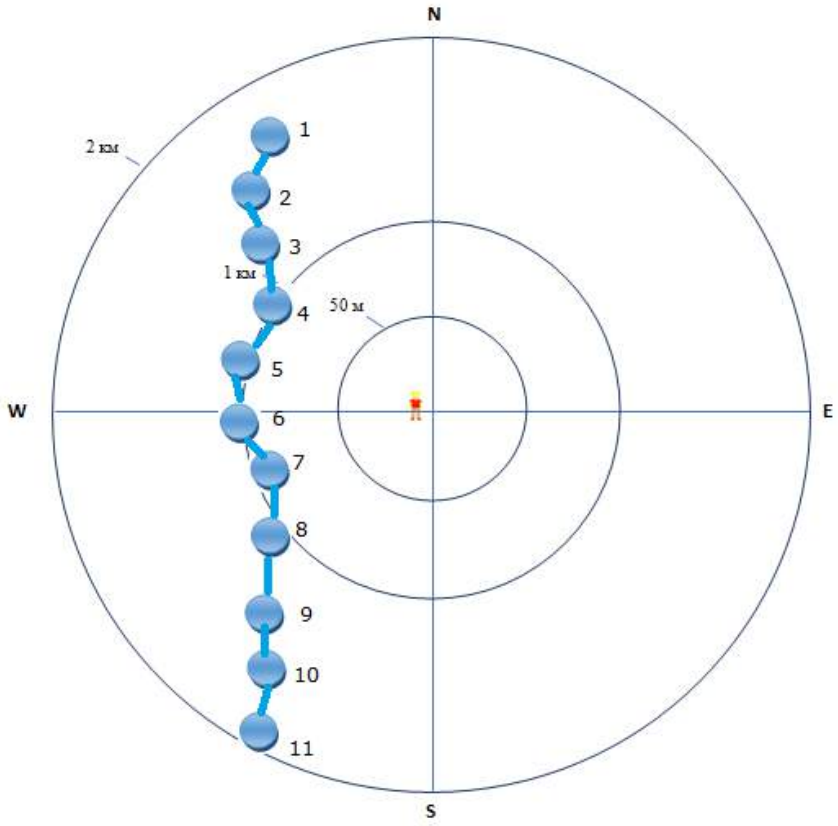


Fig.20 Flight path (VP 7), 02.11.2020

Table 133. Target species log (VP 7), 02.11.2020.

	Aquila nipalensis	1 150 m	2 150 m	3 155 m	4 150 m	5 155 m	6 155 m	7 155 m	8 150 m	9 155 m	10 155 m	11 150 m

Table 134. Secondary and other species (VP 7), 02.11.2020.

№	Latin names	English names	Amount	Flight altitude
SECONDARY SPECIES				
1.	*Circus aeruginosus*	Eurasian Marsh-Harrier	1	12-30
2.	*Aegypius monachus*	Cinereous Vulture	1	150
3.	*Buteo buteo*	Common Buzzard	1	20-30
OTHER SPECIES				
1.	*Galerida cristata*	Crested lark	16	0-15
2.	*Calandrella rufescens*	Lesser Short-toed Lark	21	0-5
3.	*Cygnus olor*	Mute swan	12	25
4.	*Oenanthe isabellina*	Isabelline wheatear	3	0-3
5.	*Corvus cornix*	Hooded Crow	6	12

VP. 8

Date: 03.11.2020.Start and end time: 9:52 – 12:55

Weather:

The air temperature around 9-13°C cloudy.

Wind speed approx. (5-6 m/s) No precipitation

Primary species not found

Table 135. Secondary and other species (VP 8), 03.11.2020.

№	Latin names	English names	Amount	Flight altitude
SECONDARY SPECIES				
1.	*Falco tinnunculus*	Kestrel	2	15-30
2.	*Buteo buteo*	Common Buzzard	1	10-25
OTHER SPECIES				
1.	*Galerida cristata*	Crested lark	8	0-15
2.	*Calandrella rufescens*	Lesser Short-toed Lark	31	0-5
3.	*Oenanthe isabellina*	Isabelline wheatear	3	0-10
4.	*Acridotheres tristis*	Indian Myna	5	2-9

VP. 6

Date: 03.11.2020.Start and end time: 13:32 – 15:35

Weather:

The air temperature around 13-12°C cloudy.

Wind speed approx. (4-6 m/s) No precipitation

Primary species not found

Table 136. Secondary and other species (VP 6), 03.11.2020.

№	Latin names	English names	Amount	Flight altitude
SECONDARY SPECIES				
1.	*Falco tinnunculus*	Kestrel	2	10-30
OTHER SPECIES				
1.	*Galerida cristata*	Crested lark	10	0-15
2.	*Calandrella rufescens*	Lesser Short-toed Lark	12	0-5
3.	*Oenanthe isabellina*	Isabelline wheatear	1	0-10
4.	*Corvus cornix*	Hooded Crow	12	10-15
5.	*Corvus frugilegus*	Eurasian Rook	34	10-12

VP.3

Date: 04.11.2020. Start and end time: 9:16 – 12:16

Weather:

The air temperature around 6-11°C sky half cloudy.

Wind speed approx. (6-7 m/s) No precipitation

Primary species not found

Table 137. Secondary and other species (VP 3), 04.11.2020

№	Latin names	English names	Amount	Flight altitude
SECONDARY SPECIES				
1.	*Pelecanus onocrotalus*	Great White Pelican	7	50
OTHER SPECIES				
1.	*Galerida cristata*	Crested lark	6	0-8
2.	*Oenanthe isabellina*	Isabelline Wheatear	2	0-4
3.	*Acridotheres tristis*	Common myna	5	6-10
4.	*Corvus corax*	Northern Raven	12	15-25
5.	*Corvus cornix*	Hooded Crow	16	10
6.	*Corvus frugilegus*	Eurasian Rook	15	8

VP. 4

Date: 04.11.2020. Start and end time: 13:33 – 15:36

Weather:

The air temperature around 12-10°C sky half cloudy.

Wind speed approx. (6-7 m/s) No precipitation

Primary species not found

Table 138. Secondary and other species (VP 4), 04.11.2020

№	Latin names	English names	Amount	Flight altitude
OTHER SPECIES				
1.	*Galerida cristata*	Crested lark	7	0-10
2.	*Oenanthe isabellina*	Isabelline Wheatear	2	0-4
3.	*Athene noctua*	Little owl	1	0-5
4.	*Nycticorax nycticorax*	Black-crowned night-heron	1	30
5.	*Calandrella rufescens*	Lesser Short-toed Lark	32	0-9
6.	*Corvus cornix*	Hooded Crow	6	8
7.	*Corvus frugilegus*	Eurasian Rook	8	7

VP. 7

Date: 10.11.2020 Start and end time: 9:27 – 12:37
Weather:
The air temperature around 9-12°C sky half cloudy.
Wind speed approx. (5-6 m/s) No precipitation

Primary species not found

Table 139. Secondary and other species (VP 7), 05.11.2020.

№	Latin names	English names	Amount	Flight altitude
OTHER SPECIES				
1.	*Athene noctua*	Little owl	1	0-5
2.	*Corvus monedula*	Jackdaw	11	8
3.	*Corvus frugilegus*	Eurasian Rook	24	10
4.	*Corvus cornix*	Eurasian Hooded Crow	5	10
5.	*Galerida cristata*	Crested lark	9	0-9
6.	*Calandrella rufescens*	Lesser Short-toed Lark	23	0-6
7.	*Oenanthe isabellina*	Isabelline wheatear	1	0-6
8.	*Acridotheres tristis*	Indian Myna	4	12
9.	*Pterocles orientalis*	Black-bellied sandgrouse	4	25

VP. 5

Date: 10.11.2020. Start and end time: 13:23 – 15:23

Weather:

The air temperature around 13-10°C partly cloudy.

Wind speed approx. (6-8 m/s) No precipitation

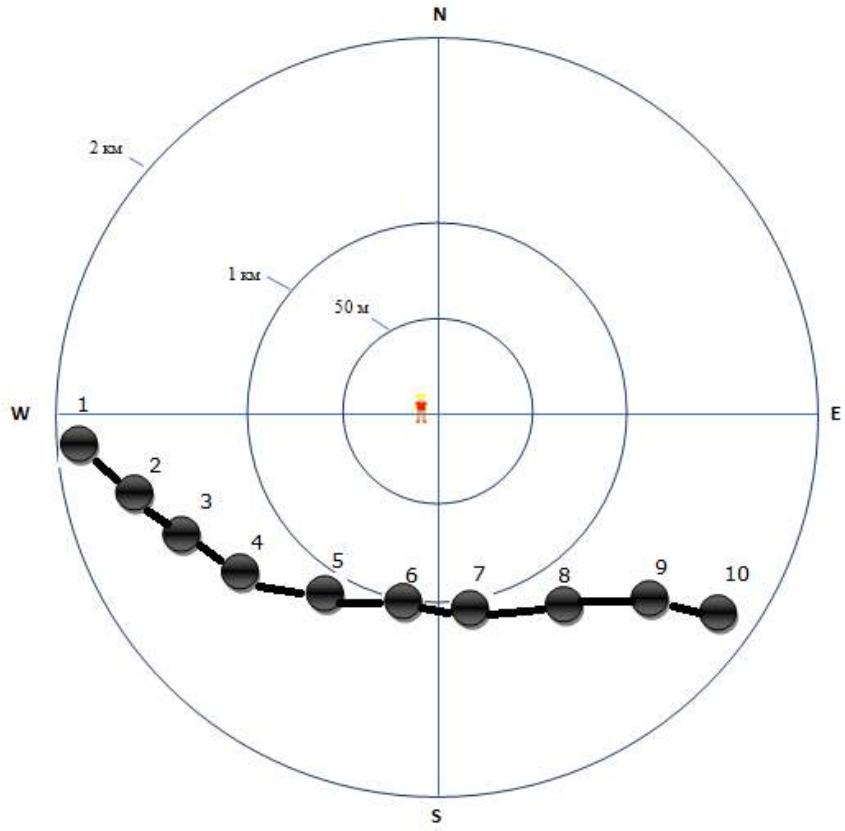


Fig.21 Flight path (VP 5), 05.11.2020

Table 140. Target species log (VP 5), 05.11.2020.

●	*Aquila nipalensis*	1 150 m	2 150 m	3 155 m	4 150 m	5 155 m	6 155 m	7 155 m	8 150 m	9 155 m	10 155 m

Table 141. Secondary and other species (VP 5), 05.11.2020.

№	Latin names	English names	Amount	Flight altitude
SECONDARY SPECIES				
1.	*Circus aeruginosus*	Eurasian Marsh-Harrier	1	12-30
2.	*Buteo buteo*	Common Buzzard	1	20-30
3.	*Falco tinnunculus*	Common Kestrel	2	12-35
OTHER SPECIES				
1.	*Galerida cristata*	Crested lark	12	0-15
2.	*Calandrella rufescens*	Lesser Short-toed Lark	23	0-5
3.	*Cygnus olor*	Mute swan	5	25
4.	*Oenanthe isabellina*	Isabelline wheatear	2	0-3
5.	*Corvus cornix*	Hooded Crow	19	12

VP. 1

Date: 11.11.2020.Start and end time: 9:51 – 12:55

Weather:

The air temperature around 9-13°C cloudy.

Wind speed approx. (5-6 m/s) No precipitation

Primary species not found

Table 142. Secondary and other species (VP 1), 06.11.2020.

№	Latin names	English names	Amount	Flight altitude
SECONDARY SPECIES				
1.	*Falco tinnunculus*	Kestrel	2	15-30
2.	*Buteo buteo*	Common Buzzard	1	10-25
OTHER SPECIES				
1.	*Larus ridibundus*	Black-Headed Gull	11	7
2.	*Galerida cristata*	Crested lark	10	0-15
3.	*Calandrella rufescens*	Lesser Short-toed Lark	19	0-5
4.	*Oenanthe isabellina*	Isabelline wheatear	2	0-10
5.	*Acridotheres tristis*	Indian Myna	6	2-9

VP. 2

Date: 11.11.2020.Start and end time: 13:32 – 15:35

Weather:

The air temperature around 13-12°C cloudy.

Wind speed approx. (5-6 m/s) No precipitation

Primary species not found

Table 143. Secondary and other species (VP 2), 06.11.2020.

№	Latin names	English names	Amount	Flight altitude
SECONDARY SPECIES				
1.	*Falco tinnunculus*	Common Kestrel	2	12-30
OTHER SPECIES				
1.	*Larus ridibundus*	Black-Headed Gull	3	7
2.	*Galerida cristata*	Crested lark	12	0-15
3.	*Calandrella rufescens*	Lesser Short-toed Lark	23	0-5
4.	*Oenanthe isabellina*	Isabelline wheatear	2	0-10
5.	*Corvus cornix*	Hooded Crow	5	10-15
6.	*Corvus frugilegus*	Eurasian Rook	23	10-12

VP. 9

Date: 12.11.2020. Start and end time: 10:56 – 13:56

Weather:

The air temperature around 9-15°C is clear.

Wind speed approx. (4-5 m/s) No precipitation

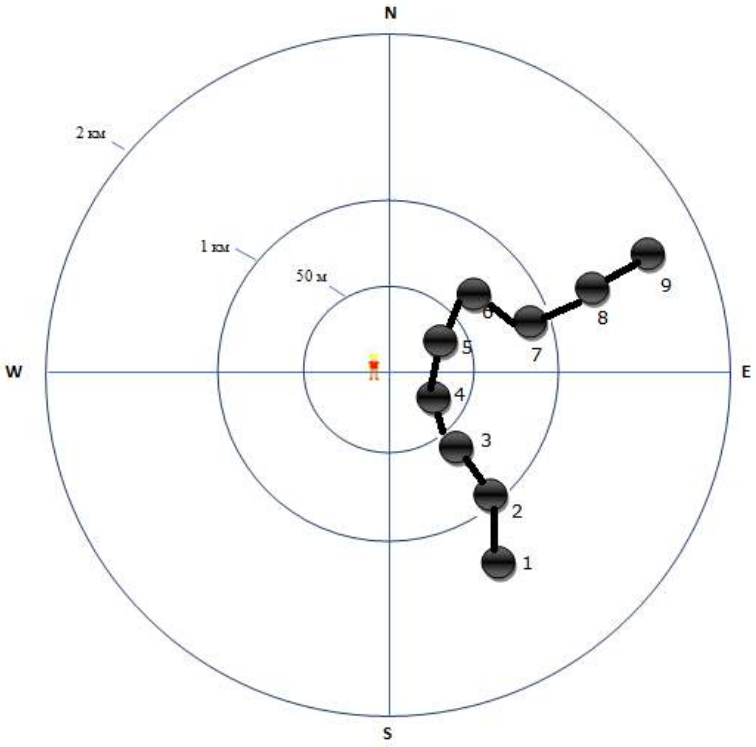


Fig. 22. Flight path (VP 9), 09.11.2020

Table 144. Target species log (VP 9), 09.11.2020

●	*Aquila nipalensis*	1 110 m	2 110 m	3 115 m	4 110 m	5 115 m	6 115 m	7 115 m	8 110 m	9 110 m

Table 145. Secondary and other species (VP 9), 09.11.2020

№	Latin names	English names	Amount	Flight altitude
OTHER SPECIES				
1.	*Corvus ruficollis*	Brown-necked Raven	2	0-3
2.	*Corvus frugilegus*	Eurasian Rook	14	30
3.	*Pica pica*	Black-billed Magpie	2	5
4.	*Galerida cristata*	Crested lark	21	0-13
5.	*Columba livia*	Pigeon	56	15
6.	*Streptopelia decaocto*	Collared Turtle Dove	2	5
7.	*Oenanthe isabellina*	Isabelline wheatear	3	0-10
8.	*Scotocerca inguieta*	Streaked Scrub Warbler	2	2
9.	*Acridotheres tristis*	Indian Myna	6	18
10.	*Turdus atrogularis*	Black-throated Thrush	26	15

VP 8

Date: 12.11.2020 Start and end time: 13:42 – 16:42

Weather:

The air temperature around 18-14°C is cloudy.

Wind speed approx. (4-6 m/s) No precipitation

Primary species not found

Table 146. Secondary and other species (VP 8), 09.11.2020

№	Latin names	English names	Amount	Flight altitude
SECONDARY SPECIES				
1.	*Circus cyaneus*	Hen (Northern) Harrier	1	10-35
2.	*Falco tinnunculus*	Common Kestrel	2	15-25
OTHER SPECIES				
1.	*Galerida cristata*	Crested lark	17	0-5
2.	*Oenanthe isabellina*	Isabelline wheatear	2	0-5
3.	*Hirundo rustica*	Barn swallow	5	5-15
4.	*Pterocles orientalis*	Black-bellied sandgrouse	3	0-15
5.	*Athene noctua*	Little Owl	1	0-5

VP 6

Date: 21.11.2020 Start and end time: 8:53 – 11:53

Weather:

The air temperature around 6-9°C sky half cloudy

Wind speed approx. (4-6 m/s) No precipitation

Primary species not found

Table 147. Secondary and other species (VP 6), 10.11.2020

№	Latin names	English names	Amount	Flight altitude
SECONDARY SPECIES				
1.	*Falco tinnunculus*	Common Kestrel	2	15-25
OTHER SPECIES				
1.	*Galerida cristata*	Crested lark	12	0-5
2.	*Oenanthe isabellina*	Isabelline wheatear	2	0-5
3.	*Pterocles orientalis*	Black-bellied sandgrouse	3	5-15
4.	*Athene noctua*	Little Owl	1	0-2
5.	*Corvus corax*	Northern Raven	25	40
6.	*Corvus cornix*	Eurasian Hooded Crow	3	10
7.	*Columba livia*	Rock Dove	14	35

VP. 5

Date: 21.11.2020 Start and end time: 12:27 – 14:27
Weather:
The air temperature around 10-14°C sky half cloudy.
Wind speed approx. (5-6 m/s) No precipitation

Primary species not found

Table 148. Secondary and other species (VP 5), 10.11.2020.

№	Latin names	English names	Amount	Flight altitude
OTHER SPECIES				
1.	*Athene noctua*	Little owl	2	0-10
2.	*Galerida cristata*	Crested lark	12	0-9
3.	*Calandrella rufescens*	Lesser Short-toed Lark	27	0-6
4.	*Oenanthe isabellina*	Isabelline wheatear	2	0-6
5.	*Acridotheres tristis*	Indian Myna	6	12
6.	*Pterocles orientalis*	Black-bellied sandgrouse	12	25
7.	*Cygnus olor*	Mute Swan	15	45
8.	*Turdus atrogularis*	Black-throated Thrush	30	15

VP. 3

Date: 22.11.2020. Start and end time: 10:23 – 13:23

Weather:

The air temperature around 9-12°C partly cloudy.

Wind speed approx. (6-8 m/s) No precipitation

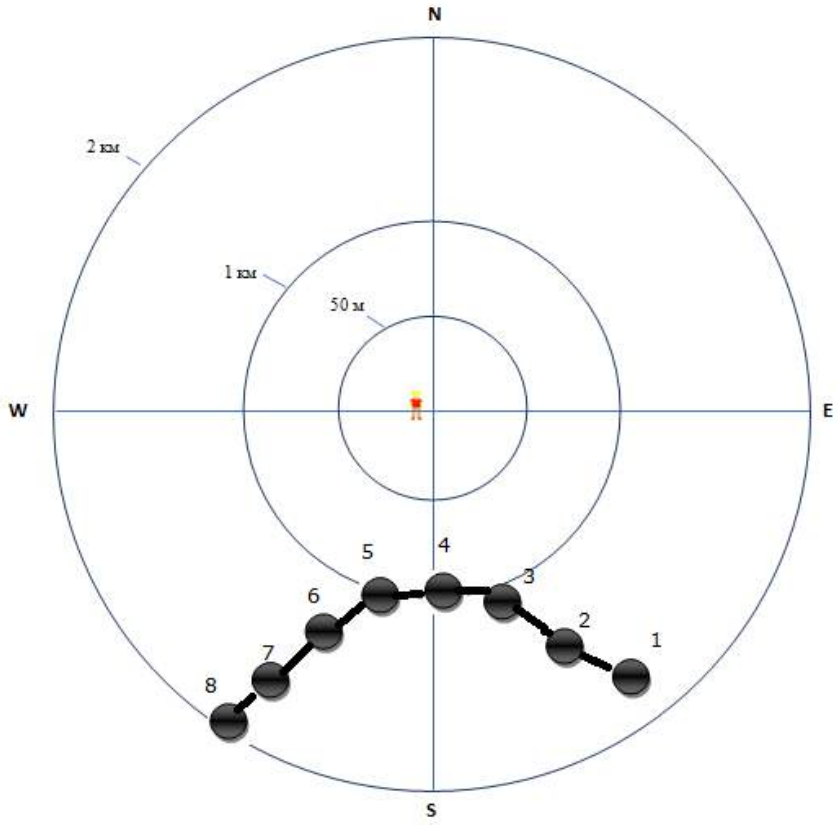


Fig.23 Flight path (VP 3), 11.11.2020

Table 149. Target species log (VP 3), 11.11.2020.

●	*Aquila nipalensis*	1 120 m	2 120 m	3 125 m	4 120 m	5 125 m	6 125 m	7 125 m	8 120 m

Table 150. Secondary and other species (VP 3), 11.11.2020.

№	Latin names	English names	Amount	Flight altitude
SECONDARY SPECIES				
1.	*Circus aeruginosus*	Eurasian Marsh-Harrier	1	12-30
2.	*Buteo buteo*	Common Buzzard	1	20-30
3.	*Falco tinnunculus*	Common Kestrel	2	12-35
OTHER SPECIES				
1.	*Tadorna ferruginea*	Ruddy Shelduck	3	35
2.	*Galerida cristata*	Crested lark	15	0-15
3.	*Calandrella rufescens*	Lesser Short-toed Lark	18	0-5
4.	*Oenanthe isabellina*	Isabelline wheatear	1	0-3
5.	*Bubo bubo*	Northern Eagle Owl	1	2-4
6.	*Corvus cornix*	Hooded Crow	2	12

VP. 4

Date: 22.11.2020.Start and end time: 13:51 – 15:55

Weather:

The air temperature around 13-10°C cloudy.

Wind speed approx. (5-6 m/s) No precipitation

Primary species not found

Table 151. Secondary and other species (VP 4), 11.11.2020.

№	Latin names	English names	Amount	Flight altitude
SECONDARY SPECIES				
1.	*Falco tinnunculus*	Common Kestrel	2	15-30
2.	*Buteo buteo*	Common Buzzard	1	10-25
3.	*Aegypius monachus*	Cinereous Vulture	2	120-150
OTHER SPECIES				
1.	*Alectoris chukar*	Chukar Partridge	6	0-3
2.	*Corvus monedula*	Jackdaw	16	8
3.	*Corvus frugilegus*	Eurasian Rook	9	10
4.	*Galerida cristata*	Crested lark	10	0-15
5.	*Calandrella rufescens*	Lesser Short-toed Lark	19	0-5
6.	*Oenanthe isabellina*	Isabelline wheatear	2	0-10
7.	*Acridotheres tristis*	Indian Myna	6	12

VP. 7

Date: 23.11.2020.Start and end time: 9:32 – 12:35

Weather:

The air temperature around 8-12°C cloudy.

Wind speed approx. (5-6 m/s) No precipitation

Primary species not found

Table 152. Secondary and other species (VP 7), 12.11.2020.

№	Latin names	English names	Amount	Flight altitude
SECONDARY SPECIES				
1.	*Falco tinnunculus*	Common Kestrel	2	5-30
OTHER SPECIES				
1.	*Galerida cristata*	Crested lark	6	0-15
2.	*Calandrella rufescens*	Lesser Short-toed Lark	13	0-5
3.	*Oenanthe isabellina*	Isabelline wheatear	1	0-10
4.	*Corvus cornix*	Hooded Crow	3	10-15
5.	*Corvus frugilegus*	Eurasian Rook	21	10-12

VP. 8

Date: 23.11.2020. Start and end time: 13:26 – 15:26

Weather:

The air temperature around 12-11°C is clear.

Wind speed approx. (4-5 m/s) No precipitation

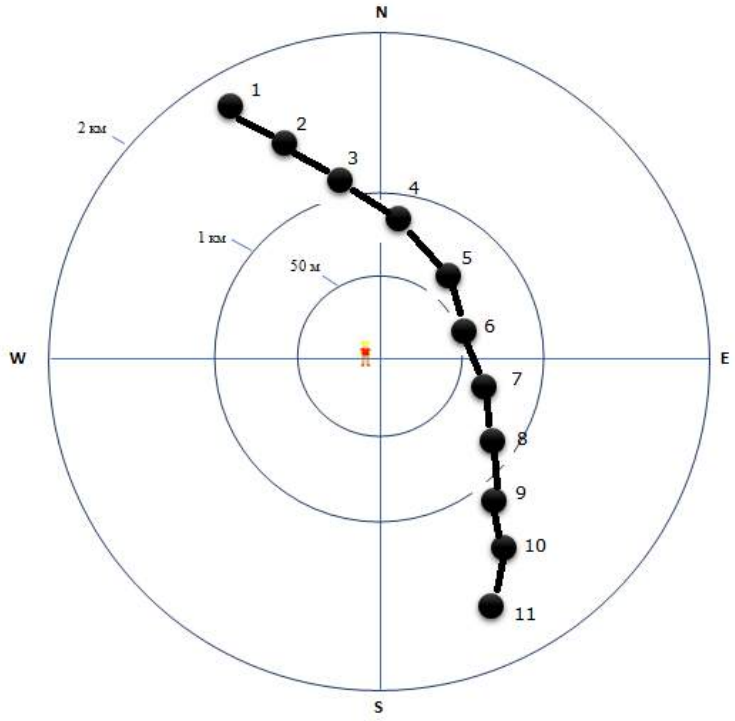


Fig. 24. Flight path (VP 8), 12.11.2020

Table 153. Target species log (VP 8), 12.11.2020

●	*Aquila nipalensis*	1 110 m	2 110 m	3 115 m	4 110 m	5 115 m	6 115 m	7 115 m	8 110 m	9 110 m	10 100 m	11 100 m

Table 154. Secondary and other species (VP 8), 12.11.2020

№	Latin names	English names	Amount	Flight altitude
SECONDARY SPECIES				
1.	*Buteo rufinus*	Long-legged Buzzard	1	40
OTHER SPECIES				
1.	*Corvus corone*	Eurasian Carrion Crow	2	0-2
2.	*Corvus frugilegus*	Eurasian Rook	12	2-6
3.	*Galerida cristata*	Crested lark	12	0-13
4.	*Oenanthe isabellina*	Isabelline wheatear	2	0-10
5.	*Scotocerca inguieta*	Streaked Scrub Warbler	3	2
6.	*Acridotheres tristis*	Indian Myna	12	18

Attachments

All the photos are taken during Autumn bird monitoring



Grus grus (Common (Eurasian) Crane)



Buteo buteo



Buteo buteo (Common Buzzard)



Buteo buteo nest 4 [redacted] [redacted]



Buteo rufinus (Long-legged Buzzard)



Athene noctua (Little Owl)



Rhombomys opimus (Great Gerbil)



Project territory landscape

Winter bird counts on lake Ayakagitma

Report Title	Winter bird counts on lake Ayakagitma
Scope	WATERBIRDS
Areas Covered	BASH WF
Seasons Covered	WINTER 2021
Notes	

WINTER BIRD COUNTS ON LAKE AGITMA

January 5, 2021

Ornithologists: Alisher Atakhodjaev and Ramzjon Sohibnazarov

Located near the project area of the Navoi Bash wind farm, Lake Ayakagitma attracts waterfowl in all seasons of the year: during migration, nesting and wintering. On January 5, 2021, winter bird counts were conducted on this lake in order to learn more about the wintering birds of this reservoir. The weather on the day of accounting was cloudy, the air temperature was about -12-14 °C, the wind speed was 4-6 m/s, sometimes 8-10 m/s, there was no precipitation. The surface of the lake was covered with ice for 2-4 meters, and surface of the bays with still water even more than that. Visibility was quite good - 400-500 meters. The survey of the lake began from the northeast side (the former bridge), and from there along the shore through the village to the opposite side of the lake. Observations were made by visual observations conducted during walked and road route surveys. Every 250-400 meters, a telescope was placed on a tripod and a record of birds flying or sitting on the water was made. In addition to the birds, the Great Gerbils were awake and active. Located on the flyway, Lake Agitma attracts birds during migration and wintering, followed by birds of prey such as the White-tailed Eagles.

It should be noted that a few days after our trip, the lake completely froze, and all the birds flew away south.

Table 1. Bird species encountered on Agitma lake on January 5, 2021

№	Latin name	English name	Naumber	IUCN status	Uzbekistan Red Book status	Nature of stay
1.	*Phalacrocorax carbo*	Cormorant	62	LC	-	**NMW**
2.	*Haliaeetus albicilla*	White-tailed Sea-eagle	9	LC	2 (VU:R)	**NMW**
3.	*Circus aeruginosus*	Marsh Harrier	6	LC	-	**NMW**
4.	*Circus cyaneus*	Hen (Northern) Harrier	1 (male)	LC	-	**MW**
5.	*Anas crecca*	Green-winged Teal	960	LC	-	**MWS**
6.	*Anas clypeata*	Northern Shoveler	144	LC	-	**NMW**
7.	*Cygnus olor*	Mute Swan	191	LC	3 (NT)	**NMW**
8.	*Cygnus cygnus*	Whooper Swan	43	LC	2 (VU:R)	**NMW**
9.	*Tadorna ferruginea*	Ruddy Shelduck	43	LC	-	**NMW**
10.	*Netta rufina*	Red-Crested Pochard	1200	LC	-	**NMW**

11.	*Aythya ferina*	Common Pochard	780	VU	-	**NMW**
12.	*Aythya fuligula*	Tufted duck	206	LC	-	**MW**
13.	*Tadorna tadorna*	Common Shelduck	236	LC	-	**NMW**
14.	*Anas platyrhynchos*	Mallard	380	LC	-	**NMW**
15.	*Mergus merganser*	Goosander	6	LC	-	**MW**
16.	*Bucephala clangula*	Common Goldeneye	38	LC	-	**MW**
17.	*Mergellus albellus*	Smew	16	LC	-	**MW**
18.	*Fulica atra*	Common Coot	4700	LC	-	**NMW**
19.	*Athene noctua*	Little Owl	2	LC	-	**R**
20.	*Calandrella rufescens*	Lesser Short-toed Lark	320	LC	-	**NMW**
21.	*Melanocorypha leucoptera*	White-winged Lark	1200	LC	-	**MW**
22.	*Corvus corone*	Eurasian Carrion Crow	5	LC	-	R
23.	*Fringilla coelebs*	Chaffinch	8	LC	-	**MW**

Photos from the survey

		
Mergellus albellus - Smew	*Cygnus olor* - Mute Swan	*Aythya fuligula* - Tufted duck
		
Athene noctua - Little Owl	*Cygnus cygnus* - Whooper Swan	*Mergus merganser* - Goosander

		
Aythya ferina - Common Pochard	*Circus cyaneus* - Hen (Northern) Harrier	*Haliaeetus albicilla* - White-tailed Sea-eagle
		
Fulica atra - Common Coot	*Calandrella rufescens* - Lesser Short-toed Lark	*Mergus merganser* - Goosander







Frozen lake on January, 11, 2021 six days after our first trip

Juru Energy

Asian Houbara Monitoring Report

Report Title	Asian Houbara Monitoring Report
Scope	BIRDS VP / BIRDS NESTING
Areas Covered	DZHANKELDY WF / BASH WF
Seasons Covered	SPRING 2021
Notes	

Juru Energy

ASIAN HOUBARA MONITORING REPORT

Bash Wind Farm

Dzhankeldy Wind Farm

Client: 5 Capitals

Anna Ten, Valentin Soldatov

Alisher Atakhodjaev

Juru Energy Ltd.

Suite 1, One George Yard, London

United Kingdom, EC3V 9DF

T: +44 207 859 4028

June 2021

Juru Energy

Contents

Contents 3
Introduction 4
Ecology 5
Density 7
Threats 9
Methods and materials 12
Results 17
Summary 23
Recommendations 24
Publications 26

Introduction

This report is a statement of work made by Juru Enery` local senior ornithologists Anna Ten and Valentin Soldatov on the territory of Bash Windfarm; senior ornithologist Alisher Atakhodjaev and ornitologists Ramzjon Sohibnazarov on the territory of Dzhankeldy Windfarm. Anna Ten performed deasktop study and analytical work. This report was reviewed by the international expert Caleb Gordon.

Asian Houbara is one of the most characteristic representatives of the avifauna of Uzbekistan, occurring during the nesting and migration mainly on the territory of Kyzylkum and Ustyurt, and occasionally wintering in the southern regions of the country (Kreutzberg-Mukhina, 2003).

Due to the intensive development of desert areas since the mid-20th century in Uzbekistan, the area of Asian Houbara's habitat significantly decreased (Meklenburtsev, 1990). In addition, its number has significantly decreased through poaching, including falconry, both in the wintering areas and on flyways. Asian Houbara is included in the Red Data Book of the Republic of Uzbekistan (2019) as a vulnerable species with a declining population. The population of this species has been regularly declining over the past decades, and the habitat is highly fragmented. Consequently, as the Red List Authority for birds on the IUCN Red List, BirdLife has recommended to IUCN that the Asian Houbara be classified as Vulnerable under Criterion A4acd, owing to an estimated population reduction of between 30% and 49% across a period of three generations, starting in the past and projected into the future. Should more accurate trend data become available, future reassessment as Endangered may prove warranted. Conversely, potential population increases driven by expanding captive breeding and release programmes could alternatively necessitate future downlisting (BirdLife International 2014)

The creation of the Bash wind farm on the territory located to the east of the Ayakagytma depression and Dzhankeldy wind farm near Kuljuktau mountains range (the central part of the Kyzylkum desert) will create additional threats: habitat loss and the threat of collisions with turbines and with TL. A preliminary study of the distribution of this species in the project area will make it possible to identify key habitats of Asian Houbara, as well as reduce threats.

Information about Asian Houbara in Kyzylkum was first given by M. N.Bogdanov (1882), who obtained it during his expedition from Kazalinsk to the Khiva oasis in 1873. In his opinion, Asian Houbara nests everywhere in suitable places. N. A. Zarudny (1915) found Asian Houbara nesting in the northern and eastern extremities of the studied area of the Kyzylkum desert. At Tamdy's oasis, he considered Asian Houbara a common species. In the years before the Second World War, during the war, and for several years after it, T. Zahidov surveyed the Kyzylkum desert, and wrote (1971) that Houbara is distributed unevenly and is absent from most places in Central Kyzylkum. Much more often he observed it in the South-Western Kyzylkum. There, nesting grounds were also recorded by D.L. Lakhanov (1977). O. V. Mitropolsky regularly visited Kyzylkum from late 1972 to April 1985 and registered Asian Houbara in many places in Central Kyzylkum. Nesting was also reliably recorded in Ayakguzhumdy, the northern foothills of Tamdytau, Kurkuduk. The biology of Asian Houbara and the population were studied by O. S. Bakaev (1972), A. F. Alekseev (1980), T. S. Ponomareva (1979, 1983, 1985). In the 1980s the Ecocenter "Jeyran" studied the nesting biology and successfully bred Asian Houbara in captivity (Mukhina, 1988).

From 2011 to the present, Robert Burnside, Maxim Koshkin and other specialists from the University of East Anglia, with the financial support of The Ahmed bin Zayed Charitable Foundation, as well as The Emirates Bird Breeding Center for Conservation, have been studying Asian Houbara in the southern part of the Kyzylkum desert within the borders of Bukhara region, including the Navoi-Bash project area. It is worth noting that the study is independent, and these donors do not influence the results of the study. During this period, the number of Asian Houbara was specified on an area of more than 14,300 km^2, the nesting biology, migration routes, threats (livestock, predators, power lines), adaptation of the captive-

bred Asian Houbara to natural conditions were studied, telemetry of captive-bred and wild birds was conducted, and many more other activities done. These studies were the basis for a number of publications by Burnside et al. 2017, Burnside et al. 2020, Koshkin et al. 2014, Koshkin et al. 2016a, Koshkin et al. 2016b, Guilherme et al. 2018.

Since 2008, in the southern part of the Kyzylkum desert, the Emirates Bird Breeding Center for Conservation (UAE) has been operating an Asian Houbara captive breeding, in total they have released 14 thousand captive-bred Asian Houbara (according to Gazeta.uz). Parallel work is carried out in the nursery located in Karnabchul.

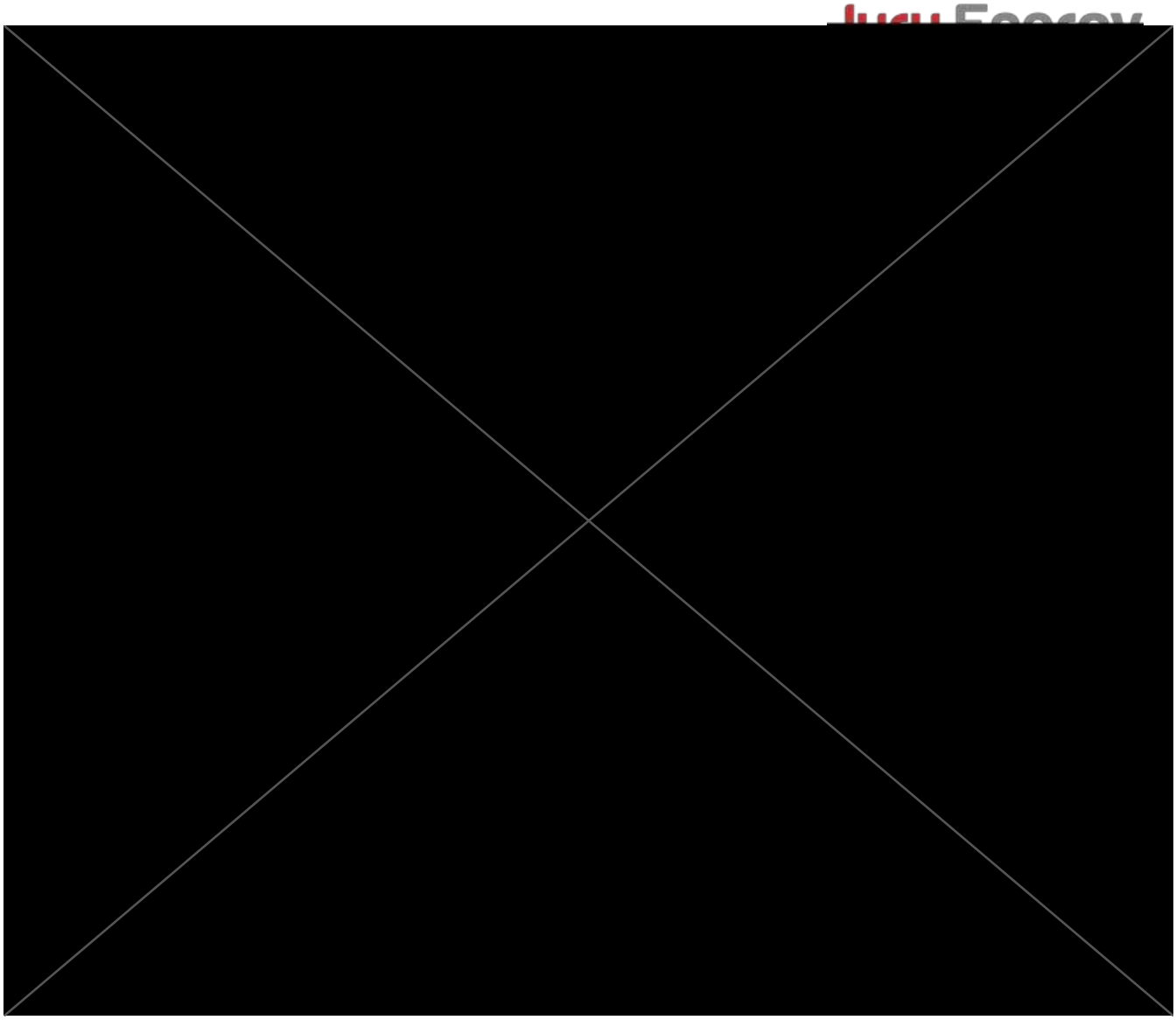
Thus, Asian Houbara is quite well studied within the Kyzylkum desert, and in particular, data are available on its density in the project area of Bash (Ayakagytma) (Koshkin et al. 2014), threats on TL (Burnside et al. 2015).

Ecology

Asian Houbara is an iconic inhabitant of steppe and semi-desert in Central Asia and the Middle East. A highly terrestrial bird, capable of going long periods without taking flight, it is nonetheless a true long-distance migrant, with some individuals travelling more than 7,500 km over the course of a single year (Combreau *et al*. 2011).

All authors consider deserts to be the habitat of Asian Houbara. It seems that a good all-round view is important for this bird, so it prefers to nest in flat areas with sparse vegetation. At the same time, fairly dense soil is important. Asian Houbara can inhabit clay plains with sagebrush grass cover (Zahidov, 1971) and the extremities of takyrs near solonchaks with scattered saltwort and camel thorn shrubs. Asian Houbara also lives on the clay-solonchak plains and Anabasis salsa takyrs of the ancient delta of the Amu Darya (Alekseev, 1981). According to N. A. Zarudny (1915), Asian Houbara prefers slightly undulating spaces with sandified surface, covered with various low shrubs, alternating sagebrush communities and small solonchaks and takyrs. O. V. Mitropolsky (oral report) repeatedly visited Kyzylkum in 1971-1985 and repeatedly encountered Asian Houbara, with only one record in each ridgy and blowout sand areas. The rest were found on piedmont plains, plateaus, takyrs, i.e. on open flat areas with more or less dense vegetation. All authors confidently point out that Asian Houbara is absent in loose sand dunes, as well as in landscapes transformed by humans even to a smallest degree (Meklenburtsev, 1990). Asian Houbara abandons areas where roads appear or the number of livestock increases (Alekseev, 1981).

During migrations, Asian Houbara practically does not go beyond the nesting area. In northern Kyzylkum, it flies in a widely spread flock, in central Kyzylkum, according to R. N. Meklenburtsev (1990), the migration starts in the last third of March, in April the flight still continues, but at the end of April, only pairs remain. The autumn migration is most thoroughly studied for north-western Kyzylkum, where birds begin flying noticeably from the last third of September and continue to fly until late October, with rare individuals recorded on November 15 and 19. The main direction of the flight is south-west (Alekseev, 1980). Asian Houbara is active during the day; apparently, it migrates during the day as well. In this respect, its behaviour is similar to that of Great Bustard and opposite to that of Little Bustard, which is a nocturnal migrant (Meklenburtsev, 1990). Asian Houbara winters, but not regularly. Local residents of the Tamdy oasis in Kyzylkum reported to Zarudny N. A. (2015) about rare encounters in winter. According to N. A. Asimov (2020, oral report), in the Pistalitau area, poachers shot 2 ringed Asian Houbaras. Further study of this question showed that the birds were most likely from the breeding center.



Male Asian Houbara attract their mates with an extravagant courtship display, which they perform at the same site each year. The display begins with a period of strutting and culminates with the male retracting his head within an ornamental shield of erected neck feathers and then running at speed in either a straight or curved line. The display is often accompanied by a series of low frequency booming calls (Gaucher et al. 1996). In the Bukhara breeding center of rare animals ”Jeyran", males began to display courtship behaviour immediately after arrival. There, 7-9 males display courtship behaviour. Each occupies a certain area, which the other males do not enter. Females appear in these areas about 10 days later, but they do not constantly stay on them, but only visit them (Mukhina, 1990).

Males play no part in rearing the young, and a brood may contain young sired by several different individuals. Females create a shallow scape in the ground in which they typically lay 3-4 eggs, and occasionally up to six eggs in long-distance migrants (Collar 1996, Combreau et al. 2002).

After tracing the incubation process from beginning to end, S. O. Bakaev (1972) found out that the female incubates the clutch for 21 days. The chicks hatch within one day. According to O. Combreau (BirdLife International 2014), the incubation period is typically 23 days, whilst fledging takes around 30 to 35 days. The growth of chicks was traced by T. S. Ponomareva (1980). According to her, they become mature by 2 months of age, i.e. by the end of July, if the eggs are laid in early April. Most chicks fledge by the end of June. Then broods break up and every bird stays alone. This is also confirmed by modern telemetry data. Satellite tracking has

revealed that females and their young separate after three to four months and that pre-migration groups in autumn comprise birds of all ages and sexes (O. Combreau 2014).

In late August 1992, an aggregation of 1,500 migrating Asian Houbaras was observed in the Karnabchul steppe area (A. Nuridjanov, private message, acc. to Kreutzberg-Mukhina 2003). Similar large aggregations of migratory birds were observed in 1994 in Bukhara region (0. Nazarov, personal message, acc. to Kreutzberg Mukhina 2003) - in total, there were about 1,000 birds in the aggregation, which formed sparse groups of several dozen individuals. In recent years, such aggregation are no longer observed and Asian Houbaras are more often recorded in small groups - from 3-5 to 10-15 individuals. According to E. A. Kreutzberg-Mukhina (2003), the passage aggregations were impacted by the increasing trophy hunting organized within the nesting area, when groups of hunters from Arab countries come to the countries of Central Asia in September-October and spend about a month there, departing in late November and sometimes in early December.

Density

Between 1956 and 1979, the Asian Houbara was regularly monitored by A. F. Alekseyev (1980). The obtained figures show that from 1956 to 1967, the numbers were decreasing but slightly, and the average remained at a level of 1 individual per 45 km of transect; in 1968-1979, the numbers dropped to one record per 132 km. That is, the population decreased 3 times. This applies to nesting birds. During the spring migration, in the first period, 1 bird was recorded on 29 km of the transect, in the second - 1 bird on 241 km. That is, the number dropped 8 times. During the autumn migration, it decreased 2.6 times. The author ascribes this to changing environmental conditions – economic development of the desert, boring of artesian wells and the growing number of sheep. The construction of a number of car roads contributes to an increase in poaching.

The surveys conducted by T. S. Ponomareva on April 19-20 and May 24-25, 1981 (Meklenburtsev, 1990) in Kyzylkum showed that the numbers vary depending on the area. In the southern foothills of Kuldjuktau, the density is one individual per an area of 9 to 24km^2. Only one individual was recorded in the north-western foothills of Tamdytau. In the Mingbulak depression, the density was 1 individual per 27km^2. In the northern foothills of Bukantau – one bird per 10.8 km^2, and in places with the largest number - 1 individual per 3.6 km^2. In the southern Kyzylkum the decline was attributed to agricultural intensification and expansion, increased disturbance, local poaching and ‘large-scale hunting on wintering grounds’ (Ponomareva 1985). Goriup (1997), citing an unpublished report suggesting 2,200–2,700 breeding females in the country, extrapolated a national total of 6,000–9,000 birds; Allinson (2014) speculated that 10% of this estimate overwinter. Recent surveys in 14,300 km2 of south-east Kyzylkum produced an initial estimate of 1,824 (1,645–2,030) breeding males (Koshkin et al. 2016a), suggesting roughly 4,000 breeding birds (Burnside et al. 2015) in a relatively small part of the available habitat; further refinement of survey data indicates 2,350 breeding females in the study area (Dolman et al. submitted by Collar et al. 2017). The species is common in an adjacent similar-sized area of the Karnabchul steppe (Martin et al. 2014). Nevertheless, demographic modelling based on feld parameters suggests that the population is declining at 9.4% a year, owing to unsustainable winter mortality (Dolman et al. submitted by Collar et al. 2017).

As is described above, experts from the University of East Anglia estimate the bustard population at 1,824 (1,645–2,030) breeding males on a site located in the southern part of the Kyzylkum desert (39.34–40.56°N 62.21-65.20°E), with an area of 14,300 km^2 (Fig.2). For the past 10 years, since 2011 they have monitored the population in this area, counting birds at 231 locations (Fig.2 by Koshkin et al. 2016a).

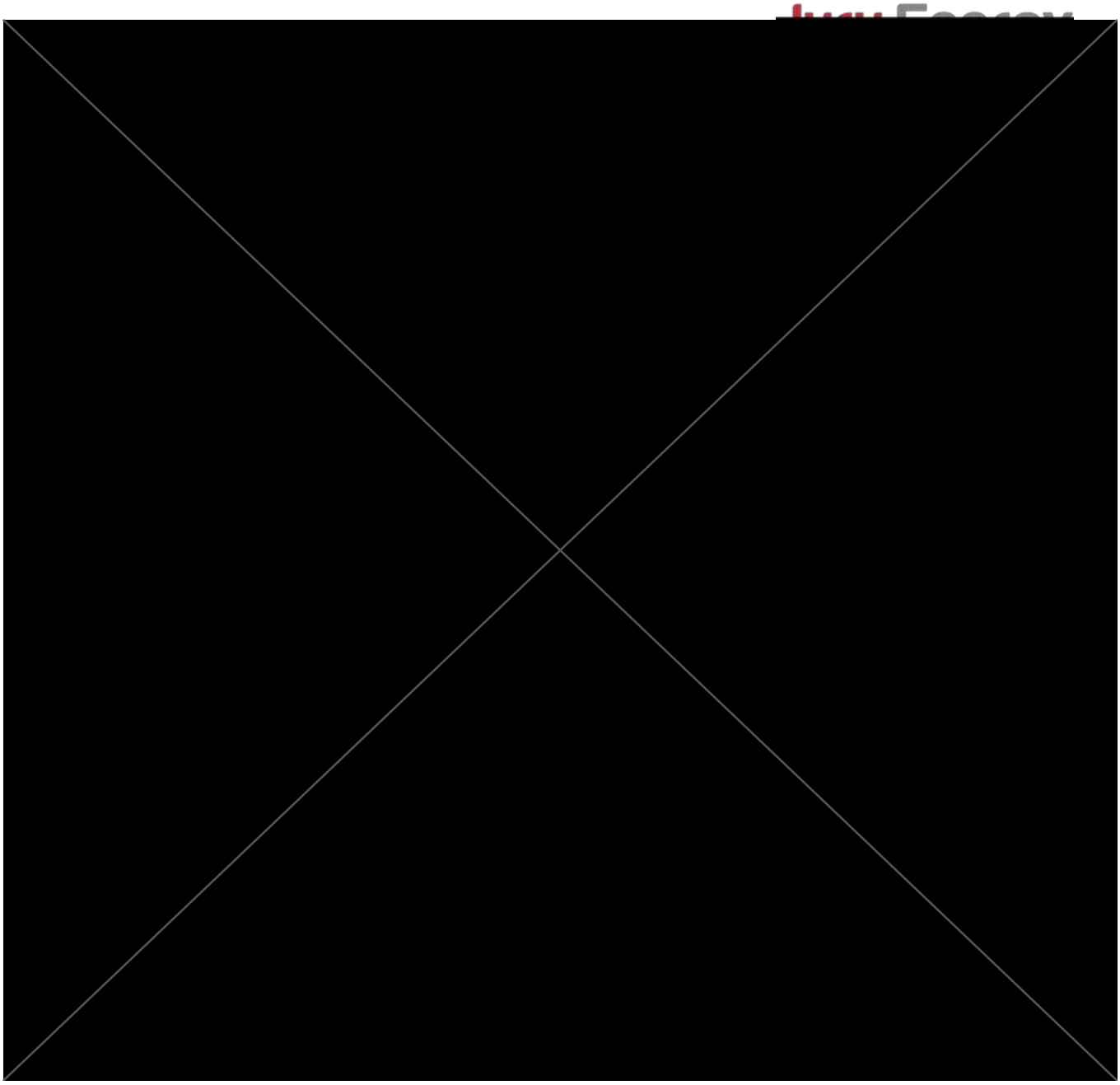


Table 1 *Comparison of density and population estimates of male Asian Houbara on point counts (including observations of unsexed birds and adjusting for proportion of males among sexed birds) from conventional distance sampling (CDS) models (not including detectability covariates) and alternate unstratified and stratified multi-covariate distance sampling (MCDS) models that included visit and time categorical detectability covariates (Koshkin et al. 2016a).*

Model (strata)	AICc	Goodness of fit (Cramer von Mises)	Density estimate (birds/km^2, 95 % CI)	Total population estimate (birds, 95 % CI)
CDS (null model)	3109.3	0.0798	0.135 (0.111–0.164)	1886 (1698–2089)
MSDC	3103.7	0.0618	0.140 (0.126–0.155)	
MSDC (5 Strata)	3103.7	0.0618		1824 (1645–2030)
Artemisia			0.090 (0.081–0.100)	243 (218–270)
Astragalus			0.150 (0.136–0.167)	532 (483–594)
Calligonum			0.041 (0.037–0.046)	61 (55–69)
Salsola arbuscula			0.146 (0.131–0.162)	529 (477–588)
Salsola rigida			0.223 (0.200–0.248)	457 (410–509)

For all models, observations were truncated at a 1.4-km distance

Threats

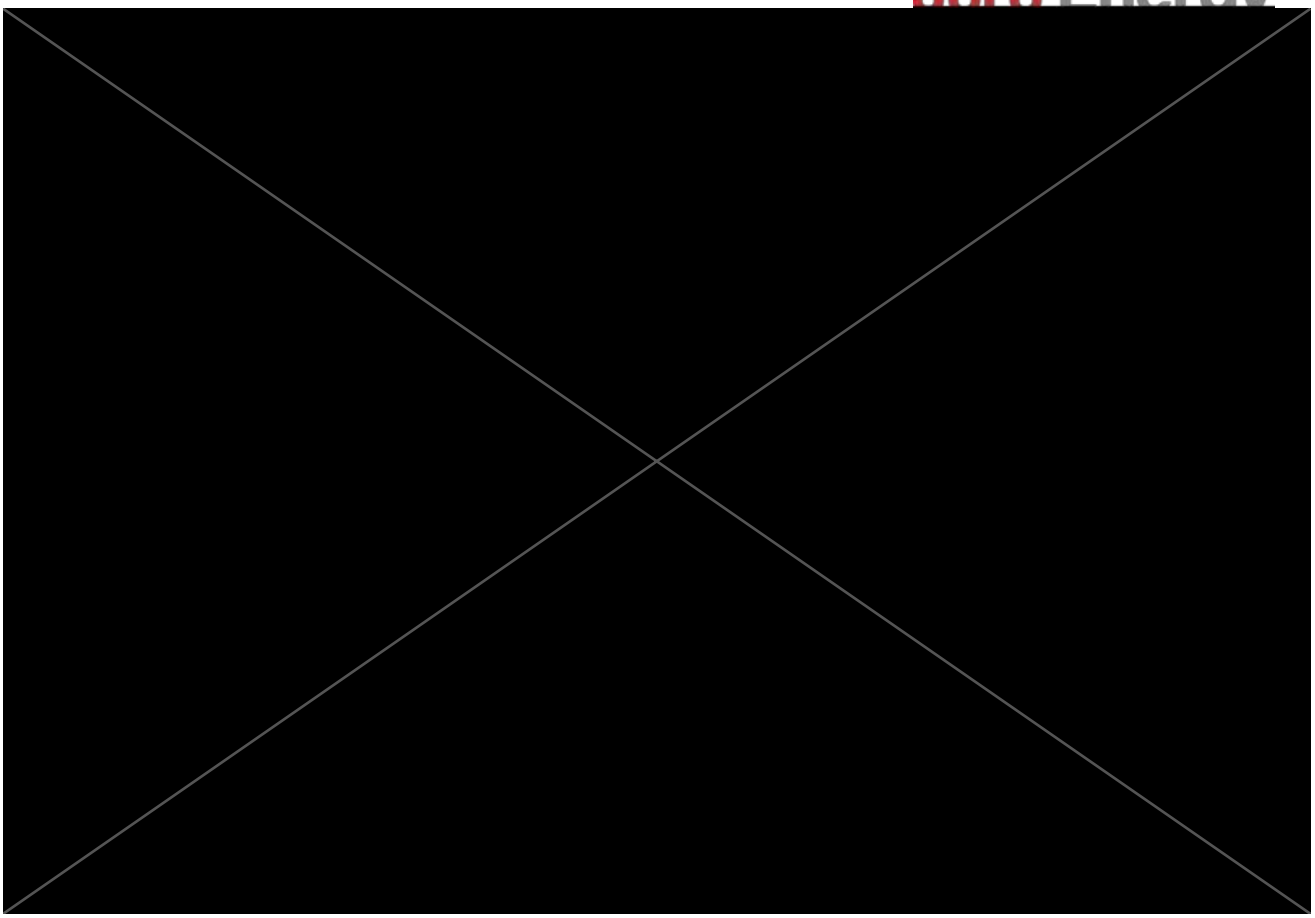
According to IUCN threats classification (BirdLife International 2014), the most commonly identified threat is biological resource use, and more specifically hunting. Agriculture, in particular grazing, is the next most widespread threat. Other threats include energy production and mining, human disturbance, climate change and severe weather, residential and commercial development, transportation and service corridors, pollution and natural system modifications.

The impact of livestock on the successful nesting of Asian Houbara in Bukhara region was studied by specialists from the University of East Anglia (Koshkin et al. 2016), this study showed the absence of any detectable effects of livestock density on houbara nest success or hatchability in successful nests. They suggest that Asian Houbara in the southern Kyzylkum have good nest success while tolerating current levels of sheep grazing and human disturbance. Thus, maintaining the grazing level, which they assess as moderate, is an important measure to conserve the species on the nesting site.

The explanations for the reasons for the falling numbers of Asian Houbara, mentioned above by A. F. Alexeev (1980) - the economic development of the desert, the boring of artesian springs and the increase in the numbers of livestock - are that in the Soviet period the cattle breeding developed on a large scale, for which purpose roads were built and farms created, power and water supply networks were built (in places where boring wells was not advisable). Currently, the farms are self-dependent and do not have the support they had 30 years ago.

The authors also identified the dependence of successful nesting on the state of migration sites and wintering grounds. From this, they are forced to conclude that the scale of anthropogenic mortality during migration and winter needs to be reduced by controlling poaching and regulating hunting (Combreau et al. 2005; Burnside et al. 2016) in order to reduce the scale of and need for captive-bred releases and to render hunting sustainable in the long term.

The study of the death of an Asian Houbara on a transmission line conducted by a group of specialists from University of East Anglia in Kyzylkum in 2014 (Burnside et al. 2015) showed that Asian Houbara is susceptible to collision with both high-and low - voltage powerlines and that the monthly probability of an adult colliding with a powerline was non-trivial, with the possibility of 30 out of every 1000 individuals perishing in this way per season in Uzbekistan (Fig.3). They estimated the mortality at 120 birds lost/year (95% CI: 0–350 birds). Powerline collisions caused the deaths of at least three adult birds in the 2014 breeding season, and at least during the April–May fieldwork this was the only confirmed source of adult mortality in our study area over two consecutive years, although other sources of mortality like poaching and hunting occur in autumn (unpublished data). After hunting and poaching, therefore, powerlines are likely to be an important additional cause of mortality in the Asian Houbara.



Research on the causes of collisions between birds and various anthropogenic objects (wind turbines, power lines) has been carried out and published in the article «Bird collisions with power lines: Failing to see the way ahead?». Authors G.R. Martin, J.M. Shaw (2010) surveyed the visual fields, blind areas which were determined in three bird species representative of families known to be subject to high levels of mortality associated with power lines; Kori bustards *Ardeotis kori, Otididae*, Blue cranes *Anthropoides paradisea, Gruidae* and White storks *Ciconia ciconia, Ciconiidae*. Vulnerability to collision depends on many factors, including bird behaviour and manoeuvrability, topography, weather and power line design and placement (Bevanger, 1994). The data of G.R. Martin, J.M. Shaw (2010) show that vision is probably a key aspect of this problem.

Measures to reduce the probability of collisions have usually involved marking obstructions with devices designed to increase the probability of detection from a greater distance, the assumption being that the obstruction is below the limit of visual resolution within the flight avoidance distance of many bird species. For example, power lines have been marked with objects such as reflective balls, flapping flags, and wire coils (Bevanger, 1994; Janss and Ferrer, 1998).However, despite more than 30 years of using such devices the probability of mortality caused by power line collisions remains high for certain species (Drewitt and Langston, 2008; Janss and Ferrer, 2000). A key aspect which could have a direct impact on collision susceptibility is visual fields. This is because regardless of the ways in which visual information is processed, visual fields determine what part of an animal's environment can influence its behaviour at any one instant (Martin, 2007). Especially important will be the characteristics of that section of a bird's visual field which projects forward and hence normally ''looks" in the direction of travel (Martin, Shaw 2010).

Bustards and cranes are also thought to be visually guided in their foraging, they take a broader array of items than storks. These include a wide range of stationary vegetable matter (seeds, berries, bulbs) and animal resources which are not necessarily evasive such as snails, orthoptera, small rodents, lizards, snakes, and bird eggs and nestlings (Ellis et al., 1996; Johnsgard, 1991). That birds can, and should, maintain visual coverage of the region ahead of them when in flight would seem a reasonable assumption. However, our data provides evidence that this may not always be the case. In bustards and cranes there are extensive blind regions in the frontal hemisphere and movements of the head downwards (forward pitch) by greater than 25 and 35° respectively would bring these blind areas to project forwards in the direction of flight. Under these circumstances any object directly ahead of the flying bird could not be detected regardless of the visual capacities of the bird's eyes or the size and contrast of the object (Martin, Shaw 2010).

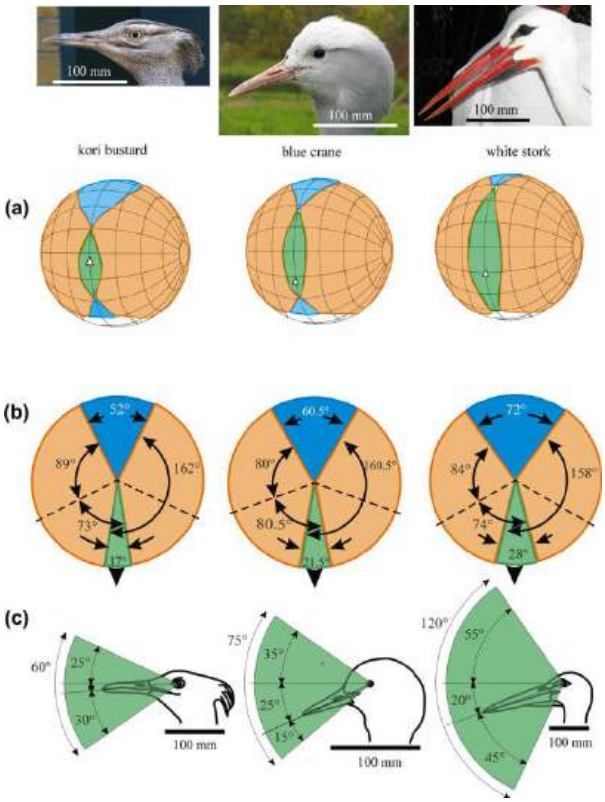


Figure 4 *Visual fields in kori bustards, blue cranes, and white storks. Green areas, binocular sectors; pink areas, monocular sectors; blue areas, blind sectors; downward pointing black arrowheads in row b, direction of the bill; white triangle direction of bill projection in row a; white pentagon direction of optic axes in row a (Martin, Shaw 2010).*

In a group of birds known to be vulnerable to collisions with power lines, aspects of their visual fields, especially the extent of blind areas that project in the frontal hemisphere above the binocular field, mean that the birds may frequently be unable to see what lies ahead of them (Martin, Shaw 2010). This will occur if the birds are searching the area below them (for conspecifics, foraging and roosting sites) and pitching their head downwards. Inability to see power lines may also occur as these birds fly upwards, either from the ground close to a power line array or in trying to avoid collision with conductors which lie directly ahead. In these situations lines may fall within the upward and forward projecting blind portion of the visual field above the binocular area. These considerations are likely to apply in other birds with similarly small binocular fields and extensive blind areas above them (Martin, Shaw 2010).

Thus visual field topographies which have evolved primarily to meet visual challenges associated with foraging may render certain bird species particularly vulnerable to collisions with human artefacts, such as power lines and wind turbines, that extend into the otherwise open airspace above their preferred habitats. For these species placing devices upon power lines to render them more visible may have limited success since no matter what the device the birds may not see them. This may help to explain why line marking appears to be ineffective for bustards (Janss, 2000; Jenkins et al., 2010). G.R. Martin, J.M. Shaw (2010) suggest that in certain situations it may be necessary to distract birds away from the obstacles, or encourage them to land nearby (for example by the use of decoy models of conspecifics, or the provision of sites attractive for roosting) since increased marking of the obstacle cannot be guaranteed to render it visible if the visual field configuration prevents it being detected. Perhaps most importantly, their results indicate that collision mitigation may need to vary substantially for different collision prone species, taking account of species specific behaviours, habitat and

foraging preferences, since an effective all-purpose marking device is probably not realistic if some birds do not see the obstacle at all.

Methods and materials

Optical instruments – binoculars x8, telescope x20-60 Optolite and laser rangefinder – were used. Birds were registered on video and photo with mobile phone using dj-scoping and a Nikon D20 digital camera with a 300mm lens. Photos and videos from the surveys on the territory of Bash Windfarm are stored in Yandex Disc cloud storage
https://disk.yandex.ru/d/Syg8CqvkQYaFHw

Maps in the report were conducted in QGIS 3.0 on base of kmz files presented by Juru, and prepared by Dr. Natalya Beshko.

Surveys on the territory of Bash Windfarm by Anna Ten and Valentin Soldatov were conducted during 19-22 April and 27-29 May 2021 during morning and evening hours from 6-10AM and 16-20 PM.

Surveys on the territory of Dzhankeldy Windfarm were conducted by Alisher Atakhodjaev and Ramzjon Sohibnazarov on April 5,7, 10, 11, 14, 16, 22, 23 and May 10, 12, 13, 14, 15, 16, 19 during morning and evening hours from 6-10AM and 16-20 PM.

The spring count of males is most optimal methods of counting this species, as Houbara are shy and difficult to see. However, during the breeding season (March–May) displaying males (and also floating males) are conspicuous and can be apparent from long distances. This provides an opportunity for male population assessment with a relatively high degree of accuracy (Koshkin et al, 2016a) (Fig.5).

On the territory of Bash Windfarm in April we chose 15 points located mainly on the top of relief and on a distance 3 km between each other. But during field work we found that at least half of the site is hilly and relief is steeper than expected. We had to changed locations of some points as they were unsuitable for count (Fig.10).

And in May we expected that the male detection will be low, and that data will be not comparable with April data. We increased number of count points to 24, and chose them randomly, with distance at least 2-2.5 km from each other (Fig.6, 8). The points did not intersect each other, as according to M. Koshkin (Koshkin et al. 2016a), the distance of detection Asian Houbara is 1400 m (Fig.5). Our observation shows maximum distance to the bird as 1000 m. So the distance at least 2 km from each other point will aboid double count.

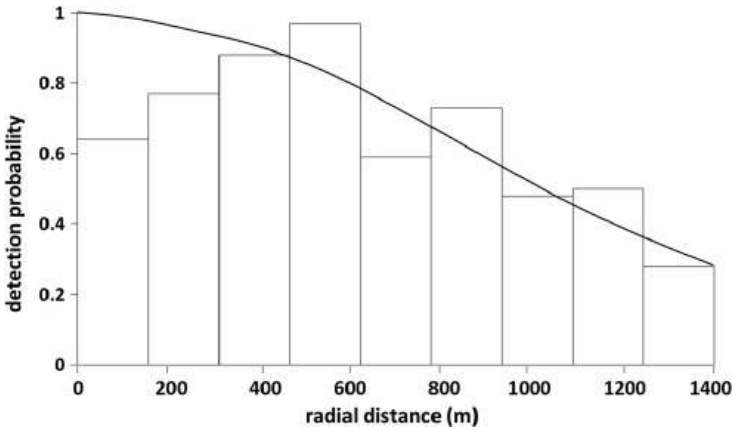


Figure 5 *Probability of detection of male houbara on point counts, based on the best MCDS model (including visit and time categorical as detectability covariates), with half-normal detection function (with cosine adjustment) fitted to visit-specific count data, truncated at 1400-m distance from the observer (Koshkin et al. 2016a).*

The habitats of Bash site were described by Dr. Natalya Beshko and used for analysis of Asian Houbara distribution on site (Fig.17). The main habitat on the site is sagebrush desert (Artemisia) (Fig.16), which covered sandy desert plain, sandy loamy desert plain, ridge of fixed

and semifixed sands and relic hills. The total area of potential habitat is 264 km^2.Cliffs and outcrops were not used in analysis as they are not suitable habitat of Asian Houbara.

Several linear objects are located in the Bash site: railway, transmission line, gaz pipeline. Farms and quarry are located there also. The preparation stage on windfarm is already started and about 20 met masts were installed on the site. (Fig.6)



Figure 6 *Transmission line locates in* Artemisia *desert*



Figure 7 *Asian Houbara: 1) female with 2 chicks (top left), 2) displaying male (top right), 3) bird observed under TL (down left) and 4) feathers (down right)*

The habitats of Dzhankeldy site were described by Dr. Natalya Beshko and used for analysis of Asian Houbara distribution on site (Fig. 19). There are a variety of plant communities there, but the main habitat of Asian Houbara on the site is sagebrush desert (Artemisia) and S. arbuscula desert (Fig.12, 13, 15). Cliffs and outcrops were not used in analysis as they are not suitable habitat of Asian Houbara.

Several linear objects are located in the Dzhankeldy site: road and transmission lines. Two villages are located nearby – Dzhankeldy and Kalaata. There are also mining areas on the site (Fig.14). A few met masts were installed on the site.

16 observation point were used for Asin Houbara survey in April and in May (Fig. 9).

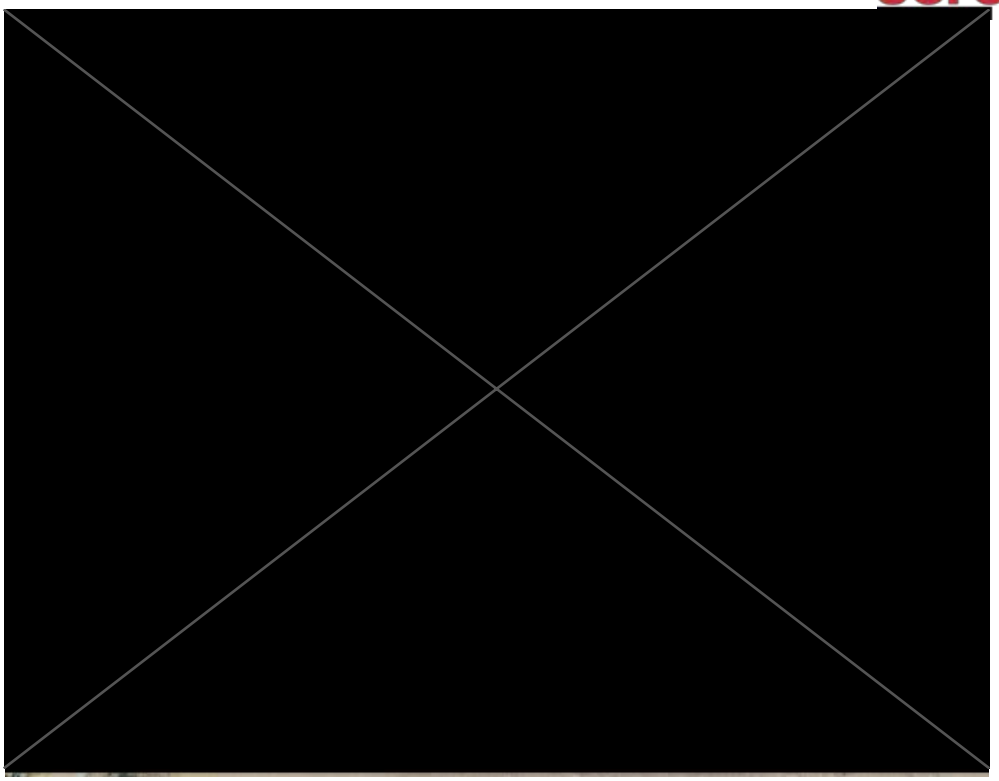


Figure 8 *HB observation points on the Bash site*

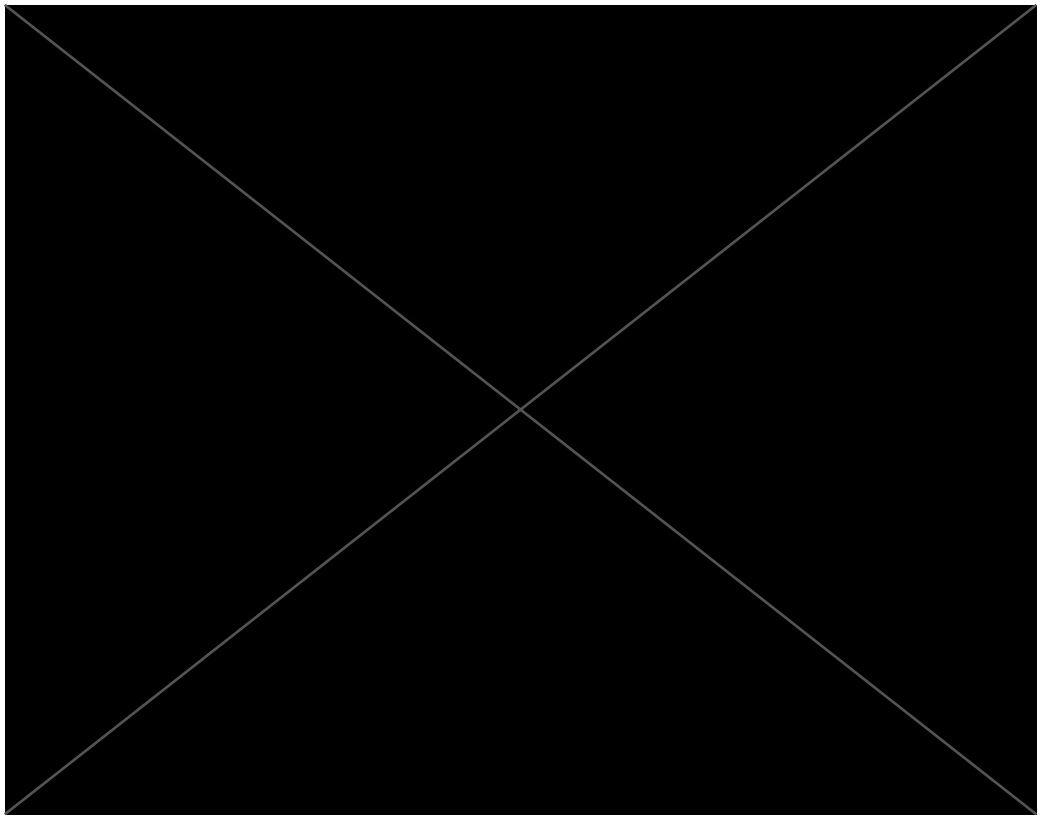


Figure 9 *HB observation points on the Dzhankeldy site*



Figure 10 *Morning observation on Dzhankeldy site*



Figure 11 *Asian houbara on April 14, 2021 on Dzhankeldy site*[redacted]



Figure 12 *Observation point HB3 on Dzhankeldy site*



Figure 13 *Observation point HB13 on Dzhankeldy site*



Figure 14 *Rubble mining on HB4 on Dzhankeldy site*



Figure 15 *Observation point HB11 on Dzhankeldy site*

Results

On the territory of Bash Windfarm Anna Ten and Valentin Soldatov observed 15 points in April, and 24 points - in May. The results of the observations in April and May 2021 on the territory of Bash Windfarm are presented in Tables 2 and 3. As total 3 displaying males were found in April and 1 - in May; no females in April and 1 female with 2 chicks in May; and 2 birds (unknown gender) in May. Also 1 bird was disturbed near TL, another bird flied from asphalt road. (Fig. 7)

Table 2 *Point count in April 2021 on Bash WF (Ayakagytma)*

№	Data	Time	[redacted]	[redacted]	biotop	Asian Houbara	Behaviour
1	17.04.2021	18:56	4[redacted]	[redacted]	Artemisia	1	male fly away under TL
2	19.04.2021	16:48-17:23	[redacted]	[redacted]	Sands Artemisia Calligonum Ferula	0	
3	19.04.2021	18:10-18:25	[redacted]	[redacted]	Sandy hills Artemisia	0	
4	20.04.2021	8:30-8:50	[redacted]	[redacted]	Sandy hills Artemisia	0	
5	20.04.2021	9:12-9:22	[redacted]	[redacted]	Clay gentle hills Artemisia	0	
6	20.04.2021	9:27-9:42	[redacted]	[redacted]	Clay gentle hills Artemisia	0	
7	20.04.2021	10:55-11:20	[redacted]	[redacted]	Clay hills Artemisia	0	
8	20.04.2021	16:14-16:35	[redacted]	[redacted]	Clay hills Artemisia	0	
9	20.04.2021	16:52-17:08	[redacted]	[redacted]	Clay, Artemisia	1	male displaying
10	20.04.2021	17:20-17:33	[redacted]	[redacted]	Clay, Artemisia	0	
11	21.04.2021	17:39-17:55	[redacted]	[redacted]	Artemisia	0	
12	21.04.2021	18:23-18:39	[redacted]	[redacted]	Artemisia	1	male displaying
13	21.04.2021	18:47-19:00	[redacted]	[redacted]	hills Artemisia	0	
14	22.04.2021	7:47-8:03	[redacted]	[redacted]	Artemisia	0	
15	22.04.2021	8:20-8:35	[redacted]	[redacted]	Artemisia	0	
16	22.04.2021	8:53-9:10	[redacted]	[redacted]	Artemisia	0	

Table 3 *Point count in May 2021 on Bash WF (Ayakagytma)*

№	Data	Time	[redacted]	[redacted]	biotop	Asian Houbara	Behaviour
1	27.05.2021	5:51	[redacted]	[redacted]	Artemisia desert	1	Flew from road
2	27.05.2021	5:57-6:35	[redacted]	[redacted]	Artemisia desert	1	probably female with chicks
3	27.05.2021	6:49-7:14	[redacted]	[redacted]	Artemisia desert	0	
4	27.05.2021	7:36-8:09	[redacted]	[redacted]	Artemisia desert	0	
5	27.05.2021	17:52-18:00	[redacted]	[redacted]	thick bushes of Saxaul	0	
6	27.05.2021	18:05-18:16	[redacted]	[redacted]	thick bushes of Saxaul	0	
7	27.05.2021	18:20-18:33	[redacted]	[redacted]	Open Artemisia desert	0	
8	27.05.2021	18:49-19:16	[redacted]	[redacted]	Open Artemisia desert	1	Displaying male
9	28.05.2021	19:29-19:52	[redacted]	[redacted]	Open Artemisia desert	0	
10	28.05.2021	6:06-6:36	[redacted]	[redacted]	Open Artemisia desert	0	
11	28.05.2021	6:58-7:15	[redacted]	[redacted]	Artemisia desert	1	shortly seen
12	28.05.2021	7:25-7:41	[redacted]	[redacted]	Artemisia desert	0	
13	28.05.2021	7:52-8:15	[redacted]	[redacted]	Artemisia desert	0	

14	28.05.2021	18:15-18:39	[redacted]	[redacted]	Artemisia desert	0	
15	28.05.2021	18:45-18:59	[redacted]	[redacted]	Artemisia desert	3	Female with 2 chicks
16	28.05.2021	19:17-19:41	[redacted]	[redacted]	Artemisia desert	0	
17	29.05.2021	7:00-7:22	[redacted]	[redacted]	Artemisia desert	0	
18	29.05.2021	7:35-7:57	[redacted]	[redacted]	Artemisia desert	0	
19	29.05.2021	8:06-8:25	[redacted]	[redacted]	Artemisia desert	0	
20	29.05.2021	8:35-8:54	[redacted]	[redacted]	Artemisia desert	0	
21	29.05.2021	17:25-17:46	[redacted]	[redacted]	Artemisia desert	0	
22	29.05.2021	18:12-18:37	[redacted]	[redacted]	Open Artemisia desert	0	
23	29.05.2021	18:49-19:00	[redacted]	[redacted]	observation bad - hills, high bushes	0	
24	29.05.2021	19:07-19-20	[redacted]	[redacted]	observation bad - hills	0	
25	29.05.2021	19:25-19:43	[redacted]	[redacted]	observation bad - hills	0	

On the territory of Dzhankeldy Windfarm Alisher Atakhodjaev and Ramzjon Sohibnazarov observed 16 points both in April and in May (Fig. 9). The results of the observations in April and May 2021 on the territory of Dzhankeldy Windfarm are presented in Tables 4 and 5. During the observations in this area in the spring of 2021, the 5 Houbara Bustard were seen. No displaying males were identified.

Table 4 *Point count in April 2021 on Dzhankeldy WF*

Data	**№ HB**	**Time**	[redacted]	[redacted]	**Biotop**	**Asian Houbara**	**Behaviour**
05.04.2021	HB 10	17:10-17:43	[redacted]	[redacted]	Dry slopes slightly overgrown with bushes	0	
07.04.2021	HB 15	07:20-07:45	[redacted]	[redacted]	Plains with gorges, Artemisia	0	
07.04.2021	HB 16	08:03-08:35	[redacted]	[redacted]	Rocky slopes with dry riverbeds	0	
10.04.2021	HB 4	07:30-08:05	[redacted]	[redacted]	Clay hills and plains, Artemisia, Ferula	0	
10.04.2021	HB 5	08:15-08:45	[redacted]	[redacted]	Stony and clay plains, Artemisia, Ferula	0	
11.04.2021	HB 6	07:23-07:52	[redacted]	[redacted]	Clay gentle hills Artemisia	0	
12.04.2021	HB 2	18:08-18:43	[redacted]	[redacted]	Plain Artemisia, Ferula	1	first ran, then flew away
14.04.2021	HB 1	08:55-09:34	[redacted]	[redacted]	Clay hills Artemisia	2	ran away in different directions
16.04.2021	HB 11	06:49-07:15	[redacted]	[redacted]	Slopes overgrown with shrubs of Artemisia	0	
16.04.2021	HB 12	07:30-08:02	[redacted]	[redacted]	Artemisia	0	
16.04.2021	HB 13	08:14-08:45	[redacted]	[redacted]	Plains, Artemisia	0	
22.04.2021	HB 3	06:15-06:45	[redacted]	[redacted]	Clay gentle hills Artemisia	1	didn't fly away, just left
23.04.2021	HB 7	07:02-07:34	[redacted]	[redacted]	Clay hills Artemisia	0	
23.04.2021	HB 8	07:55-08:20	[redacted]	[redacted]	Clay hills Artemisia	0	
23.04.2021	HB 9	08:32-09:05	[redacted]	[redacted]	Dry riverbeds, Artemisia, Ferula	0	

Table 5 Point count in May 2021 on Dzhankeldy WF

Data	№ HB	Time	[redacted]	[redacted]	Biotop	Asian Houbara	Behaviour
10.05.2021	HB 8	17:30-08:02	[redacted]	[redacted]	Clay hills Artemisia	0	
12.05.2021	HB 6	18:10-18:40	[redacted]	[redacted]	Clay gentle hills Artemisia	0	
13.05.2021	HB 13	05:25-05:55	[redacted]	[redacted]	Plains, Artemisia	0	
13.05.2021	HB 14	06:15-06:45	[redacted]	[redacted]	Plains with gorges, Artemisia	0	
13.05.2021	HB 15	07:00-07:33	[redacted]	[redacted]	Plains with gorges, Artemisia	0	
14.05.2021	HB 9	06:20-06:50	[redacted]	[redacted]	Dry riverbeds, Artemisia, Ferula	0	
14.05.2021	HB 11	07:08-07:35	[redacted]	[redacted]	Slopes overgrown with shrubs of Artemisia	1	Flying 10 meters above the ground
14.05.2021	HB 12	07:55-08:10	[redacted]	[redacted]	Artemisia	0	
15.05.2021	HB 1	06:15-06:45	[redacted]	[redacted]	Clay hills Artemisia	0	
15.05.2021	HB 2	07:04-07:35	[redacted]	[redacted]	Plain Artemisia, Ferula	0	
15.05.2021	HB 7	17:15-17:45	[redacted]	[redacted]	Clay hills Artemisia	0	
15.05.2021	HB 10	17:58-18:30	[redacted]	[redacted]	Dry slopes slightly overgrown with bushes	0	
16.05.2021	HB 4	06:40-07:10	[redacted]	[redacted]	Clay hills and plains, Artemisia, Ferula	0	
16.05.2021	HB 5	07:25-07:55	[redacted]	[redacted]	Stony and clay plains, Artemisia, Ferula	0	
19.05.2021	HB 3	17:45-18:15	[redacted]	[redacted]	Clay gentle hills Artemisia	0	

Density of this species according to data of M. Koshkin and his colleagues (2016) on Artemisia is 0.090 (0.081-0.1) birds (males)/km^2 (95% CI). The total area of this type of desert on Bash site is 264 km^2, so extrapolated male population in the study site is estimated 21-26 individuals, which when extrapolated to include females if the sex ratio was 1:1 (Combreau et al 2002) would give a total population of 42-52 breeding individuals.



Figure 16 *Artemisia (sagebrush) desert is main habitat for Asian Houbara in Bash*

The density of detected males according to our April survey is 0.022 males/km^2 (2 adult males on 15 points) at least in 4 times less than expected. And density of all birds in May 2021 is 0,027 birds/km^2 (4 adult bird on 24 points) which is in 5 times less. The calculation of population density based on surveys of the 1 season cannot be compared with the density calculated from the data of large-scale work carried out by University of East Anglia specialists during 10 years.

During analysis we found that all records of Asian Houbara in Bash are located in sandy desert plain, except the part with thick saxaul forest (yellow habitat, fig. 17). Also during observation in May we found that sandy loamy desert plain (especially in north western part of Bash site) covered with more thick low bushes of sagebrush (beige color habitat, fig. 17), this area has great food resource - with different lizards, Steppe agama and etc. So we propose that this site will be very attractive for Asian Houbara's broods during summer time.

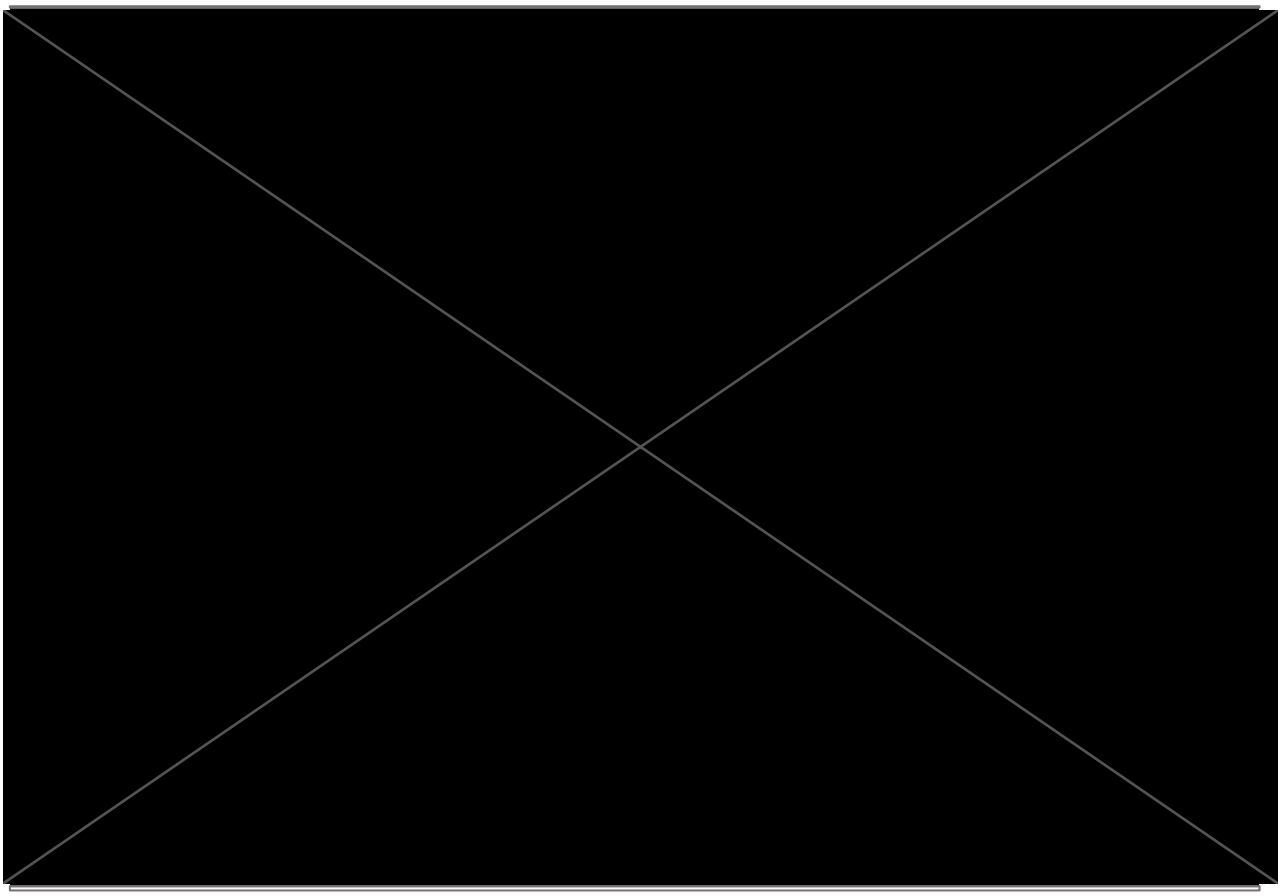


Figure 17 *Navoi Bash habitats and distribution of count points in April-May 2021*

This data allowed to define key breeding sites for Asian Houbara on Bash WF site. The comparing data of Asian Houbara records and locations of turbines (Fig 18) shows that there are 31 turbines located in key for Asian houbara sites during breeding season.

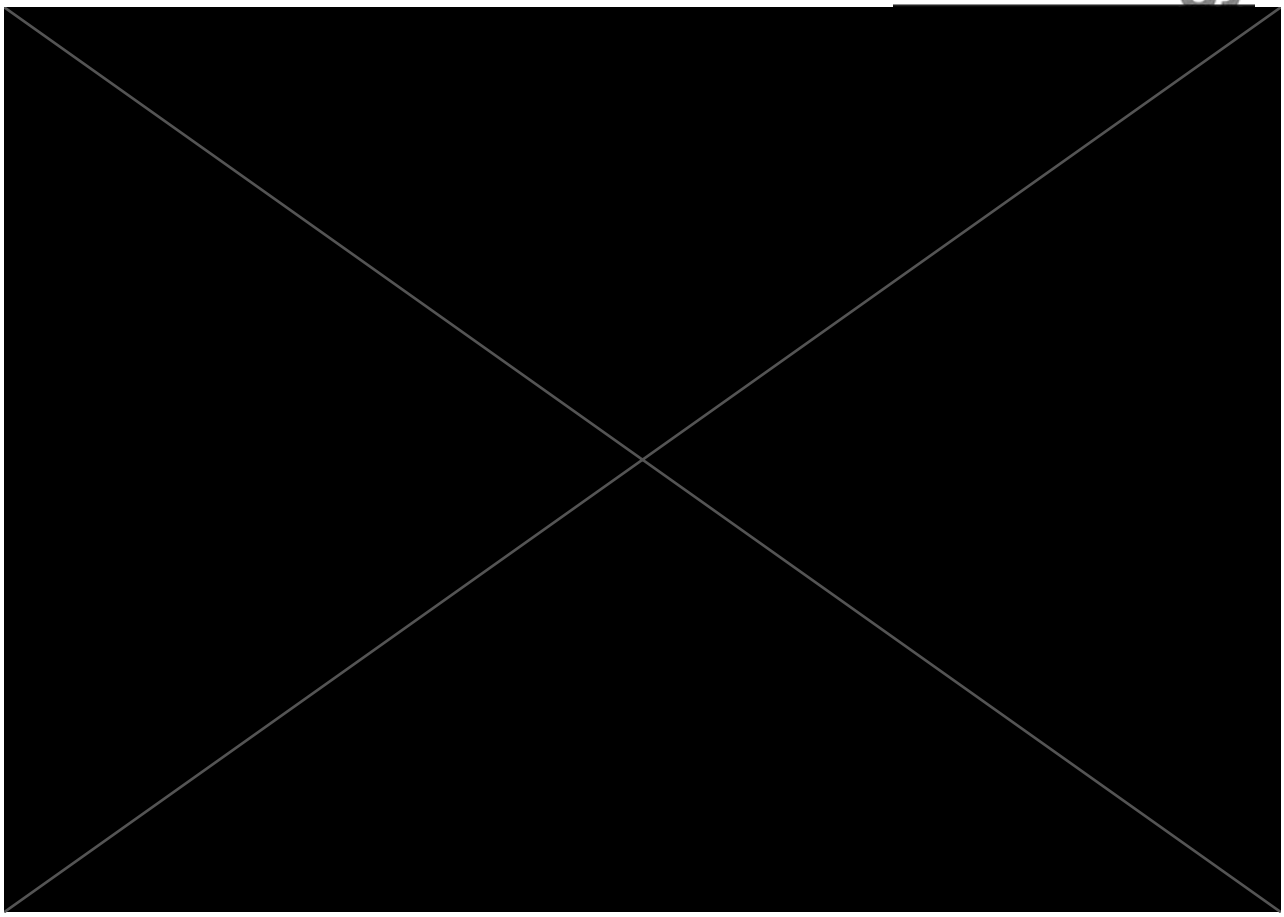


Figure 18 *Planned locations of wind turbines showed that key habitat for Asian Houbara*

The Asian Houbara's records (total 4 birds) under and near TL in Bash show that this TL is located in key breeding habitat. That mean that Asian Houbara annually lost here 3% of breeding population, according to R. Burnside (Burnside et al, 2015).

The density calculated from the data of University of East Anglia density varies greatly for the territory of Dzhankeldy Windfarm, because unlike Bash site, there are a lot of plant communities there: for example, the density on Artemisia desert is 0.090 (0.081-0.1) birds (males)/km^2 (95% CI) and on S. arbuscula desert is 0.146 (0.131-0.162) birds (males)/km^2 (95% CI) (see table 1). Besides, the study area of University of East Anglia covers only the part of Dzhankeldy Windfarm near Kalaata village, and not to the north of it. All the Asian Houbara recorded on Dzhankeldy Windfarm this Spring were found on Artemisia desert and according to N. Beshko mapping the Artemisia desert is the main habitat on Dzhankeldy project site now (Fig. 19). The total area of this type of desert on Dzhankeldy site is 317 km^2. So extrapolated male population in the study site is estimated 29 individuals, which when extrapolated to include females if the sex ratio was 1:1 (Combreau et al 2002) would give a total population of 58 breeding individuals. All the Asian Houbara recorded in Dzhankeldy were startled birds. Generally startled birds are not taken into account for density calculation, but the calculation was made based on April data and the density turned out to be 0.04 individuals per km^2, since there is no data on whether these were males or females, we assumed that they were both. This equals about 12.68 individuals for the entire Artemisia desert habitat on Dzhankeldy project site. Thus 21.8% of the potential Asian Houbara population was recorded.

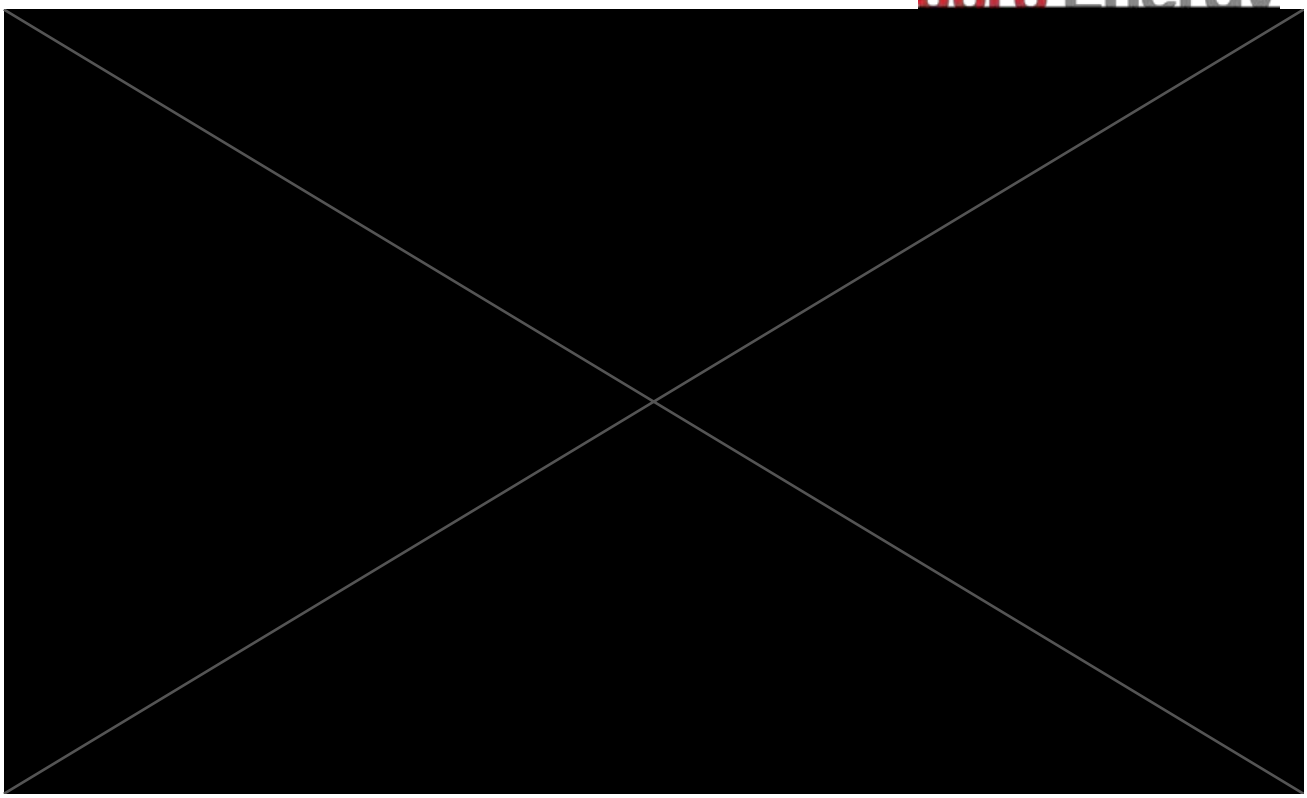


Figure 19 Dzhankeldy habitats and distribution of count points in April-May 2021

Summary

Asian Houbara is a highly terrestrial bird, capable of going long periods without taking flight, it is nonetheless a true long-distance migrant, with some individuals travelling more than 7,500 km over the course of a single year (Combreau et al. 2011).

Spring migration in frames of Kyzylkum desert starts in February (in warm winters), but usually in March and lasts till the end of April. The main direction of the flight is south-west. Autumn migration starts in September and lasts until mid-November. Asian Houbara is a rare wintering bird in southern Kyzylkum.

Asian Houbaras are often recorded as single bird or in small groups - from 3-5 to 10-15 individuals during migration. In Ecocenter “Djeyran” (Bukhara region), for instance, we observed the flock of 12 individuals in the 1st decade of October 2015.

Breeding season starts with males displaying in mid-March and goes till the end of July when broods break up and every bird stays on its own. The hatching of chicks usually starts from the beginning of May. The females often feeds with chicks near roads where they collect insects and reptiles. In Ecocenter “Djeyran” (Bukhara region) a female fed chicks till July 21 (chicks hatched on April 30) (Gubin, 2004). So the end of July could be also the end of breeding season.

Asian Houbaras are active during the day; apparently, it migrates during the day as well. In hot summer time they could feed also in moonlight nights and active only early morning and late evening (Gubin, 2004).

There is no information about the flight altitude of Asian Houbara, but it is well known that this bird fly low. Usually we observed Asian Houbaras flying away from the disturbance at the altitude of 30-50 m. In October 2015 in Ecocenter “Djeyran” (Bukhara region) the flight altitude of the flying flock of 12 Asian Houbaras that we observed was about 50-70m. During migration the altitude of flying birds is higher, it is known from literature that Asian Houbaras could fly above low mountains on altitude about 1500-2000 m (Combreau et al 2011).

1. The Asian Houbara is a species difficult to study due to its secretive lifestyle, on the one side, and one of the most vulnerable bird species to wind turbines and power lines collisions, on the other.
2. The bustard is a common non-numerous breeding and migrating species on the Bash site. Research in April and May 2021 confirmed the importance of the area for breeding, incubation and feeding of chicks. We could define the key breeding habitats for Asian Houbara on Bash site (fig.18).
3. Density of this species according to data of M. Koshkin and his colleagues (2016) on Artemisia is 0.090 (0.081-0.1) birds (males)/km^2 (95% CI). The total area of this type of desert on Bash site is 264 km^2, so extrapolated total population could be estimates as 42-52 breeding adults. The total area of this type of desert on Dzhankeldy site is 317 km^2. so extrapolated total population could be estimates as 58 breeding individuals.
4. The study of the death on a transmission line (Burnside et al. 2015) showed that Asian Houbaras were susceptible to collision with both high-and low - voltage powerlines and that the mortality estimated in 120 birds lost/year for Uzbekistan (95% CI: 0–350 birds). After hunting and poaching, therefore, powerlines are likely to be an important additional cause of mortality in the Asian Houbara. The analysis shows that TL on Bash site lies in key habitat and that mortality could be 3% every year.
5. This report is presented data analysis on breeding season of Asian Houbara and do not include information about migrating. However, well known that this site is lies on the main migration route of Asian Houbara (Fig.1).

Recommendations

1. Analysis showed that 31 wind turbines are planned to be built in key breeding habitat on Bash site. We suggest to provide protected alternative breeding habitat for Houbara Bustard as a compensatory measure.
2. Incorporate rigorous, operations-phase impact monitoring programs (for both collision and displacement impacts), as well as a flexible, “adaptive” biodiversity management program that includes a contingency to implement mitigation for Houbara Bustard, should unacceptable impact levels be detected during the Project’s operations phase. One benefit of this latter approach is that it could serve to fill a current scientific knowledge gap regarding whether or not HB is adversely impacted by the installation of wind turbines.
3. All existing power lines and planned turbines on both project sites need to be fitted with the appropriate insulation and bird flight deflectors, diverters and other which help birds to detect powerlines and turbines.
4. Taking into account research of the visual fields and blind spots of birds, including bustards, and the importance of vision in detecting obstacles conducted by G. R. Martin and J. M. Shaw (2010), and their main conclusion that in addition to visualization of obstacles on power lines or turbines there should be other methods of behavior management of birds, we suggest the modification of the habitat. The creation of the zone of thick bushes (saxaul and others) around turbines and power lines would not allow bustards to takeoff close to the obstacles and problem of blind zones will be solved as bird collisions mainly happen during takeoff and landing. This proposal need to be discussed among experts.
5. Reduce rubbish on sites. During the installation of met masts, household waste was left on the sites. Bustards can swallow trash and die.
6. Use existing roads, create new roads only when needed.
7. The construction of turbines on both project sites should not cover breeding season, especially in key habitats.

8. The future works of conservation Asian Houbara in Bash and Dzhankeldy windfarms should be planned with close contribution with leading experts (John Burnside) from University of East Anglia. As they have more deep and wide knowledge of ecology, behaviour, threats and migration measurues for this vulnerable species.

Publications

1. 800 Asian Houbaras Released Into the Wild (“На волю выпущены 800 дроф-красоток”) news by Gazeta.uz https://www.gazeta.uz/ru/2020/09/07/birds/
2. Alekseev, A. F. Asian Houbara Chlamydotis undulata macqueenii in the North-Western Kyzylkum (Дрофа-красотка (Chlamydotis undulata macqueenii) в Северо- Западных Кызылкумах) / / Zoological magazine. 59, 8, 1980 1263-1266.
3. Bakaev S. On the ecology of Asian Houbara in the lower reaches of the Zeravshan River (Бакаев С. К экологии дрофы-красотки в низовьях р. Зеравшан). // Ornitologiya. 1972. Issue 10. Pp. 324-326.
4. Bevanger, K., 1994. Bird interactions with utility structures – collision and electrocution, causes and mitigating measures. Ibis 136, 412–425.
5. Bevanger, K., 1998. Biological and conservation aspects of bird mortality caused by electricity power lines: a review. Biological Conservation 86, 67–76.
6. BirdLife International (2014) Review of the global conservation status of the Asian Houbara Bustard Chlamydotis macqueenii. Report to the Convention on Migratory Species Office – Abu Dhabi. Cambridge, UK: BirdLife International.
7. BirdLife International. 2019. Chlamydotis macqueenii (amended version of 2017 assessment). The IUCN Red List of Threatened Species 2019: e.T22733562A155425140. https://dx.doi.org/10.2305/IUCN.UK.2019-3.RLTS.T22733562A155425140.en. Downloaded on 28 May 2021.
8. Bogdanov, M. N. Essays on the nature of the Khiva oasis and the Kyzyl-Kum desert (Очерки природы Хивинского оазиса и пустыни Кызыл-Кум). Tashkent, 1882.
9. Burnside, Buchan, C., Salliss, D., Collar, N.J., Dolman, P.M. (2020) Releases of Asian houbara must respect genetic and geographic origin to preserve inherited migration behaviour: evidence from a translocation experiment. Royal Society Open Science, https://doi.org/10.1098/rsos.200250
10. Burnside, R.J., Collar, N.J., Dolman, P.M. (2017) Comparative migration strategies of wild and captive-bred Asian Houbara Chlamydotis macqueenii. Ibis 159,374–389. doi: 10.1111/ibi.12462
11. Burnside, R.J., Collar, N.J., Koshkin, M.A., Dolman, P.M. (2015) Avian powerline mortalities, including Asian Houbara Chlamydotis macqueenii, on the Central Asian flyway in Uzbekistan. Sandgrouse 37, 161–168.
12. Collar N. J., H. S. Baral, N. Batbayar, G. S. Bhardwaj, N. Brahma, R. J. Burnside, A. U. Choudhury, O. Combreau, P. M. Dolman, P. F. Donald, S. Dutta, D. Gadhavi, K. Gore, O. A. Goroshko, Hong C., G. A. Jathar, R. R. S. Jha, Y. V. Jhala, M. A. Koshkin, B. P. Lahkar, G. Liu, S. P. Mahood, M. B. Morales, S. S. Narwade, T. Natsagdorj, A. A. Nefedov, J. P. Silva, J. J. Thakuri, M. Wang, Y. Zhang & A. E. Kessler (2017) Averting the extinction of bustards in Asia. Forktail 33 (2017): 1–26.
13. Collar, N. J. (1996) Family Otididae. In: Del Hoyo J, Elliot A, Saragatal J, eds. Handbook of the birds of the World. Barcelona: Lynx Editions. pp 240–273.
14. Combreau, O., Qiao, J., Lawrence, M., Gao, X. J. Yao, J., Yang, W. and Launay, F. (2002) Breeding success in a Houbara Bustard Chlamydotis [undulata] macqueenii population on the eastern fringe of the Jungar Basin, People’s Republic of China. Ibis 144: E45–E56.
15. Drewitt, A.L., Langston, R.H.W., 2008. Collision effects of wind-power generators and other obstacles on birds. Year in Ecology and Conservation Biology 1134, 233–266.
16. Gaucher, P., Paillat, P., Chappuis, C., Saint Jalme, M., Lotfikhah, F. and Wink, M. (1996) Taxonomy of the Houbara bustard Chlamydotis undulata subspecies considered on the basis of sexual display and genetic divergence. Ibis 138: 273–282.
17. Goriup, P. D. (1997). The world status of the Houbara Bustard Chlamydotis undulata. Bird Conservation International 7: 373–397.

18. Guilherme, J.L., Burnside, R.J., Collar, N.J. Dolman, P.M. (2018) Consistent nest-site selection across habitats increases fitness of Asian Houbara. Auk 135, 192-205. doi: 10.1642/AUK-17-156.1
19. Janss, G.F.E., 2000. Avian mortality from power lines: a morphologic approach of a species-specific mortality. Biological Conservation 95, 353–359.
20. Janss, G.F.E., Ferrer, M., 2000. Common crane and great bustard collision with power lines: collision rate and risk exposure. Wildlife Society Bulletin 28, 675–680.
21. Jenkins, A.R., Smallie, J.J., Diamond, M., 2010. South African Perspectives on a Global Search for Ways to Prevent Avian Collisions with Overhead Lines, in press, doi:10.1017/S0959270910000122.
22. Koshkin, M., Collar, N.J., Dolman, P.M. (2014) Do sheep affect distribution and habitat of Asian Houbara Chlamydotis macqueenii? Journal of Arid Environments 103, 53-62. Doi: 10.1016/j.jaridenv.2014.01.002
23. Koshkin, M.A., Burnside, R.J., Collar, N.J., Guilherme, J.L., Showler, D.A., Dolman, P.M. (2016a) Effects of habitat and land use on breeding season density of male Asian Houbara Chlamydotis macqueenii. Journal of Ornithology 157, 811–823. doi: 10.1007/s10336-015-1320-4
24. Koshkin, M.A., Burnside, R.J., Packman, C.E., Collar, N.J., Dolman, P.M. (2016b) Effects of habitat and livestock on nest productivity of the Asian houbara Chlamydotis macqueenii in Bukhara province, Uzbekistan. European Journal of Wildlife Research 62, 447-459. doi: 10.1007/s10344-016-1018-9
25. Kreutzberg-Mukhina E. A. The current state of bustards in Uzbekistan (Современное состояние дрофиных птиц в Узбекистане) / / Bustards of Russia and neighboring countries. - 2003. Issue 2. Pp. 64-75.
26. Lakhanov Zh. L. Some features of adaptation of birds to life in the desert and ecological analysis of their nesting period (Некоторые черты приспособления птиц к жизни в пустыне и экологический анализ их гнездового периода). Samarkand State University, new series, issue 324. Samarkand, 1977. Pp. 33-46.
27. Martin, G. R. & Shaw, J. M. (2010) Bird collisions with power lines: failing to see the way ahead? Biol. Conserv. 143: 2695–2702
28. Martin, G.R. (2007) Visual fields and their functions in birds. Journal of Ornithology 148 (Suppl. 2), 547–562.
29. Martin, T. E., Nivet-Mazerolles, V., Landsmann, C., Guilleman, M., Dubos, J., Valejo, F. & Dombrovski, V. (2014) Bird records from south-central Uzbekistan, 2010–2013. Sandgrouse 36: 34–49.
30. Meklenburtsev R.N. The Bustard family, order Gruiformes (Семейство Дрофиные, отряд Журавлеобразные) / / Birds of Uzbekistan. Tashkent: FAN Publishing House, 1990. Vol. 2. Pp. 7-17.
31. Mukhina E. A. Asian Houbara (Chlamydotis undulata macqueenii) in the Bukhara special nursery, colony structure, population dynamics, ecology (Джек (Chlamydotis undulata macqueenii) в Бухарском спецпитомнике, структура поселения, динамика численности, экология) // Zoological magazine Vol. 69. Issue 7. 1990, pp. 107-116.
32. Mukhina E. A. Results and prospects of Asian Houbara's breeding in captivity, in a special nursery in Bukhara. // Ecology, protection and rational use of birds in Uzbekistan. (Итоги и перспективы вольерного содержания джека в Бухарском спецпитомнике. // Экология, охрана и рациональное использование птиц в Узбекистане.) Materials of the II Republican Ornithological Conference. - Tashkent: FAN, 1988. Pp. 44-46.
33. Newman, JR & SA Nesbitt. 2010. Potential for collisions and electrocutions associated with the proposed Talimarjan transmission line project, Uzbekistan. http://uz.denemetr.com/tw_files2/urls_2/88/d-87163/7z-docs/1.pdf
34. Ponomareva T. S. Asian Houbara (current state and prospects of conservation) (Пономарева Т.С. Джек (современное состояние и перспективы сохранения)). // Okhota i okhotnichye khozyaystvo, 1979. No. 11. Pp. 26-27.

35. Ponomareva T. S. Asian Houbara numbers in Bukhara region, according to bird monitoring data. (Численность джека в Бухарской области по данным авиучета.) // Bulletin of the Moscow Council of the society of naturalists. Department of Biology Vol. 90. Issue 1. 1985. Pp. 25-29.
36. Ponomareva T. S. Breeding behaviour and distribution of Asian Houbara (Chlamydotis undulata macqueenii) in nesting sites. (Репродуктивное поведение и распределение джека (Chlamydotis undulata macqueenii) в местах гнездования.) // Zoological magazine. 1983. Vol. 62. Issue 4. Pp. 592-603.
37. Ponomareva, T. (1985) The Houbara Bustard: present status and conservation prospects [in the USSR]. Okhota I okhotnich'e khozyaistvo 11 [1979]: 26–27.
38. Red Data Book of Uzbekistan (2019) Volume II. Animals. Tashkent. "Chinor ENK"- 392p.
39. Zakhidov T. Z., Mecklenburtsev R.N., Bogdanov O. P. Nature and the animal world of Central Asia (Природа и животный мир Средней Азии). Vol. II. Vertebrates (Позвоночные животные). - Tashkent: Shkituvchi, 1971
40. Zarudny, N. A. Birds of the Kyzylkum desert (Птицы пустыни Кызылкум) / / Materials for the knowledge of the fauna and flora of the Russian Empire. Department of Zoology. Moscow, 19 15. Issue 14. 149 p.
41. Gubin B.M. 2004. Houbara bustard – Almaty, 2004.
42. Combreau O, Riou S, Judas J, Lawrence M, Launay F (2011) Migratory Pathways and Connectivity in Asian Houbara Bustards: Evidence from 15 Years of Satellite Tracking. PLoS ONE 6(6): e20570. https://doi.org/10.1371/journal.pone.0020570

Juru Energy

COLLISION RISK MODELING ANALYSIS

Report Title	Bird Collision Risk Modeling Analysis for the Navoi-Bash Wind Energy Project
Scope	BIRDS VP
Areas Covered	BASH WF
Seasons Covered	SPRING 2020 / SUMMER 2020 / AUTUMN 2020 / WINTER 2021-2022
Notes	

Xenops Environmental, LLC
720 N. Plumer Avenue
Tucson, Arizona, USA 85719
713-670-6007
caleb@xenops-env.com



8 April, 2022 (revised 14 April, 2022)

Jushkinbek Ismailov
Juru Energy Ltd.

Dear Mr. Ismailov,

This memorandum contains Xenops Environmental, LLC (Xenops)' results for the final bird collision risk modeling (CRM), covering the entire, 12-month baseline bird Vantage Point survey period for the Navoi-Bash Wind Energy Project (NBWEP), per the contract between Xenops and Juru Energy, Ltd. (Juru). The NBWEP is a 500MW proposed wind energy facility to be located roughly 30 km W of the city of Kokcha in Vabkent District, Republic of Uzbekistan. This analysis was performed using the Band (2012) model, following Scottish Natural Heritage (SNH) Guidance recommendations, with collision avoidance rate parameters derived from an original review of technical literature, supported by expert judgment, where specific information on certain species of interest was not available in previously published studies. Input data for the modeling effort were provided by local ornithologist, Alisher Atakhodjaev, based on a total of 1095 hours of Vantage Point (VP) survey data collected by him and his associates from March 14 through November 23, 2020, plus an additional 315 hours of VP survey data for the winter season collected by Uzbek ornithologists Maksim Mitropolskiy and Luiza Mardonova from 1 December, 2021 through 8 March, 2022. Both sets of observations were collected at the same set of nine vantage points that cover the site. The present memo presents an analysis based on the currently selected turbine technology and layout, consisting of 79 Envision EN 171/6.5 turbines.

In summary, the CRM analysis indicated an overall low-moderate level of collision risk for sensitive bird species (tier 1 and tier 2 target species, a category that includes all raptors and all bird species with elevated national and/or international conservation/protected status) as well as other modeled bird species (additional large-bodied water bird species observed during the Vantage Point surveys) for the Project, based on a 12-month analysis spanning three years of data collection. No tier 1 target bird species are predicted to experience annual collision frequency greater than one fatality per 4 years (Steppe Eagle) under the most likely, empirically-based, collision avoidance rate scenarios modeled. Of the tier 2 target species modeled, only the Eurasian Kestrel (*Falco tinnunculus*), Common Crane (*Grus grus*), and Lesser Kestrel (*Falco naumanni*) were predicted to experience greater than one fatality per year under the most likely collision avoidance rate scenarios modeled (7.30, 2.23, and 1.31 collisions/year, respectively). Collision rates above 1 per year are predicted for some additional tier 1 and tier 2 target species under hypothetical, or most conservative collision avoidance scenarios modeled, as well as for some non-target bird species that were modeled. A detailed description of the methods and results of this analysis, including separate analyses and results for each of three seasons (spring, summer, autumn), is included below.

Please do not hesitate to contact me if you have any questions or comments regarding the analysis or results.

Sincerely,

Caleb Gordon, Ph. D.

12-Month Bird Collision Risk Modeling Analysis for the Navoi-Bash Wind Energy Project

Xenops Environmental, LLC
caleb@xenops-env.com 713-670-6007

Bird Collision Risk Modeling Analysis for the Navoi-Bash Wind Energy Project

Caleb Gordon and Phoebe Gordon, Xenops Environmental, LLC

Introduction

Collision Risk Modeling (CRM) using the model developed and refined by William Band, has become a standard method in international industry practice for obtaining quantitative predictions of estimated fatality rates of birds at wind farms, where suitable field observation data from Vantage Point (VP) surveys have been collected, conforming to the data input assumptions of the Band (2012) model, and following the guidance for such surveys and subsequent CRM promulgated by Scottish Natural Heritage (SNH 2017). The Band CRM predicts the expected collision rates of particular bird species or species groups at a given wind farm based on the specific dimensions and physical characteristics of the rotors, the birds, the wind farm, and the density of bird flights recorded in the wind farm area. The latter parameter is termed "bird density" and is derived from the VP survey data, further differentiated with regard to the altitude of the birds' flights relative to the rotor swept altitudes of the rotors. While the basic mechanism of the Band model does not incorporate the ability or tendency of birds to alter their flight paths in response to the presence of wind turbines (avoidance), such behavior is believed to be a very important dynamic influencing actual bird collision rates at wind farms (Cook et. al. 2012), hence a "collision avoidance rate" parameter is typically applied for each bird species or species group when conducting CRM for wind farms using the Band model (Whitfield and Madders 2006a, 2006b, Garvin et al. 2011, Band 2012, SNH 2014, Whitfield and Urquhart 2015).

We conducted CRM using the Band (2012) model for the purpose of obtaining quantitative predictions of collision risk during migratory, wintering, and breeding seasons for target bird species, as well as selected additional species, based on their observed patterns of seasonal abundance and use of airspace at the site, as described by observations gathered during VP surveys. We performed this analysis separately for each of four seasons, using VP survey data gathered at the NBWEP site during the corresponding season. Seasons were defined based on general timing of migratory, wintering, and breeding periods for target bird species within the region as follows:

Spring (migration): March 16[1]-May 15, 2020

Summer (breeding): May 16-August 31, 2020

Autumn (migration): September 1-November 23[2], 2020

Winter: December 1, 2021 – March 8, 2022

[1] VP surveys were initiated at the site on March 14, 2020, and the distinction between March 14 and March 16 is not significant relative to available information on species-specific migration and breeding phenology in the region, hence data for the Spring season CRM were inclusive of the period from March 14-May 15.

[2] End date reflects the actual last day in which VP surveys were conducted during the autumn season.

The VP survey protocols were developed with guidance from Xenops, and intended to conform with SNH (2017) recommendations, in order to provide input data suitable for performing CRM with the Band (2012) model. In addition to guidance in the form of an initial set of recommendations, Xenops also reviewed and commented on a draft workplan, geospatial information regarding the selection and placement of a suitable number of VP survey locations, and quarterly VP survey summary reports. Furthermore, Xenops also provided templates for the VP field survey data sheet and a data compilation spreadsheet, and instructions for monthly and quarterly VP survey reporting for use by the local ornithologists, Alisher Atakhodjaev (2020 surveys), Maksim Mitropolskiy and Luiza Mardonova (2021-2022 surveys), as well as requests for additional species-specific data inputs necessary for the CRM, based on field observations and expert judgment of the ornithologists who conducted the VP surveys. While this communication provides some assurance that the input data used for this CRM effort conforms to SNH guidance and the model's input assumptions, the reliability of the results of this CRM is ultimately dependent on the qualifications and diligence of the field observers, as well as the veracity of their results, as they were reported to Xenops by the Uzbek ornithologists.

The species for which CRM was conducted included all primary and secondary "target" bird species, as defined within the NBWEP bird and bat baseline survey workplan, for which at least one observation occurred during the VP surveys. The list of such species was developed with input from regional bird experts, and was intended to include all potentially high- or moderate- sensitivity bird species that could occur at the site, including all species of raptors and vultures, and all species with any elevated conservation status at the national (Uzbekistan Federal Government 2019) or international (IUCN Red List of Threatened Species) levels. Furthermore, certain target species that were not observed, or not observed flying within rotor swept height during the VP survey effort were, nonetheless, modeled using a hypothetical scenario in which one individual was observed flying within rotor swept altitudes in the N + 1 hour of survey effort, where N is the number of hours of VP survey effort actually conducted during a given season. The purpose of these modeled hypothetical scenarios was to generate an upper bound collision risk estimate or "worst case" scenario for certain high-sensitivity species, given the observed result of zero observations for such species in the actual VP Survey effort. Finally, we also modeled collision risk for selected non-target species of large-bodied water birds that were observed at least one time during the VP survey effort. The species included within the CRM for the NBWEP are shown in Table 1, along with their national and international conservation status, their Project-specific priority level[3], and the total number of VP survey observations that were included within the CRM analysis for each season[4].

[3] Project-specific priority levels are defined in the Project's workplan, and are based on consideration of likely susceptibility to wind farm impacts and likelihood of occurrence at the site, as well as national and international conservation (protected) status.

[4] Note that observations that were recorded outside of the maximum reliable observation radius were regarded as "incidental" observations, and were excluded from the analysis.

Table 1: Summary of conservation/sensitivity status and numbers of VP survey observations in each season for each bird species included within the Collision Risk Modeling analysis for the Navoi-Bash Wind Energy Project. Conservation/protected status are as follows: EN = Endangered; VU = Vulnerable; NT = Near Threatened; (blank) = Least Concern (IUCN) or not-listed nationally. Color-coding of species' project-sensitivity classification is as follows: pink = tier 1 target species; yellow = tier 2 target species; green = other (non-target) modeled species.

Scientific Name	English Common Name	Uzbek status[5]	IUCN status[6]	VP Observations			
				Spring	Summer	Autumn	Winter
Chlamydotis macqueenii[7]	Houbara Bustard	VU	VU	0 (1)	0 (1)	0 (1)	0 (1)
Neophron percnopterus	Egyptian Vulture	VU	EN	32	29	1	
Aegypius monachus	Cinereous Vulture	NT	NT			14	4
Clanga clanga	Greater Spotted Eagle	VU	VU				2
Aquila nipalensis	Steppe Eagle	VU	EN	8	5	12	9
Aquila chrysaetos	Golden Eagle	VU		12	2		3
Falco cherrug[8]	Saker Falcon	NT	EN	0 (1)	0 (1)	0 (1)	0 (1)
Tetrax tetrax	Little Bustard	VU	NT				1
Grus grus	Common Crane			236		372	
Pelecanus onocrotalus	Great White Pelican	VU				30	
Gyps fulvus	Eurasian Griffon	VU	NT	1		1	
Hieraaetus pennatus	Booted Eagle	VU		1			
Haliaeetus albicilla	White-tailed Eagle	VU					7
Circus aeruginosus	Eurasian Marsh-Harrier			18	19	17	3
Circus cyaneus	Hen Harrier			32	18	14	2
Accipiter badius	Shikra			1			

[5] Uzbekistan Federal Government, 2019. Uzbekistan Red List of Threatened Species

[6] IUCN Red List of Threatened Species, accessed 4 April, 2022

[7] Houbara Bustard was included in the CRM in spite of zero in-flight observations during the VP survey effort because of the high level of Project-specific priority for this species, because this species was observed on the ground on several occasions during the VP surveys, because the species was observed in flight during an incidental observation near the Project site, in the vicinity of Lake Ayakagytma, and because it is known to breed at the Project site. It was modeled under the hypothetical assumption that a single bird was seen flying within rotor swept height during the N+1 hour of VP survey observations in each season, where N = the number of hours of survey effort actually conducted in that season.

[8] Saker Falcon was included in the CRM in spite of zero in-flight observations during the VP survey effort because of the high level of Project-specific priority for this species, and because this species is known to have nested historically in the vicinity of the Project area, recorded nesting in the Ayakagytma cliffs as recently as 2011. It was modeled under the hypothetical assumption that a single bird was seen flying within rotor swept height during the N+1 hour of VP survey observations in each season, where N = the number of hours of survey effort actually conducted in that season.

Scientific Name	English Common Name	Uzbek status[5]	IUCN status[6]	VP Observations			
				Spring	Summer	Autumn	Winter
Accipiter nisus	Eurasian Sparrowhawk			10	2		1
Buteo buteo[9]	Common Buzzard					15	11
Buteo rufinus	Long-legged Buzzard			33	14	8	5
Falco naumanni	Lesser Kestrel	NT			20		
Falco tinnunculus	Eurasian Kestrel			15	25	53	13
Cygnus olor	Mute Swan					52	26
Tadorna ferruginea	Ruddy Shelduck				3	35	
Anas strepera	Gadwall					76	
Anas platyrhynchos	Mallard					188	
Anas crecca	Green-winged Teal					7	
Aythya fuligula	Tufted Duck					260	
Phalacrocorax pygmaeus	Pygmy Cormorant				8	24	
Phalacrocorax carbo	Great Cormorant					26	
Nycticorax nycticorax	Black-crowned Night-Heron				34	19	

Model Input Data

Data inputs for the CRM analysis were derived from the results of the VP surveys, as well as various additional sources, depending on the type of information needed. Specific sources and pertinent assumptions for each type of input data used in the CRM are described further below.

Turbine and wind farm data

Specific physical parameters of the turbines, towers, and wind farm used for the CRM are based on the specifications and layout provided by 5 Capitals Consulting in March, 2022, and are detailed and explained in Table 2.

Table 2: Model input data on physical characteristics of the turbines, towers, and wind farm configuration used in the Collision Risk Modeling for the Navoi-Bash Wind Energy Project, along with notes and explanations of each.

Parameter	Value(s) used in Modeling	Explanation
Turbine model	Envision EN 171/6.5	Provided by developer
# blades	3	from manufacturer's specifications
Rotation speed (rpm)	7.5	Representative intermediate value from range provided by developer
Rotor radius (m)	85.5	from manufacturer's specifications
Hub height (m)	100	Provided by developer
Percent of time operational	Monthly values ranging from 63.8% to 84.6%	Project specific data not available, representative values taken from SOSS example
Maximum blade width (m)	4.5	Calculated using proportion of blade length to blade width from similar turbine

[9] Includes observations assigned to "upland buzzard" and "eastern buzzard," as these forms are sometimes considered conspecific with Common Buzzard.

Parameter	Value(s) used in Modeling	Explanation
Pitch (degrees)	47.5	From manufacturer's specifications
# turbines	79	Provided by developer
latitude	40.6	Approximate midpoint of NBWEP area
Rotor swept altitude range (risk height, m)	14.5-185.5	Based on rotor diameter and hub height

Data on Physical and Observational Characteristics of Birds

In addition to bird densities derived from VP survey data, CRM using the Band model requires certain data on the physical and observational characteristics of each modeled species of bird. Input values used in the CRM analysis are presented in Table 3. As a general rule, data on physical dimensions of birds were derived from Cornell Lab of Ornithology's Birds of the World[10], while information specific to the VP survey observations, such as typical flight speeds, flight styles, and maximum effective radius of observation/identification were provided by the local ornithologists, based on their observations at the site and expert judgment.

Table 3: Physical and observational characteristics of each bird species included within the Collision Risk Modeling analysis for the Navoi-Bash Wind Energy Project. Color-coding of species' project-sensitivity classification is as follows: pink = tier 1 target species; yellow = tier 2 target species; green = other (non-target) modeled species.

Scientific Name	English Common Name	Length (m)	Wingspan (m)	Flight type[11]	Flight speed (m/sec)[12]	Detection distance (km) [13]
Chlamydotis macqueenii	Houbara Bustard	0.65	1.5	flapping	11.10	0.1
Neophron percnopterus	Egyptian Vulture	0.62	1.6	gliding	13.90	2
Aegypius monachus	Cinereous Vulture	1.1	2.73	gliding	19.40	1
Clanga clanga	Greater Spotted Eagle	0.65	1.68	Gliding	18.06	0.5
Aquila nipalensis	Steppe Eagle	0.70	1.9	gliding	18.06	0.5
Aquila chrysaetos	Golden Eagle	0.77	2.03	gliding	18.06	0.5
Falco cherrug	Saker Falcon	0.51	1.12	flapping	22.20	0.4
Tetrax tetrax	Little Bustard	0.44	1.1	Flapping	11.1	0.3
Grus grus	Common Crane	1.08	1.9	flapping	16.67	0.5
Pelecanus onocrotalus	Great White Pelican	1.56	2.93	flapping	15.60	2
Gyps fulvus	Eurasian Griffon	1.01	2.52	gliding	19.40	1

[10] https://birdsoftheworld.org/bow/home, accessed 5-9 August, 2020 and 4-14 January, 2021

[11] The model does not permit inclusion of multiple flight styles, hence only the most prevalent flight type was used for each species, based on the observations of A. Atakhodjaev

[12] Estimated for some species by A. Atakhodjaev, based on his observations during the VP survey effort. Some species flight speeds derived from Alerstam et. Al. (2007).

[13] Maximum reliable detection distance estimated for each species by A. Atakhodjaev based on his observations during the VP survey effort, and accounting not only for the distance at which each species could be reliably *observed*, but also the distance at which each species could be reliably *distinguished from other species* (identified)

Scientific Name	English Common Name	Length (m)	Wingspan (m)	Flight type[11]	Flight speed (m/sec)[12]	Detection distance (km) [13]
Hieraaetus pennatus	Booted Eagle	0.47	1.26	flapping	16.67	0.5
Haliaeetus albicilla	White-tailed Eagle	0.83	2.19	Gliding	16.67	1
Circus aeruginosus	Eurasian Marsh-Harrier	0.48	1.3	gliding	11.10	0.8
Circus cyaneus	Hen Harrier	0.46	1.1	gliding	11.10	0.5
Accipiter badius	Shikra	0.35	0.58	flapping	19.40	0.3
Accipiter nisus	Eurasian Sparrowhawk	0.34	0.67	flapping	19.40	0.2
Buteo buteo	Common Buzzard	0.46	1.23	gliding	16.70	0.4
Buteo rufinus	Long-legged Buzzard	0.53	1.3	gliding	16.70	0.4
Falco naumanni	Lesser Kestrel	0.31	0.66	flapping	13.90	0.2
Falco tinnunculus	Eurasian Kestrel	0.31	0.68	flapping	13.90	0.2
Cygnus olor	Mute Swan	1.4	2.2	flapping	16.20	2
Tadorna ferruginea	Ruddy Shelduck	0.66	1.3	flapping	22.20	1
Anas strepera	Gadwall	0.52	0.9	flapping	22.20	0.4
Anas platyrhynchos	Mallard	0.58	0.88	flapping	22.20	0.4
Anas crecca	Green-winged Teal	0.37	0.61	flapping	22.20	0.4
Aythya fuligula	Tufted Duck	0.44	0.69	flapping	22.20	0.4
Phalacrocorax pygmaeus	Pygmy Cormorant	0.5	0.85	flapping	15.20	0.5
Phalacrocorax carbo	Great Cormorant	0.9	1.45	flapping	15.20	1
Nycticorax nycticorax	Black-crowned Night-Heron	0.62	1.09	flapping	13.90	0.5

VP Survey Data Used to Derive Bird Density

Bird density inputs in CRM analysis represent the density of birds flying within the surveyed area at any given moment in time. These values are calculated based on the observations gathered during the VP surveys, and then further differentiated based on the percent of such flights that occurred within "risk height" equivalent to the range of altitudes swept by the turbines to be installed. The effective survey area is based on the area covered in a single VP survey, but varies among species based on the maximum effective detection radius (Table 3). For tier 1 target species and select tier 2 species, the paths and altitudes of each individual birds' flights were plotted every 15 seconds while the birds were inside of the specified observation radius (up to 2 km from the observer). For these species, the bird density was calculated by dividing the total number of fractional minutes of the birds' presence flying within the specified observation radius, by the total number of minutes of VP survey observation for the period, and then dividing that by the effective survey area, as function of the species-specific maximum reliable detection radius. For observations of most tier 2 target species and "other" species, only a single, representative flight height was recorded for each observation of an individual or flock observed flying within the specified observation radius during the VP surveys. In order to calculate the number of "observation minutes" for such species, we estimated representative observation durations by

calculating the time it would take a bird to transit the entire diameter of the surveyed area, defined by species-specific detection distances, at species-specific flight speeds (Table 3). Summaries of the VP survey data used to calculate bird density values in each season are presented in Tables 4-7. Note that these tables show cumulative values for each season, but in the CRM analysis, the data are broken down further by month.

Table 4: Observational data from the Vantage Point surveys used to derive bird density inputs for the **spring** season Collision Risk Modeling analysis for the Navoi-Bash Wind Energy Project. For all species, the total duration of observations was equivalent to the total of 291 hours, or 17,460 minutes of VP survey effort conducted at the Project during the spring season. Color coding of species by project-specific priority level follows that of Tables 1 and 3.

Scientific Name	English Common Name	Number of observations[14]	% at rotor swept height	Total bird minutes	Effective survey area (km^2)
Chlamydotis macqueenii	Houbara Bustard[15]	1	100	0.25	0.0314
Neophron percnopterus	Egyptian Vulture	32	100	80	12.6
Aquila nipalensis	Steppe Eagle	8	100	4	0.785
Aquila chrysaetos	Golden Eagle	12	100	6.25	0.785
Falco cherrug	Saker Falcon[16]	1	100	0.25	0.503
Grus grus	Common Crane	236	47.5	141	0.785
Gyps fulvus	Eurasian Griffon	1	100	1.25	3.14
Hieraaetus pennatus	Booted Eagle	1	100	0.5	0.785
Circus aeruginosus	Eurasian Marsh-Harrier	18	67.3	21.6	2.01
Circus cyaneus	Hen Harrier	32	49.2	24.0	0.785
Accipiter badius	Shikra	1	100	0.258	0.283
Accipiter nisus	Eurasian Sparrowhawk	10	75	1.72	0.126
Buteo rufinus	Long-legged Buzzard	33	92.7	13.2	0.503
Falco tinnunculus	Eurasian Kestrel	15	88.4	3.60	0.126

[14] Observations of birds that were further from the observer than the maximum detection distance are regarded as incidental observations, and were not included in the CRM analysis

[15] Note, this species was not actually observed during the spring VP surveys, but in order to characterize a "worst case" scenario, we modeled a hypothetical scenario in which a single bird is observed for 15 seconds, flying at rotor swept height during the 292nd hour of survey.

[16] Note, this species was not actually observed during the spring VP surveys, but in order to characterize a "worst case" scenario, we modeled a hypothetical scenario in which a single bird is observed for 15 seconds, flying at rotor swept height during the 292nd hour of survey.

Table 5: Observational data from the Vantage Point surveys used to derive bird density inputs for the **summer** season Collision Risk Modeling analysis for the Navoi-Bash Wind Energy Project. For all species, the total duration of observations was equivalent to the total of 438 hours, or 26,280 minutes of VP survey effort conducted at the Project during the summer season. Color coding of species by project-specific priority level follows that of Tables 1 and 3.

Scientific Name	English Common Name	Number of observations[17]	% at rotor swept height	Total bird minutes	Effective survey area (km^2)
Chlamydotis macqueenii	Houbara Bustard[18]	1	100	0.25	0.0314
Neophron percnopterus	Egyptian Vulture	29	100	78.8	12.6
Aquila nipalensis	Steppe Eagle	5	100	2.75	0.785
Aquila chrysaetos	Golden Eagle	2	100	1.75	0.785
Falco cherrug	Saker Falcon[19]	1	100	0.25	0.503
Circus aeruginosus	Eurasian Marsh-Harrier	19	67.3	22.8	2.01
Circus cyaneus	Hen Harrier	18	49.2	13.5	0.785
Accipiter nisus	Eurasian Sparrowhawk	2	75	0.344	0.126
Buteo rufinus	Long-legged Buzzard	14	92.7	5.60	0.503
Falco naumanni	Lesser Kestrel	20	76.1	4.80	0.126
Falco tinnunculus	Eurasian Kestrel	25	88.4	6.00	0.126
Tadorna ferruginea	Ruddy Shelduck	3	100	2.25	3.14
Phalacrocorax pygmaeus	Pygmy Cormorant	8	25	4.39	0.785
Nycticorax nycticorax	Black-crowned Night-Heron	34	100	20.4	0.785

[17] Observations of birds that were further from the observer than the maximum detection distance are regarded as incidental observations, and were not included in the CRM analysis

[18] Note, this species was not actually observed during the summer VP surveys, but in order to characterize a "worst case" scenario, we modeled a hypothetical scenario in which a single bird is observed for 15 seconds, flying at rotor swept height during the 439th hour of survey.

[19] Note, this species was not actually observed during the summer VP surveys, but in order to characterize a "worst case" scenario, we modeled a hypothetical scenario in which a single bird is observed for 15 seconds, flying at rotor swept height during the 439th hour of survey.

Table 6: Observational data from the Vantage Point surveys used to derive bird density inputs for the **autumn** season Collision Risk Modeling analysis for the Navoi-Bash Wind Energy Project. For all species, the total duration of observations was equivalent to the total of 366 hours, or 21,960 minutes of VP survey effort conducted at the Project during the autumn season. Color coding of species by project-specific priority level follows that of Tables 1 and 3.

Scientific Name	English Common Name	Number of observations[20]	% at rotor swept height	Total bird minutes	Effective survey area (km^2)
Chlamydotis macqueenii	Houbara Bustard[21]	1	100	0.25	0.0314
Aquila nipalensis	Steppe Eagle	12	100	6.75	0.785
Neophron percnopterus	Egyptian Vulture	1	100	2.75	12.6
Aegypius monachus	Cinereous Vulture	14	100	12.0	3.14
Falco cherrug	Saker Falcon[22]	1	100	0.25	0.503
Grus grus	Common Crane	372	47.5	186	0.785
Pelecanus onocrotalus	Great White Pelican	30	100	64.1	12.6
Gyps fulvus	Eurasian Griffon	1	100	0.860	3.14
Circus aeruginosus	Eurasian Marsh-Harrier	17	67.3	20.4	2.01
Circus cyaneus	Hen Harrier	14	49.2	10.5	0.785
Buteo buteo	Common Buzzard	15	100	6.00	0.503
Buteo rufinus	Long-legged Buzzard	8	92.7	6.80	0.503
Falco tinnunculus	Eurasian Kestrel	53	88.4	12.7	0.126
Cygnus olor	Mute Swan	52	100	107	12.6
Tadorna ferruginea	Ruddy Shelduck	35	100	26.3	3.14
Anas strepera	Gadwall	76	100	22.8	0.503
Anas platyrhynchos	Mallard	188	100	56.5	0.503
Anas crecca	Green-winged Teal	7	100	2.10	0.503
Aythya fuligula	Tufted Duck	260	100	78.1	0.503
Phalacrocorax pygmaeus	Pygmy Cormorant	24	25	13.2	0.785
Phalacrocorax carbo	Great Cormorant	26	100	28.5	3.14
Nycticorax nycticorax	Black-crowned Night-Heron	19	100	11.4	0.785

[20] Observations of birds that were further from the observer than the maximum detection distance are regarded as incidental observations, and were not included in the CRM analysis

[21] Note, this species was not actually observed during the autumn VP surveys, but in order to characterize a "worst case" scenario, we modeled a hypothetical scenario in which a single bird is observed for 15 seconds, flying at rotor swept height during the 367th hour of survey.

[22] Note, this species was not actually observed during the autumn VP surveys, but in order to characterize a "worst case" scenario, we modeled a hypothetical scenario in which a single bird is observed for 15 seconds, flying at rotor swept height during the 367th hour of survey.

Table 7: Observational data from the Vantage Point surveys used to derive bird density inputs for the **winter** season Collision Risk Modeling analysis for the Navoi-Bash Wind Energy Project. For all species, the total duration of observations was equivalent to the total of 315 hours, or 18,900 minutes of VP survey effort conducted at the Project during the winter season. Color coding of species by project-specific priority level follows that of Tables 1 and 3.

Scientific Name	English Common Name	Number of observations[23]	% at rotor swept height	Total bird minutes	Effective survey area (km^2)
Chlamydotis macqueenii	Houbara Bustard[24]	1	100	0.25	0.0314
Aegypius monachus	Cinereous Vulture	4	100	4.36	3.14
Clanga clanga	Greater Spotted Eagle	2	100	0.923	0.785
Aquila nipalensis	Steppe Eagle	9	91.2	6	0.785
Aquila chrysaetos	Golden Eagle	3	100	2	0.785
Falco cherrug	Saker Falcon[25]	1	100	0.25	0.503
Tetrax tetrax	Little Bustard	1	100	0.45	0.283
Haliaeetus albicilla	White-tailed Eagle	7	85.7	7	3.14
Circus aeruginosus	Eurasian Marsh-Harrier	3	69.0	3.60	2.01
Circus cyaneus	Hen Harrier	2	48.4	1.50	0.785
Accipiter nisus	Eurasian Sparrowhawk	1	69.2	0.172	0.126
Buteo buteo	Common Buzzard	11	100	4.40	0.503
Buteo rufinus	Long-legged Buzzard	5	93.3	2.00	0.503
Falco tinnunculus	Eurasian Kestrel	13	88.0	3.12	0.126
Cygnus olor	Mute Swan	26	100	53.5	12.6

Collision Avoidance Parameter

Published, validated collision avoidance (CA) parameters are not available for most of the target species we modeled at the NBWEP, yet the CA parameter is well-known to be a very important parameter in Band CRM analysis, with outcomes very sensitive to slight variation in CA (Cook et. al., 2012). For each species included within the CRM analysis for the NBWEP, we developed a "most realistic" CA parameter value, bounded by a "conservative" low parameter estimate, and a high estimate, reflecting an upper bound, based on a comprehensive review of available literature, interpreted with species- and site-specific information. The values used for each species are presented in Table 8, and then a brief explanation/justification is presented for each species below.

[23] Observations of birds that were further from the observer than the maximum detection distance are regarded as incidental observations, and were not included in the CRM analysis

[24] Note, this species was not actually observed within the maximum reliable observation radius during the winter VP surveys, but in order to characterize a "worst case" scenario, we modeled a hypothetical scenario in which a single bird is observed for 15 seconds, flying at rotor swept height during the 316th hour of survey.

[25] Note, this species was not actually observed during the winter VP surveys, but in order to characterize a "worst case" scenario, we modeled a hypothetical scenario in which a single bird is observed for 15 seconds, flying at rotor swept height during the 316th hour of survey.

Table 8: Collision avoidance parameters used in the bird Collision Risk Modeling analysis for the Navoi-Bash Wind Energy Project (see text for explanation and justification). Color coding of species by project-specific sensitivity categories follows that of previous tables.

Scientific Name	English Common Name	Lower bound value	Most realistic value	Upper bound value
Chlamydotis macqueenii	Houbara Bustard	0.95	0.99	0.995
Neophron percnopterus	Egyptian Vulture	0.99	0.9958	0.999
Aegypius monachus	Cinereous Vulture	0.98	0.99	0.995
Clanga clanga	Greater Spotted Eagle	0.981	0.9958	0.999
Aquila nipalensis	Steppe Eagle	0.981	0.9958	0.999
Aquila chrysaetos	Golden Eagle	0.981	0.9958	0.999
Falco cherrug	Saker Falcon	0.995	0.998	0.999
Tetrax tetrax	Little Bustard	0.95	0.99	0.995
Grus grus	Common Crane	0.95	0.99	0.995
Pelecanus onocrotalus	Great White Pelican	0.95	0.99	0.995
Gyps fulvus	Eurasian Griffon	0.98	0.99	0.995
Hieraaetus pennatus	Booted Eagle	0.981	0.9958	0.999
Haliaeetus albicilla	White-tailed Eagle	0.95	0.975	0.99775
Circus aeruginosus	Eurasian Marsh-Harrier	0.95	0.99	0.999
Circus cyaneus	Hen Harrier	0.95	0.99	0.999
Accipiter badius	Shikra	0.99	0.995	0.999
Accipiter nisus	Eurasian Sparrowhawk	0.99	0.995	0.999
Buteo buteo	Common Buzzard	0.978	0.995	0.999
Buteo rufinus	Long-legged Buzzard	0.978	0.995	0.999
Falco naumanni	Lesser Kestrel	0.873	0.969	0.999
Falco tinnunculus	Eurasian Kestrel	0.873	0.969	0.999
Cygnus olor	Mute Swan	0.98	0.997	0.998
Tadorna ferruginea	Ruddy Shelduck	0.95	0.99	0.995
Anas strepera	Gadwall	0.95	0.99	0.995
Anas platyrhynchos	Mallard	0.95	0.99	0.995
Anas crecca	Green-winged Teal	0.95	0.99	0.995
Aythya fuligula	Tufted Duck	0.95	0.99	0.995
Phalacrocorax pygmaeus	Pygmy Cormorant	0.95	0.99	0.995
Phalacrocorax carbo	Great Cormorant	0.95	0.99	0.995
Nycticorax nycticorax	Black-crowned Night-Heron	0.95	0.99	0.995

Eagles in the genera Aquila, Clanga, and Hieraaetus

The Golden Eagle (*Aquila chrysaetos*) has been the subject of several empirical research studies designed toward the objective of defining the most appropriate Collision Avoidance (CA) parameters for use with this species in modeling its risk of colliding with wind turbines, using the Band CRM. The low bound CA parameter value of 0.981 selected for the present analysis, corresponds to the lowest CA value estimated for Golden Eagles in Whitfield and Madders, 2006a, based on their analysis of data from wind farms in California. This value is likely to be conservative, underestimating the true extent of Golden Eagles' avoidance of collisions with wind turbines, as Whitfield and Madders (2009) suggested that a CA parameter of 0.99 is "precautionary" for this species. The CA value selected as "most likely" for the present analysis, 0.9958, corresponds to the mean adjusted CA estimate for Golden Eagles at the Altamont Wind Facility in California, USA, presented by Whitfield and Madders (2009), and is very close

to the median CA value for this species of 0.995, presented by Whitfield and Madders (2006a), and the value of 0.99 recommended by SNH (2018). The upper bound CA value of 0.999 for Golden Eagles was selected based on the upper bound of 100% CA presented for Golden Eagles by Whitfield and Madders (2006a). No published estimates of CA were available for Steppe Eagle (*Aquila nipalensis*), or Greater Spotted Eagle (*Clanga clanga*) so we used the same CA values for these species as we did for Golden Eagle, based on the similarity of these three similar species in terms of size, shape, behavior, and flight morphology. Although the Booted Eagle (*Hieraaetus pennatus*) is considerably smaller in size, we also used the same CA values for this species, in the absence of published CA estimates specific to Booted Eagles. This choice was justified both based on the generally similar ecology and flight morphology of *Aquila* and *Hieraaetus* eagles, and also based on a similar proportion of wind turbine collision events for Booted Eagles in relation to numbers of flights, and "at risk" flights, in a three year aggregate dataset from 13 wind farms in northern Spain, discussed in Whitfield and Madders (2006a).

White-tailed Eagle

For the White-tailed Eagle (*Haliaeetus albicilla*), a species whose behavior around, and risk of collisions with wind turbines has been extensively studied at the Smøla Wind Farm in coastal Norway, we used the value of 0.95 CA recommended by SNH (2018) as a lower bound, with values of 0.975 and 0.99775 for the most realistic, and upper bound CA values, respectively, based on empirically derived CA parameter values presented in May et. al. (2011) on the basis of satellite telemetry studies.

Egyptian Vulture

No published CA values were available for this species. However, the aggregate dataset from northern Spain discussed in Whitfield and Madders (2006a) indicates that this species has a strong tendency to avoid collisions with wind turbines, as zero collisions were detected in datasets containing 134 observations of Egyptian Vultures at wind farms, including 30 "at risk" flights. Based on this evidence, and the overall similar size and flight morphology between Egyptian Vulture and *Aquila* eagles, we applied the same CA values for Egyptian Vulture as we did for the *Aquila* eagles, with the exception of applying the slightly higher lower bound value of 0.99, described as a "precautionary" CA value for Golden Eagles by Whitfield and Madders (2009).

Eurasian Griffon and Cinereous Vulture

To represent the CA values for these two closely-related, morphologically and ecologically similar species, we used a range of values following the recommendations of Vasilakis et. al. (2016), who generated empirically-based estimates of 0.99 and 0.995 CA parameters for Cinereous Vulture in a study comparing flight behaviors and wind farm collision fatality rates at wind farms in eastern Mediterranean Europe. We used these two values as the median and upper bound CA values, respectively for these two species. Vasilakis et. al. (2016) also suggested that the CA value for Cinereous Vulture could be as low as 0.98 taking into account potential sources of error and uncertainty in their analysis, hence we used this as our lower bound CA parameter value for these two vulture species.

Saker Falcon

No published CA values were available for this species. To fill this gap, we used values empirically derived by Whitfield and Madders (2006a) for the ecologically similar congeneric species, Prairie Falcon (*Falco mexicanus*), with 0.995 representing the low bound, 0.998 representing the median CA value, and 0.999 substituted for 1 (100% avoidance) as the upper bound.

Eurasian and Lesser Kestrels

We represented these two kestrel species in the model using a range of CA values developed for the congeneric American Kestrel (*Falco sparverius*) based on the analysis of Whitfield and Madders (2006a), with 0.873 representing the lower bound CA value, 0.969 representing the median value (close to the value of 0.95 recommended for kestrels by SNH [2018], and 0.999 substituted for 1 (100% avoidance), as the upper bound CA value.

Harriers (genus Circus)

We used published CA values empirically derived for the Hen Harrier (*Circus cyaneus*) to represent the collision avoidance tendencies of both of the *Circus* species observed during the spring VP surveys at the NBWEP. In their review of wind farm impacts to Hen Harriers, Whitfield and Madders (2006b) concluded that a CA value of 0.95, used by some authors for this species, was "too low," suggesting that a value of 0.99 was "more realistic." Accordingly, we used the value of 0.95 as a lower bound CA value, and 0.99 as our most likely value, also noting that SNH (2018) recommends using a value of 0.99 for Hen Harrier. We used a CA value of 0.999 as the upper bound for modeling harrier collision risk in our analysis, corresponding to the median CA value for *Circus cyaneus* presented in Whitfield and Madders (2006a).

Hawks in the genus, Accipiter

No published CA values were available for either of the species in this genus that were recorded during the spring VP surveys at the NBWEP. For the purpose of the modeling effort, we based our hypothesized CA values for these species on very limited data on susceptibility of *Accipiter* species (including *Accipiter nisus*) to wind farm collisions presented in Whitfield and Madders (2006a), as well as the results of Garvin et al. (2011), which indicated a very strong tendency for *Accipiter* hawks to avoid collisions with wind turbines (100% avoidance), selecting CA values of 0.99, 0.995, and 0.999 to represent the low bound, most likely, and upper bound parameter estimates, respectively, for both of the *Accipiter* species we modeled.

Long-legged and Common Buzzards

No published CA values were available for these two species, hence we relied on CA values empirically derived for a congener, the Red-tailed Hawk (*Buteo jamaicensis*) by Whitfield and Madders (2006a), as follows: lower bound – 0.978; median value (or "most likely" in our analysis) – 0.995; upper bound – 0.999 (substituted for the value of 1, or 100% avoidance, presented as the upper bound CA value by Whitfield and Madders [2006a]).

Bustards, Cranes, Ducks, Cormorants, and Herons

No published CA values were available for the species included within our analysis, hence we based our hypothesized CA values for these species on the recommendations of Cook et. al. (2012), who suggested using 0.95, 0.99, and 0.995 as a range of CA values to represent species for which no species-specific information is available, which is generally consistent with the 2018 SNH recommendation to use a value of 0.98 for species whose CA parameters have not been empirically characterized. We note that all of these birds are large-bodied birds, and that this set of CA values is generally similar to, and a bit conservative in relation to CA values that have been empirically derived for a variety of morphologically similar species, such as swans, geese, and cormorants (Cook et. al. 2012).

Mute Swan

To represent the CA value of Mute Swan, we used published CA values from a study of wind turbine collision avoidance in Bewick's Swans (Whitfield and Urquhart 2015) to represent the most realistic and upper bound values (0.997 and 0.998, respectively), with a lower bound value of 0.98 deriving from results for Whooper Swans, presented in SNH (2010). This range encompasses, and is generally consistent with the SNH (2018) recommendation to use a value of 0.995 for swans.

Results and Conclusions

The results of the CRM analysis for the NBWEP are summarized in Tables 9-13. Tables 9-12 present each of the single season CRM results for each modeled species, and Table 13 presents the cumulative collision risk predictions of the CRM analysis for the entire, 12-month survey period. The cumulative results were generated by adding the values for the four seasons together for each species, hence preserving the natural between-season variation in risky flight behavior deriving from the empirical data.

Overall, the results of the CRM analysis indicate that the NBWEP has a low-moderate level of collision risk for sensitive bird species. No tier 1 target bird species are predicted to experience an annual collision frequency greater than one fatality per 4 years under the empirically-based, most likely collision avoidance rate scenarios modeled (Table 13). Three tier 2 target species were predicted to experience greater than one fatality per year (Eurasian Kestrel – 7.30 collisions/year; Common Crane – 2.23 collisions/year; Lesser Kestrel 1.31 collisions/year) under the most realistic collision avoidance rate scenarios modeled (Table 13). Additional collision rates above 1 per year were predicted for some tier 1 and tier 2 target species under hypothetical, or most conservative collision avoidance scenarios modeled, as well as for some non-target bird species that were modeled. More detailed discussions of bird collision risk for species in each of the Project's sensitivity categories are presented below.

Collision Risk in Tier 1 Target Species

The CRM analysis predicts that none of the tier 1 target species are likely to experience collision frequencies greater than 1 per 4 years (Steppe Eagle, Table 13), based on the CRM results for empirical scenarios using the most likely CA parameter values. *At this level of predicted collision risk, we conclude that the NBWEP has a low likelihood of generating severe, or population-level impacts to any of these species*. However, we note that predicted fatality rates greater than one fatality per 10 years (Egyptian Vulture, Cinereous Vulture) or per 20 years (Golden Eagle, Table 13) may be considered a significant concern, particularly for slow-reproducing, highly sensitive species that are known to be, or suspected of being susceptible to collisions with wind turbines, such as the three species named above. The strength and certainty of this conclusion are limited by the uncertainties inherent in predicting bird fatality rates using CRM, compounded in this case by the fact that species-specific CA parameter values have not been published for most of the high sensitivity bird species that could occur within the NBWEP area.

For Houbara Bustard, the modeled scenario with the most likely CA parameter predicted a collision rate of 1.22 collisions per year. However, it is important to note that this modeled scenario was based on hypothetical observations. In the actual VP data set, no observations of flying Houbara Bustards were recorded within the maximum reliable observation radius, hence the actual modeled collision risk for Houbara Bustard based on the empirical data set is zero. The hypothetical scenario modeled for this species (one observation of a single bird flying for 15 seconds within rotor swept height in the N+1 hour of observation in each season, where N is the number of hours of VP survey actually conducted in each

season) was included to provide an upper bound to possible collision risk for this species, given the strength of the sampling effort in the VP survey data set. To illustrate this point with another hypothetical example, if zero observations of a species had been recorded for a species, but only one hour of VP survey effort had been conducted, then the addition of one observation in the N+1 hour of survey effort would lead to a prediction of a very high collision rate, indicating that the actual data set, while predicting zero fatalities, does not eliminate the possibility of high collision risk for the species. It is interesting to note that there is a large difference between the predicted collision rates for the Houbara Bustard and Saker Falcon, the other tier 1 target species that was not actually observed during the VP survey effort, but was modeled under the same hypothetical scenario. The model predicted a much higher collision rate for the former than for the latter with identical survey effort, and identical sets of (4) hypothetical observations. This difference illustrates the importance of the other model inputs, including the CA parameter, flight speed, effective survey area, body length, and wingspan, most of which increase the overall collision susceptibility of the bustard in relation to the falcon. In the end, although both of these tier 1 target species are known to occur in the Project area or vicinity, hence collision risk must be regarded to be greater than zero, the results of the hypothetical scenarios modeled indicate that the 1410-hour VP survey effort was substantial enough to provide a positive indication that collision risk is truly low for Saker Falcon. For Houbara Bustard, collision rates as high as 1.22 per year cannot be ruled out by the existing data set.

Among tier 1 target species that were documented during the VP surveys, Greater Spotted Eagle, Steppe Eagle, Golden Eagle, and Egyptian Vulture, the CRM predicted fatality rates ranging from one per 4 years (Steppe Eagle) to one per 83 years (Greater Spotted Eagle), under the most realistic CA parameter values, suggesting that collision risk is low-moderate for all of these species. Under the most conservative modeled scenarios, the CRM predicts that collision rates could be as high as 0.933 collisions per year (Steppe Eagle, Table 13). Though these predicted fatality levels suggest that collision risk is low-moderate for all tier 1 target species, the substantial numbers of observations of four tier 1 species at the Project site (Egyptian Vulture, Cinereous Vulture, Steppe Eagle, Golden Eagle, Table 1), as well as the known susceptibility of Golden Eagles to collisions with wind turbines (AWWI 2019), and the presumed susceptibility of the other eagle and vulture species, based on their similar size, flight morphology, and behavior, indicate that potential impacts to these species should be considered an important risk factor to be monitored and managed for the Project. It is also worth noting that the effective survey area modeled for Egyptian Vulture was roughly 16x larger than it was for Steppe Eagle and Golden Eagle (Tables 4-7) based on the maximum reliable observation (and identification) radius of 2km for Egyptian Vulture, compared with 0.5 km for these two eagle species, reported by the local ornithologist who performed the surveys. This difference had the effect of neutralizing the effect of the considerably larger number of observations of Egyptian Vultures (62 observations) compared with Steppe Eagle (34 observations) or Golden Eagle (17 observations, Table 1). While we do not discount the difference in maximum observation radius among these species reported by the local ornithologist, we note that in light of the inherent residual uncertainty in CRM, the raw observational data (Table 1) contains an indication that of the tier 1 target species, Egyptian Vultures are the most prevalent in the area during the Spring through Fall seasons, the most likely to be breeding within the vicinity of the Project area, and potentially the most likely to be impacted by the Project.

Collision Risk in Tier 2 Target Species

For tier 2 target species, the CRM analysis predicts collision rates of 7.30 Eurasian Kestrel fatalities/year, 2.23 Common Crane fatalities/year, and 1.31 Lesser Kestrel fatalities/year (Table 13), with predicted fatality rates below one per year for all other tier 2 target species, under the most realistic collision avoidance scenarios modeled (Table 13). *At this level of predicted collision risk, the NBWEP does not raise a concern about potentially severe, or population-level impacts to any of these species*. It should be noted that although classified as tier 2 target species, the upper bounds of predicted impacts to Common Cranes or Eurasian Kestrels would not represent a significant conservation concern or serious impact of concern for the Project, as both of these species are very abundant, widespread species with very large global populations, and neither is classified with an elevated protected/conservation status at either the national or international levels. Nonetheless, we note that the predicted collision rates for tier 2 target species, as with tier 1 species, could be viewed as a concern. Furthermore, for both tier 1 and tier 2 species, the conclusion of low-moderate collision risk resulting from the present analysis must be tempered by acknowledgment of the inherent limitations and uncertainties of predicting collision fatality rates using CRM, compounded in this case by a lack of published CA parameter value estimates for most of the species modeled. For this reason, the possibility that some target species could experience concerning levels of collision fatality from the Project cannot be eliminated, and should be monitored and verified through operations-phase fatality monitoring. We also note that some species classified as tier 2 target species, including Eurasian Griffon, White-tailed Eagle, and Booted Eagle, have elevated conservation/protected status at the national and/or international levels (Table 1), and all pertain to taxonomic groups with known susceptibility to wind turbine collisions, hence they could be considered at a similar level of priority to the species presently classified as tier 1 target species. Of these three species, the highest predicted fatality rate was for White-tailed Eagle, with a prediction of one collision every 8 years under the most realistic collision avoidance rate scenario (Table 13), while the other two species were very rare, with predicted fatality rates of one per 150 years or rarer (Table 13).

Collision Risk in Other Species

For other (non-target) modeled bird species, the CRM analysis predicts collision rates of 2.66 collisions per year for Mallard, 2.15 per year for Tufted Duck, 0.938 per year for Gadwall, and 1.01 per year for Black-crowned Night-Heron, using the most realistic CA parameter values (Table 13). These four species are all very abundant, widespread species with large global and national populations, and no elevated conservation/protected status at national or international levels, hence these predicted collision rates do not raise a serious conservation concern or risk issue. Predicted collision rates for all other species under most realistic CA scenarios are below one per 6 years (Table 13). *At this level of predicted collision risk, the NBWEP does not raise significant concerns for potential impacts to any of these species*. As with collision rate predictions for target species, it must be noted here that the collision rates predicted for the non-target species we included within our analysis are subject to the uncertainties inherent to the enterprise of predicting collision risk using CRM. The predictions of low-moderate risk should be validated through operations-phase fatality monitoring, as very little is currently known about the susceptibility of birds to wind turbine collisions in Uzbekistan, and as fatalities to any species could constitute a significant risk issue if fatality rates are high enough.

Table 9: Estimated rates of collisions per **spring** season for bird species at the Navoi-Bash Wind Energy Project, predicted by Band Collision Risk Modeling analysis, under a range of Collision Avoidance (CA) parameter values (see Table 8 for specific CA values for each species, and see text for explanation and justification of each). Color coding of species by project-specific sensitivity level follows that of other tables.

English Common Name	Using lower bound CA value		Using most realistic CA value		Using upper bound CA value	
	Collisions/spring	Years to 1 spring collision	Collisions/spring	Years to 1 spring collision	Collisions/spring	Years to 1 spring collision
Houbara Bustard[26]	2.53	<1	0.505	1	0.253	3
Egyptian Vulture	0.152	6	0.0639	15	0.0152	65
Steppe Eagle	0.258	3	0.0570	17	0.0136	73
Golden Eagle	0.179	5	0.0397	25	0.00948	105
Saker Falcon[27]	0.0170	58	0.00682	146	0.00341	293
Common Crane	4.84	<1	0.966	1	0.484	2
Eurasian Griffon	0.00720	138	0.00360	277	0.00180	555
Booted Eagle	0.0240	41	0.00530	188	0.00126	793
Eurasian Marsh-Harrier	0.719	1	0.144	6	0.0144	69
Hen Harrier	1.20	<1	0.241	4	0.0241	41
Shikra	0.00924	108	0.00462	216	0.000924	1080
Eurasian Sparrowhawk	0.222	4	0.111	9	0.0222	45
Long-legged Buzzard	0.975	1	0.222	4	0.0445	22
Eurasian Kestrel	4.54	<1	1.11	<1	0.0353	28

[26] Note, this species was not actually observed in flight during the spring VP surveys, but in order to characterize a "worst case" scenario, we modeled a hypothetical scenario in which a single bird is observed for 15 seconds, flying at rotor swept height during the 292nd hour of survey.

[27] Note, this species was not actually observed during the spring VP surveys, but in order to characterize a "worst case" scenario, we modeled a hypothetical scenario in which a single bird is observed for 15 seconds, flying at rotor swept height during the 292nd hour of survey.

Table 10: Estimated rates of collisions per **summer** season for bird species at the Navoi-Bash Wind Energy Project, predicted by Band Collision Risk Modeling analysis, under a range of Collision Avoidance (CA) parameter values (see Table 8 for specific CA values for each species, and see text for explanation and justification of each). Color coding of species by project-specific sensitivity level follows that of other tables.

English Common Name	Using lower bound CA value		Using most realistic CA value		Using upper bound CA value	
	Collisions/summer	Years to 1 summer collision	Collisions/summer	Years to 1 summer collision	Collisions/summer	Years to 1 summer collision
Houbara Bustard[28]	0.624	1	0.124	8	0.0623	16
Egyptian Vulture	0.103	9	0.0435	22	0.0103	97
Steppe Eagle	0.124	8	0.0274	36	0.00651	153
Golden Eagle	0.0536	18	0.0119	84	0.00282	354
Saker Falcon[29]	0.00420	238	0.00168	595	0.000840	1190
Eurasian Marsh-Harrier	0.552	1	0.111	9	0.0111	90
Hen Harrier	0.495	2	0.0994	10	0.00994	100
Eurasian Sparrowhawk	0.0224	44	0.0111	90	0.00223	448
Long-legged Buzzard	0.424	2	0.0966	10	0.0192	52
Lesser Kestrel	5.21	<1	1.27	<1	0.0410	24
Eurasian Kestrel	9.16	<1	0.360	2	0.0721	13
Ruddy Shelduck	0.0478	20	0.00957	104	0.00478	209
Pygmy Cormorant	0.112	8	0.0225	44	0.0112	89
Black-crowned Night-Heron	3.45	<1	0.689	1	0.345	2

[28] Note, this species was not actually observed in flight during the summer VP surveys, but in order to characterize a "worst case" scenario, we modeled a hypothetical scenario in which a single bird is observed for 15 seconds, flying at rotor swept height during the 439th hour of survey.

[29] Note, this species was not actually observed during the summer VP surveys, but in order to characterize a "worst case" scenario, we modeled a hypothetical scenario in which a single bird is observed for 15 seconds, flying at rotor swept height during the 439th hour of survey.

Table 11: Estimated rates of collisions per **autumn** season for bird species at the Navoi-Bash Wind Energy Project, predicted by Band Collision Risk Modeling analysis, under a range of Collision Avoidance (CA) parameter values (see Table 8 for specific CA values for each species, and see text for explanation and justification of each). Color coding of species by project-specific sensitivity level follows that of other tables.

English Common Name	Using lower bound CA value		Using most realistic CA value		Using upper bound CA value	
	Collisions/autumn	Years to 1 autumn collision	Collisions/autumn	Years to 1 autumn collision	Collisions/autumn	Years to 1 autumn collision
Houbara Bustard[30]	1.44	<1	0.288	3	0.144	6
Egyptian Vulture	0.00195	512	0.000819	1220	0.000195	5120
Cinereous Vulture	0.141	7	0.0705	14	0.0141	70
Steppe Eagle	0.202	4	0.0445	22	0.0106	94
Saker Falcon[31]	0.00975	102	0.00388	257	0.00194	515
Common Crane	6.29	<1	1.25	<1	0.629	1
Great White Pelican	0.702	1	0.140	7	0.0702	14
Eurasian Griffon	0.00595	168	0.00297	336	0.00149	671
Eurasian Marsh-Harrier	0.412	2	0.0826	12	0.00826	121
Hen Harrier	0.342	2	0.0685	14	0.00686	145
Common Buzzard	0.434	2	0.0985	10	0.0197	50
Long-legged Buzzard	0.161	6	0.0365	27	0.00731	136
Eurasian Kestrel	16.4	<1	3.99	<1	0.129	7
Mute Swan	0.477	2	0.0714	14	0.0477	20
Ruddy Shelduck	0.687	1	0.137	7	0.0687	14
Gadwall	4.70	<1	0.938	1	0.470	2
Mallard	13.3	<1	2.66	<1	1.33	<1

[30] Note, this species was not actually observed in flight during the spring VP surveys, but in order to characterize a "worst case" scenario, we modeled a hypothetical scenario in which a single bird is observed for 15 seconds, flying at rotor swept height during the 367th hour of survey.

[31] Note, this species was not actually observed during the autumn VP surveys, but in order to characterize a "worst case" scenario, we modeled a hypothetical scenario in which a single bird is observed for 15 seconds, flying at rotor swept height during the 367th hour of survey.

English Common Name	Using lower bound CA value		Using most realistic CA value		Using upper bound CA value	
	Collisions/autumn	Years to 1 autumn collision	Collisions/autumn	Years to 1 autumn collision	Collisions/autumn	Years to 1 autumn collision
Green-winged Teal	0.281	3	0.0561	17	0.0281	35
Tufted Duck	10.8	<1	2.15	<1	1.08	<1
Pygmy Cormorant	0.229	4	0.0458	21	0.0229	43
Great Cormorant	0.709	1	0.141	7	0.0710	14
Black-crowned Night-Heron	1.63	<1	0.325	3	0.162	6

Table 12: Estimated rates of collisions per **winter** season for bird species at the Navoi-Bash Wind Energy Project, predicted by Band Collision Risk Modeling analysis, under a range of Collision Avoidance (CA) parameter values (see Table 8 for specific CA values for each species, and see text for explanation and justification of each). Color coding of species by project-specific sensitivity level follows that of other tables.

English Common Name	Using lower bound CA value		Using most realistic CA value		Using upper bound CA value	
	Collisions/winter	Years to 1 winter collision	Collisions/winter	Years to 1 winter collision	Collisions/winter	Years to 1 winter collision
Houbara Bustard[32]	1.17	<1	0.233	4	0.117	8
Cinereous Vulture	0.0852	11	0.0426	23	0.0213	46
Greater Spotted Eagle	0.0543	18	0.0120	83	0.00286	350
Steppe Eagle	0.305	3	0.0674	14	0.0161	62
Golden Eagle	0.0883	11	0.0195	51	0.00465	215
Saker Falcon[33]	0.00785	127	0.00314	318	0.00157	636
Little Bustard	0.213	4	0.0425	23	0.0213	47

[32] Note, this species was not actually observed in flight during the spring VP surveys, but in order to characterize a "worst case" scenario, we modeled a hypothetical scenario in which a single bird is observed for 15 seconds, flying at rotor swept height during the 367th hour of survey.

[33] Note, this species was not actually observed during the autumn VP surveys, but in order to characterize a "worst case" scenario, we modeled a hypothetical scenario in which a single bird is observed for 15 seconds, flying at rotor swept height during the 367th hour of survey.

English Common Name	Using lower bound CA value		Using most realistic CA value		Using upper bound CA value	
	Collisions/winter	Years to 1 winter collision	Collisions/winter	Years to 1 winter collision	Collisions/winter	Years to 1 winter collision
White-tailed Eagle	0.232	4	0.116	8	0.0104	95
Eurasian Marsh-Harrier	0.116	8	0.0232	43	0.00231	432
Hen Harrier	0.122	8	0.0244	40	0.00244	409
Eurasian Sparrowhawk	0.0258	38	0.0129	77	0.00258	387
Common Buzzard	0.366	2	0.0833	12	0.0167	60
Long-legged Buzzard	0.171	5	0.0389	25	0.00778	128
Eurasian Kestrel	5.83	<1	1.42	<1	0.0459	21
Mute Swan	0.231	4	0.0346	28	0.0231	43

Table 13: Estimated rates of collisions per **year** (12-months) for bird species at the Navoi-Bash Wind Energy Project, predicted by Band Collision Risk Modeling analysis, under a range of Collision Avoidance (CA) parameter values (see Tables 9-12 for predicted seasonal collision rates; see Table 8 for specific CA values for each species, and see text for explanation and justification of each). Color coding of species by project-specific sensitivity level follows that of other tables.

English Common Name	Using lower bound CA values for each season		Using most realistic CA values for each season		Using upper bound CA values for each season	
	Collisions/year	Years to 1 collision	Collisions/year	Years to 1 collision	Collisions/year	Years to 1 collision
Houbara Bustard[34]	6.11	<1	1.22	<1	0.611	1
Egyptian Vulture	0.257	3	0.102	9	0.0257	38
Cinereous Vulture	0.237	4	0.118	8	0.0365	27
Greater Spotted Eagle	0.0543	18	0.0120	83	0.00286	350
Steppe Eagle	0.933	1	0.206	4	0.0491	20
Golden Eagle	0.339	2	0.075	13	0.0179	56

[34] Note, this species was not actually observed in flight within the maximum reliable observation radius during the VP surveys, but in order to characterize a "worst case" scenario, we modeled a hypothetical scenario in which a single bird is observed for 15 seconds, flying at rotor swept height during the final hour of survey in each of the four seasons.

English Common Name	Using lower bound CA values for each season		Using most realistic CA values for each season		Using upper bound CA values for each season	
	Collisions/year	Years to 1 collision	Collisions/year	Years to 1 collision	Collisions/year	Years to 1 collision
Saker Falcon[35]	0.0412	24	0.0165	60	0.00823	121
Little Bustard	0.213	4	0.0425	23	0.0213	47
Common Crane	11.1	<1	2.23	<1	1.11	<1
Great White Pelican	0.702	1	0.140	7	0.0706	14
Eurasian Griffon	0.0131	76	0.00658	151	0.00329	303
Booted Eagle	0.0240	41	0.00530	188	0.00126	793
White-tailed Eagle	0.232	4	0.116	8	0.0104	95
Eurasian Marsh-Harrier	1.93	<1	0.386	2	0.0386	25
Hen Harrier	2.32	<1	0.464	2	0.0464	21
Shikra	0.00924	108	0.00462	216	0.000924	1080
Eurasian Sparrowhawk	0.289	3	0.144	6	0.0289	34
Common Buzzard	0.833	1	0.189	5	0.0379	26
Long-legged Buzzard	1.85	<1	0.421	2	0.0842	11
Lesser Kestrel	5.35	<1	1.31	<1	0.0421.	23
Eurasian Kestrel	38.2	<1	7.30	<1	0.301	3
Mute Swan	0.744	1	0.112	8	0.0744	13
Ruddy Shelduck	0.736	1	0.147	6	0.0736	13
Gadwall	4.70	<1	0.938	1	0.470	2
Mallard	13.3	<1	2.66	<1	1.33	<1
Green-winged Teal	0.281	3	0.0561	17	0.0279	35
Tufted Duck	10.8	<1	2.15	<1	1.08	<1
Pygmy Cormorant	0.341	2	0.0683	14	0.0334	29
Great Cormorant	0.709	1	0.142	7	0.0710	14
Black-crowned Night-Heron	4.14	<1	1.01	<1	0.507	1

[35] Note, this species was not actually observed in flight within the maximum reliable observation radius during the VP surveys, but in order to characterize a "worst case" scenario, we modeled a hypothetical scenario in which a single bird is observed for 15 seconds, flying at rotor swept height during the final hour of survey in each of the four seasons.

Literature Cited

Alerstam, T., Rosen, M., Backman, J., Ericson, G. P., Hellgren, O.. (2007). Flight Speeds among Bird Species: Allometric and Phylogenetic Effects, *PLoS Biology,* v. 5(8): e197.

American Wind Wildlife Institute (AWWI). (2019). AWWI Technical report: A summary of bird fatality data in a nationwide database. Washington, DC.

Band, B.. (2012). Using a collision risk model to assess bird collision risks for offshore windfarms. Produced for the Crown Estate, Strategic Ornithological Support Services programme, project SOSS-02, including accompanying Collision Risk spreadsheet and worked example.

Bevanger, K. (1998). Biological and conservation aspects of bird mortality caused by electricity power lines: a review. Biological Conservation 86:67-76.

Cook., A. S. C. P., A. Johnston, L. J. Wright, & N. H. K. Burton. (2012). A review of flight heights and avoidance rates of birds in relation to offshore wind farms. BTO research report #618. Prepared for the Crown Estate - Strategic Ornithological Support Services programme, project SOSS-02. The nunnery, UK.

Garvin, J. C., C. S. Jennelle, D. Drake, & S. M. Grodsky. (2011). Response of raptors to a windfarm. Journal of Applied Ecology, 48(1), 199–209. https://doi.org/10.1111/j.1365-2664.2010.01912.x

May, R., T. Nygård, E. L. Dahl, O., Reitan, K. Bevanger, 2011. Collision risk in white-tailed eagles – Modelling kernel-based collision risk using satellite telemetry data in Smøla wind power plant. NINA report #692. 22pp.

Scottish Natural Heritage. (2010). Use of Avoidance Rates in the SNH Wind Farm Collision Risk Model.

Scottish Natural Heritage. (2014). Guidance: Assessing impacts to pink-footed and graylag geese from small-scale wind farms in Scotland.

Scottish Natural Heritage. (2017). Recommended bird survey methods to inform impact assessment of onshore wind farms. V2, September, 2018.

Scottish Natural Heritage. (2018). Avoidance rates for the onshore SNH wind farm collision risk model. V2, March, 2017.

Uzbekistan Federal Government. (2019). Red List of Threatened Species (Russian).

Vasilakis, D. P., Whitfield, D. P., Schindler, S., Poirazidis, K. S., & Kati, V. (2016). Reconciling endangered species conservation with wind farm development: Cinereous vultures (Aegypius monachus) in south-eastern Europe. *Biological Conservation*, *196*, 10–17.

Whitfield, D. P.. (2009). Collision avoidance of golden eagles at wind farms under the 'Band' collision risk model. Report to Scottish Natural Heritage. Natural Research. Ltd. Banchory, UK.

Whitfield, D. P. & M. Madders. (2006a). Deriving collision avoidance rates for Red Kites (*Milvus milvus*). Natural Research Information Note 3. Banchory, UK.

Whitfield, D. P. & Madders, M.. (2006b). A Review of the Impacts of Wind Farms on Hen Harriers (Circus cyaneus) and an Estimation of Collision Avoidance Rates. Natural Research Information Note 1 (revised). Banchory, UK.

Whitfield, D. P. & B. Urquhart. (2015). Deriving an avoidance rate for swans suitable for onshore wind farm collision risk modelling. Natural Research Information Note 6. Banchory, UK.

Juru Energy

Summer-Autumn Bats Monitoring Report

Report Title	Summer-Autumn Bats Monitoring Report
Scope	BAT ACOUSTIC MONITORING
Areas Covered	BASH WF
Seasons Covered	SUMMER 2020 / AUTUMN 2020
Notes	

Juru Energy

Summer-Autumn Bats Monitoring Report

BASH WIND FARM:

BIRD AND BAT MONITORING

CLIENT: 5 CAPITALS

Date: December 2020

Juru Energy Ltd.

Suite 1, One George Yard, London

United Kingdom, EC3V 9DF

T: +44 207 859 4028

Contents

Introduction 4

Bat calls recording 5

Bat calls identification 7

Results 8

References 10

Attachments 11

Introduction

Wind farms can affect bats in the following ways:

I. Collision mortality, barotrauma and other injuries (although it is important to consider these in the context of other forms of anthropogenic mortality)
II. Loss or damage to commuting and foraging habitat, (wind farms may form barriers to commuting or seasonal movements, and can result in severance of foraging habitat);
III. Loss of, or damage to, roosts;
IV. Displacement of individuals or populations (due to wind farm construction or because bats avoid the wind farm area).

Bat surveys are required to quantify the impact of the project on key *Chiroptera* species to:

- inform final turbine layout;
- develop additional mitigation (*e.g*. turbine shut down, cutting speeds, habitat/species management plan); and
- form the baseline for any future required supplementary surveys and operational monitoring.

To ensure that bats are protected by minimising the risk of collision, an assessment of impact at a site requires a detailed appraisal of:

- The level of activity of all bat species recorded at the site assessed both spatially and temporally.
- The risk of turbine-related mortality for all bat species recorded at the site during bat activity surveys.
- The effect on the species' population status if predicted impacts are not mitigated.

The bat acoustic survey sampling effort in Uzbekistanis restricted to encompass 7-month warm season, extending from the beginning of April through the end of October, based on a lack of bat activity expected within the region during the colder months. It was proposed to conduct at least 3 complete nights of bat acoustic recording per location using Wildlife Acoustics Song Meter SM4 recoder, encompassing various locations spread throughout the Project area. We note that there is only a single species of bat occurring in Uzbekistan with an elevated conservation status according to IUCN, the Giant Noctule (*Nyctalus lasiopterus*, IUCN "Vulnerable"), and this species is unlikely to occur at the Navoi Bash wind farm site, as it is primarily a species of forested habitats, and primarily occurs to the west of the Caspian Sea[1]. Nonetheless, the risk of bat fatalities is typically a concern of international lenders, and bat acoustic surveys are typically recommended for wind-wildlife baseline surveys, as bat fatality rates are typically higher than bird fatality rates at wind energy facilities worldwide. As detectors were first installed only July 2, surveys for bats may need to resume in spring 2021 to fill in the gap in the active season.

[1] IUCN redlist of threatened species, accessed 27 March, 2020

Bat calls recording

We used the static bat detectors Wildlife Acoustics Song Meter SM4 to monitor bats activity in Summer and Autumn at six locations within the project's area (Table 1).

Table 1. Detector locations



Two detectors recorded data in Summer: July 2-7, July 14-21 and August 5-8 in five locations (Table 2).

Table 2 Relative abundance and frequency of occurrence of bats' calls in Summer

Species	Summer locations								
	2-1	2*	3-1	4	4	1	**All**	**Relative abundance, %**	**Frequency of occurrence, %**
Eptesicus bottae	9	0	72	95	4	1	**181**	22,9	80
Eptesicus serotinus	13	0	13	13	7	4	**50**	6,3	80
Hypsugo savii	0	0	0	0	1	0	**1**	0,1	20
Pipistrellus pipistrellus	19	6	168	212	37	29	**471**	59,7	100
Plecotus sp.	0	0	0	0	0	0	**0**	0,0	0
Rhinolophus sp.	2	0	13	18	51	0	**84**	10,6	60
Vespertilio murinus	0	0	1	1	0	0	**2**	0,3	40
Total:	43	6*	267	339	100	34	**789 (783**)**	100,0	
Dates of work	2-7. 07	07. 07*	14-17.07	18-21.07	5-8. 08	5-8. 08			
Days of work	6	1*	4	4	4	4	**23 (22**)**		
Acoustic activity index (AI)	7,2	6*	66,8	84,8	25,0	8,5	**35,6***		

Notes: * - This data is not included in the calculation of the average values as the detector has only been on for a few hours; ** - without data from location № 2.

In autumn one detector recorded data on October 5-15 at four locations (Table 3).

Usually, the detector worked at one location for several days (from 2 to 6 days, except location № 2, where detector worked only a few hours on July 7) before it was moved to another location.

We identified bat calls to species whenever it was possible (the term “bat call” refers to one file with any bat species signals). After that, for all bat calls we calculated "Relative abundance", "Frequency of occurrence" and acoustic activity index (AI). Relative abundance is the frequency at which calls of some species are recorded among all types of signals (excluding noise, social calls and unidentified calls).

Table 3 Relative abundance and frequency of occurrence of bats' calls in Autumn

Species	**Autumn locations**						
	1	2	3	4	**All**	**Relative abundance**, %**	**Frequency of occurrence, %**
Eptesicus bottae	0	0	0	0	0	0,0	0
Eptesicus serotinus	8	9	9	6	32	5,2	100
Hypsugo savii	0	0	0	0	0	0,0	0
Pipistrellus pipistrellus	50	183	171	53	457	73,8	100
Plecotus sp.	1	0	2	0	3	0,5	50
Rhinolophus sp.	0	0	0	0	0	0,0	0
Vespertilio murinus	34	33	46	14	127	20,5	100
Total:	**93**	**225**	**228**	**73**	**619**	100,0	
Dates of work	5-9.10	10-11.10	12-13.10	14-15.10			
Days of work	5	2	2	2	11		
Acoustic activity index (AI)	18,6	112,5	114	36,5	56,3		

The frequency of occurrence is the relative number of locations where signals of some species were registered. Acoustic activity index (AI) is the average number of calls registered on one location for one day of monitoring. The detector installed at location № 2 on July 7, worked only on for a few hours, so the data obtained than was not used in calculating the Relative abundance, Frequency of occurrence and acoustic activity index (AI).

Bat calls identification

According to the literature data on bats of Uzbekistan (Bogdanov, 1953; Benda et al., 2011; Gritsina et al., 2013) and semi-arid ecosystems, 9 species of bats are most likely to inhabit Navoi Bash project area: *Rhinolophus bocharicus, Eptesicus bottae, Eptesicus gobiensis, Eptesicus serotinus, Hypsugo savii, Myotis davidii, Nyctalus noctula, Pipistrellus pipistrellus, Vespertilio murinus.* Another 11 species known for Uzbekistan and neighboring countries may be found in Navoi Bash also (Benda et al., 2011; Benda et al., 2012; Dietz, Kiefer, 2016): *Rhinolophus ferrumequinum, Rhinolophus hipposideros, Plecotus sp.* (Gritsina et al., 2013)*, Myotis bucharensis, Myotis emarginatus, Myotis blythii, Myotis capaccinii, Barbastella caspica, Pipistrellus kuhlii, Otonycteris leucophaea, Tadarida teniotis.*

Some of bat species inhabiting Uzbekistan are found in Europe also, and the parameters of ultrasound calls are known for the European populations of these species (Barataud, 2015; Dietz, Kiefer, 2016). For some bats of Uzbekistan, the parameters of ultrasonic calls are not known. Determination of these species according ultrasonic calls is a complex process since manual identification is required. We used the Kaleidoscope Pro Auto Analysis program with "preloaded" parameters of ultrasonic calls from "European" bats found in Uzbekistan for the primary processing of audio recordings. After that, we used the BatSound 4 program to measure the signal parameters and check the identification of bat calls made by the Kaleidoscope Pro Auto Analysis program. We used bat calls parameters known for European bat populations (Barataud, 2015) and bat species from neighboring countries for Uzbekistan (Benda et al., 2012).

Results

The detectors recorded 1851 files in summer (6.92 GB) and 2052 files in autumn (10.8 GB) during the entire operation period. Among the summer files, 1062 were noise and insect sounds; and 789 were bat calls. Among the autumn files, 1427 were noise; and 619 were bat calls. We analyzed audio recordings and found calls of 6 bat species in summer and 4 bat species in autumn.

All the bat species, which calls were detected on the project area, are classified as LC ("Least concern", IUCN) are not considered threatened and are not included in the Red Book of the Republic of Uzbekistan (Uzbekistan ..., 2019).

Table 4. Relative abundance and frequency of occurrence of bats' calls

Species	Summer and Autumn**		
	All	Relative abundance, %	Frequency of occurrence, %
Eptesicus bottae	181	12,9	66,7
Eptesicus serotinus	82	5,8	100,0
Hypsugo savii	1	0,1	16,7
Pipistrellus pipistrellus	928	66,2	100,0
Plecotus sp.	3	0,2	33,3
Rhinolophus sp.	84	6,0	50,0
Vespertilio murinus	129	9,2	83,3
Total:	1402	100,0	
Days of work	33		
Acoustic activity index (AI)	42,5		

Note: ** - This data does not include data from location №2 on July 7.

Calls of 7 bats species were found on the project's area (Table 2-3): *Eptesicus bottae*, *Eptesicus serotinus*, *Hypsugo savii*, *Pipistrellus pipistrellus, Plecotus sp., Rhinolophus sp.* (CF-calls) and *Vespertilio murinus*. CF-signals of horseshoe bats (Barataud, 2015) had FME (Frequency of maximal energy) = 98-104 kHz. This is probably *Rhinolophus bocharicus*. This species is common in Uzbekistan, but absent in Europe, and parameters of ultrasound calls are not known for this species. The misidentification of calls from *Eptesicus serotinus* and *Eptesicus bottae* is possible because these species have similar and, probably, overlapping parameters of ultrasound signals (Benda et al., 2012). The frequencies of occurrence of calls of different species are shown in the Table 4.

Calls of *Pipistrellus pipistrellus* are dominant on the project's area. Calls of this species dominate in both summer and autumn. Calls of other bat species are much less common. A high density of the bat calls is typical for the project's area (total AI = 42.5 calls per day). AI have high level of variability on the project's area. Lowest level of AI is 7.2 bat calls/day at location № 2-1 in early July. The highest level of AI is 114 bat calls per day at location № 3 in the middle of October.

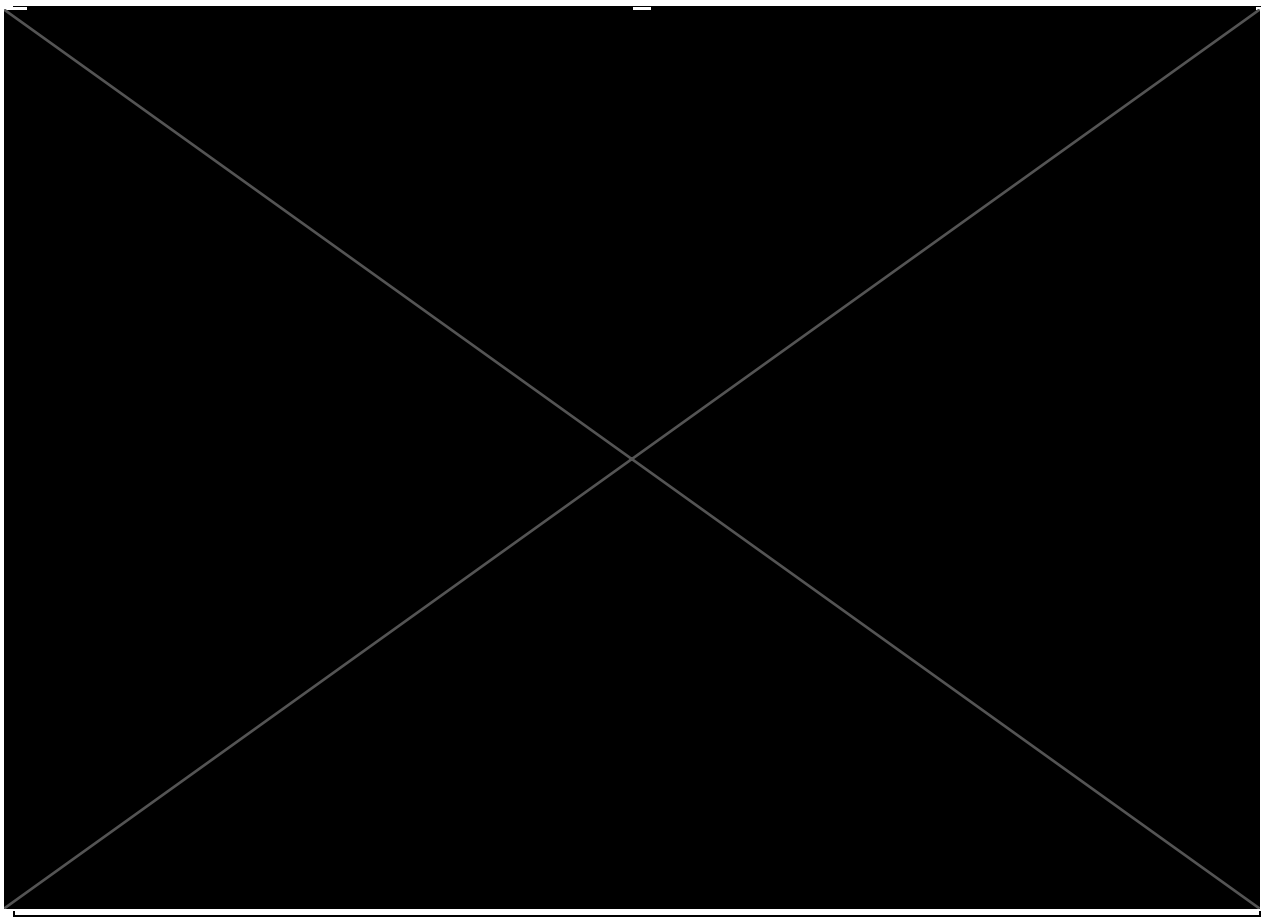
In general, the highest AI values are typical for the southern part of the project's area (locations 2 and 3). AI has variability in values over time. In particular, in location № 4 the AI value changed during the detector's operation period: from 85 bat calls/day in mid-July to 25 bat calls/day in early August and to 36.5 bat calls/day in mid-October. As the most abundant species, *P. pipistrellus* contributes the most to this high AI frequency. Moreover, the relative abundance of this species increases (Tables 2-3) from summer (59,7%) to autumn (73,8%). It is possible that this species migrates through the project area in October.

***P. pipistrellus* does not often fly at high altitudes and has an average risk of collision with wind turbine blades (Roemer et al., 2017; Wellig et al., 2018). However, it is necessary to take into account the possibility of massive displacements of *P. pipistrellus* on the project area when planning the installation of wind turbines (Wellig et al., 2018) and their operating mode (operating time, rotor speed, etc.).**

References

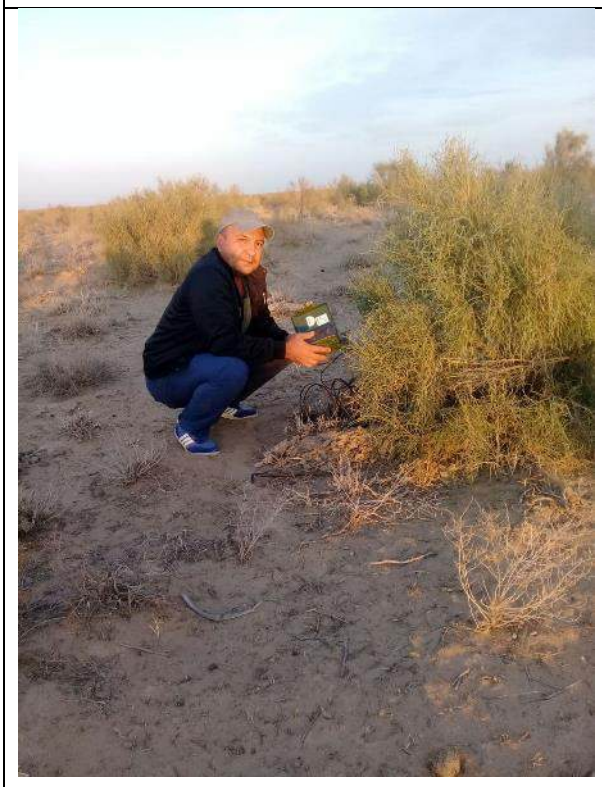
1. The Red Book of the Republic of Uzbekistan, Tashkent, 2019 (in Russian)
2. Bogdanov O. P. Bats // Issue 2 Mammals, volume III "Fauna of the Uzbek SSR". Tashkent: publishing house Of the Academy of Sciences of the Uzbek SSR, 1953. 159 p. (in Russian)
3. Gritsina M. A., Nuridjanov D. A., Abduraupov T. V. Some new finds of bats (Mammalia: Chiroptera) in Uzbekistan // Materials of the Republican scientific conference "Theoretical and applied problems of animal biodiversity conservation in Uzbekistan". Tashkent, 2013. Pp. 24-26 (in Russian)
4. Barataud, M., *Acoustic Ecology of European Bats. Species Identification, Study of Their Habitats and Foraging Behavior*, Paris: Biotope, Meze; Museum National d'Histoire Naturelle, 2015.
5. Benda V., Hanák V., Červený J. Bats (Mammalia: Chiroptera) of the Eastern Mediterranean and Middle East. Part 9. Bats from Transcaucasia and West Turkestan in collection of the National Museum, Prague. Acta Soc. Zool. Bohem. 2011. 75: 159–222.
6. Benda P., Faizolâhi K, Andreas M., Obuch J., Reiter A., Ševčík M., Uhrin M., Vallo P., Ashrafi S. Bats (Mammalia: Chiroptera) of the Eastern Mediterranean and Middle East. Part 10. Bat fauna of Iran. Acta Soc. Zool. Bohem. 2012. 76: 163–582.
7. Dietz, C. and Kiefer, A., *Bats of Britain and Europe*, London: UK: Bloomsbury Publ., 2016.
8. Gritsina M.A., Nuridjanov D.A., Abduraupov T.V. 2013. Some new findings of bats in Uzbekistan. – Plecotus et al. 15-16: 44–52 (In Russian with English Summary).
9. Roemer C., Disca T., Coulon A., Bas Y. (2017) Bat flight height monitored from wind masts predicts mortality risk at wind farms. Biological Conservation 215 (2017) 116-122.
10. Wellig SD, Nusslé S, Miltner D, Kohle O, Glaizot O, et al. (2018) Mitigating the negative impacts of tall wind turbines on bats: Vertical activity profiles and relationships to wind speed. PLOS ONE 13(3): e0192493. https://doi.org/10.1371/journal.pone.0192493













Bat detector installation on the project territory in Autumn

Juru Energy

Bats Monitoring Report

Report Title	Bats Monitoring Report
Scope	BAT ACOUSTIC MONITORING
Areas Covered	BASH WF
Seasons Covered	SPRING 2021 / SUMMER 2021
Notes	

Juru Energy

Bats Monitoring Report

BASH WIND FARM:

BIRD AND BAT MONITORING

CLIENT: 5 CAPITALS

Date: 2021

Denis Vasenkov, PhD

Juru Energy Ltd.

Suite 1, One George Yard, London

United Kingdom, EC3V 9DF

T: +44 207 859 4028

Contents

Introduction 4
Materials and methods 5
Bat calls identification 6
Results 9
References 17
Attachments 18

Introduction

Wind farms can affect bats in the following ways:

I. Collision mortality, barotrauma and other injuries (although it is important to consider these in the context of other forms of anthropogenic mortality)
II. Loss or damage to commuting and foraging habitat, (wind farms may form barriers to commuting or seasonal movements, and can result in severance of foraging habitat);
III. Loss of, or damage to, roosts;
IV. Displacement of individuals or populations (due to wind farm construction or because bats avoid the wind farm area).

Bat surveys are required to quantify the impact of the project on key *Chiroptera* species to:

- inform final turbine layout;
- develop additional mitigation (*e.g*. turbine shut down, cutting speeds, habitat/species management plan); and
- form the baseline for any future required supplementary surveys and operational monitoring.

To ensure that bats are protected by minimising the risk of collision, an assessment of impact at a site requires a detailed appraisal of:

- The level of activity of all bat species recorded at the site assessed both spatially and temporally.
- The risk of turbine-related mortality for all bat species recorded at the site during bat activity surveys.
- The effect on the species' population status if predicted impacts are not mitigated.

The bat acoustic survey sampling effort in Uzbekistanis restricted to encompass 7-month warm season, extending from the beginning of April through the end of October, based on a lack of bat activity expected within the region during the colder months. It was proposed to conduct at least 3 complete nights of bat acoustic recording per location using Wildlife Acoustics Song Meter SM4 recoder, encompassing various locations spread throughout the Project area. We note that there is only a single species of bat occurring in Uzbekistan with an elevated conservation status according to IUCN, the Giant Noctule (*Nyctalus lasiopterus*, IUCN "Vulnerable"), and this species is unlikely to occur at the Bash wind farm site, as it is primarily a species of forested habitats, and primarily occurs to the west of the Caspian Sea[1]. Nonetheless, the risk of bat fatalities is typically a concern of international lenders, and bat acoustic surveys are typically recommended for wind-wildlife baseline surveys, as bat fatality rates are typically higher than bird fatality rates at wind energy facilities worldwide.

[1] IUCN redlist of threatened species, accessed 27 March, 2020

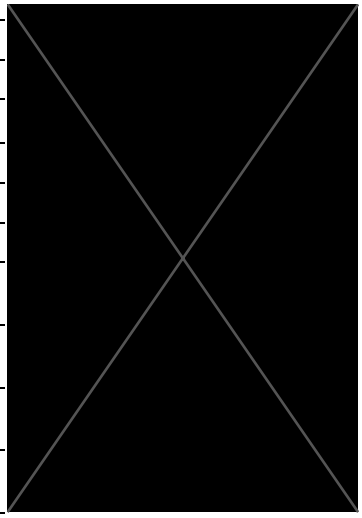
Materials and methods

Study area and bat calls recording

We used the stationary bat detectors Wildlife Acoustics Song Meter SM4 to monitor bats activity in Spring and Summer at seven locations (at the meteomast №6 – twice) within the project's area (Table 1, Fig. "Locations of bat detectors" in Attachments).

Table 1. Detector locations

№ location	Location name	Work days
1	St_Det_3-1_2021	4-6 April
2	St_Det_3-2_2021	8-18 April
3	St_Det_3-3_2021	19 April – 1 May
4	St_Det_6-1_2021	16 April – 1 May
5	Det_3-MM_8 (met mast 8)	2 May – 1 June
6	Det_6-MM_6 (met mast 6)	2 May – 1 June
7	Det_3-MM_6 (met mast 6)	2 June – 3 July
8	Det_6-MM_4 (met mast 4)	2-24 June



The detectors were installed on two weather masts the location of which was agreed with 5Capitals at an altitude of 45 meters by professional climbers for the period from May 2 to July 3. On June 2, the detectors were collected for data download and battery replacement and were returned to the 45 meters height the same day.

One detector (No. 3) recorded data from April 4 to May 1 (from buildings) at three locations (№1, 2, 3) from 18:00 to 7:00 every night (excluding 7 April). Further, this detector recorded data at a height of 45 m at meteorological mast №8 from May 2 to June 1 and at meteorological mast №6 from June 2 to July 3. Second detector (№6) recorded data on April 16 to May 1 at one location (№4) from 18:00 to 7:00 every night. Further, this detector recorded data at a height of 45 m at meteorological mast №6 from May 2 to June 1 and at meteorological mast №4 on June 2-24. Usually, the detector worked at one location for several nights (from 3 to 31 nights) before it was moved to another location (Tabl. 1).

Bats activity accounting by ultrasound calls was carried out by two methods in 2021. The first method consists in counting bats ultrasound calls by detectors installed at low height (ground surface or human buildings). This is a traditional technique. It was also applied at the first stage of the project in the second half of 2020 (Vasenkov, 2020). The second technique differs greatly in the height of the detector position. Ultrasound detectors were installed on meteorological masts at a height of 45 meters from the ground. Unfortunately, the results obtained by two differing methods cannot be correctly compared with each other. Therefore, we consider these data separately. The second

method is better suited for assessing the activity of bats during feeding and migrations in the air at an altitude (50-150 m) at which wind turbines operate (Rodrigues et al., 2015; Voigt et al., 2021). The first technique is less suitable for these purposes, especially when the registration bats ultrasound calls is carried out by detectors installed on human buildings. The main problem is that human buildings are often bats roosts in the desert zone, including on the territory of the planned Bash wind farm (Gritsina, 2021). Unfortunately, due to technical reasons, bats ultrasound calls registration in 2020 and April 2021 could not be carried out according to the second method, and it was done by first method only. Details are described in the Results section.

Bat calls identification

According to the literature data on bats of Uzbekistan (Bogdanov, 1953; Benda et al., 2011; Gritsina et al., 2013) and semi-arid ecosystems, 9 species of bats are most likely to inhabit Bash project area (Tabl. 2): *Rhinolophus bocharicus, Eptesicus bottae, Eptesicus gobiensis, Eptesicus serotinus, Hypsugo savii, Myotis davidii, Nyctalus noctula, Pipistrellus pipistrellus, Vespertilio murinus.*

Table 2. Species that were more likely to be found in the vicinity of Bash (semi-arid ecosystems).

Species	IUCN Red List	Red Book of the Republic of Uzbekistan (2019)	Parameters of ultrasound calls (references)	Basic flight information (flight height; presence of migrations)	Level of collision risk (Rodrigues et al., 2015)
Rhinolophus bocharicus	LC (Least concern)	absent	no data (CF-type calls)	Most likely, *R. bocharicus* is a sedentary species, foraging low from the ground (like other horseshoe bats (Bogdanov, 1953; Rodrigues et al., 2015)).	low
Eptesicus bottae	LC	absent	Benda et al. (2012); Hackett et al. (2016)	*E. bottae* ranks among small- to medium-sized bats hunting its prey mostly in a slow hawking flight (Benda et al., 2012); probably sedentary.	medium
Eptesicus gobiensis	LC	absent	no data	no data	medium
Eptesicus serotinus	LC	absent	Benda et al. (2012)	Medium height (Roemer et al., 2017); usually sedentary (Dietz, Kiefer, 2016)	medium
Hypsugo savii	LC	absent	Benda et al. (2012)	Medium height (Roemer et al., 2017); no data on migration (Dietz, Kiefer, 2016)	high
Myotis davidii	LC	absent	no data	Low height (Roemer et al., 2017); probably sedentary	low
Nyctalus noctula	LC	absent	Barataud (2015)	High height (Roemer et al., 2017); migrate (Dietz, Kiefer, 2016)	high
Pipistrellus pipistrellus	LC	absent	Benda et al. (2012)	Medium height (Roemer et al., 2017; Wellig et al., 2018); sedentary (Bogdanov, 1953; Dietz, Kiefer, 2016)	high
Vespertilio murinus	LC	absent	Barataud (2015)	High height (Roemer et al., 2017); usually migrate (Dietz, Kiefer, 2016)	high

Another 11 species known for Uzbekistan and neighboring countries (Tabl. 3) may be found in Bash also (Benda et al., 2011; Benda et al., 2012; Dietz, Kiefer, 2016): *Rhinolophus ferrumequinum, Rhinolophus hipposideros, Plecotus sp.* (Gritsina et al., 2013), *Myotis bucharensis, Myotis emarginatus, Myotis blythii, Myotis capaccinii, Barbastella caspica, Pipistrellus kuhlii, Otonycteris leucophaea*[2], *Tadarida teniotis.*

Table 3. The bat species that inhabiting in Uzbekistan and neighboring countries and can be found in the vicinity of Bash

Species	IUCN Red List	Red Book of the Republic of Uzbekistan (2019)	Parameters of ultrasound calls	Basic flight information (flight height; presence of migrations)	Level of collision risk (Rodrigues et al., 2015)
Rhinolophus ferrumequinum	LC	absent	Benda et al. (2012)	Low height (Roemer et al., 2017); sedentary (Dietz, Kiefer, 2016)	low
Rhinolophus hipposideros	LC	Vulnerable, declining 2(VU:D)	Benda et al. (2012)	Low height (Roemer et al., 2017); sedentary (Dietz, Kiefer, 2016)	low
Plecotus sp. (Gritsina et al., 2013)	?	absent	Barataud (2015), Benda et al. (2012)	Low height (Roemer et al., 2017); sedentary	low
Myotis bucharensis	DD (data deficient)	Critically Endangered 1(CR)	no data	Low height (Roemer et al., 2017); probably sedentary	low
Myotis emarginatus	LC	absent	Barataud (2015)	Low height (Roemer et al., 2017); sedentary (Dietz, Kiefer, 2016)	low
Myotis blythii	LC	absent	Benda et al. (2012)	Low height (Wellig et al., 2018); sedentary (Dietz, Kiefer, 2016)	low
Myotis capaccinii (?)	VU (vulnerable)	absent	Benda et al. (2012)	Low height; short to middle-range migrant (Dietz, Kiefer, 2016)	low
Barbastella caspica (*Barbastella leucomelas)*	LC	absent	Benda et al. (2012); Hackett et al. (2016)	Probably low height; probably sedentary	medium
Pipistrellus kuhlii	LC	absent	Benda et al. (2012)	Low height (Roemer et al., 2017); sedentary (Dietz, Kiefer, 2016)	high
Otonycteris leucophaea	DD	Vulnerable, naturally rare 2(VU:R)	no data	Low height (Benda et al., 2012), probably sedentary	unknown
Tadarida teniotis	LC	Vulnerable, naturally rare 2(VU:R)	Benda et al. (2012)	High height (Wellig et al., 2018); no seasonal migration, foraging area up to 100 km distant from summer roost (Dietz, Kiefer, 2016)	high

[2] *Otonycteris hemprichi* does not inhabit Uzbekistan (Benda et al., 2011). It was indicated for Uzbekistan in the 20th century (Bogdanov, 1953), when the species *Otonycteris hemprichi* and *Otonycteris leucophaea* were not distinguished. Only *Otonycteris leucophaea* lives in Uzbekistan according to the modern concepts of taxonomists. From a formal point of view, this is a different species. Most likely, the authors of the essays in the Red Book of Uzbekistan (2019), have not being familiar with modern data (for example, Benda et al., 2011), and wrote down an "outdated" name that currently refers to other animals found, for example, in Iran (Benda et al., 2012). Both of these species are found in Iran.

Some of bat species inhabiting Uzbekistan are found in Europe also, and the parameters of ultrasound calls are known for the European populations of these species (Barataud, 2015; Dietz, Kiefer, 2016). For some bats of Uzbekistan, the parameters of ultrasonic calls are not known (Tabl. 2, 3). Determination of these species according ultrasonic calls is a complex process since manual identification is required.

Identification of bats from the acoustic recordings gathered during this study was performed by Dr. Denis Vasenkov, a professional bat biologist affiliated with the A. N. Severtsov Institute of Ecology and Evolution of the Russian Academy of Sciences. Dr. Vasenkov's experience includes studying bats for about 20 years, including 10 years working with time expansion and real-time bat detectors. Dr. Vasenkov worked with bats and their ultrasonic calls from various regions of Russia (European and Asian parts), Ethiopia and Vietnam. Dr. Vasenkov has experience in analyzing bats ultrasound calls using ***BatSound***, ***SonoBat*** and ***Kaleidoscope*** software. We used the Kaleidoscope Pro Auto Analysis program with "preloaded" parameters of ultrasonic calls from "European" bats found in Uzbekistan for the primary processing of audio recordings. After that, we used the BatSound 4 program to measure the call parameters and check the identification of bat calls made by the Kaleidoscope Pro Auto Analysis program. We used bat calls parameters known for European bat populations (Barataud, 2015) and bat species from neighboring countries for Uzbekistan (Benda et al., 2012).

Additionally, we used bat calls parameters of *Rhinolophus bocharicus* and *Eptesicus bottae ognevi* recorded our colleagues during fieldwork (Gritsina, unpubl.). Colleagues searched for bats' roosts in the vicinity and on the territory of Bash Wind Farm in the spring and summer of 2021 (Gritsina, 2021). One species of bats, the Common pipistrelle bat (*Pipistrellus pipistrellus*), have been found as a result of these fieldwork.

We identified bat calls to species whenever it was possible (the term "bat call" refers to one file with any bat species calls). After that, for all bat calls we calculated "Relative abundance" and acoustic activity index (AI). Relative abundance is the frequency at which calls of some species are recorded among all types of calls (excluding noise, social calls and unidentified calls).

Acoustic activity index (AI) is the average number of calls registered on one location for one day of monitoring. We used data of ultrasound detectors from meteorological masts on days with average activity of bats to calculate the "Relative abundance" and acoustic activity index (AI) (Table 5).

Results

The detectors recorded 16668 files (63.2 GB) during the entire operation period (Tabl. 4). Most of the files contained noises, not bats ultrasound calls. Therefore, an automatic filtering of calls from noise was carried out. Noisy files were excluded from work.

Table 4. The total number of files recorded by passive detectors in locations.

Location name	Amount	
	files	Gb
St_Det_3-1_2021	115	0,7
St_Det_3-2_2021	1127	6,09
St_Det_3-3_2021	2977	11,9
St_Det_6-1_2021	1664	5,4
Det_3-MM_8 (met mast 8)	4801	21,2
Det_6-MM_6 (met mast 6)	2718	5,96
Det_3-MM_6 (met mast 6)	2003	9
Det_6-MM_4 (met mast 4)	1263	2,95
Total:	**16668**	**63,2**

We analyzed bats calls number change at all locations during the period of operation of the detectors. The activity of bats varied greatly in different locations.

Bats activity according to the data collected "from the buildings"

The activity of bats was small, but increased from April 4 to April 6 in the location St_Det_3-1. Bats calls were recorded here from 2 to 16 times per night (Fig. 1). Bat calls were usually more frequent in other locations. The bats' roosts were probably located near these locations, and, possibly, in the same buildings as the detectors. The activity of bats was high and irregular (Fig. 1) at locations St_Det_3-2 (8-18 April) and St_Det_3-3 (19 April – 1 May) in April.

The St_Det_3-2 detector recorded bats activity increase from April 8 to 18. Bats activity varied from 5 to 188 calls per night during this period. In next location, where this detector worked (St_Det_3-3), no stable dynamics of bats activity was noted. However, a strong variability of bats activity was recorded. It varied from 2 to 212 calls per night. Detector St_Det_6-1 (Fig. 2) also registered a relatively high and irregular activity of bats at this time (from April 16 to May 1). Bats calls frequency of abundance varied from 2 to 232 calls per night. These detectors worked simultaneously in the last decade of April at a distance of 9 km from each other. However, the minimum values of bats activity were recorded on them at approximately the same dates: April 21-22, 25-26 and 30 (Fig. 1, 2). We believe that this may be a consequence of the influence of unfavorable weather conditions on bats activity (wind, rain, or unfavorable temperatures).

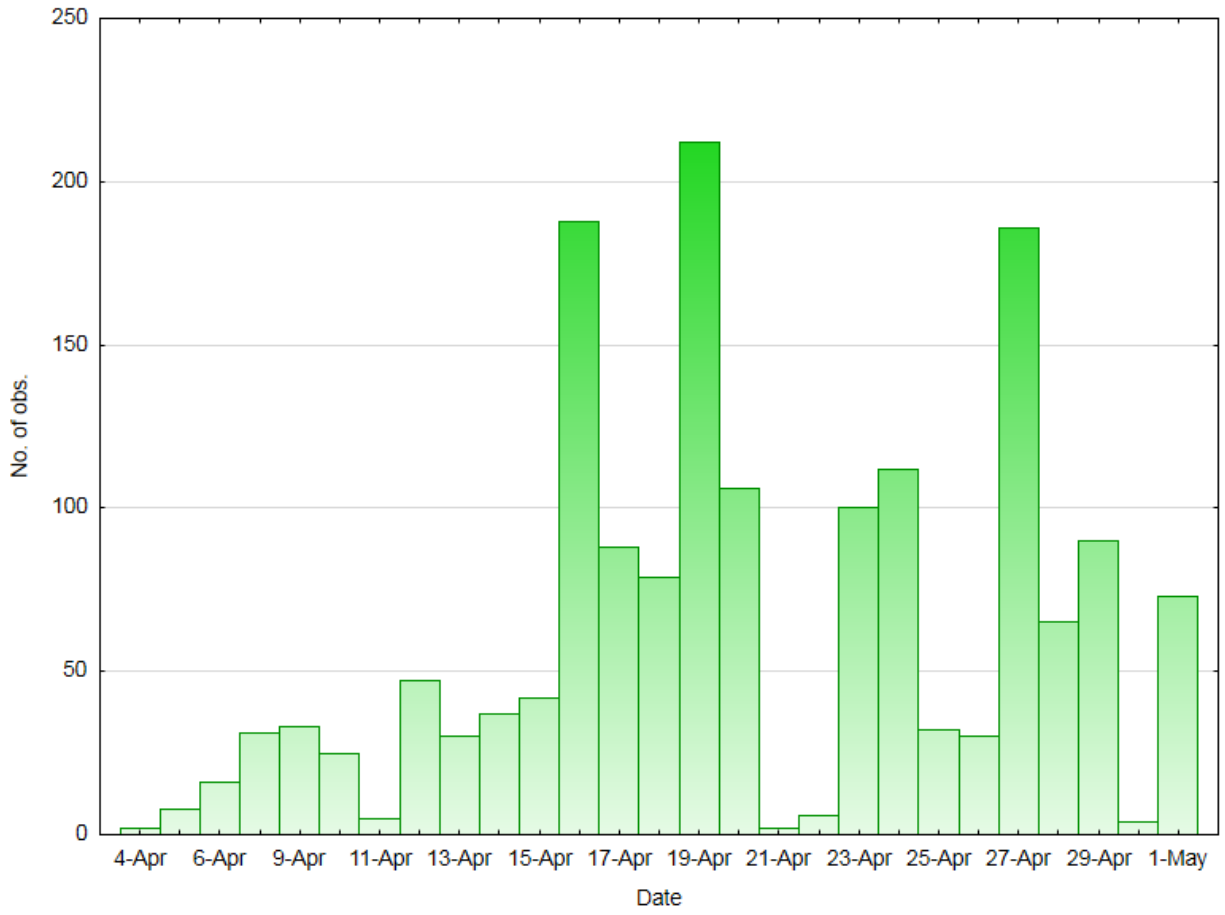


Fig. 1. Bats activity (number of calls for a full night of counting) in April from detector №3. Accounting in three locations: St_Det_3-1 (4-6 April), St_Det_3-2 (8-18 April), St_Det_3-3 (19 April – 1 May).

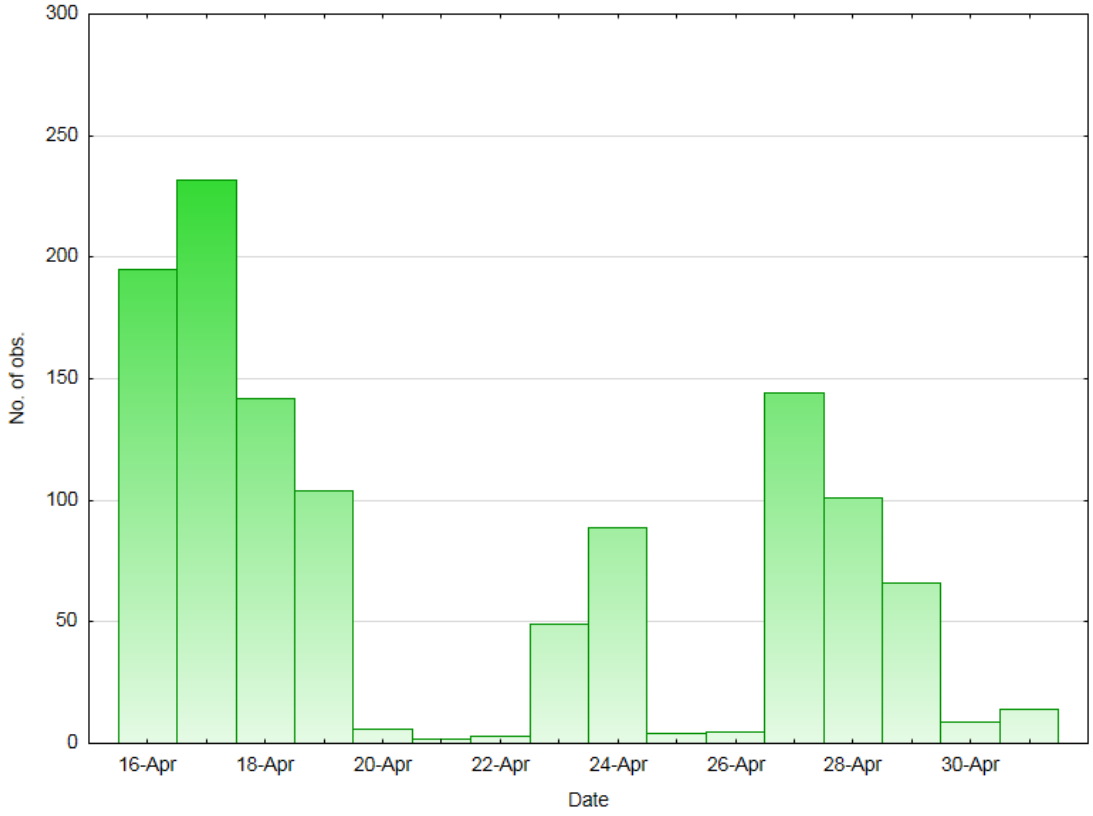


Fig. 2. Bats activity (number of calls for a full night of counting) in April from detector № 6. Accounting at one location: St_Det_6-1 (April 16 – May 1).

Bats activity according to the data collected from meteorological masts (from a height of 45 m)

Detectors register true activity in places of feeding and flights during its work on meteorological masts, unlike detectors installed on human buildings, because they are distant from potential roosts, water bodies, or "spot" feeding sites that can serve as points of attraction for bats. The detectors were installed at three meteorological masts at a height of 45 meters in the territory of the projected Bash wind farm and recorded bats ultrasound calls in the lower height of wind turbines (Voigt, 2021).

Detector 3 was moved to the MM-8 meteorological mast (in May) after working in location St_Det_3-3. Detector 6 was moved to the MM-6 meteorological mast (in May) after working in location St_Det_6-1. After that (in June) detector 3 was moved to the MM-6 meteorological mast after working in location MM-8. Detector 6 was moved to the MM-4 meteorological mast (in June) after working in location MM-6 (Tabl. 1). Unfortunately, it was discovered after the work completion that only the audio recordings from detector № 3, made in May at meteorological mast 8, are suitable for processing. The rest of the recordings from the meteorological masts are of poor quality. Despite the large number of audio files (Tab. 4), almost all of them contain noise recordings (Fig. 3). Detector № 3 did not work well in June. Detector № 6 did not work well in May and June. The cause of this phenomenon is unknown. However, the following reasons are possible: due to the fact that the weather masts vibrate and make a lot of noise, the detectors worked without pause and they recorded a large number of files with noise, this could lead to premature battery discharge. The second possible reason for the shutdown of the detectors could be extremely high temperatures in desert conditions, especially at high altitude. The temperature could reach 60 degrees Celsius in May and June, which could affect both the operation of the detectors themselves and the operation of the batteries. Degradation process of audio signals recorded by detectors is shown in Figure 3. Figure 3 shows the spectrograms of the following files recorded by detector 6 at different times: S4U11500_20210501_180042.wav (top), S4U11500_20210601_180122.wav (middle), S4U11500_20210619_224622.wav (bottom). Therefore, we give a quantitative analysis of bats activity only for met mast 8 in May below (Fig. 4).

Bats activity near this meteorological mast was variable in time according to ultrasound monitoring data. Bats activity peak occurred on the night of May 4-5 (Fig. 4), when 44 bats calls were recorded. This is a rare event. There were only five nights during the entire detector operation period at met mast 8 (31 nights from May 2 to June 1), when bats activity exceeded 20 calls per night. Typically, bats activity varied within 0-10 calls per night (acoustic activity index (AI) = 7,3 calls per night). Activity data calculated for 3 "middle" nights (May 17-19) are given in Table 5.

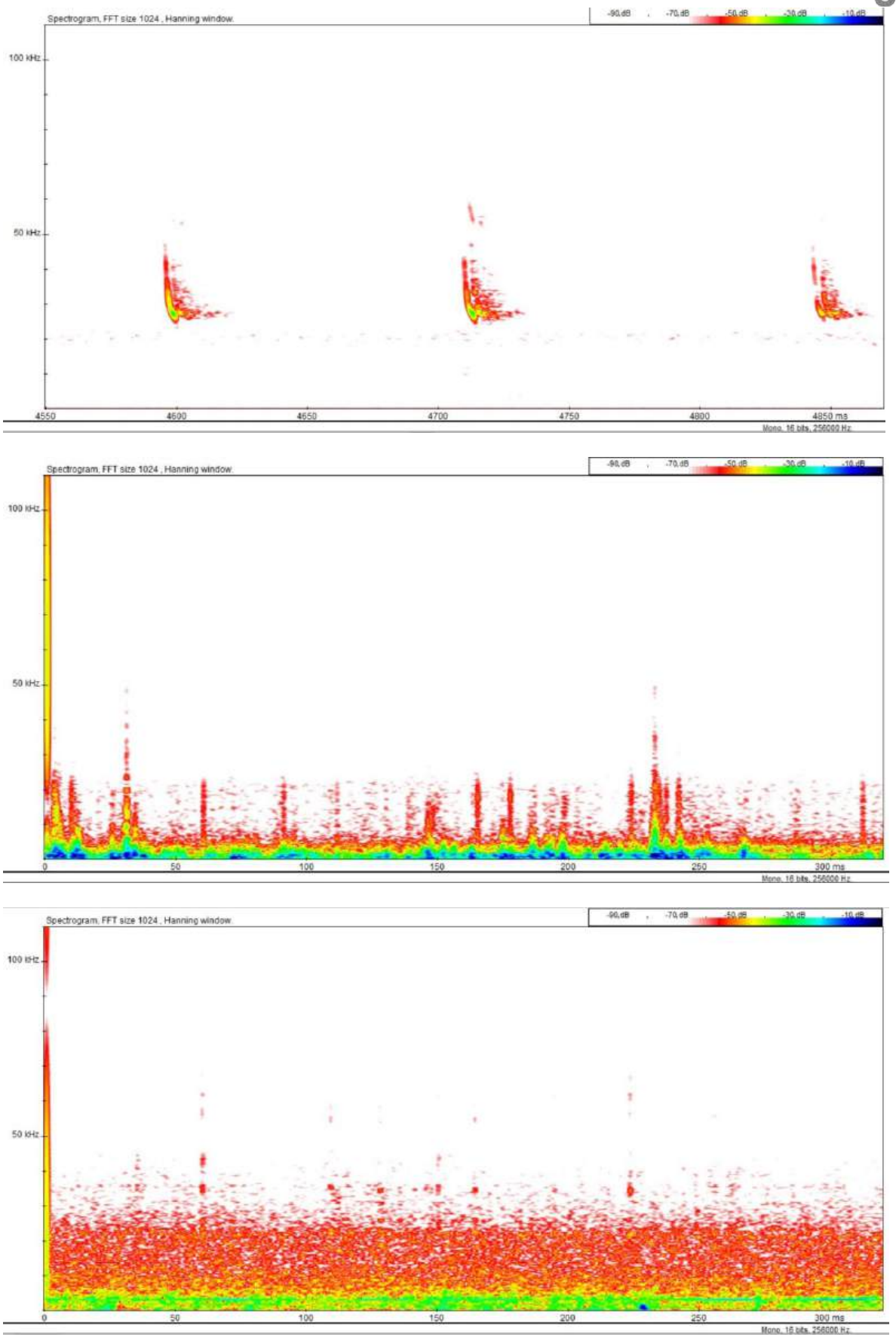


Fig. 3. Degradation of the detector № 6 during its operation at the meteorological masts. Examples of spectrograms of audio files (threshold all files = 10; top down): 01 May 2021 (with bat calls), 01 June 2021, 19 June 2021.

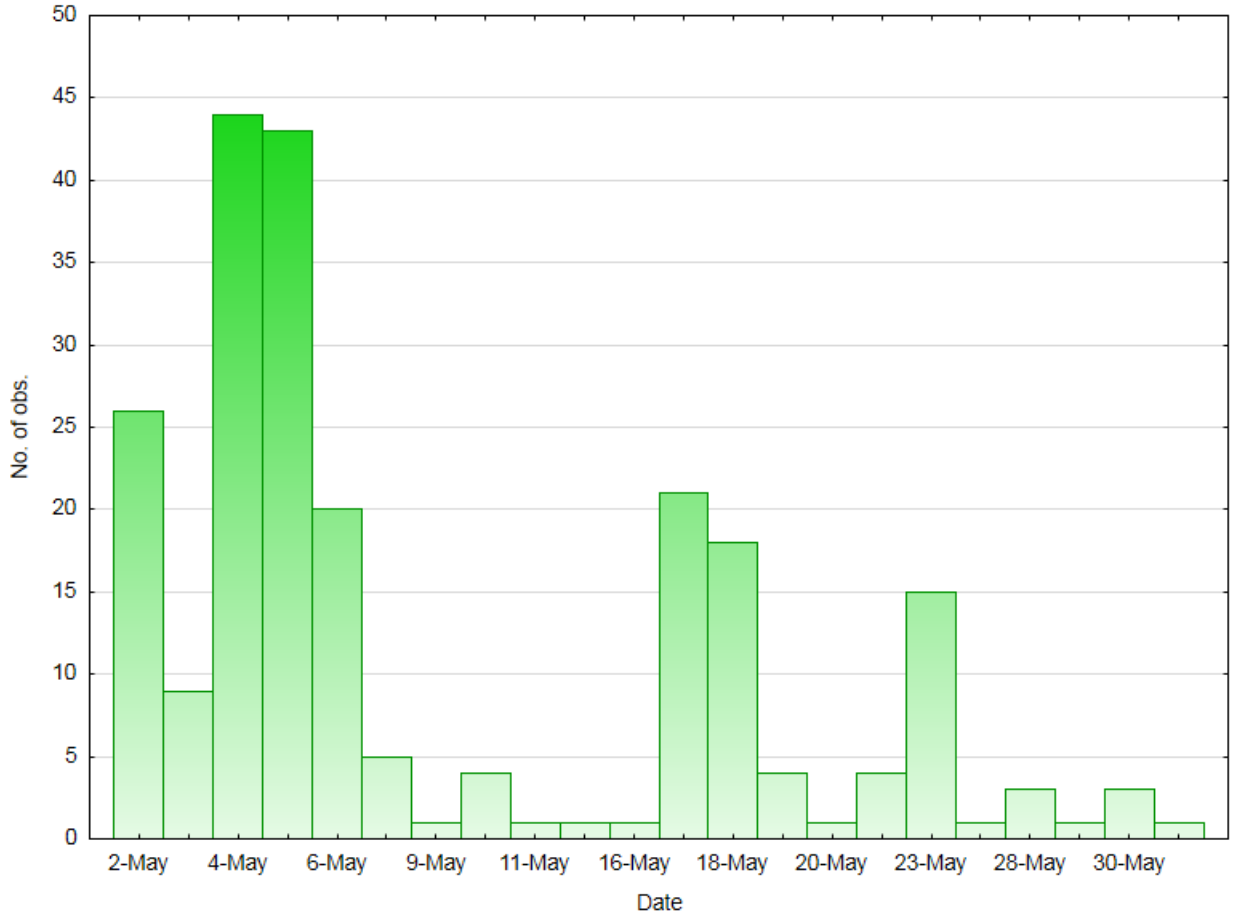


Fig. 4. Bats activity (number of calls for a full night of count) in May (May 2 – June 1) in the vicinity of meteorological mast 8 (MM-8).

Only data obtained from meteorological masts were used for bats activity calculating (calls per night (AI) and relative abundance (RA)). This makes it possible to avoid overestimating of results of counting bats activity due to potential closely spaced bats colonies (when the detector is operating from buildings). For the calculation, we chose three nights of "average" bats activity on May 17-19. These days fall on the period of reproductive activity of bats, when pregnant females are in summer habitats and prepare for the birth of cubs.

Calls of 6 bats species were found on the project's area: *Eptesicus sp. (Eptesicus bottae* and *Eptesicus serotinus)*, *Pipistrellus kuhli, Pipistrellus pipistrellus, Rhinolophus bocharicus, Vespertilio murinus*. CF-calls of horseshoe bats (Barataud, 2015) had FME (Frequency of maximal energy) = 100.5-101.5 kHz. This is *Rhinolophus bocharicus*. This species is common in Uzbekistan. Ultrasound calls of *Rhinolophus bocharicus* were recorded from bats of this species found during checking of potential bats' roosts (Gritsina, 2021).

Table 5. Bat species (all locations exclude Det_6-MM_4 *– no bat calls), activity (calls per night) and relative abundance (RA) at location Det_3-MM_8.*

Species	St_Det_3-1	St_Det_3-2	St_Det_3-3	St_Det_6-1	Det_6-MM_6	Det_3-MM_6	Det_3-MM_8 (17-19 Apr)		Avg Bat Calls/Night (AI)
							call pass	RA, %	
Eptesicus sp. (E. bottae + E. serotinus)	+	+	+	+	+	+	25	58,1	8,3
P. kuhli			+				0	0,0	0
P. pipistrellus		+	+	+		+	9	20,9	3
R. bocharicus	+	+	+	+			0	0,0	0
V. murinus		+	+	+			9	20,9	3
Total:	3	5	6	5	2	3	43	100,0	14,3

Other horseshoe bats from Uzbekistan (*Rhinolophus ferrumequinum, Rhinolophus hipposideros*) have different FME (~80 kHz, ~110 kHz, respectively; Benda et al., 2011; Benda et al., 2012) compared to our data (~101 kHz (100-102 kHz)). The misidentification of calls from *Eptesicus serotinus* and *Eptesicus bottae* is possible because these species have similar and, probably, overlapping parameters of ultrasound calls (Benda et al., 2012).

Only calls of the genus *Eptesicus, P. pipistrellus* and *V. murinus* were recorded on meteorological masts on the project's area (calls *E. bottae* and *E. serotinus* are not separated). Calls of the other two species (*P. kuhli*, *Rhinolophus bocharicus*) were found only from "near ground" locations, not from meteorological masts.

Discussion

Ultrasonic calls of 6 species of bats were found in the project area. The habitation of 1 species (*P. pipistrellus*) was confirmed by field studies during the search for bats' roosts (Gritsina, 2021).

All bat species, which calls were detected on the project area, are classified as LC ("Least concern", IUCN) and are not considered threatened. The Red Book of the Republic of Uzbekistan (2019) include four bat species: *Rhinolophus hipposideros* (VU), *Tadarida teniotis* (VU), *Otonycteris hemprichi* (VU)[3], *Myotis bucharensis* (CE). The fact that none of these listed species was detected during the acoustic monitoring effort provides an indication that the Project is not likely to generate impacts to any protected species of bats.

But bats, whose calls have been recorded at the site, have a risk of collision with the wind turbine. Low-flying species *Rhinolophus bocharicus* have the lowest risk of such a collision (Tabl. 2). *Rhinolophus bocharicus* has the least threat from wind turbines compared to other found species, because, most likely, it hunts from perches at a low height, like other species of the genus (Rodrigues et al., 2015). There is some risk of injury to other found bat species from wind turbines, because they can use high height for feeding and transit flights. Ultrasonic calls from this bat species were not detected by detectors installed at a height of 45 m on meteorological masts.

The two medium-flying species of the genus *Eptesicus* (58.1% relative abundance) have the medium risk of collisions (Roemer et al., 2017). Another species with a high risk of collision with wind turbines is high-flying *Vespertilio murinus* (Roemer et al., 2017). The abundance of its calls is 20.9%. Ultrasound calls from the other species (*P. pipistrellus*) were infrequently recorded, although these species have medium collision risks (Roemer et al., 2017; Wellig et al., 2018).

The data on the activity of bats obtained in the second half of 2020 (Vasenkov, 2020) are not suitable for comparison with the results of 2021, because were obtained primarily from detectors installed in human buildings.

But the data obtained in 2021 indicate large fluctuations in bats activity in the project area, from 0 to 44 registrations of flights per night. Nights with high activity of bats (more than 20 registrations per night) are rare - approximately once every 6 days. The average activity of bats in the project area is rather low - about 14,3 registrations per night. The reasons for the bursts of bats activity are not known. This may be an activity

[3] *Otonycteris hemprichi* does not inhabit Uzbekistan (Benda et al., 2011). It was indicated for Uzbekistan in the 20th century (Bogdanov, 1953), when the species *Otonycteris hemprichi* and *Otonycteris leucophaea* were not distinguished. Only *Otonycteris leucophaea* lives in Uzbekistan according to the modern concepts of taxonomists. From a formal point of view, this is a different species. Most likely, the authors of the essays in the Red Book of Uzbekistan (2019), have not being familiar with modern data (for example, Benda et al., 2011), and wrote down an "outdated" name that currently refers to other animals found, for example, in Iran (Benda et al., 2012). Both of these species are found in Iran.

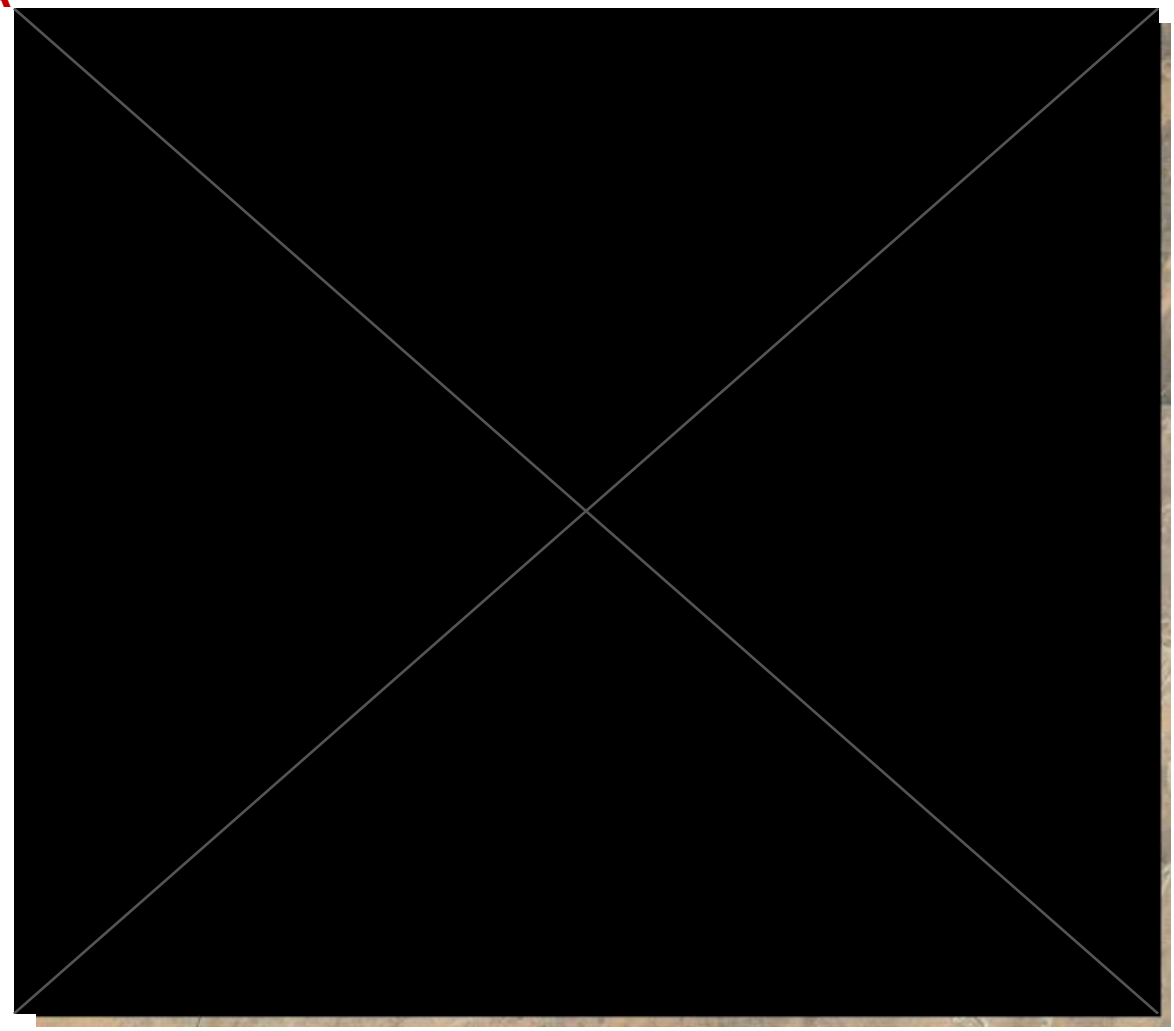
associated with the temporary attractiveness of the vicinity of the meteorological masts for some feed objects, which in turn attract bats.

The potential negative impact of wind turbines on bats (death from collisions, barotrauma) in the project area can be minimized if use automated ultrasonic detectors to estimate the activity and identity of bats in the zone of highest mortality risk at wind turbine in order to formulate mitigation schemes, such as increased curtailment speeds to prevent casualties (Voigt et al., 2021). The economic damage from such stops will be minimal, because high bats activity in the project area occurs once every 10 days and most likely occurs at nights with low wind speed, when the efficiency of power generation is low (Arnett et al., 2011). As known, increase of the cut-in wind speed and / or feathering of blades during low wind speed conditions reduces bat mortality (Arnett et al., 2011). Cut-in wind speed and / or feathering of blades can be especially important in days when a high activity of bats is registered. This will prevent massive death of bats and the associated risks of "environmental" damage.

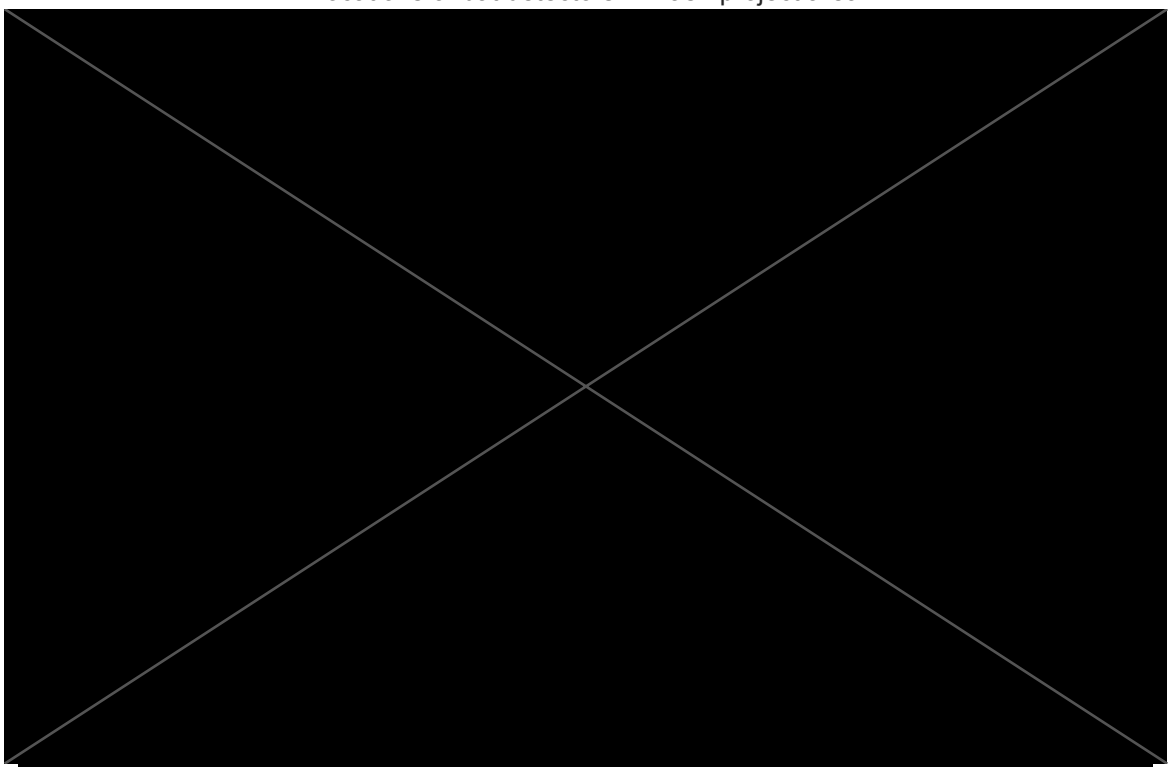
References

1. Arnett E., Huso M., Schirmacher M., Hayes J. (2011). Altering turbine speed reduces bat mortality at wind-energy facilities. Frontiers in Ecology and the Environment. 9. 209-214. 10.2307/41149768
2. Barataud, M., *Acoustic Ecology of European Bats. Species Identification, Study of Their Habitats and Foraging Behavior*, Paris: Biotope, Meze; Museum National d'Histoire Naturelle, 2015.
3. Benda V., Hanák V., Červený J. Bats (Mammalia: Chiroptera) of the Eastern Mediterranean and Middle East. Part 9. Bats from Transcaucasia and West Turkestan in collection of the National Museum, Prague. Acta Soc. Zool. Bohem. 2011. 75: 159–222.
4. Benda P., Faizolâhi K, Andreas M., Obuch J., Reiter A., Ševčík M., Uhrin M., Vallo P., Ashrafi S. Bats (Mammalia: Chiroptera) of the Eastern Mediterranean and Middle East. Part 10. Bat fauna of Iran. Acta Soc. Zool. Bohem. 2012. 76: 163–582.
5. Bogdanov O. P. Bats // Issue 2 Mammals, volume III "Fauna of the Uzbek SSR". Tashkent: publishing house Of the Academy of Sciences of the Uzbek SSR, 1953. 159 p. (in Russian)
6. Dietz, C. and Kiefer, A., Bats of Britain and Europe, London: UK: Bloomsbury Publ., 2016.
7. Gritsina M.A., Nuridjanov D.A., Abduraupov T.V. 2013. Some new findings of bats in Uzbekistan. – Plecotus et al. 15-16: 44–52 (In Russian with English Summary).
8. Gritsina M. 2021 Bat roost search / Report_Bash Wind Farm Project. Juru Energy Ltd. 1-27 pp.
9. Hackett T., Holderied M., Korine C. (2016). Echolocation call description of 15 species of Middle-Eastern desert dwelling insectivorous bats. Bioacoustics. 26. 1-19. 10.1080/09524622.2016.1247386.
10. Rodrigues L., Bach L, Dubourg-Savage M.-J., Karapandza B., Kovac D., Kervun T., Dekker J., Kepel A., Bach P., Collins J., Harbusch C., Park K., Micevski B., Minderman J. (2015): Guidelines for consideration of bats in wind farm projects - Revision 2014. EUROBATS Publication Series № 6 (English version). UNEP/EUROBATS Secretariat, Bonn, Germany, 133 pp.
11. Roemer C., Disca T., Coulon A., Bas Y. (2017) Bat flight height monitored from wind masts predicts mortality risk at wind farms. Biological Conservation 215 (2017) 116-122.
12. The Red Book of the Republic of Uzbekistan, Tashkent, 2019 (in Uzbek, Russian, with a summary in English)
13. Vasenkov D.A. 2020. Summer-Autumn Bats Monitoring Report / Bash Wind Farm: Bird and Bat monitoring. Juru Energy Ltd. 1-19 pp.
14. Voigt, C. C., Russo, D., Runkel, V., & Goerlitz, H. R. (2021). Limitations of acoustic monitoring at wind turbines to evaluate fatality risk of bats. Mammal Review. doi: 10.1111/mam.12248
15. Wellig SD, Nusslé S, Miltner D, Kohle O, Glaizot O, et al. (2018) Mitigating the negative impacts of tall wind turbines on bats: Vertical activity profiles and relationships to wind speed. PLOS ONE 13(3): e0192493. https://doi.org/10.1371/journal.pone.0192493

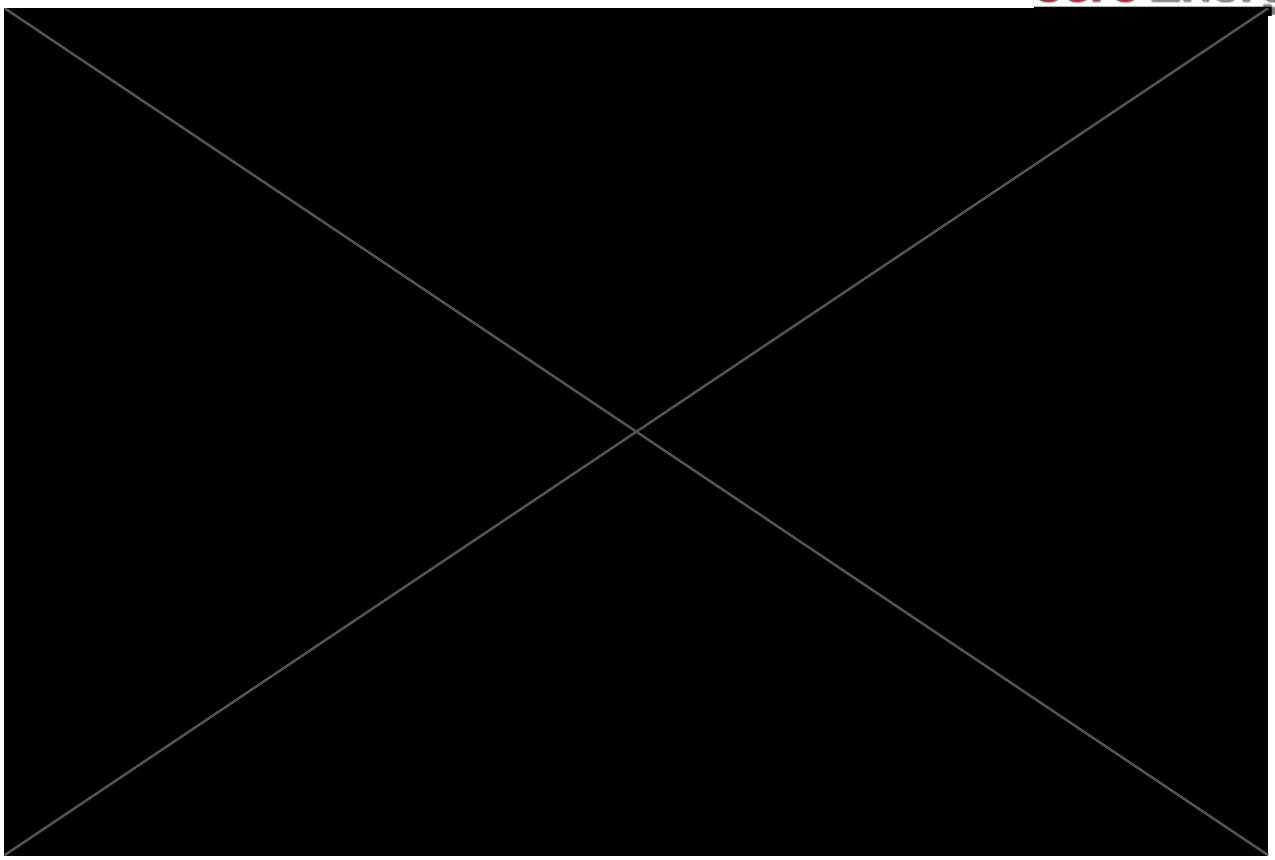
A



Locations of bat detectors in Bash project area



Bat detector installation on weather mast in Bash project area



Bat detector installation on weather mast in Bash project area

Bat roost search report

Report Title	Bat roost search report
Scope	BAT ROOST SEARCH
Areas Covered	BASH WF
Seasons Covered	SPRING 2021 / SUMMER 2021
Notes	

Bat roost search



BASH WF

CLIENT: 5 CAPITALS

Date: July 2021

Mariya Gritsina

Juru Energy Ltd.

Suite 1, One George Yard, London

United Kingdom, EC3V 9DF

T: +44 207 859 4028

Contents

INTRODUCTION 2
MATERIALS AND METHODS 3
Equipment 4
GEOGRAPHICAL FEATURES OF THE STUDIED AREA 5
RESULTS 6
Common pipistrelle bat 10
CONCLUSIONS 12
RECOMENDATIONS 13
REFERENCES 14
Appendix 1. The results of the potential bat roosts survey on the Bash WF project territory 15
Appendix 2. Photos 21

INTRODUCTION

Bats (*Chiroptera*) are the only mammals that have mastered active flight. Together with birds, these are the only modern vertebrates that have inhabited the air environment. Bats are the second largest order of mammals in Uzbekistan. At the moment, there are 21 species of Bats known in Uzbekistan, however, this order is the least studied, especially in remote desert areas.

This report contains the results of the field survey carried out on the territory of Bash WF project area on the north-eastern part of the Ayakagytma depression. Field visits was carried out on April 20-21 and June 23- 25, 2021.

The main purpose of the expedition was to confirm the presence/absence of Bats in potential roosting places identified based on topographic and literary material. In case of bats location, it was planned to determine the species, their number and reproductive status (breeding/non-breeding individuals), the presence of brood colonies.

MATERIALS AND METHODS

The survey methodology consisted of two stages:

Desktop preparation, which was an analysis of detailed topographic maps of the area (scale: 1:100 000, 1:200 000) and Google Earth satellite images. The maps identified the locations (GPS coordinates) of potential bat roosts – caves, mines/tunnels, human buildings, wells, cattle cotes. Those locations were then transferred to the LocusPro smartphone application for further use in the field. A total of 16 places were identified for the survey at this stage.

Field work included a survey of potential roosts identified during the desktop stage. When a roost was found, it was thoroughly examined, both for the presence of bats themselves, and for signs of their presence – excrement, food remains (insect wings, legs, etc.). In addition to pre-identified roosts, during the field survey the most used bats roosts were found – the draining tunnels under the roads. These are concrete or iron structures (the latter are not used by Bats) of various sizes and shapes, laid under highways or railway tracks, in order to divert mudflows from the residual mountains during seasonal precipitation.

Each surveyed object was mapped, photographed, its brief description was made, including notes on the suitability of the objects for bats as either a temporary roost or a permanent one, notes on the potential degree of disturbance/threat. Where necessary the height, width and length of the roost were measured. In case of detection of Bats, the surface temperature was measured. All the draining tunnels examined in spring were re-examined in summer. We also examined areas that go beyond the project territory, because bats fly long distances (up to several kilometres) from their roosts in search of food.

When Bats were detected, their species, gender, age and number were determined. Species identification was carried out according to generally accepted methods (Kuzyakin, 1950; Bogdanov, 1953; Dietz, von Helversen 2004). The captured bats were examined, photographed and immediately released in the places of capture. We discovered one bat species Common pipistrelle bat (*Pipistrellus pipistrellus*).

In total, 514 km were covered by survey transects, 11 potential roost places were examined as well as chinks on the north-eastern side of the Agytma depression.

Equipment

To navigate the terrain and record tracks, a smartphone *(BV9900E)* was used with the *LocusPro* application installed, with preloaded *Google Hybrid* and *Marshruty.ru* maps. Two binoculars were used to view the area: Nikon Aculon 10x42 and *Nikon Prostaff 7S 10x42*.

Photographing was carried out using smartphones *(BV9900E)* and *MIUI REDME 5+*, as well as two SLR cameras: *Nikon D3200* with a *Nikkor 18:200* lens and *Nikkon D3200* with a *Nikkor 50 mm* lens.

The following equipment was used for the examination of bat roosts: a torch (*Fenix HP30R)* (2), cloth bags (2), thick gloves (2), forceps (2), a tape measure (1), a surface electronic thermometer *TFA* (1), an electronic scale *SF-400* (1), a *Digital caliper 0-150 mm* caliper (1).

All the collected information was recorded in a notebook, the surveyed roosts and bats registration locations were mapped in the *LocusPro* smartphone application.

GEOGRAPHICAL FEATURES OF THE STUDIED AREA

Ayakagytma Lake is located in the Agytma depression, in the southern part of the Kyzylkum desert to the southeast of the ridge. Agytma depression's length is 35 km, width is 15 km, and surface area is 600 km². The minimum absolute height of the bottom is 133 m. The sides of the depression are smooth and steep (chinks). The bottom is a desert landscape with an extensive salt marsh. In the center of the depression there is a salt lake measuring 15x10 km. The lake is replenished with water through a collector from the Zarafshan River (Fig. 1).

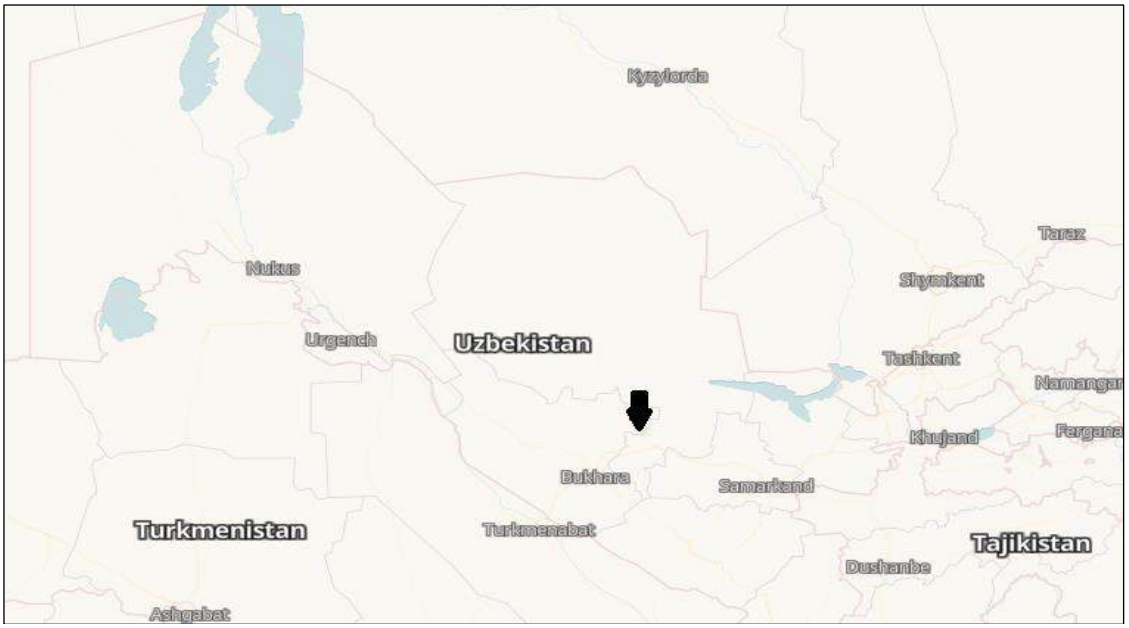


Figure 1 The location of the Bash WF in the context of Uzbekistan

The project territory of the Bash wind farm occupies a significant area located on the north-eastern shore of the Ayakagytma depression (Fig. 2).

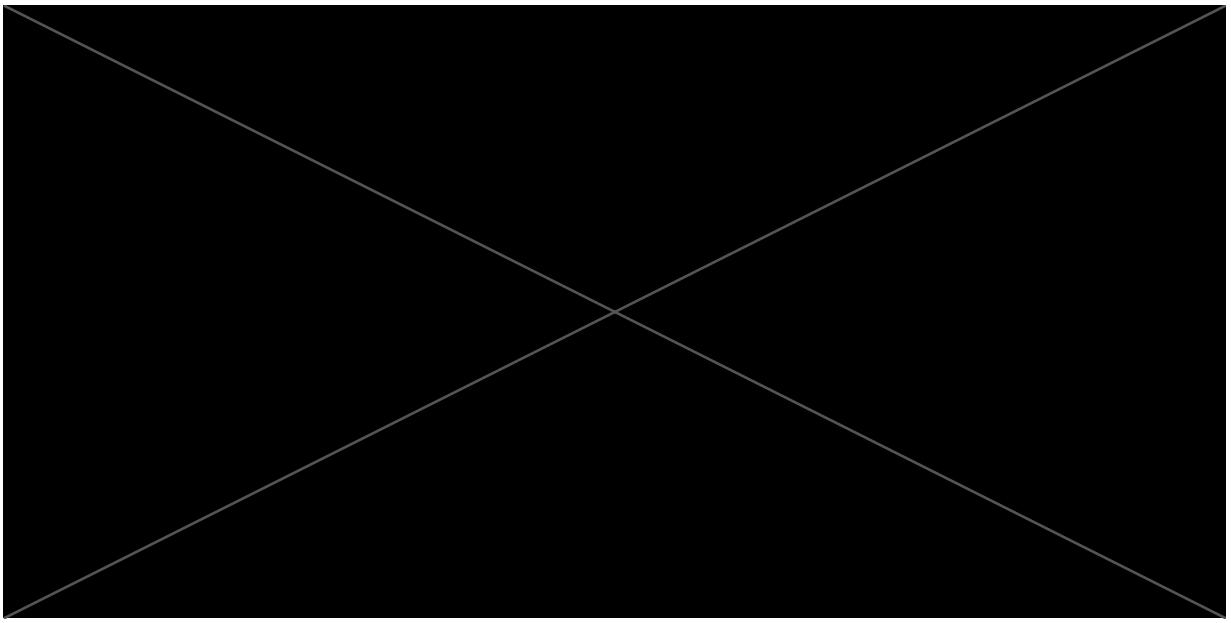


Figure 2 Location of the the Bash WF

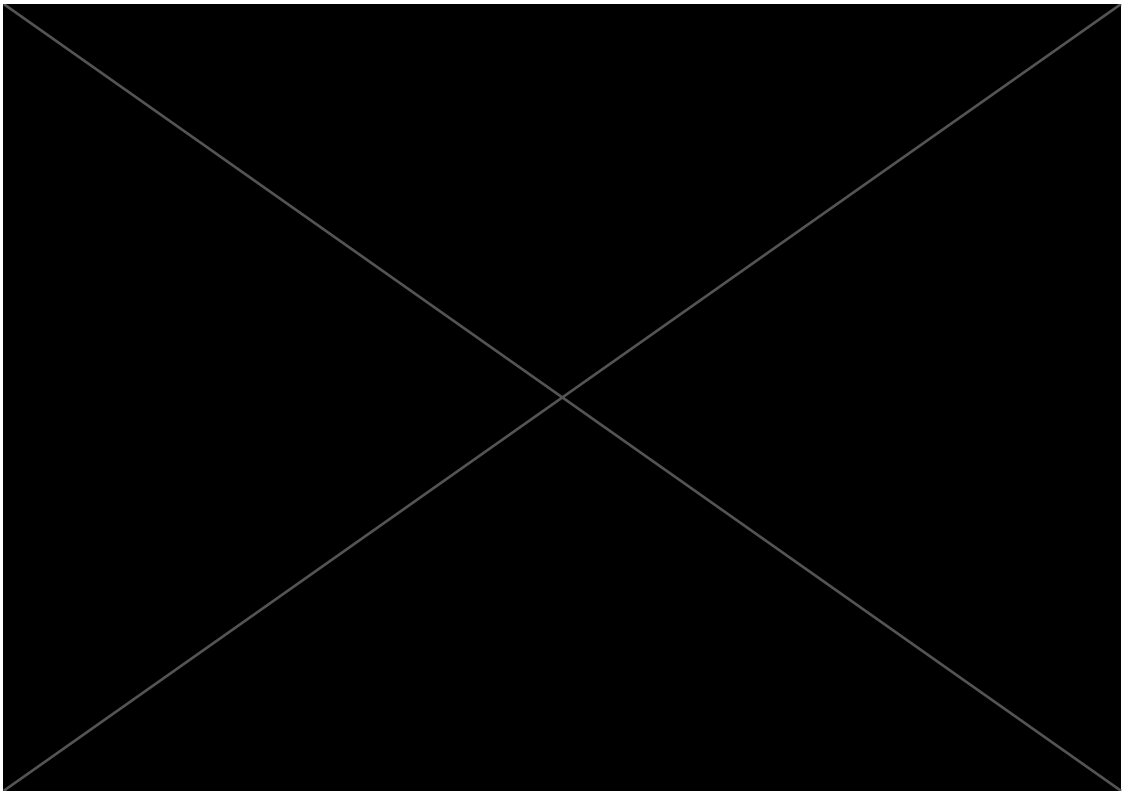
RESULTS

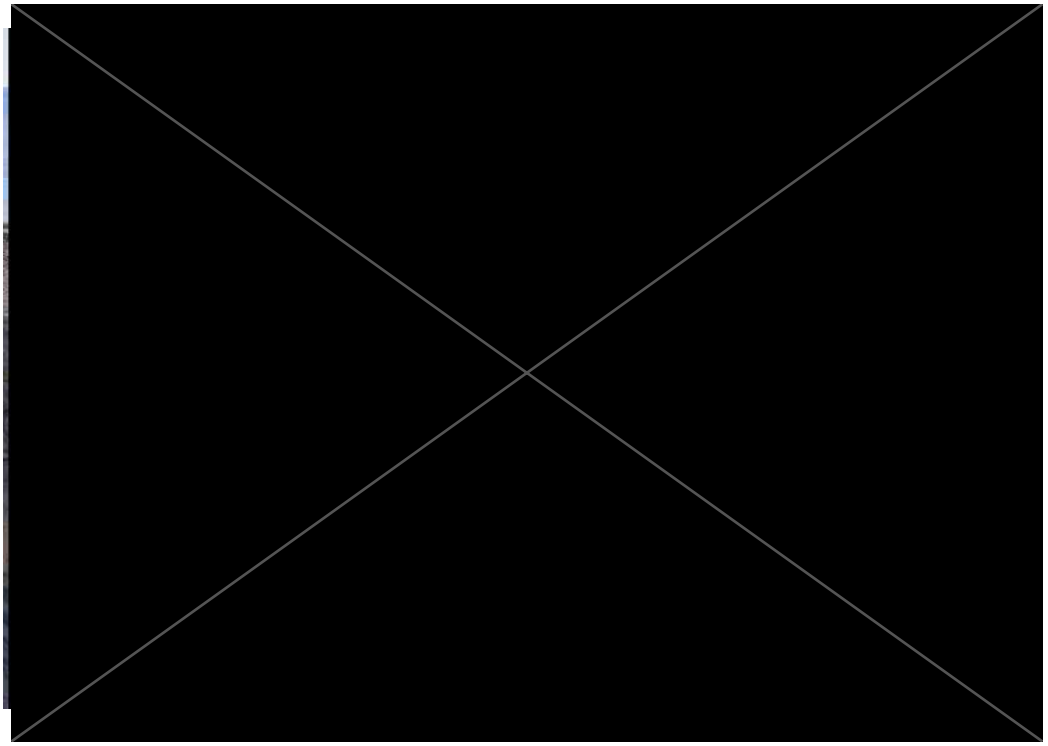
Potential bat roosts in the studied region can be divided into the following categories: **anthropogenic** – wells, sheep cotes, abandoned buildings (farms, small settlements), residential buildings in villages; and **natural** – grottos, crevices, caves. In total, one species of bats was discovered – Common pipistrelle bat (*Pipistrellus pipistrellus*).

A total of 11 potential habitats were visited, and about one roost the information was received from the mammal experts of the Bash project E. A. Bykova and A.V. Esipov. Some of the surveyed locations were a complex consisting of an abandoned house and a hut, a house and a well, abandoned village etc. Thus, 15 potential roosts were examined, including wells (1), shepherd huts/houses (10), residential buildings (1), abandoned school (1), cemetery (1) and cowshed (1). The presence of bats was noted in 6 roosts; and according to the consultations with local residents one surveyed location bats use for wintering (Fig. 3).

In Appendix 1, all the potential roosts visited during the field trip are described in detail.

We also examined the available crevices and grottoes in the chinks along the lake shoreline, but no bats were found. The chink is a steep cliff, up to 200-300 meters high, with sharp cliffs and gorges (Fig. 3 and 4). It is definitely a key habitat in the study area for bats and contains man roosts most of which are inaccessible for surve s.





All the examined potential roosts were divided according to the degree of suitability for bats (Table 1):

1. 1 potential roost location is **completely unsuitable** – concreted well without ctacks.
2. **Potentially used as short-term roosts:** these are mainly houses (3 locations).
3. **Roosts suitable for breeding** offspring (2 locations) - houses.
4. **Roosts suitable as temporary shelters, and possibly for breeding** (1).
5. According to the consultations with local residents, one location is a **wintering bat roost**.
6. **Chink**, with a lot of deep crevices and grottoes.

Thus, 7 roosts turned out to be actually suitable for bats.

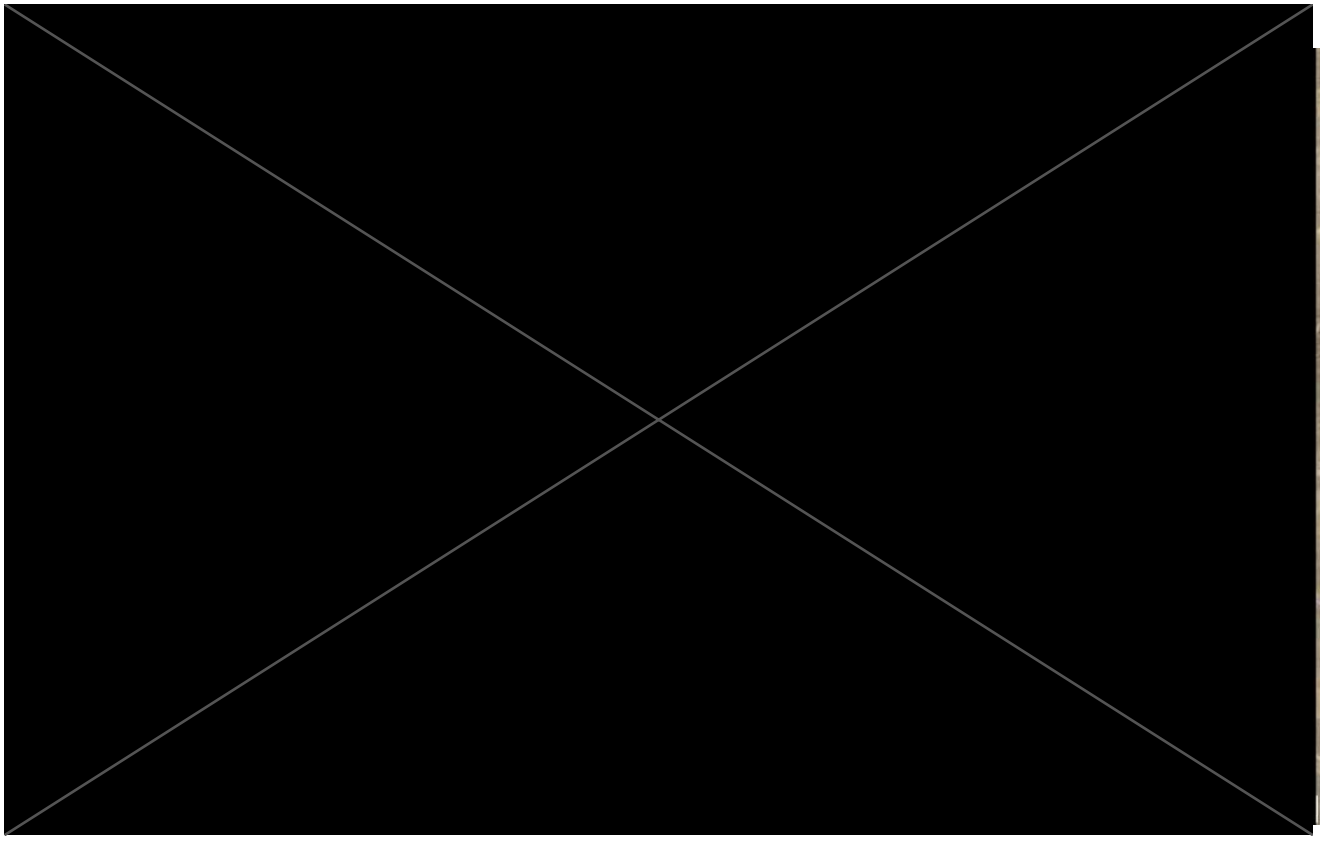


*Table 1 Assessment of the suitability of the surveyed roosts for bats****

Roost №	The degree of suitability for bats*	Degree of distress**
1	2	2
2	1	1
3	6	5
4	3	3
5	3	3
6	2	2
7	4	3
8	2	2
9	5	4
10	6	5
11	6	5

Notes:
**1 – not suitable; 2 - places potentially used as temporary roosts; 3 - roosts suitable for breeding offspring; 4 – roosts suitable for wintering; 5 – absence/ presence is not known.*

*** 1-absent; 2-low; 3-average; 4-high; 5 - not known (given at the time of the survey).*

**** The numbering in table 2 corresponds to the number of roosts in Appendix 1.*

The level of existing anthropogenic threats in the studied territory has a different character, depending on the habitat. For example, the roosts in chinks, due to their inaccessibility, are not disturbed by humans. In villages, on the other hand, people sometimes purposefully destroy colonies and individual bats, sometimes anxiety occurs

during repair work.

More detailed information on Common pipistrelle bat (*Pipistrellus pipistrellus*) recorded on the project territory is presented below.

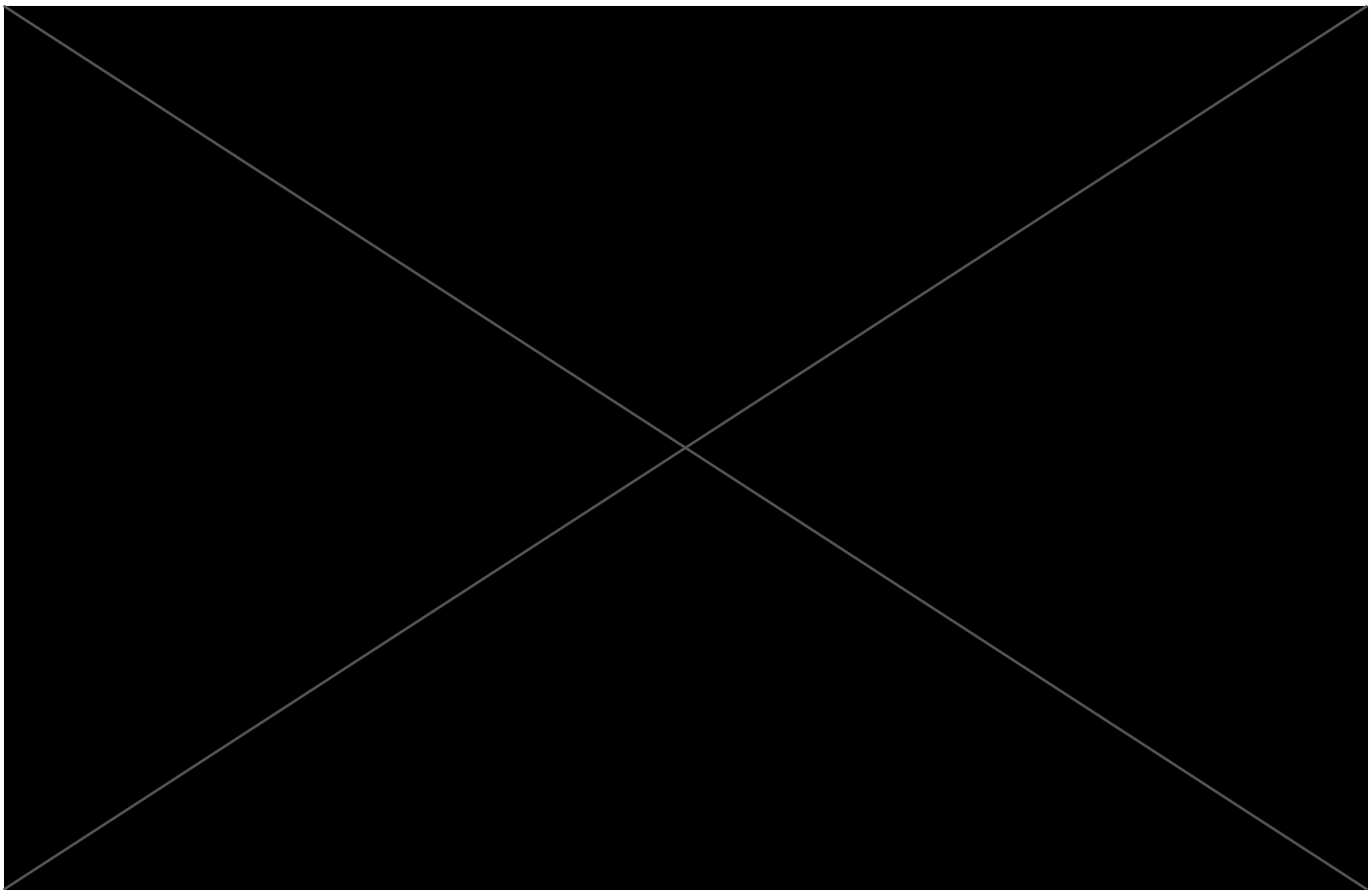
Common pipistrelle bat

Common pipistrelle bat (*Pipistrellus pipistrellus*) is one of the most common and widespread species of Uzbekistan (LC, IUCN), whose roosts are mainly confined to human buildings.

In Uzbekistan, according to literature data, the majority of male bats stay alone and disperse over a wide area in summer, while females form large colonies, which become obvious due to continuous squeaking (Bogdanov, 1953).

We found colonies of Common pipistrelle bats in the village of Ayakagytma (Fig. 6). We had an opportunity to inspect a residential building in the village with the permission of the owner. Bats settled in the cracks of the window frames; when approaching, social squeaks were heard from afar and a significant accumulation of excrement was noted on the window sills. We managed to extract two individuals, which turned out to be females. It was impossible to extract the remaining bats without breaking out the frames, since the frame slots were very narrow. Given the manner of the female Common pipistrelle bats to create separate colonies in summer, it was most likely a brood colony of females. The number of individuals, judging by the squeaks and the amount of excrement, was at least 30 individuals, probably more. The owner said that bats have been inhabiting the frames of their house for about 25 years.

The second building we examined in the village was an abandoned school. The window frames were examined. Visually, 17+7+4+6 bats were observed (34 individuals in total). All captured bats appeared to be males. Definitely, the number of bats was much larger, since most of them were impossible to extract for examination. An inspection of the inner part of the school building was carried out. There was a significant accumulation of excrement of different sizes, which indicates the presence of at least two species of bats. All roosts were inaccessible for examination however.



Most likely, Common pipistrelle bat and other bat species inhabit most of the houses in the village, where there are suitable roosts, but it is necessary to enlist the support of the village authorities for inspection. In addition, there is a possibility that our actions may lead to the destruction of the colonies by local residents.

CONCLUSIONS

Our survey of the Bash WF project territory, as planned, was carried out first during the migration period (Spring), and then during the most important period in bats' life – pregnancy and breeding (Summer). This allowed us to obtain information on the biology of Common pipistrelle bat.

As a result of two field visits, a significant area with 11 potential roosts was surveyed. 6 roosts turned out to be suitable for bats, as well as chinks on the north-eastern side of the Agytma depression.

The level of existing anthropogenic threats in the studied territory is associated with human activity. The most significant threats is the destruction of bat colonies in residential settlements both purposefully and accidentally.

In general, the bats population density on the project territory is quite high for a desert area. This is due to the presence of shelters, as well as a lake with an open water surface.

RECOMENDATIONS

1. Conduct a survey of residential buildings in the village of Ayakagitma (with support from the mahalla committee), in which additional bat species can be identified;

2. In order to preserve the colonies in the residential buildings, the owners of the houses where bats live should be made “keepers”. Alternatively, develop signs indicating that they are “bat keepers” and hang them on the houses;

3. Install a stationary bat detector near the school, where the accumulation of bats is recorded;

4. The school building is currently abandoned, it may be demolished or repaired in the future, which leave bats without roosts and probably some of the bats will die. Consider the possibility of preserving this building, either through negotiations with the local authorities or find funds for its purchase;

5. Conduct a winter survey for the presence/absence of bats;

6. Conduct operational bat monitoring after the completion of the construction of the wind farm, especially during the period of seasonal migrations and breeding;

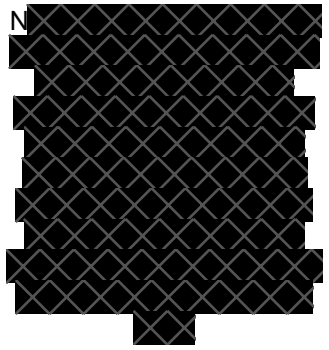
7. During operational monitoring, it is necessary to organize the collection of bat genetic material. For this purpose, it is necessary to obtain all permits from the State Committee of Ecology and the Academy of Sciences of the Republic of Uzbekistan.

REFERENCES

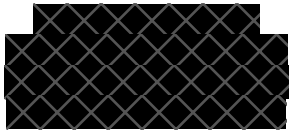
1. Богданов О.П. Рукокрылые // Фауна Узбекской СССР. Том III. Млекопитающие. Вып.2. Издательство Академии наук УзССР. Ташкент, 1953. 131 с.
2. Кузякин А.П. Летучие мыши. Систематика, образ жизни и польза для сельского и лесного хозяйства. Советская наука, Москва, 1950. 442 с.
3. Красная книга Республики Таджикистан. - Душанбе, второе издание, 2015, - С.198-210.
4. Benda, P., Kruskop, S.V. & Srinivasulu, B. 2019. Rhinolophus bocharicus. The IUCN Red List of Threatened Species 2019
5. Dietz C., Helversen O. von. 2004. Illustrated identification key to the bats of Europe. Electronic publication. Version 1.0. Tuebingen & Erlangen: 72.

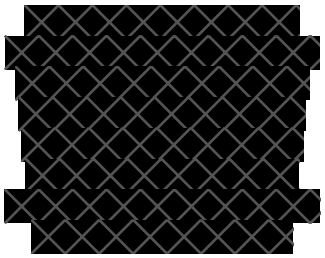
Appendix 1. The results of the potential bat roosts survey on the Bash WF project territory

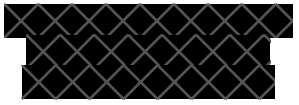
№	N	E	Roost type	Description	Presence/absence of bats	Photo
1	[redacted]		[redacted]	[redacted]	In April, excrement was observed, however the observation in June did not indicate any bats or excrement. Probably used as a temporary roost during migration	
2			[redacted]	[redacted]	Not detected	

3					Unknown	
4					At least 30-40 individuals (*Pipistrellus pipistrellus*)	

5					*Pipistrellus pipistrellus* inhabits practically all frames of the building, where there are cracks. Inside the building there are numerous excrements of various sizes.	
6					The excrement of a single bat was found. Apparently, it was a rare visit	 

7					Not detected	
8					Not detected	

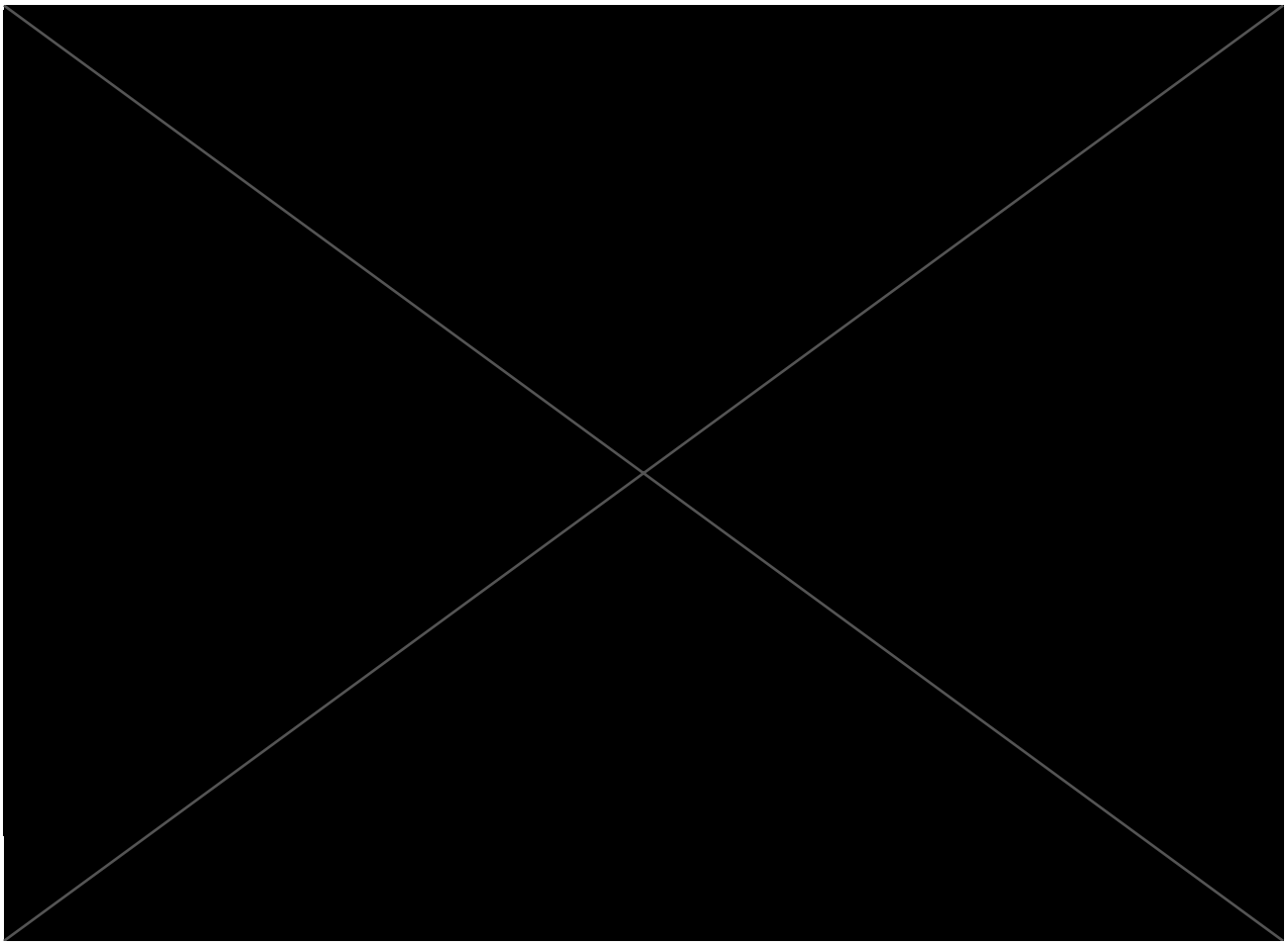
9					Not detected, however, a potential wintering roost	
10					Not detected	

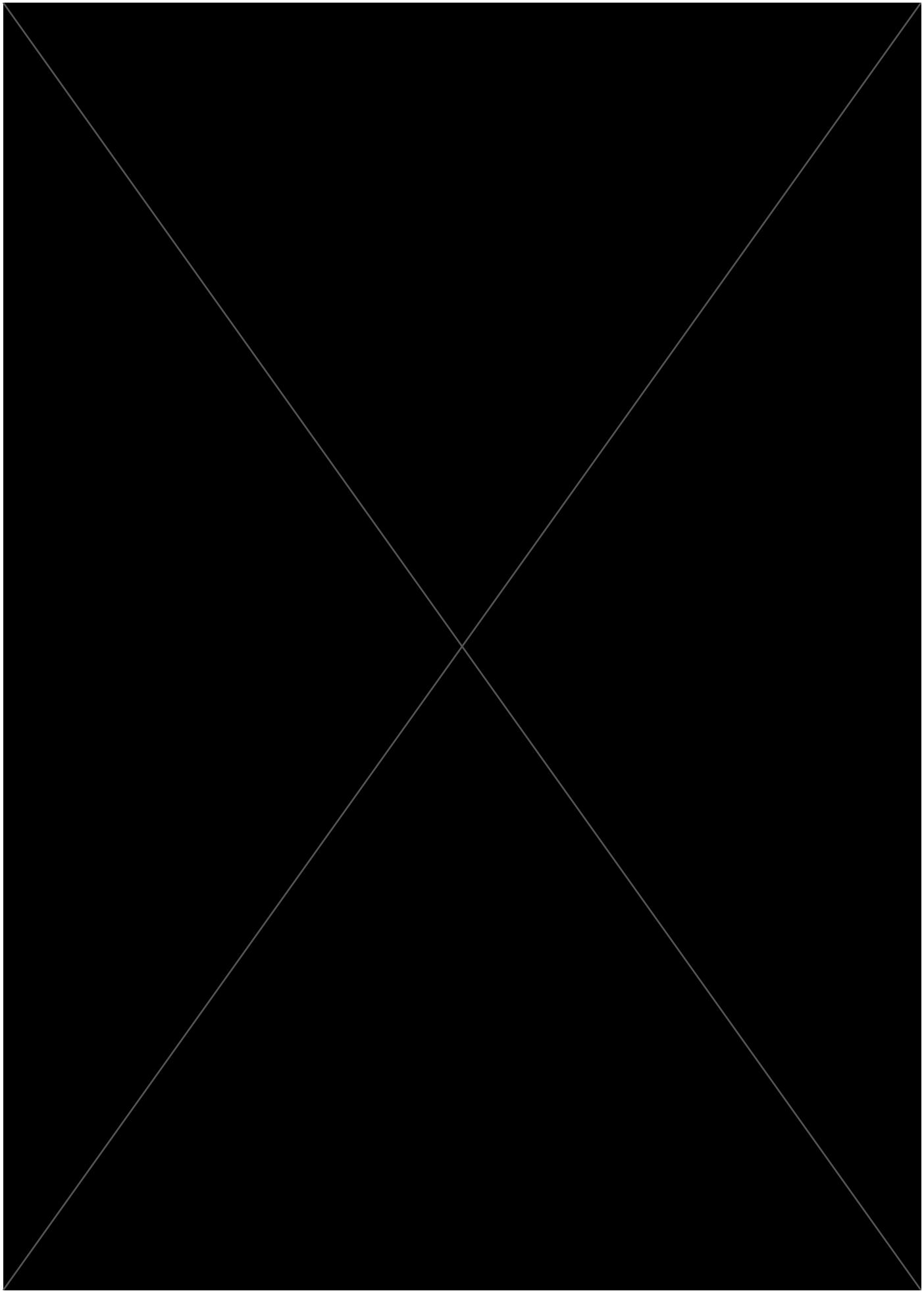
11					Not detected	
12					Excrement	

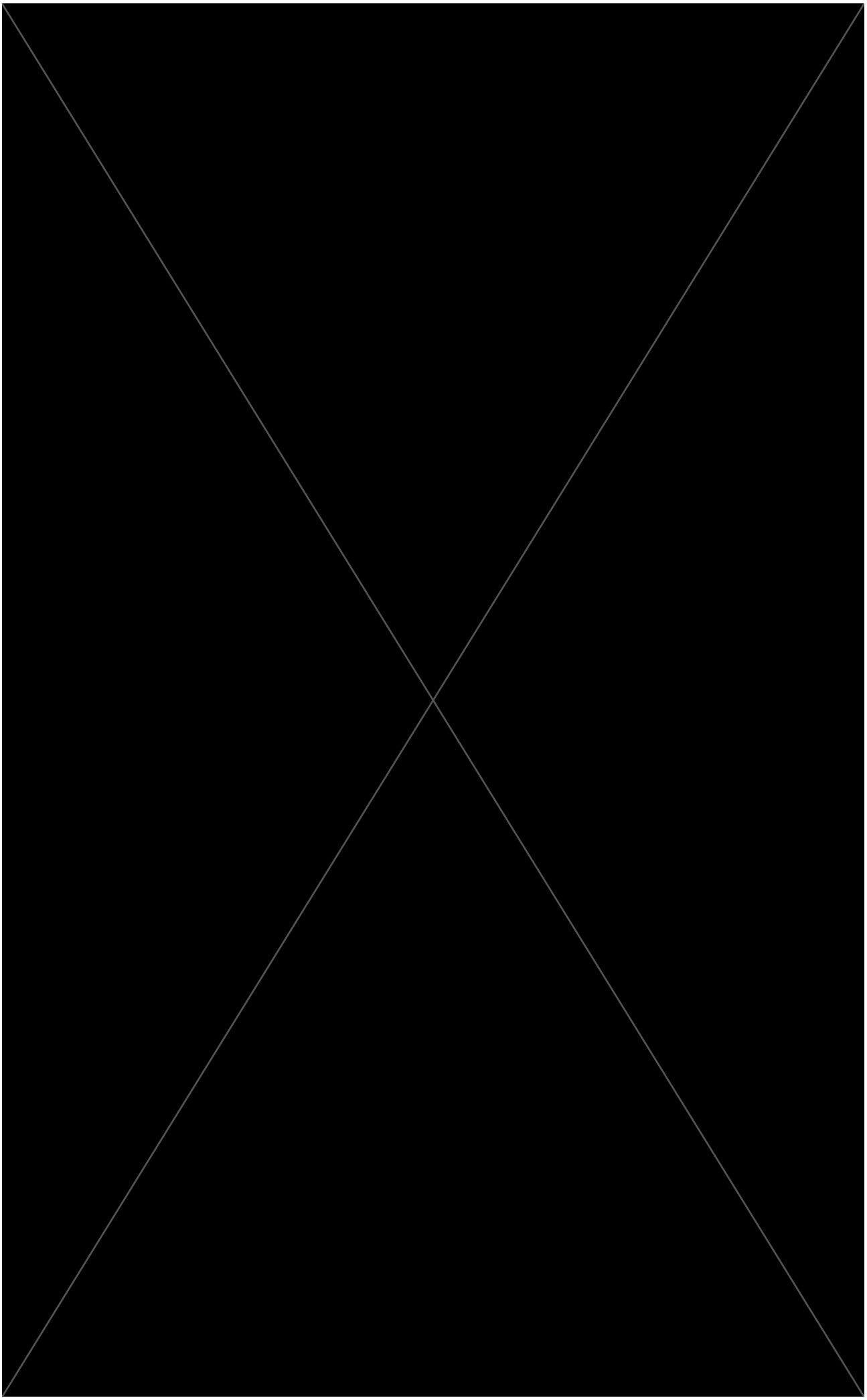
Appendix 2. Photos

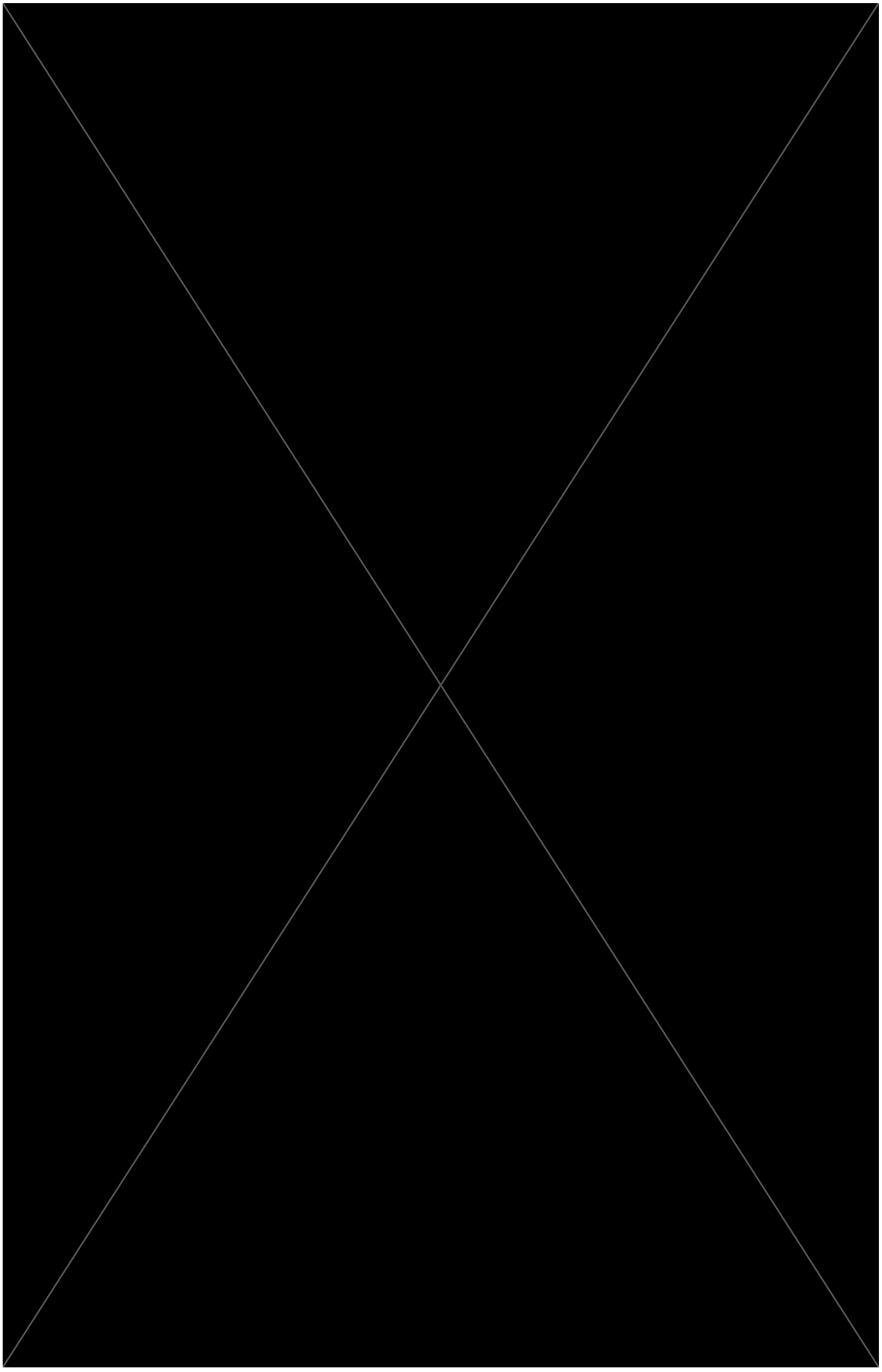


Male Common pipistrelle bat (Pipistrellus pipistrellus)







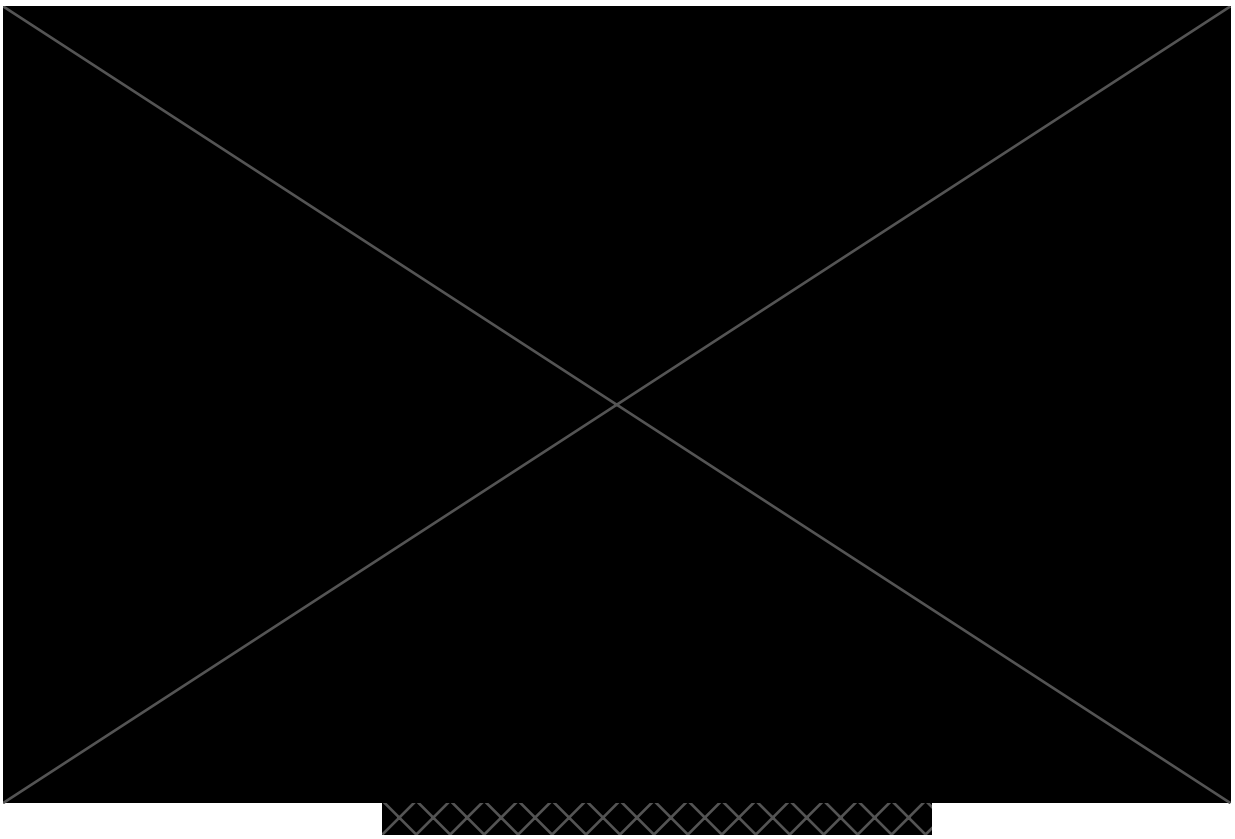


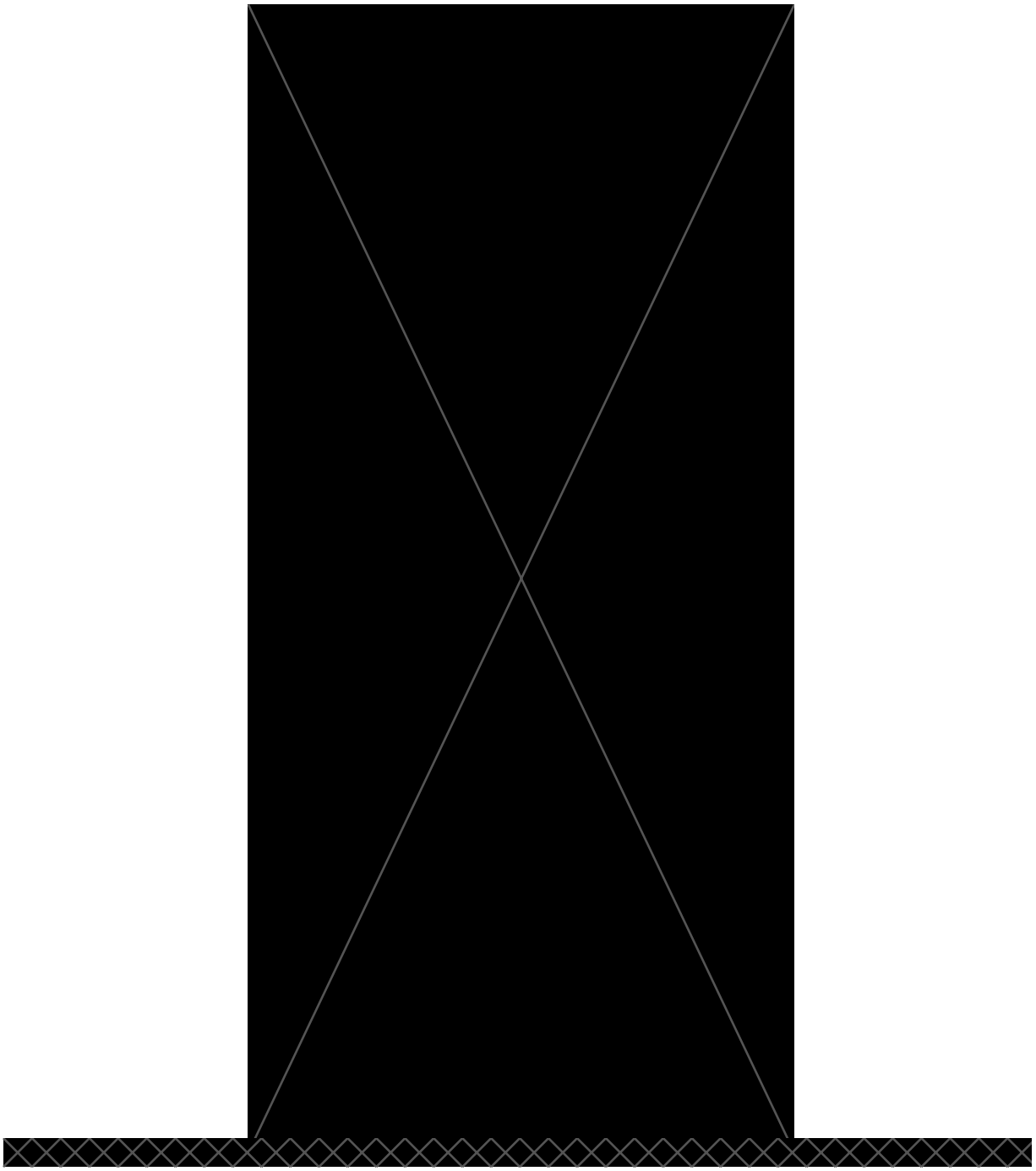


T









Juru Energy

Mammal survey report

Report Title	Mammal survey report
Scope	MAMMALS
Areas Covered	BASH WF/ BASH TO KARAKOL OHTL
Seasons Covered	SPRING 2021 / SUMMER 2021
Notes	

Juru Energy

MAMMAL SURVEY



BASH WIND FARM PROJECT

CLIENT: 5CAPITALS

Date: July 2021

Elena Bykova

Alexander Esipov

Juru Energy Ltd.

Suite 1, One George Yard, London

United Kingdom, EC3V 9DF
T: +44 207 859 4028

Contents

INTRODUCTION....4
LITERATURE REVIEW....5
MATERIAL AND METHODS....6
RESULTS AND DISCUSSION....9
Mammal species review....9
Ground transect survey....16
Camera trapping....23
Planned Bash WF – Karakul SS OHTL survey....26
CONCLUSION....31
RECOMENDATIONS....33
References....34
Appendix: Records from camera traps....36

INTRODUCTION

The survey for terrestrial mammals (excluding bats) was **aimed** to establish the presence/absence, status and distribution of mammal species within the Bash project territory and its surrounding areas. In order to accomplish this the following steps were taken:

- Conducting a ground survey on mammal species (except for bats) throughout the study area including AoI and EAAA in Spring and Summer;
- Collecting data from camera traps (from April to June 2021) installed in the most suitable locations and collecting data from camera traps to get information about mammal species presence, distribution, seasonal dynamic and behavior;
- Collecting questionnaire data from local people on mammal species presence/absence, status and threats;
- Analysis of the preliminary field data including number of species and distribution; and
- Compiling a mammal species list based on field data, questionnaire data and data from literature sources, including endangered and non-endangered species.

The field surveys within the Bash project territory and its surrounding areas were conducted twice: in Spring (on April 18-21, 2021) and Summer (June 26-28, 2021).

LITERATURE REVIEW

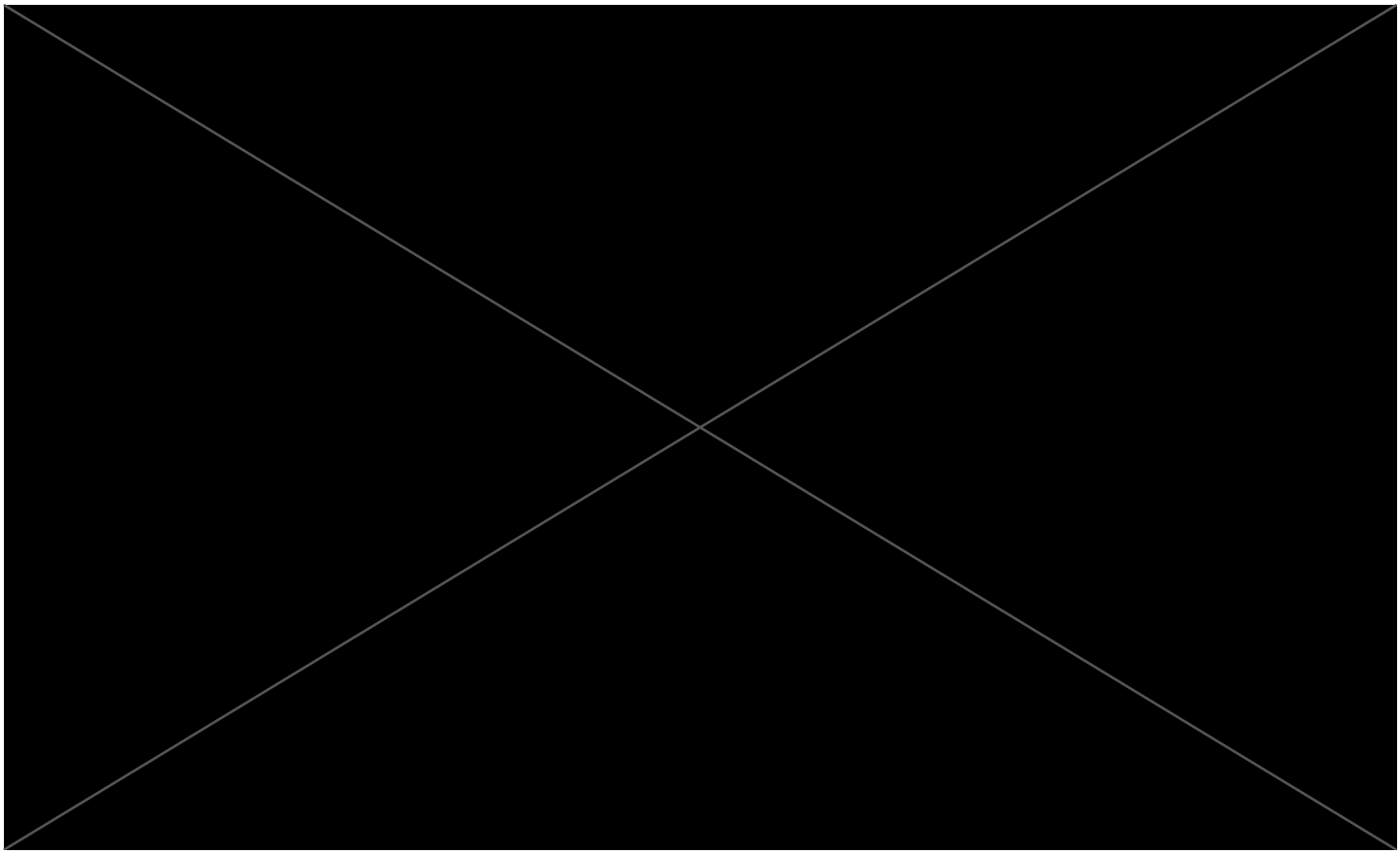
The project area includes Ayakagitma lake and surrounding areas of South Kyzyl Kum desert at the project area of Bash wind farm, not far from the Kuldzhuktau mountain range. Lake formed in the center of the Ayakagitma saline depression. The level of the coastline of this lake is not constant and varies greatly depending on the season. Ayakagitma saline depression was characterized by the presence of typical salt marshes and the so-called ‘chokolaks’ - hills overgrown with Tamarix and Saxaul. In the 80s of the 20th century, the basin of Ayakagitma saline depression was filled with waste water from the irrigated fields of the Bukhara oasis along the 70-kilometer Agytma collector. Ayakagitma lake is surrounded by salt marshes, sandy desert, clay and gypsum cliffs and deep (over 10 m) canyons, which are excellent habitats for many species.

Historic data on mammal fauna of the Ayakagitma lake and surrounding areas of South Kyzyl Kum desert, particularly within the area of planned Bash WF project is fragmentarily described in the fundamental works of I.I. Kolesnikov (1953) and G.I. Ishunin (1961, 1987), Heptner & Sludskii (1972), which provide information on the distribution and biology of rodents, carnivores and ungulates, including those in our study area. In the monograph by T.Z. Zakhidov (1971) a description of the ecosystems of the Kyzyl Kum desert is given, and specific information about animals - vertebrates, including mammals of the South and Central Kyzyl Kum is provided. It is important to note, that in that time Ayakagitma Lake did not exist, and authors described mammal fauna typical for saline desert and sandy desert. Currently we have newly created environment - artificial water reservoir and some fragments of different types of desert in the surrounded territories. Creation of a lake resulted in the creation of the new habitats – wetlands, that gave start for natural succession. Currently some hydrophilic species like badgers and jackals joined the list of mammals of this region.

Totally, the list of mammals (except for bats) of the study area includes 24 species of 5 orders: *Insectivora* (3 species), *Lagomorpha* (1 species), *Rodentia* (11 species), *Carnivora* (8 species) and *Artiodactyla* (1 species). Brandt's hedgehog, Marbled polecat and Goitered gazelle are included in the Red Book of Uzbekistan (2019) and the IUCN Red List. https://www.iucnredlist.org (Table 1), the presence of three more endangered species - Sand cat, Corsac fox and Steppe polecat require additional confirmation.

MATERIAL AND METHODS

The survey was carried out in the South (Southeast) Kyzylkum dessert, in area of Ayakagitma lake and adjacent territories (Fig. 1)



our survey we used two basic methods:

1. Ground transect survey;
2. Camera trapping

During ground transect survey we studied about mammal species number and species composition in walking transect survey. Total length of the walking transect was 25 km, vehicle transect – 75 km, vehicle transect survey with headlight – 22 km (tables 2, 3).

During the field survey, non-invasive approach was implemented, not related to the capture and killing of wild animals, including:

- visual observation of mammals both by eye and using 10x binocular;
- registration of tracks of the vital activity of wild mammals, including animal tracks (paw footprints on the ground), feces, diggings, burrows, dead animals, etc.;

- taking photo of the animals, their tracks and traces of their vital activity, typical habitats.



Five standard Bushnell 119936C camera traps were installed from April, 18 to June 26, 2021. Totally cameras were installed for a 2.5 months at 5 locations in various types of biotopes in the places of the most probable visit of wild animals (trails, watering points, animal marking places, and places of natural constrictions of relief) (Fig 1). Two of five camera traps worked for almost the entire period from start to finish (67-68 days), one camera worked for 49 days, after which the memory card was filled as a result of long photo sessions of Asian wildcat and Eagle owl, one camera was turned over by a Brandt's hedgehog, having worked only 5 days. One camera trap was stolen by local people. Totally we carried out camera trapping during 189 camera traps/days. As a result 11039 total captures including 1143 effective captures with animal records were obtained (table 4, 5). In addition, we interviewed local people – citizens from Ayakagitma village and shepherds.



RESULTS AND DISCUSSION

Mammal species review

The **Order Insectivora** is represented by 3 species: **Long-eared and Brandt's hedgehogs, Lesser white-toothed shrew** (table 1.).

The **Long-eared hedgehog** is a eurytopic species inhabiting all types of ecosystems from foothills to deserts, it does not avoid anthropogenic landscapes. We recorded hedgehog's skins in Egyptian vulture *Neophron percnopterus* nesting place (Ag 03) in April and June (4 skins). Two skins also were recorded in resting place of Eagle owl *Bubo bubo* (Ag 05) in June 2021 (table 2, 3).



Figure 4 Brandt's hedgehog near Ayakagitma lake (Ag 01). Photo by Alexander Esipov

Brandt's hedgehog, near threatened (NT) species included in the Red Data Book of Uzbekistan (2019). During vehicle transect survey with headlight one hedgehog was found (black form, 0,08 indi/ha). Also black hedgehogs were captured by camera traps (4 captures in two locations) (table 4, 5) in clay and gypsum cliffs and caves in vicinity of Ayakagitma lake. In addition, skins and skulls of the Brandt's hedgehogs (black and white forms) were found in Egyptian vulture nesting place in April and June (5 skins and 2 skulls) (table 2, 3). One dead hedgehogs (black form) was found on the road in the vicinity of Zafarabad (Kukcha) town close to project area.



Figure 5 Female Brandt's hedgehog killed by road accident in Zafarabad town. Photo by Elena Bykova

Lesser white-toothed shrew was recorded by Zakhidov (1971) in Agytma area. The small shrew is a hydrophilic species, and usually it inhabits along the banks of water reservoirs, near wells, in oases. We didn't found this species because this required special traps but we found good habitat conditions in *Tamarix* scrublands along the lake.

Tolai hare is the only representative of the Order **Lagomorpha** in the project area (table 1). It is a typical inhabitant of river forests and reed thickets, it also occurs in the foothills and deserts. We recorded one hare during nocturnal survey with headlight in monitoring site Ag_05 (table 2, 3). In addition, shepherds informed that 10-20 hares inhabited the hilly area outside of Ayakagitma lake.

10 **rodents** were recorded in the project area (table 1). The rodent community includes the synanthropic species - **House mouse** that indicate human presence (shepherd's stops, fishery houses, Ayakagitma village), as well as common inhabitants of the clay desert - **Small five-toed jerboa** we observed during survey with headlight in April 2021 (monitoring site Ag 01). We also observed **Yellow ground squirrels** in gravelly and clay deserts in sites Ag 02 and Ag 04. **Severtsov's jerboa** we recorded in the vicinity of Ayakagitma village. Typical inhabitants of sandy desert - **Long-clawed suslik** and

Northern three-toed jerboa was recorded in Ayakagitma area by authors (Zakhidov, 1971; Burnside et al, 2014)

Zaisan mole vole, **Grey dwarf hamster**, and three species of gerbils, including **Great gerbil**, the **Libyan** and **Midday jirds** were also recorded in project area. Colonies of these species were observed in the surveyed area. Also we found dead Libyan jird in nesting place of Egyptian vulture. All gerbils were recorded by Tisha Zakhidov in Ayakogitma area (1971).

Three species of **Mustelidae** inhabited in project area according to the literature data (Ishunin, 1961, 1987; Zakhidov, 1971). We recorded only **Asian badger** by footprints in shrub land (Tamarix sp.) and sandy shore of the Ayakagitma lake (Table 2, 3). The presence of two other species including endangered **Marbled** and **Steppe polecats** were noted in the literature and requires confirmation.



From **Canidae** family three species presented at the project area including **Golden jackal** (Zakhidov, 1971; our questionnaire data), **Red fox** (Zakhidov, 1971; data of our ground survey and camera trapping), **Corsac fox** (Zahkidov, 1971). **Red fox** is the most common and widely distributed predator in desert biotopes, cliffs and cages in the survey

area. We have recorded foxes by footprints, feces, and by camera traps (25 captures time in one location (Ag 01) (table, 4, 5).

Felidae represented by **Asiatic wildcat** and probably S**and cat**. **Asiatic wildcat** is the most common cat species. During camera trapping it was spotted 10 times by two cameras in locations Ag 01 and Ag 05 (table 4, 5). **Sand cat** is one of the most rare species, his status in Uzbekistan is unknown. But authors reported about Sand cat from Southern Kyzylkum (Zakhidov, 1971; Burnside et al, 2014). During the Soviet period, there appears to have been a well-established presence of the cat in the Kyzylkum Desert of Uzbekistan where it was also hunted (Heptner & Sludskii 1972). Records in recent years reported by Robert Burnside with co-authors (2014) by three separate sightings of Sand cats - two in 2013 and one in 2014 in sandy semi-desert and shrub on a clay and gravel plain vegetated with Salsola spp. Threats for sand cat in Southern Kyzylkum are disturbance from the high density of sheep flocks, severe winters, food competitors of the sand cat are Red fox and Asiatic wildcat (Bogdanov, 1992; Gritsina, 2014; Gritsina et al., 2016; Burnside et al, 2014).

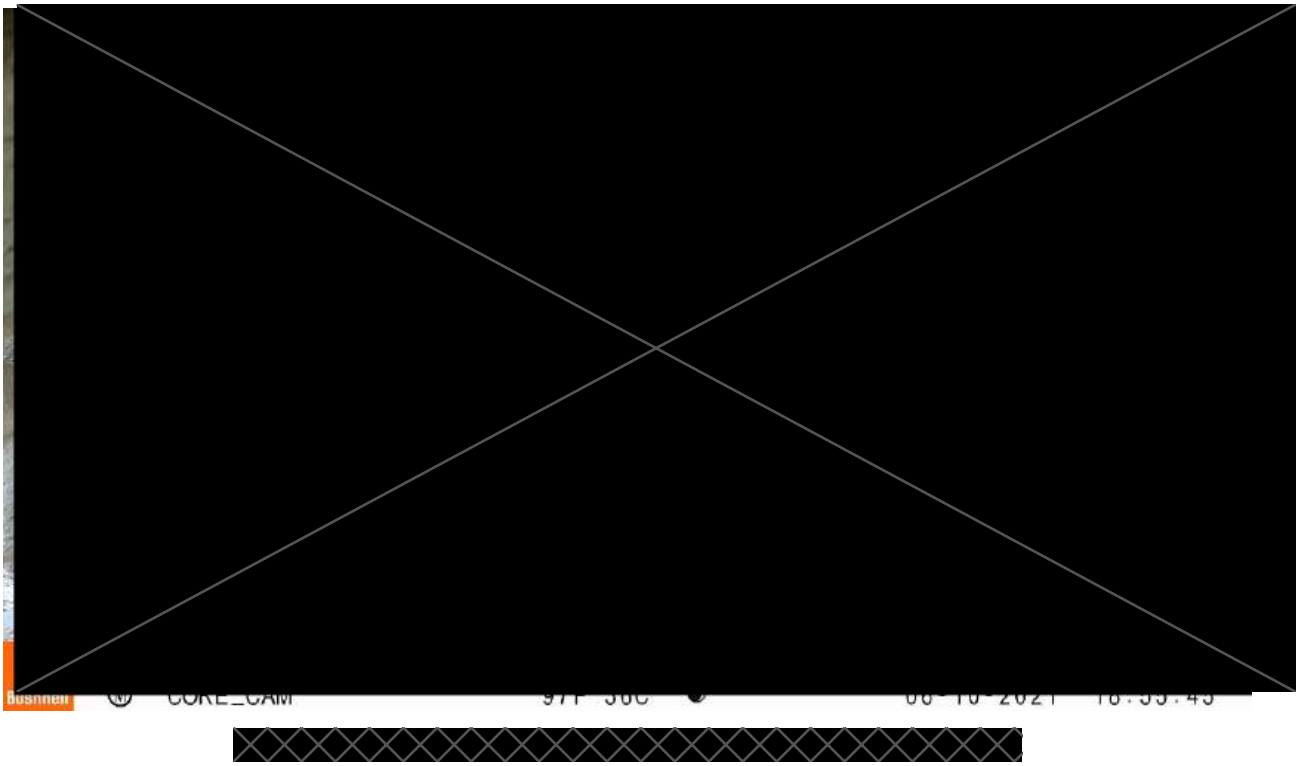


Table 1 - Characteristics of non-bat mammals in the project area and adjacent areas of the Southern Kyzylkum (Ayakagitma ridge, Navoi province, Bash WF project site)

№ п/п	Species	Conditional population estimate	Status of threat IUCN RedList/Uzbekistan RDB	Sources
1	Long-eared hedgehog *Hemiechinus auritus* Gmelin, 1770	O-M	LC/-	Ground survey
2	Brandt's hedgehog *Paraechinus hypomelas* (Brandt, 1836)	P-E	LC/3NT	Camera trapping; road accident (Zafarabad);
3	Lesser white-toothed shrew *Crocidura suaveolens* Pallas, 1811	O-H	LC/-	Zakhidov, 1971; Volozheninov, 1981
4	Tolai hare *Lepus totai* Pallas, 1778	O-M	-/ game species	Ground survey, camera trapping, road accident (OHTL 115 km); Zakhidov, 1971
5	Long-clawed ground squirrel *Spermophilopsis leptodactylus* (Lichtenstein, 1823)	O-H	LC/-	Zakhidov, 1971; Burnside et al, 2014
6	Yellow ground squirrel *Spermophilus fulvus* (Lichtenstein, 1823)	O-M	LC/-	Ground survey; Zakhidov, 1971
7	Small five-toed jerboa *Allactaga elater* (Lichtenstein, 1825)	O-M	-	Ground survey; Zakhidov, 1971
8	Severtzov's jerboa *Allactaga severtzovi* Vinogradov, 1925	O-H	LC/-	Zakhidov, 1971; road accident (near Agytma village)
9	Northern three-toed jerboa *Dipus sagitta* (Pallas, 1773)	O-H	LC/-	Zakhidov, 1971
10	Great gerbil *Phombomys opimus* (Lichtenstein)	O-M	LC/-	Ground survey; Zakhidov, 1971
11	Libyan jird *Meriones libycus* Lichtenstein, 1823	O-M	LC/-	Ground survey; camera trapping; Zakhidov, 1971
12	Midday jird *Meriones meridianus* (Pallas, 1773)	O-M	LC/-	Ground survey; Zakhidov, 1971
13	Grey dwarf hamster *Cricetulus migratorius* Pallas, 1773	O-H	LC/-	Zakhidov, 1971
14	Zaisan Mole Vole *Ellobius tancrei* Blasius, 1884	O-M	LC/-	Ground survey; Zakhidov, 1971
15	House mouse *Mus musculus* Linnaeus, 1758	O-H	-/-	Ground survey; Zakhidov, 1971
16	Golden Jackal *Canis aureus* (Linnaeus, 1758)	O-H	LC/game species	questionattie data

17	Corsac Fox Vulpes corsac (Linnaeus, 1768)	P-E	LC/2(VU:D)	Zakhidov, 1971; Red data book of Uzbekistan, 2019; need to be confirmed
18	Red fox *Vulpes vulpes* Linnaeus, 1758	O-M	LC/ game species	Ground survey; camera trapping; Zakhidov, 1971
19	Marbled Polecat *Vormela peregusna* (Güldenstädt, 1770)	P-E	VU/2(VU:D)	Zakhidov, 1971; Red data book of Uzbekistan, 2019
20	Steppe Polecat *Mustela eversmanii* Lesson, 1827	P-E	LC/2(VU:D)	Zakhidov, 1971; Red data book of Uzbekistan, 2019
21	Asian Badger *Meles leucurus* (Hodgson, 1847)	O-H	LC/game species	Ground survey
22	Asiatic wildcat *Felis sylvestris ornate* Gray, 1830	O-M	-/ game species	Ground survey, camera trapping; Ishunin, 1961, 1987; Zakhidov, 1971
23	Sand cat *Felis margarita* Loche, 1858	P-E	LC/3NT	Zakhidov, 1971; Burnside et al, 2014
24	Goitered Gazelle *Gazella subgutturosa* (Güldenstädt, 1780)	P-H	VU/3(VU)	Ground survey; questionattie data; Marmazinskaya & Gritsina, 2017; Gritsina et al, 2017; Red data book of Uzbekistan, 2019; Bykova et al, 2020

Notes: *Conditional estimate of the number: E - single, H - few, M - Numerous; O - common, R - rare. IUCN Red List categories: Extinct (EX); Extinct in the Wild (EW); Critically Endangered (CR); Endangered (EN); Vulnerable (VU); Near Threat (NT); Least concern (LC); Data Deficient (DD); Categories of the Red Data Book of the Republic of Uzbekistan (2019): Extinct 0 (EX); Extinct in the Wild 0 (EW); Critically Endangered 1 (CR); Endangered 1 (EN); Vulnerable 2 (VU: D); Naturally Rare 2 (VU: R); Near Threat 3 (NT); Data Deficient (DD).*



Figure 8 Goitered gazelle in a desert near Ayakagitma lake. Photo by Alexander Esipov

The area of the planned Bash WF project is inhabited by the only species of wild ungulates - the **Goitered gazelle**. The animals inhabiting in Ayakagitma lake belong to the Central Kyzylkum population, the total number of which is about 3000-5000 individuals (Gritsina et al., 2016; Marmazinskaya, Gritsyna, 2017; Bykova et al., 2020). During our survey, we recorded single Goitered gazelle in vegetation in sandy desert close to Ayakagitma lake. During camera trapping we also captured three gazelles (male, female with calf) in dry canyon connecting desert plain and lake. Gazelles use this area as daily migratory corridor (monitoring site Ag-03). We also obtained questionnaire data from local shepherds on the constant records of small groups of gazelles – groups of 2-5 individual in Ayakagitma area and surrounded areas. According to our expert assessment, about 125-150 individuals are present in the project area. Since the presence of a wolf has not been confirmed in the project area, it seems that Goitered gazelle has no natural predators in the area. The main threats are poaching, habitat loss, habitat degradation and fragmentation due to economic development of the region, lack of forage in snowy winters, shepherd's dog's depredation of calves, and human disturbance.

Ground transect survey

On April 18-21, and June 23-25 we conducted ground transect survey to collect spring data with focus on seasonal species (ground squirrels). Additionally, we used information about animals killed by predators, or accidentally killed on the road in project area, particularly main road in the vicinity of Zafarabad (Kukcha) town. We also used questionnaire data from local people.



Totally 13 mammal species have been registered visually and by the tracks of the vital activity (table 2, 3), including 2 insectivores (Paraechinus hypomelas, Hemiechinus auritus), 1 hare, five rodents, four carnivores and one ungulate species. Two species - Brandt's hedgehog and Goitered gazelle are listed as endangered species. We also got questionnaire data on mammals, including common species – jackal, red fox, Asian badger, wild cat, tolai hare, and endangered species – goitered gazelle.



[redacted]



[redacted]

Table 2 – Mammals recorded in monitoring locations during field survey in the project area (Ayakagitma ridge, Navoi province, Bash project site) in April, 2021

# Monitoring site	Coordinates, WGS-84, grade/min/sec	Data	Biotope	Mammals recorded in monitoring site	Notes
Ag_01	[redacted]	18.04.21	Degraded mountain, sandy desert, shrub land (*Tamarix* sp.) in Ayakagitma lake shore	*Rhombomys opimus* *Paraechinus hypomelas* *Allactaga elater* *Meles leucurus* *Vulpes vulpes*	livestock (domestic goats and sheep) tracks
Ag_02	[redacted]	19.04.2021	Stony-sandy mountain desert, degraded mountains with rocks, niches, caves 227 m asl	*Spermophilus fulvus* *Rhombomys opimus* *Ellobius tancrei* *Meles leucurus* *Canis auritus* *Vulpes vulpes*	livestock (domestic goats and sheep) tracks and scats
				Meles leucurus - common *Canis auritus – a few* *Vulpes vulpes - common* *Gazella subgutturosa – 2 females in NE Ayakagitma lake in March 2021*	Questionnaire data by local shepherd
Ag_03	[redacted]	19.04.2021	Clay semi desert, dry gorge with cliff heights up to 10 m	*Rhombomys opimus* *Paraechinus hypomelas* *Hemiechinus auritus*	

				Meriones libycus *Ellobius tancrei* *Vulpes vulpes* *Gazella subgutturosa*	
Ag_04	[redacted]	20.04.2021	Sandy and clay desert and *Tamarisk* shabland along lake. Area covered foothills of degraded mountains and bank of Ayakagitma	*Rhombomys opimus* *Ellobius tancrei*	
				Meles leucurus *Canis auritus* *Vulpes vulpes* *Felis silvestris ornate*	Questionnaire data by fisherman Kholmurad Azimov
	[redacted]		Area between Ayakagitma lake and railway. Sandy desert with Saxaul shrubs	*Rhombomys opimus* *Ellobius tancrei* *Gazella subgutturosa*	Natural gas pipelines and infrastructure in some points of survey area Vehicle transect survey
	[redacted]		Trail along railway. Sandy desert with semi-shrubs	*Paraechinus hypomelas* *Spermophilus fulvus* *Rhombomys opimus* *Ellobius tancrei*	Vehicle transect survey
Ag_05	[redacted]	21.04.2021	The eastern slope of a solitary peak with numerous rocky outcrops and grottoes on opposite side from Ayakagitma lake	*Hemiechinus auritus* *Paraechinus hypomelas* *Lepus totai* *Meriones libycus*	High pressure by domestic livestock, and anthropogenic factor – all area covered with network of ground roads and

				Ellobius tancrei *Rhombomys opimus*	industrial objects (railway, railway stations, power lines). Vehicle transect survey
				Lepus totai *Felis silvestris ornate* *Gazella subgutturosa*	Questionnaire data by local shepherd Maksud Sherimov

Table 3 – Species composition and number in the project area (Ayakagitma ridge, Navoi province, Bash project site) in April, 2021 gathered during ground survey and questionnaires

№№	Species	Monitoring site	route length (km) / surveyed area (ha)	Number, individuals/colonies/ burrows	Survey methods	Number assessment
Mammals						
1	*Hemiechinus auritus*	Ag_03 Ag_05	3 km NA	4 skins in nesting place of Egyptian vulture; 2 skins in resting place of eagle owl	Ground transect survey	A few, locally distributed
2	*Paraechinus hypomelas (black and white forms)*	Ag_01, Ag_03, Ag_05	12 km; 3 km; 10 km	1 indi (black form, visually) + 5 indi (5 skins and 2 skulls in nest of Egyptian vulture)	Vehicle transect survey with headlight; Ground transect survey; vehicle transect survey	A few, widely distributed
3	*Lepus totai*	Ag_05	10 km	1 indi, 10-20 indi (questionnaire data)	Vehicle transect survey with headlight; questionnaire data	A few, widely distributed
4	*Spermophilus fulvus*	Ag_02 Ag_04	3 km 50 km	3 indi 3 indi	Ground transect survey; Vehicle survey	Common, locally distributed
5	*Ellobius tancrei*	Ag_02 Ag_04 Ag_05	4 km 50 km 10 km	1+10 +2 + 5 inhabited colonies+2 inhabited colonies 2 inhabited colonies+2 inhabited colonies	Ground transect survey Vehicle transect survey	Common, widely distributed
6	*Allactaga elater*	Ag_01	12 km	1 indi	Vehicle transect survey with headlight	A few, widely distributed

7	*Rhombomys opimus*	Ag_01, Ag_02, Ag_03 Ag_04 Ag_05	3 + 3 + 3+3 km 50 km 10 km	4 (inhabited) + 9 (5 inhabited + 4 uninhabited) + 5 (inhabited) + 25 (inhabited)+5 (inhabited) 28 inhabited colonies and 2 indi visually+5 inhabited colonies	Ground transect survey Vehicle transect survey	Common, widely distributed
8	*Meriones libycus*	Ag_03 Ag_05	3 km 10 km	1 individual killed by Egyptian vulture + 2 inhabited colonies	Ground transect survey Vehicle transect survey	Common, widely distributed
9	*Canis auritus*	Ag_04	NA	1-2 indi (questionnaire data)	Questionnaire data	A few, locally distributed
10	*Vulpes vulpes*	Ag_02	3 km + 3 km	1 +2 scats	Questionnaire data	Common, widely distributed
11	*Meles leucurus*	Ag_01, Ag_02 Ag_04	3 + 3 km NA	1+1 indi (visually) 10 indi (questionnaire data)	Ground transect survey Questionnaire data	Common, locally distributed
12	*Felis silvestris ornate*	Ag_04	NA	Single individuals by questionnaire data	Questionnaire data	A few, widely distributed
13	*Gazella subgutturosa*	Ag_02, Ag_03, Ag_05	3 km 15 km NA	1-2 indi per group (questionnaire data) 1 indi visually	Ground transect survey Vehicle transect survey Questionnaire data	A few, widely distributed

Camera trapping

Camera trapping was conducted from April, 18 till June, 26 in different biotopes of South East Kyzylkum desert in the area of Ayakagitma lake in Bash WF project area, including rocky cliffs with numerous grottoes, caves, rocky canyons, dry stream in Saxaul forest. Area visited by shepherds and railway workers. One of five camera traps was stolen by local people (more likely), so we analysed data from 4 camera traps, which recorded 4 species of wild mammals, including two endangered species – Brandt's hedgehog and Goitered gazelle (Table 4, 5).

Table 4 - List of mammals captured by camera traps in the Bash WF project area (Ayakogitma lake), April, 18 - June, 26, 2021

##	Species	Captures number					
		Ag 01	Ag 02	Ag 03	Ag 04	Ag 05	всего:
1	Brandt's hedgehog *Paraechinus hypomelas*	1	3	-	-	-	4
2	Red fox *Vulpes vulpes*	25 / 2	-	-	-	-	25
3	Asiatic wildcat *Felis sylvestris ornate*	2	-	-	-	8	10
4	Goitered Gazelle *Gazella subgu*	-	-	7 / 2	-	-	7
	Total captures	**28**	**3**	**7**	**-**	**8**	**46**

The total number of registrations of wild mammals was 46. The number of captures of wild mammals per camera trap ranged from 3 (Ag 02) to 28 (Ag 01). The number of wild mammal species recorded by one camera trap ranged from 1 (Ag 02, Ag 03, Ag 05) to 3 (Ag 01).

The largest number of records was made of Red fox (25 captures by one camera, including in one case there were 2 individuals interacted in one point). Asiatic wildcat was spotted 10 times by two cameras. Goitered gazelle was captured by one camera seven times, including once two animals (female and calf). Brandt's hedgehog has been recorded four times by two cameras.

In addition, camera traps recorded a large number of livestock (sheep, goats, horses), people (on foot and on motorcycles), as well as birds (e.g. endangered Egyptian vulture), reptiles and invertebrates.

Camera trapping is a very good method for the capturing endangered species such Brandt's hedgehog and Goitered gazelle. Our survey also showed that cameras are very

successful in registering foxes, hedgehogs, wild cats and a number of animals that use shelters in the summer time (see Appendix).

Cameras also help to observe some features of animal biology, for example, the marking behavior of young foxes, one of which marked with urine, another sniffed a urinary tag. We were also able to obtain information on the daily activity of different species, including Goitered gazelles. Cameras recorded how gazelles in the morning walked towards the watering place on the Ayakagitma lake, and in the evening they returned back to the desert using canyon created in dry river bed as a corridor. In addition, using these images, we obtained data on the age and sex ratio of captured gazelles - our cameras recorded a single male and a female with a calf. We also observed food behavior of two birds of prey - a little owl *Athene noctua* eating a steppe agama *Trapelus sanguinolentus* and Egyptian vulture *Neophron percnopterus* walking from the corpse of a dead sheep (we observed this corpse at the moment of taking the camera off and realized that the vulture was returning from a meal) (see Appendix).

Table 5 – Camera trap locations, nearest wind turbines and mammals recorded in monitoring sites by camera traps in the Bash WF project area (Ayakogitma lake) in April, 18 - June, 26, 2021

# Monitoring site	Coordinates, WGS-84, (N E A)	## turbine / dist (km)	Biotop	Start /finish records	Camera traps / days	total captures/ effective captures	Mammals recorded in monitoring site	Number of records / max number of individuals
Ag 01	[redacted]	B057 / 2.54 B056 / 2.55 B058 / 2.61	Degraded mountain, sandy desert, shrub land (*Tamarix* sp.) in Ayakagitma lake bank	18. 04/ 23.06	67	5076 / 492	Brandt's hedgehog Red fox Asian wildcat	1 25 / 2 2
Ag 02		B059 / 0.85 B060 / 0.90 B058 / 1.20	Stony-sandy mountain desert, degraded mountains with rocks, niches, caves 227 m asl	19.04 / 23.06	5	111 / 31	Brandt's hedgehog	3
Ag 03		[redacted] / 0.77 B085 / 1.20 B087 / 1.21	Clay semi desert, dry gorge with cliff heights up to 10 m	19.04/ 25.06	68	684 / 206	Goitered gazelle	7 / 2
[redacted]		B070 / 0.81 B069 / 1.28 B068 / 1.78	Dry stream bed under railway. Sandy desert with semi-shrubs	20.04 / -	-	-	-	-
Ag 05		B083 / 5.24 B082 / 5.68 B054 / 5.77	The eastern slope of a solitary peak with numerous rocky outcrops and grottoes on opposite side from Ayakagitma lake	21.04 / 8.06	49	5168 / 414	Asian wildcat	8

Planned Bash WF – Karakul SS OHTL survey

On June 29-31, 2021 we conducted ground transect survey to collect data about mammal species along planned Bash WF - Karakul SS OHTL in Navoi and Bukhara districts.

We used a method of ground transect survey with walking transects each 15 km (Bash WF - Karakul SS). We stopped each 15 km and walked approximately 1 km from the planned OHTL line, to gather information about mammals (and other animals) including:

- visual observation of mammals both by eye and using 10x binocular;
- registration of tracks of the vital activity of wild mammals, including animal tracks (paw foot prints on the ground), feces, digging, burrows, dead animals, etc.;
- taking photo of the animals, their tracks and traces of their vital activity, typical habitats.

Totally we conducted walked transects at Bash WF - Karakul SS with total length 8 km (table 6). Also we conducted vehicle survey with headlight at Bash WF - Karakul SS (10 km).

Table 6. Data on mammals (and other vertebrates) inhabited along planned OHTLs collected along planned Dzankeldy WF-Bash WF OHTL and Bash WF - Karakul SS OHTL in June 2021

# transect	Biotop	Mammals	Other wild and domestic animals
Bash WF - Karakul SS OHTL, June, 2021 (interval 15 km)			
Transect 1	Semi-shrub steppe, furrows from old saxaul plantations	Small five-toed jerboa (2 inhabited barrows) Libyan jird (1 inhabited colony) Red fox (1 indi, diggings)	Sunwatcher *Phrynocephalus helioscopus* Many tracks and dungs of domestic livestock
Transect 2	*Tamarix* spp. shrub land, reeds	Tolai hare (1 indi)	Many tracks and dungs of domestic livestock
Transect 3	Canal with *Tamarix* spp. shrubs and reeds	No any signs of mammals	Long-legged buzzard *Buteo rufinus* Tracks and dungs of domestic livestock
Vehicle transect survey with headligh, 10 km	Sandy desert with *Ferula assa-foetida* and saxaul *Haloxylon* spp.	Mammals didn't recorded	Flock of domestic sheep
Transect 4	Sandy desert with *Ferula assa-foetida* and saxaul *Haloxylon* spp.	No any signs of mammals	Passeriformes
Transect 5	Road along canal: *Tamarix* spp., reed overgrazing rice paddy fields	No any signs of mammals	Glossy ibis *Plegadis falcinellus* (10 indi), purple heron *Ardea purpurea* (2 indi), Charadriformes, Passeriformes
Transect 6	Vegetation desert with Alhagi and Carelinia	Long-clawed ground squirrel (2 inhabited barrows, tracks) Small five-toed jerboa (1 indi, tracks) Great gerbil (2 inhabited colony) Midday jird (3 inhabited colony)	Eremias scripta (1 indi), Passeriformes
Transect 7	Canal and crops overgrazing by reed and Alhagi	No any signs of mammals	Purple heron *Ardea purpurea* (1 indi), European roller Coracias garrulous (1 indi), Passeriformes

Transect 8	Old craps overgrazing by reed, Alhagi and Carelinia	Yellow ground squirrel (2 indi) Red fox (1 indi, tracks)	Blue-cheeked bee-eater *Merops superciliosus* (6 indi), carrion crow *Corvus corone* (3 indi), Passeriformes









CONCLUSION

As a result of the survey (Table 6), 13 of 24 mammalian species were observed in the Bash WF project area, including 2 species Brandt's Hedgehog and Goitered Gazelle listed in Red Data Book of Uzbekistan and IUCN Red List. General diversity of observed area is rich, because it conisists of different landscapes including different types of desert, desert clay and gypsum hills with some rocky sites, niches and caves, canyons, scrublands and coastal zone and Ayakagitma lake itself. All this creates a wide variety of biotopes, and good natural conditions for the different species of animals, including mammals.

Table 6. Summary list on the mammals recorded in area of the Bash WF project (ground survey, April/June 2021; camera trapping, April - June, 2021)

	NAME OF SPECIES		IUCN /RDB STATUS	TOTAL NO. OBSERVED
	LATIN	ENGLISH		
1	*Hemiechinus auritus*	Long-eared hedgehog	LC/-	6 individuals
2	*Paraechinus hypomelas*	Brandt's hedgehog	LC/3NT	6 individuals/4 camera trap captures
3	*Lepus totai*	Tolai hare	-/game sp	1 individuals
4	*Spermophilus fulvus*	Yellow ground squirrel	LC/-	6 individuals
5	*Ellobius tancrei*	Zaisan Mole Vole	LC/-	24 inhabited colonies
6	*Allactaga elater*	Small five-toed jerboa	-	1 individuals
7	*Allactaga severtzovi*	Severtzov's jerboa	LC/-	1 individuals
8	*Phombomys opimus*	Great gerbil	LC/-	2 individuals; 77 inhabited colonies
9	*Meriones libycus*	Libyan jird	LC/-	1 individual; 2 inhabited colonies
10	*Vulpes vulpes*	Red fox	LC/ game sp	3 individuals/25 camera trap captures
11	*Meles leucurus*	Asian Badger	LC/game sp	2 individuals
12	*Felis silvestris ornate*	Asiatic wildcat	-/game sp	10 camera trap captures
13	*Gazella subgutturosa*	Goitered Gazelle	VU/3(VU)	1 individual /7 camera trap captures (1 male: 1 femail:1 young)

Critical habitats located in trans zonal area including coastal zone and Ayakagitma lake, desert hills and plain between them. This area is inhabited by Brandt's Hedgehog and Goitered gazelle. Also this area is inhabited by other mammal species including such important and interesting species as Asiatic wildcat, Asian badger, Fox, Jackal, Tolai

hare, Long-eared hedgehog, Gerbils, Ground squirrels etc. Ayakagitma lake plays a significant role as a resting and feeding place for migratory birds. Lake attracts a large number of waterfowl and near-water birds (e.g. we observed flocks of the endangered flamingo, mute swans), clay cliffs bordering the Ayakagitma depression are excellent nesting places for birds of prey (e.g. we observed endangered Egyptian vulture, Eagle owl and Liittle owl). In addition, this area is inhabited by numerous reptiles including endangered species - Desert monitor and Russian tortoise. From another hand this area is impacted by overgrazing, and human disturbance near the settlement and linear infrastructure - railway, water and gas pipelines and assisted infrastructure. All of this clearly demonstrate that Ayakagitma lake and surrounded areas (desert plain up to railway and Zafarabad railway station) is a critical area for biodiversity and requires protection.

Our data from Bash WF - Karakul SS OHTL demonstrated very low diversity of mammals due to very strong development of land for agriculture. This led for habitat loss, fragmentation and degradation. Almost all existing virgin lands looks transformed or degraded. List of mammals includes 8 species: 1 hare, 6 rodents, 1 carnivore (table 7). We didn't record any endangered mammals. Glossy Ibis is the only endangered bird species was found.

Table 7. Summary list of the mammals recorded in area of the Bash WF - Karakul SS OHTL (ground transect survey, each 15 km 1 km transect, June 2021)*

	NAME OF SPECIES		IUCN /RDB STATUS	TOTAL NO. OBSERVED
	LATIN	ENGLISH		
1	*Lepus totai*	Tolai hare	-	1 individual
2	*Spermophilus fulvus*	Yellow ground squirrel	LC/-	2 individuals
3	*Spermophilopsis leptodactylus*	Long-clawed ground squirrel	LC/-	2 individuals
4	*Phombomys opimus*	Great gerbil	LC/-	2 inhabited colonies
5	*Meriones libycus*	*Libyan jird*	LC/-	1 inhabited colony
6	*Meriones meridianus*	*Midday jird*	LC/-	3 inhabited colonies
7	*Allactaga elater*	Small five-toed jerboa	-	1 individual, 2 inhabited burrows
8	*Vulpes vulpes*	Red fox	LC/-	2 individuals

Notes: *8 transects

RECOMENDATIONS

- to move first line of wind turbines (B01-B056) that are nearest to the lake to the distance up to the railway

- to continue monitoring of mammals both during construcrion and after commissioning of the wind turbines

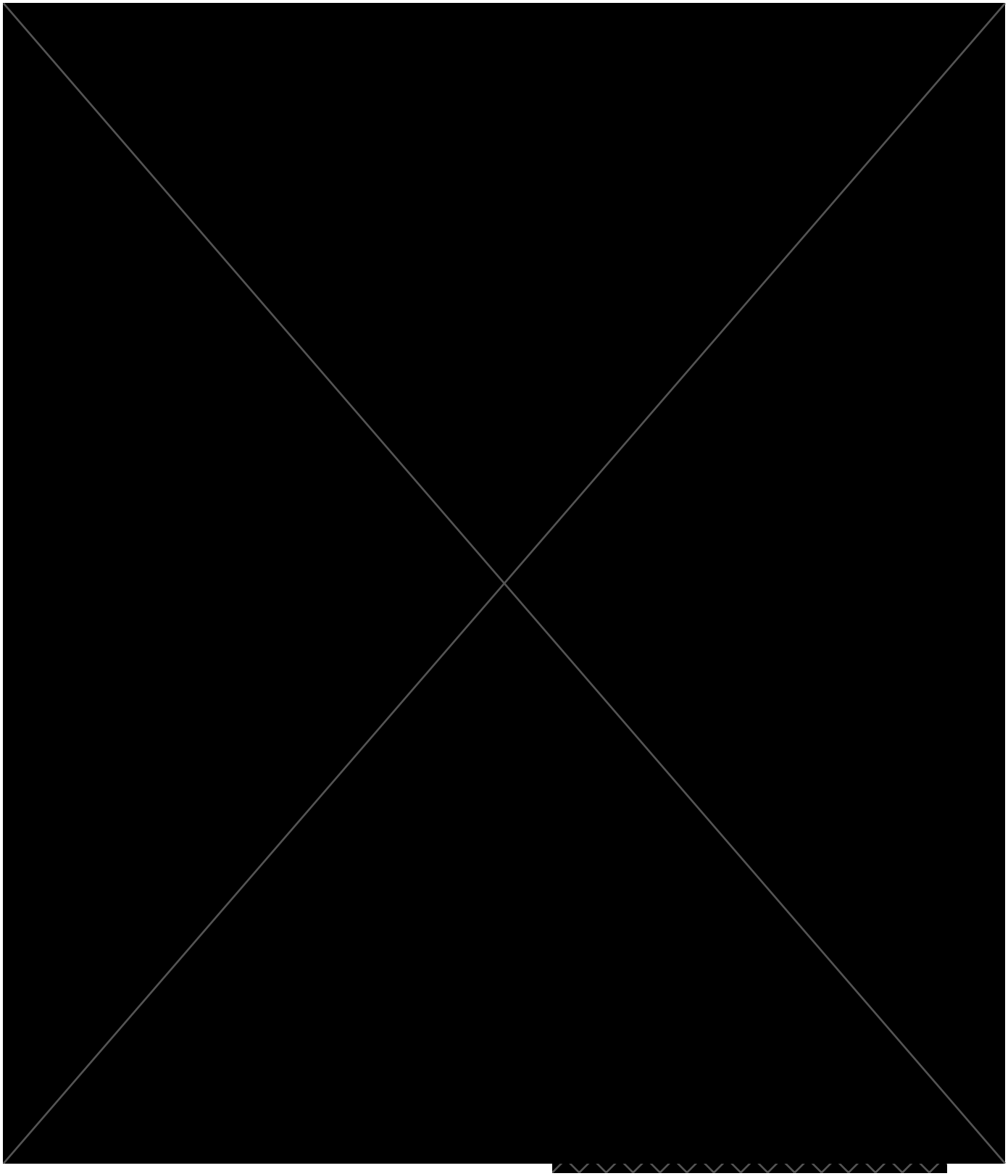
- to develop conservation measures to protect sub-populations of globally threatened Goitered gazelle and other vulnerable wild species, including preparing of a justification for organizing Ayakagitma reserve (zakaznik), public awareness and strengthening the capacity building of the regional biodiversity rangers to combat poaching.

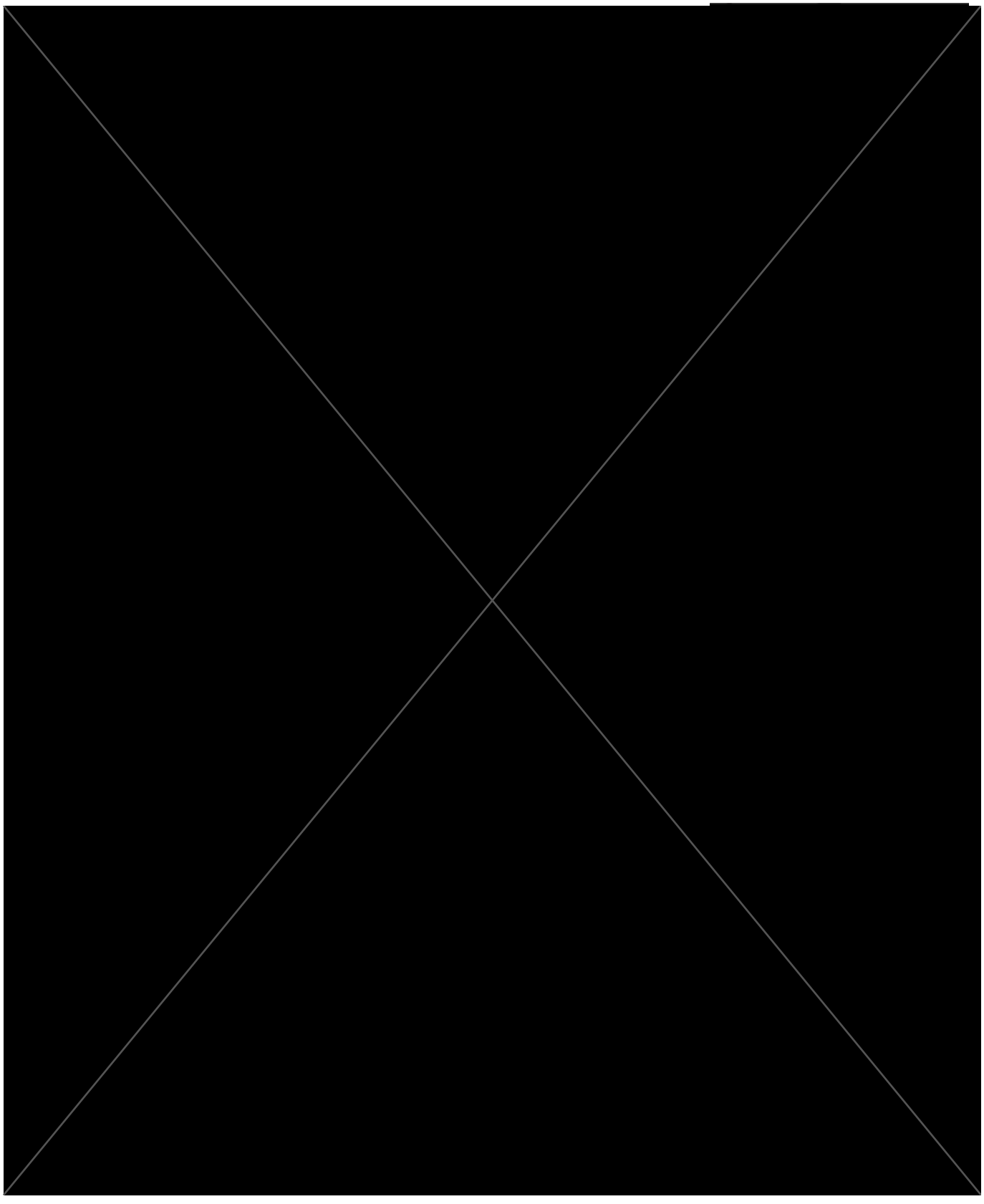
References

1. Bogdanov O. P. Rare animals of Uzbekistan: Encyclopedic reference book. Tashkent, 1992. 400 p. (in Russian) [Богданов О.П. Редкие животные Узбекистана: Энциклопедический справочник. Ташкент, 1992. 400 с.]
2. Bykova E.A., Marmazinskaya N.V., Esipov A.V., Gritsyna M.A. A brief overview of the state of rare ungulates in Uzbekistan. “Ecosystems of Central Asia: Research, Conservation, Rational Use”. Krasnoyarsk, 2020. P. 199-205. (in Russian) [Быкова Е.А., Мармазинская Н.В., Есипов А.В., Грицына М.А. Краткий обзор состояния редких копытных Узбекистана. “Экосистемы Центральной Азии: исследование, сохранение, рациональное использование”. Красноярск, 2020. С. 199-205.]
3. Gritsina M. Sand cats in Uzbekistan. Sand Cat Working Group. http://www.sand-cat.wild-cat.org. Accessed on 19 April 2014.
4. Gritsina, M.A., D.A. Nuridjanov, N.V. Marmazinskaya, T.V. Abduraupov, V.A. Soldatov & A.N. Barashkova Some rare faunistic findings related to the mammals in the Territory of Uzbekistan]. Some rare faunistic findings related to the mammals in the Territory of Uzbekistan. Tashkent, 2016, pp. 77–82. (in Russian) [Грицына М.А., Нуриджанов Д.А., Мармазинская Н.В., Абдураупов Т.В. Солдатов В.А., Барашкова А.Н. Некоторые редкие фаунистические находки млекопитающих на территории Узбекистана // Современные проблемы сохранения редких, исчезающих и малоизученных животных Узбекистана, Ташкент. 2016. - С.77-82.]
5. Heptner, V.G. & A.A. Sludskii Mammals of the Soviet Union. Vol. 1, Part 2. Carnivora (Hyenas and Cats)]. Vysshaya Shkola, Moscow, 1972, pp. 366–384. (in Russian) [Гептнер В.Г., Слудский А.А. Млекопитающие Советского Союза. Том второй. Хищные (гиены и кошки). - Москва: Высшая школа, 1972. - С. 457 – 477.]
6. Ishunin, G. I. Mammals (Predators and Ungulates). The Fauna of Uzbek SSR. V.3. Tashkent, 1961. 230 p. *(in Russian)* [Ишунин Г.И. Млекопитающие (хищные и копытные). Фауна Узбекской ССР. Т.3. Ташкент, 1961. 230 с.]
7. Kolesnikov I.I. Mammals (Ridents). The Fauna of Uzbek SSR. V 3, Issue.5. Tashkent, 1953. 137 p. *(in Russian)* [Колесников И.И. Млекопитающие (грызуны). Фауна Узбекской ССР. Т.3, вып.5. Ташкент, 1961. 137 с.]

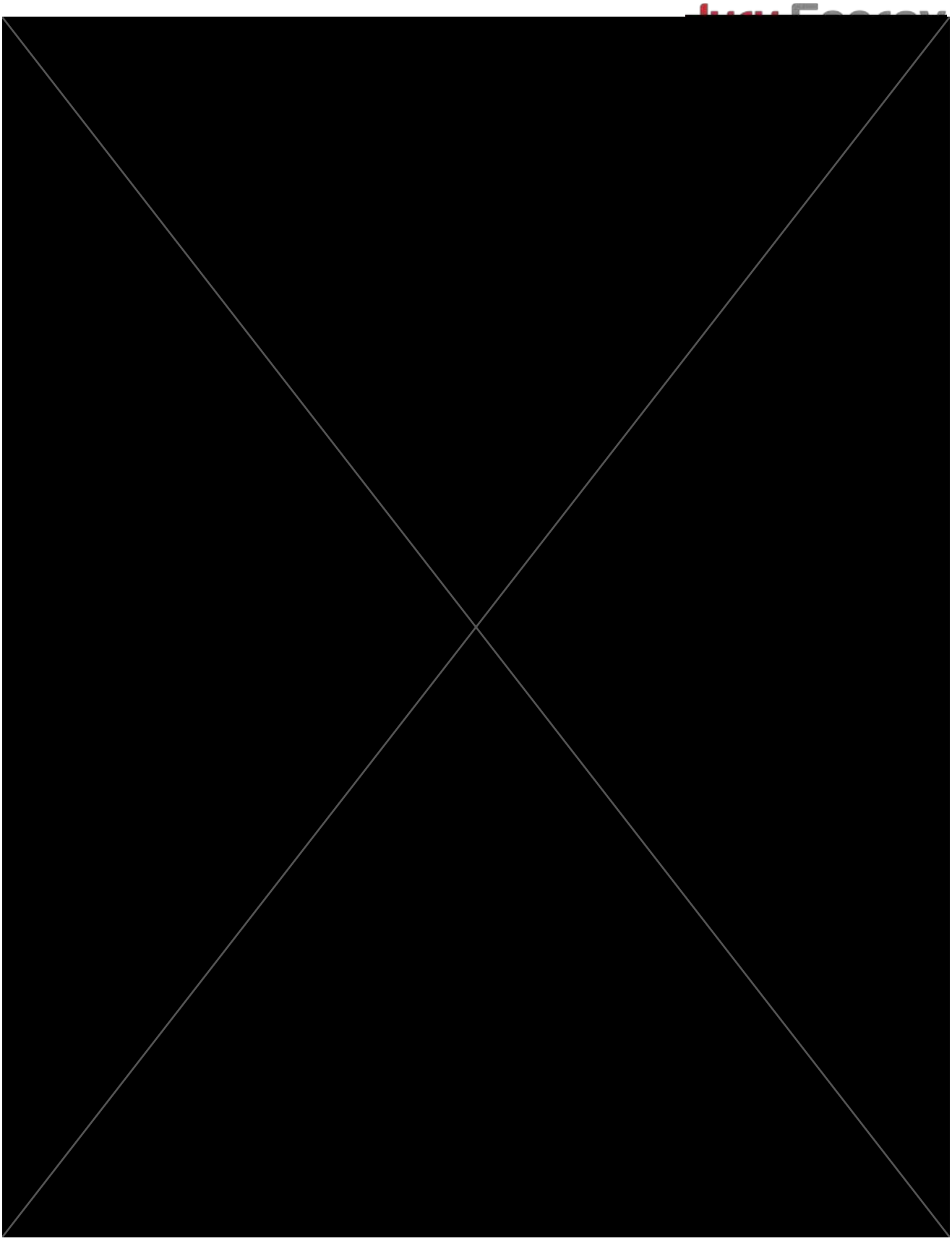
8. Marmazinskaya N.V., Gritsyna M.A. Modern distribution of goitered gazelle Gazella subgutturosa Güldenstädt, 1780 in the Kyzylkum desert (Uzbekistan). Spatial-temporal dynamics of biota and ecosystems of the Aral-Caspian basin. Orenburg, 2017. P. 261-267. (in Russian) [Мармазинская Н.В., Грицына М.А. Современное распространение джейрана Gazella subgutturosa Güldenstädt, 1780 в пустыне Кызылкум (Узбекистан). Пространственно-временная динамика биоты и экосистем Арало-Каспийского бассейна. Оренбург, 2017. С. 261-267.]
9. Robert J. Burnside, Maxim Koshkin and Paul M. Dolman Breeding population of sand cat in the Southern Kyzylkum Desert, Uzbekistan. Cat news N 60 Spring 2014. P.25-26.
10. Zakhidov T.Z. Biocenoses of the Kyzyl Kum Desert (experience of the ecological and faunistic analysis and synthesis). Tashkent, 1971, 304 p. (*in Russian*) [Захидов Т.З. Биоценозы пустыни Кызылкум (опыт эколого-фаунистического анализа и синтеза). Ташкент, 1971. 304 с.

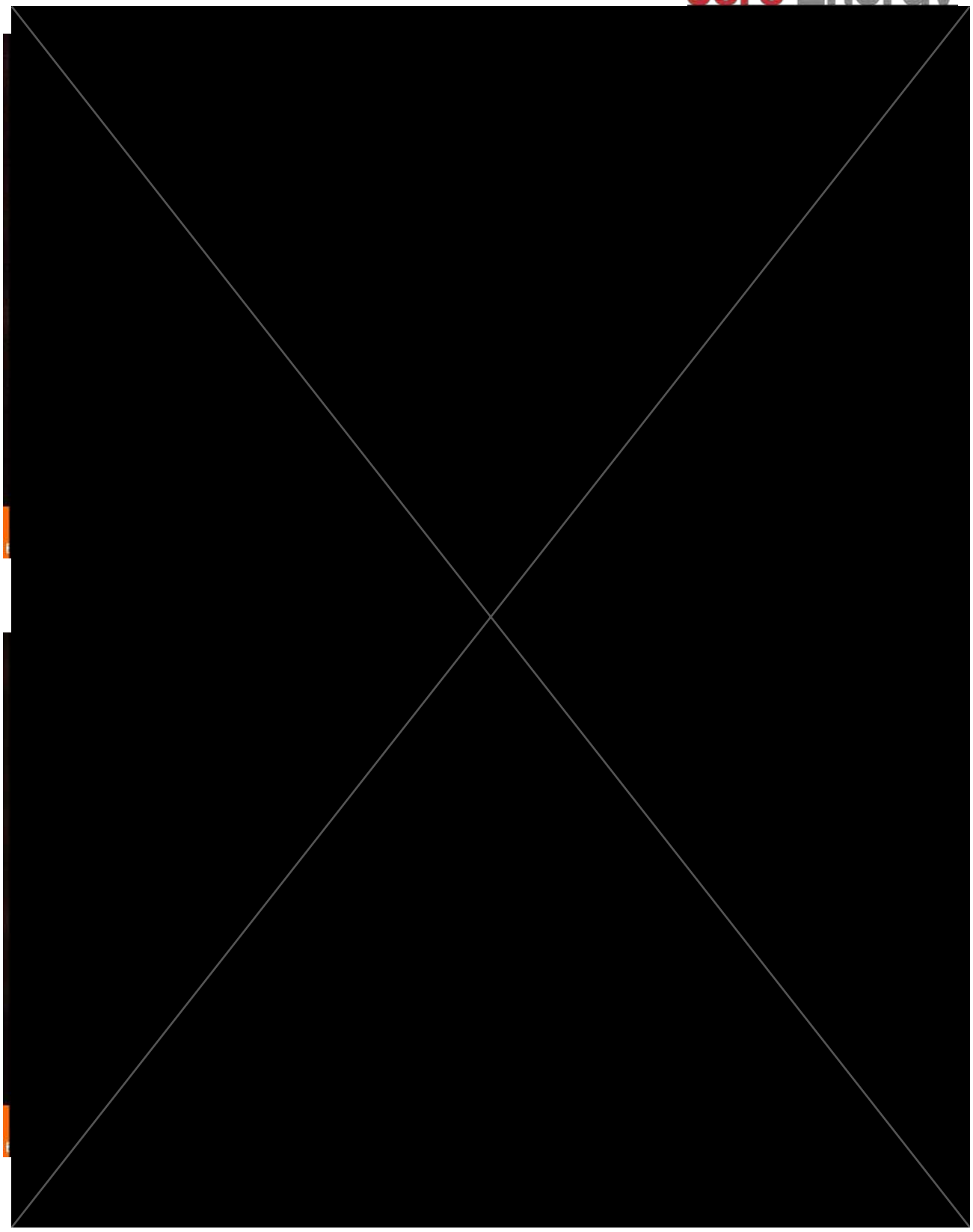
Juru Energy

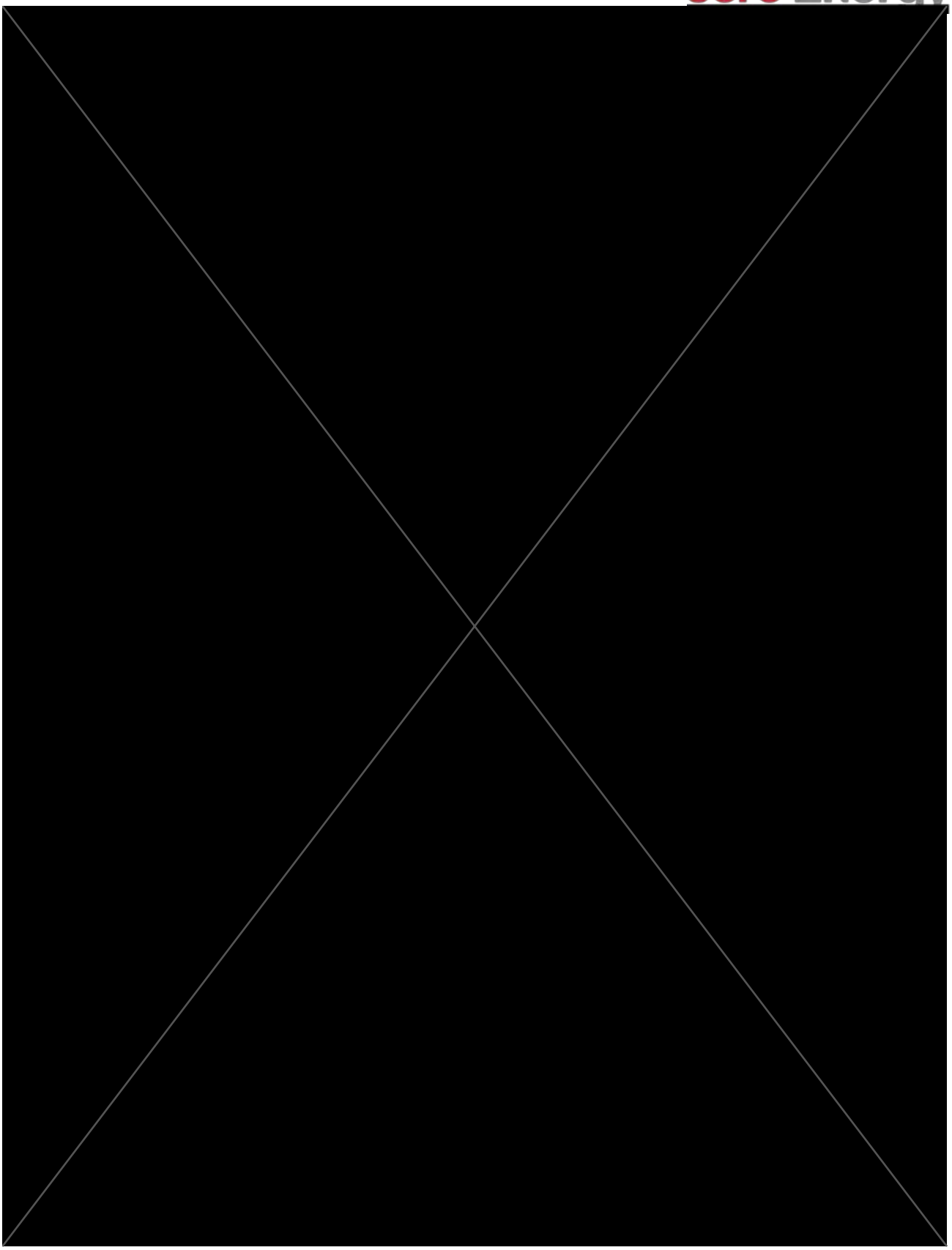


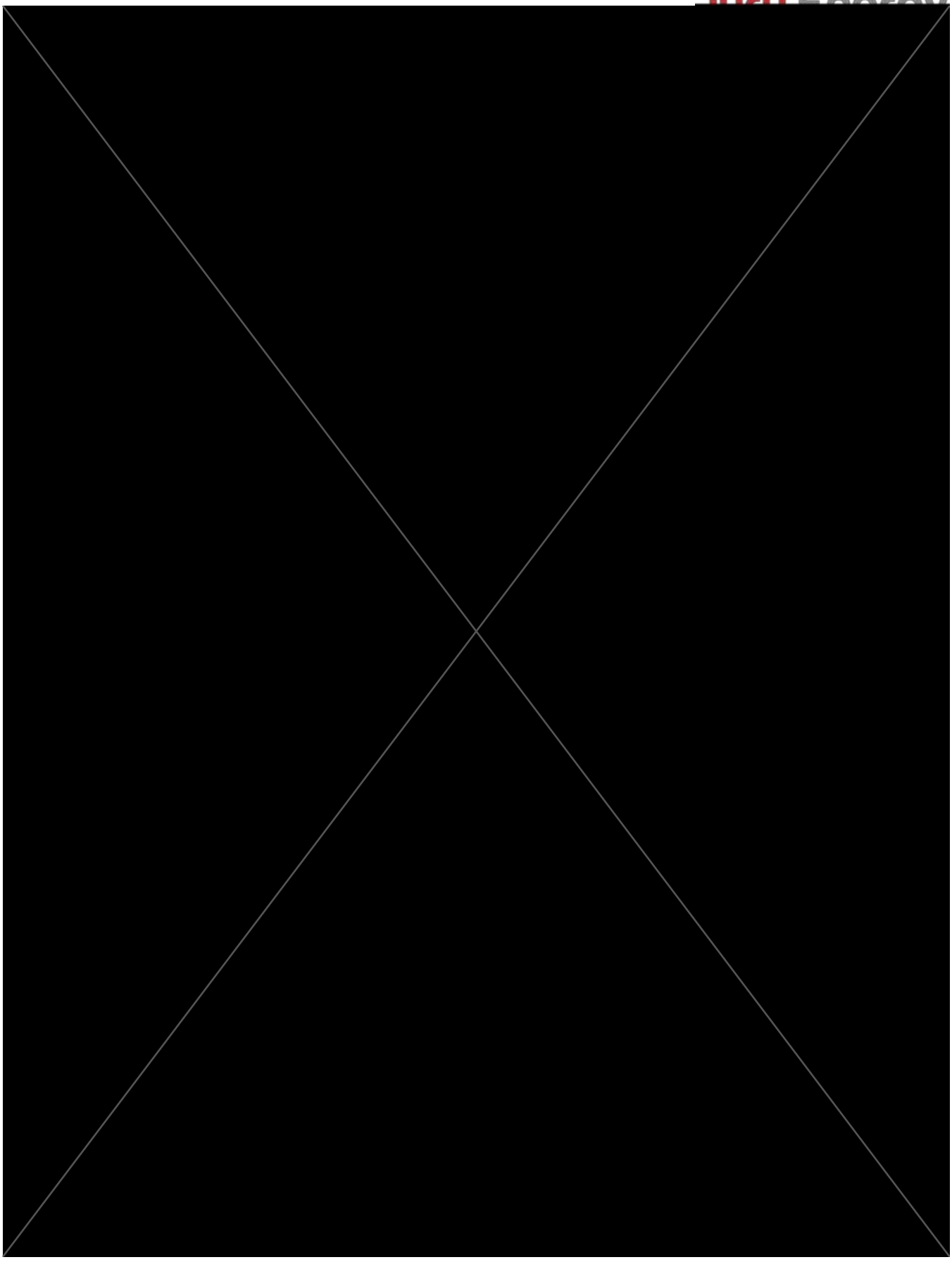


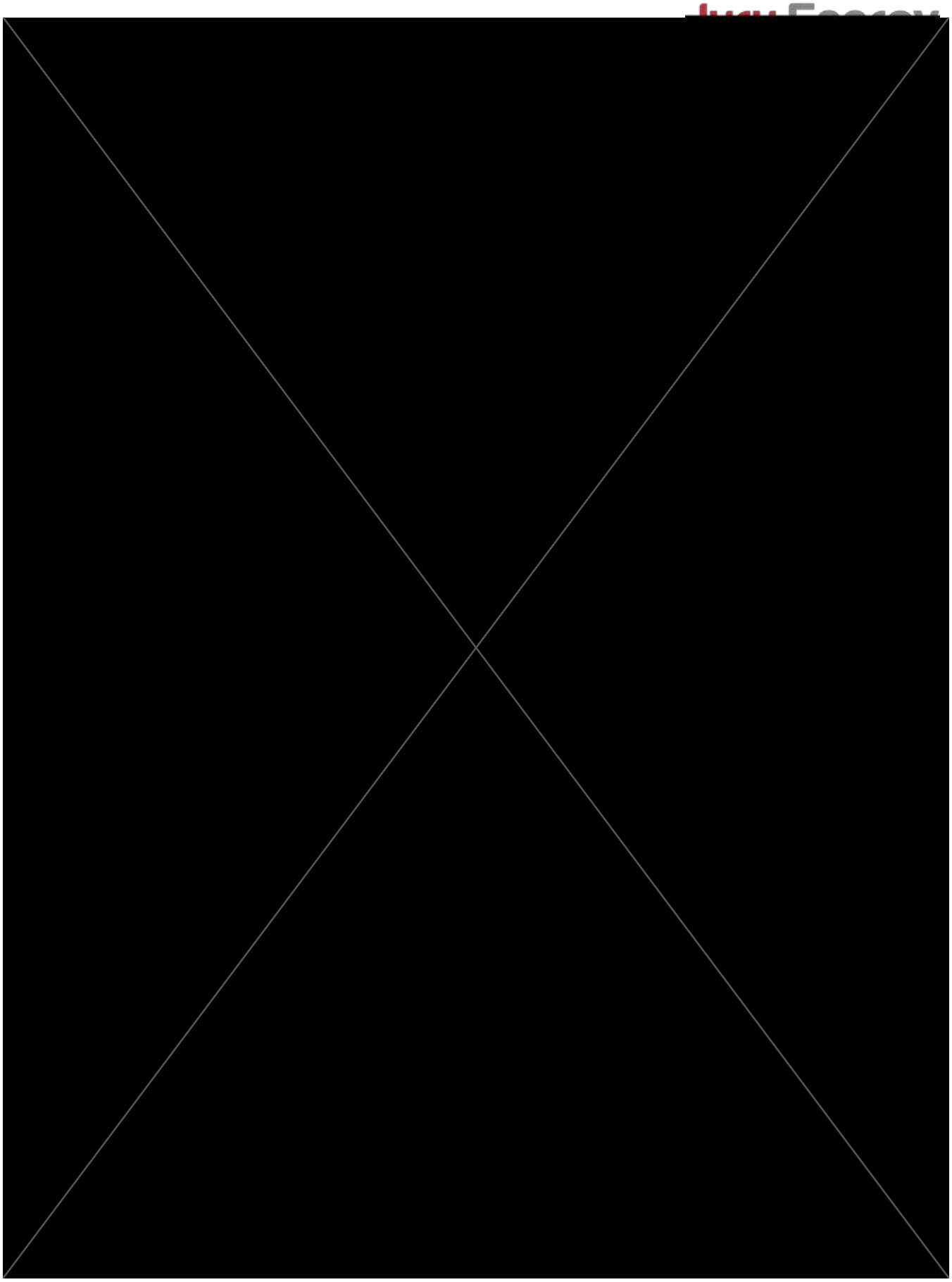
(Ag 01 site)











Juru Energy

HERPETHOLOGICAL SURVEY REPORT

Report Title	HERPETHOLOGICAL SURVEY
Scope	HERPETOFAUNA
Areas Covered	DZHANKELDY WF / DZHANKELDY TO BASH OHTL / BASH WF / BASH TO KARAKOL OHTL
Seasons Covered	SPRING 2021 / SUMMER 2021
Notes	

HERPETHOLOGICAL SURVEY



BASH WIND FARM PROJECT

DZHANKELDY WIND FARM PROJECT

CLIENT: 5CAPITALS

Date: July 2021

Timur Abduraupov

Juru Energy Ltd.

Suite 1, One George Yard, London

United Kingdom, EC3V 9DF

T: +44 207 859 4028

Contents

INTRODUCTION 1
HISTORY OF THE STUDY OF THE REGION 2
PHYSIOGRAPHICAL DESCRIPTION OF THE RESEARCH AREA 3
CLIMATE, WATER, SOIL AND VEGETATION 5
METHODS OF CONDUCTING HERPETOLOGICAL FIELD SURVEY 6
RESULTS 8
Herpetological survey in the Dzhankeldy WF project area (Kuldzhuktau residual mountains) 8
Spring survey (April 2021) 11
Summer survey (June 2021) 18
Herpetological survey in the Bash WF project area (Ayak-agitma lake) 23
Spring survey (April 2021) 25
Summer survey (June 2021) 29
Herpetological survey along planned Dzhankeldy-Bash OHTL 31
Herpetological survey along planned Bash-Karakul OHTL 38
RARE SPECIES OF REPTILES INHABITING THE PROJECT TERRITORIES 43
SUMMARY TABLES 52
CONSTRUCTION-RELATED THREATS 54
RECOMMENDATIONS 54
REFERENCES 56

INTRODUCTION

Uzbekistan is located in the central part of Central Asia and has common borders with five countries - Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan and Afghanistan in the south. This geographical location at the junction of a number of biogeographic regions determines the antiquity, diversity, origin and complex genetic relationships of flora and fauna. The gene pool of wild animals inhabiting the territory of the Republic of Uzbekistan is unique. Our country is an important habitat for endemic species and subspecies of animals of Central Asian origin. Most of it is represented by native fauna (Yunusov et al., 2015).

Nowadays, it becomes increasingly clearer that sustainable nature management is the only right way for the further development of humanity.

One of such sustainable approaches is the introduction and use of alternative energy sources.

It should be noted that Resolution No. UP-5544 "On Approval of the Strategy of Innovative Development of the Republic of Uzbekistan for 2019-2021" (President of the Republic of Uzbekistan, 21 September 2018) prescribes an increase in the portion of electric energy production using renewable energy sources to the level of at least 20% by 2025.

In addition, Resolution No. PP-4422 "On accelerated measures to improve the energy efficiency of economic and social sectors, introduce energy-saving technologies and develop renewable energy sources" (President of the Republic of Uzbekistan, 22 August 2019) approves long-term target parameters for the development of renewable energy sources and organisational and practical measures for further development of renewable energy sources.

This resolution prescribes an increase in the portion of electricity production using renewable energy sources to at least 25% by 2030.

To achieve these targets, the government has developed a plan to build almost 10 GW of new renewable energy facilities, including 5 GW of solar (excluding the capacity of individual households), 3 GW of wind and 1.9 GW of hydroelectric power plants.

At the same time, the construction of new renewable energy facilities with a total capacity of more than 10 GW and the modernization of existing hydroelectric power plants will ensure the production of more than 37 billion kWh of electricity by renewable energy facilities (in 2018 – 5.9 billion kWh), as well as expected annual savings of more than 8.1 billion m^3 of natural gas.

This report presents a faunal overview of the territories designed for the construction of wind power plants in the Bukhara region: Dzankeldy (in the western foothills of the Kuldzhuktau residual mountains) and Bash (near the northern chinks of the Ayak-Agitma depression). The report also contains the results of a survey of the projected power transmission lines that will connect Dzankeldy and Bash wind farms and OHTL that will connect Bash wind farm with Karakul substation.

HISTORY OF THE STUDY OF THE REGION

The history of the study of reptiles inhabiting the territory of Uzbekistan, as was the case with other vertebrates in Central Asia, began with the trip of E. A. Eversmann and K. Pander from Orenburg to Bukhara (October 1820 – April 1821). The few and occasional collections of E. A. Eversmann, transferred to the University of Berlin, were processed by Prof. G. Lichtenstein and published in 1823 as an appendix to the work of E. A. Eversmann (Bogdanov, 1960).

A. P. Khoroshkhin left Jizzakh in April 1872 and drove along the foot of the Nuratau Range and past the Aristan-Beltau mountains, and arrived in Tamdy, from where he travelled to the Aktau and Bukantau mountains. However, A. P. Khoroshkhin was not a specialist and did not collect reptiles, and in the book published in 1876 he mentioned only a tortoise, monitor lizard and sand racer.

G. Ye. Grum-Grzhimailo travelled across Uzbekistan with his expedition in 1885 (see Fauna of the Uzbek SSR, vol. II). His collections were processed by A. M. Nikolsky (1915).

The book by A. M. Nikolsky 'Reptiles and amphibians of the Turkestan general-governorship' is a complete literary summary of that time, was published in 1899. The author processed the materials of A. P. Fedchenko and others who collected them in Central Asia. The paper provides information on the distribution of 7 species of amphibians, 3 species of tortoises, 42 species of lizards and 28 species of snakes. Of these, 2 species of amphibians, 1 tortoise species and more than half of the species of lizards and snakes were caught in the territory of Uzbekistan (Sultanov, Persianova, 1982).

In 1933, 1934 and 1935 A. M. Andrushko collected in the central part of Kyzylkum more than 700 individuals of reptiles. Her article published in 1953 lists 23 species and specifies their distribution across biotopes. 7 species of reptiles (Transcaspian bent-toed gecko, Turkestan thin-toed gecko, Reticulated toad-headed agama, Striped racerunner, Tatary sand boa, Spotted whip snake, Diadem snake) were for the first time discovered in this part of the desert.

O. P. Bogdanov in his work "Fauna of the Uzbek SSR. Amphibians and reptiles" (1960) provides data that he collected in Central Kyzylkum in 1949, 1950, 1954 and 1955.

N. N. Shcherbak (1974) studied racerunners (genus *Eremias*) throughout their habitat, including the central part of Kyzylkum, in particular, in the area near the towns of Zaravshan and Uchkuduk.

The publication of D. A. Bondarenko and E. A. Peregontseva (2017) describes the spatial distribution of the Russian tortoise *Testudo horsfieldii* in Uzbekistan, mostly in the central part of the Kyzylkum desert.

Also, this report presents the author's personal data collected during field studies of the area in 2012, 2014, 2015, 2018 and 2019.

The list of reptiles is given according to the latest updated reptile database

(http://www.reptile-database.org/data/Reptile_checklist_2019_07.xlsx.)

PHYSIOGRAPHICAL DESCRIPTION OF THE RESEARCH AREA

The Kyzylkum physiographical region (Fig. 1) is located almost in the very center of the flat part of Central Asia, which is associated with truly desert landscape. It includes the western part (belonging to Uzbekistan) of the Kyzylkum Desert (its northern and eastern parts are on the territory of Kazakhstan). In the north lies the border of the region with Kazakhstan, in the south-west – with Turkmenistan, in the east is the Mirzachul area, in the south-east – the Zarafshan area and in the west – the lower Amudarya area (Gulomov et al., 2013).

The surface of the area slopes slightly down from south-east to north-west. The average altitude above sea level is 200-300 m, in the south-east the heights reach 350-400 m, in the north-west – only 100 m. The lowest point is the Mingbulak depression 12 m below sea level. The highest point is Aktau peak (922 m) in the Tamdytau Mountains (Gulomov et al., 2013).

The Kyzylkum Desert in the north-west is bordered by the Aral Sea, in the north-east by the Syr Darya, in the east by the spurs of the Tien Shan and Pamir Alai, in the south-west by the Amu Darya. The area of the desert is about 300 thousand square kilometers (Yugai, 1964).



The Kyzylkum Desert is a plain generally sloping to the north-west (altitudes above sea level range from 300 meters in the south-east to 53 meters in the northwest); it has a

number of closed depressions and highly dissected isolated residual (island) mountains – Bukantau (764 m), Kuldzhuktau (up to 785 m), Tamdytau (922 m) and others, composed of strongly dislocated and metamorphosed Paleozoic shales, hornstones, limestones, granites. (Yugai, 1964). The mountains are barren and mostly have levelled peaks and rocky, heavily cut slopes. Between these mountains are the Mingbulak, Karakata, Mullali and Ayakagitma depressions. The lower parts of these depressions are occupied by *solonchaks*, *takyrs* and sands (Gulomov et al., 2013).

Most of the desert is occupied by extensive sandy areas composed of semi-fixed sands. The most widespread are meridionally-oriented sandy ridges. The relative height of the ridges is from 3 to 30 m, with a maximum of up to 75 m. The flat portions are composed of Cenozoic clays and sandstones, in the north and north-west – loamy and mixed sandy and loamy river sediments. A characteristic feature of the Kyzylkum desert is the existence in its central and south-western parts of isolated low mountains – residual (island) mountains. These are Bukantau, Dzhetymtau, Tamdytau, Kuldzhuktau, as well as Sultanuizdag in the west. All of them are remnants of Paleozoic (Hercynian) folded chains located on the continuation of the structures of the northern chains of the Pamir-Alai (Turkestan and Nuratau Ranges) and formed by the latest tectonic processes. The elevations are composed of highly dislocated and metamorphosed Paleozoic slates, limestones and granites. The tops and crests of many of the residual (island) mountains have levelled surfaces used for unirrigated farming. The slopes of the residual (island) mountains are strongly dissected; at the feet there are aprons composed of pebbly and sandy accumulations, which often contain fresh groundwater and in some places feed the springs that supply mining villages with water. The area of the residual (island) mountains also features flat hilly elevations and plateaus of the cuesta type, composed of slightly disturbed Cretaceous and Paleogene sedimentary rocks (marls, sands, clays). Another characteristic feature is the existence of extensive closed basins (the Karakat and Ayakagytma basins) in the central and south-western parts of the desert (Gulomov et al., 2013).

Loose sand dunes are found near human settlements and around wells. In most cases, the exposure of the sands is the result of excessive grazing and trampling of vegetation by livestock near watering holes, as well as the use of shrubs and saxaul for fuel (Gulomov et al., 2013).

Sheep and goats, as well as camels and horses and, to a lesser extent, cattle graze in the Kyzylkum desert. The organization of pasture use and the creation of new wells made it possible to significantly increase the livestock population (Gulomov et al., 2013).

Large artesian basins were discovered in the central and south-western parts of the desert. Agriculture is beginning to develop near artesian wells in depressions, where melons and pumpkins are cultivated and experimental stations are established to provide livestock with additional feed (Gulomov et al., 2013).

CLIMATE, WATER, SOIL AND VEGETATION

The climate of the Kyzylkum physiographical region is arid and sharply continental. It is characterized by high summer temperatures, a very low level of annual precipitation and a strong fluctuation of daily and annual temperatures (Gulomov et al., 2013).

Winter in Kyzylkum is cold. The reason for this is the frequent invasions of dry and cold Arctic air masses and the Siberian anticyclone from the north. On such days, the air temperature drops sharply to –31–35 ° C. Western air masses bring precipitation and a slight increase in temperature. The average temperature in January in the north of Kyzylkum is –5–10 ° C, in the middle part –2–4 ° C, in the south –1–2 ° C (Gulomov et al., 2013).

With the coming of spring, the temperature gradually rises and rainfalls become quite frequent. Nature awakens and the earth becomes covered with ephemeral plants. The precipitation season is already over in April. In the long summer period (lasts more than 150 days), the air temperature is the same almost throughout. This is due to the large amount of solar radiation (total annual radiation is 120 kcal per 1 cm^3) and the penetration of hot tropical air masses from the south. The average temperature in the southern and central parts is + 30 °, in the north + 26 + 28 ° C; on some days the temperature reaches + 48 ° C. At this time, the sands warm up to +75 + 80 ° C.

Autumn in Kyzylkum is usually dry. There is little precipitation (up to 75–100 mm annually), and it is unevenly distributed over the seasons. The largest portion of the annual amount of precipitation falls in spring (up to 48%) and winter (up to 30%), but the evaporation rate reaches 1,000–1,500 mm (Gulomov et al., 2013).

The region has a significant stock of groundwater. The dynamic amount of groundwater is 58–60 m^3/sec. The groundwater is salty. Fresh artesian waters are available in the strata of the Mesozoic and Paleogene sediments. Also, mineral thermal waters were found in the Paleozoic deposits (Gulomov et al., 2013).

In Kyzylkum, sandy and mixed sandy and loamy soils are widespread in the plains, foothills and on the slopes of the elevations – grey-brown soils, and in the basins – solonchak and marshy solonchak soils (Gulomov et al., 2013).

More than 600 plant species grow in the Kyzylkum area. They are dominated by ephemerals and ephemeroids with a short spring growing season: bulbous bluegrass, sedge, Bromus danthoniae, tulips, snowdrops, Ixiolirion, Cousinia microcarpa. When the hot season sets in, they wither. Plants adapted to droughts and solonchaks continue to grow in summer (Gulomov et al., 2013).

Calligonum, white saxaul, Stipagrostis, sand acacia inhabit fixed sands. Sagebrush and weed widely occur on grey-brown soils (Gulomov et al., 2013).

Black saxaul, tamarisk, Climaooptera crassa, Halocnemum grow on solonchak and solonchak-marshy soils, Gamanthos – on takyr (Gulomov et al., 2013).

METHODS OF CONDUCTING HERPETOLOGICAL FIELD SURVEY

During the field survey an attempt was made to assess the status of reptiles and amphibians in the study area (specification of the species and quantitative composition, territorial distribution, including places of concentration, the state of habitats). However, it should be noted that cold weather did not allow for a full survey in this area, while single records of reptiles do not give a complete understanding of the composition of the biodiversity in the area. Therefore, the combination of field survey and desktop analysis was used.

Field studies were carried out according to generally accepted zoological methods for identifying species composition. The following methodological guidelines were used in the survey: L. G. Dinesman, M. L. Kaletskaya (1978), V. M. Makeev, A. T. Bozhansky (1988) and N. N. Shcherbak (1989), D. A. Bondarenko, Chelintsev, (1996). Literature sources and statistical data had been processed.

The main research method used was mixed stationary and transect survey. Points and transects for conducting research were outlined at the project monitoring stations in accordance with different types of habitats.

The field research methodology reflects the following aspects:

- species composition in the study area;

- distribution across habitats;

- daily and seasonal changes in activity;

Thus, the method of quantitative assessment was based on the ecology of the species under consideration, landscape and geographical conditions, season and type of work.

The quantitative assessment of reptiles and amphibians was mainly based on the transect survey. The transect method consists in counting individuals along a fixed long line (transect), on both sides of it, with the duration of the survey determined by the known distance, which is selected depending on the type of reptile and the area, but does not exceed 1 km in one way. In this case, all individuals encountered on the transect are registered, regardless of the distance they are identified at. The perpendicular distance is measured between the transect axis and each individual. The results obtained are used to calculate the density of recorded reptiles. The one-kilometer transect was chosen because heaviest errors arise when long transects are used for species that, like the Russian Tortoise, have high density, daily and seasonal activity cycles fluctuations with high peak values, and are caused by incorrect selection of a minimum survey area for a particular species (Vashetko et al, 2001).

The Russian tortoise population density (***D***) was calculated using the following formula (Bondarenko, Chelintsev, 1996):

$$\boldsymbol{D = \frac{n}{2LB}}$$

where ***n*** – number of animal individuals recorded on the transect; ***L*** – length of the transect; ***B*** – formula to calculate an effective width of the survey strip:

$$B = W(0,79F + 0,21F^4)$$

where ***W*** – width of the limited strip on both sides of the transect axis; ***F****:*

$$F = \frac{2y}{W}$$

The use of perpendicular distances to carry out survey on a strip of limited width excludes underestimation of the population density of the Russian tortoise caused by a decrease in their detectability in remote parts of the survey strip, regardless of the degree of its limitation (Bondarenko and Chelintsev, 1996).

The survey method for the Southern Even-fingered Gecko (*Alsophylax laevis*) is different from the method of accounting for other reptile species. This is mainly due to the small size, secretiveness and other aspects of the biology of this species such as nocturnalism.

Southern Even-fingered Gecko (Alsophylax laevis) is distinguished by the acoustic interaction between individuals, but louder signals are noted in males. Acoustic signals of females are practically not audible in the field. The signals of males, under ideal weather conditions, can be heard within a radius of 100 meters or more.

Before starting accounting of Southern Even-fingered Gecko, it is necessary to identify the optimal biotope for this species. Since the Southern Even-fingered Gecko is a stenobiont species, the survey should be carried out only on a suitable biotope.

The method of accounting for the Southern Even-fingered Gecko (*Alsophylax laevis*) is carried out after sunset; the surveyor takes a position on the optimal biotope, preferably on a hill so that the acoustic signals reach the surveyor better. After taking the position, the surveyor must observe absolute silence and not turn on the lighting devices. The acoustic signals produced by the Southern Even-fingered Gecko in the accounting radius, which on average covers 1 ha, are recorded in a notebook with information about the direction of the acoustic signals and the distance to the gecko.

Since only males can be heard, the resulting density should be multiplied by a factor of 0.3 when extrapolating. This coefficient is derived from the males: females ratio in a gecko population (2 males per one female in average).

The abundance of the reptiles in habitats was estimated using the following population density scale for 1 ha (Kuzyakin, 1962): 0.1 – 0.9 – rare, 1.0 – 9.9 – common, 10.0 and higher – abundant.

RESULTS

This section provides historical data and data collected during the field trips carried out in Spring and Summer of 2021. Also, in this section, the primary abundance of reptiles found at the accounting points (transects) and the average density derived by analyzing the primary data at each of the accounting points are shown. These data will help to create a map of the abundance and distribution of reptiles in the project area in the future, as well as help to create an action plan to reduce the burden on the populations.

The basis for compiling the list of herpetofauna of the studied territory was the modern list of amphibian fauna of Uzbekistan, consisting of 3 species from two families and the list of reptile species of Uzbekistan, consisting of 62 species from 13 families.

Herpetological survey in the Dzhankeldy WF project area (Kuldzhuktau residual mountains)

Herpetological survey in this area is of particular interest because there are various biocenoses and, consequently, the species diversity of reptiles is very rich. The most concerning species is critically endangered Southern Even-fingered Gecko (*Alsophylax laevis*), which was first found in this area last century. However, it should be noted that Southern Even-fingered Gecko inhabiting this territory is more likely to be a separate new species (Figure 2). And most likely it is an even rarer and endemic species that inhabits only this territory. Currently, the active study of this species is being conducted. Due to the fact that this species is the only representative of vertebrates on the project territory that is included in the Red List of the International Union for Conservation of Nature (IUCN Red List) with the status CR - critically endangered, survey on this particular species was given priority.



Figure 2 Southern Even-fingered Gecko at Dj 8 point in April 2021 (adult male)

The first field visit was made in April 2021. April is the period of the highest activity of the Russian tortoise (*Testudo horsfieldii*), which is also listed in the Red List of the International Union for Conservation of Nature (IUCN Red List) as VU - vulnerable. However, April appeared to be not optimal for the gecko survey this year, since night temperatures were still quite low, and the weather in the desert is not stable at this time of the year. During this period, the very first individuals appear on the surface, while most are waiting for warmer weather. In connection with the above, the accounting of this species in April is not indicative. More information that is accurate was collected during the summer survey, when an absolute number of individuals were active. As for the Caspian monitor (*Varanus griseus caspius*), the situation is almost the same as with the gecko, in April only some individuals were active. The Desert sand boa (*Eryx miliaris*) is active in both spring and summer, but this species can be observed in the daytime only in spring (Figure 3).



Figure 3 Young Desert sand boa (*Eryx miliaris*) at Dj 20 point in April 2021

The second field visit was carried out in June 2021. In the summer months, it is almost impossible to find Russian tortoise on the territory, since this species has a period of aestivation (summer hibernation). Occasionally in summer, individual tortoises can be seen on the surface in those places where the green juicy grass is preserved. No such places were found on the project territory, as well as the tortoises themselves in the summer period. For other listed species, such as the Southern Even-fingered Gecko and Caspian monitor, summer is the period of the highest activity.

All 4 species are listed also in the Red Book of the Republic of Uzbekistan and were found in the project area around the Kuldzhuktau residual mountains.

Table 1 List of reptile species inhabiting the Dzankeldy WF project area

№	Species	Species presence acc. to literary sources	Author's earlier personal data	April 2021 field expedition data	June 2021 field expedition data	Endemism	Conservation status		
							UzRDB	IUCN	CITES
Family *Bufonidae* (toads)									
1	Turan Toad *Bufotes turanensis*	+	+	+		UZ, TJ, TM			
2	Marsh frog *Pelophylax ridibundus*	+	+	+				LC	
Family *Testudinidae* (tortoises)									
1	Russian tortoise *Testudo horsfieldii*	+	+	+			2 (VU)	VU	II
Family *Gekkonidae* (geckoes)									
2	Southern Even-fingered Gecko *Alsophylax laevis*	+		+	+	UZ, TM	VU:D	CR	
3	Caspian Bent-Toed Gecko *Tenuidactylus caspius*	+	+	+	+			LC	
4	Turkestan thin-toed gecko *Tenuidactylus fedtschenkoi*	+	+	+	+	UZ, TJ, TM, KZ			
Family *Agamidae* (agamas)									
5	Steppe agama *Trapelus sanguinolentus*	+	+	+	+				
6	Sunwatcher toad-headed agama *Phrynocephalus helioscopus*	+	+	+	+				
7	Reticulated toad-headed agama *Phrynocephalus reticulatus*	+	+	+	+	UZ, TM		LC	
Family *Lacertidae* (true lizards)									
8	Rapid Lizard *Eremias velox*	+	+	+	+				
9	Aralo-Caspian racerunner *Eremias intermedia*	+		+					
Family *Varanidae* (monitor lizards)									

10	Caspian Monitor *Varanus griseus caspius*	+	+				2 (VU:D)		I
Family *Boidae* (Boas)									
11	Desert sand boa *Eryx miliaris*	+		+			3 (NT)		II
Family *Colubridae* (colubrid snakes)									
12	Sand racer *Psammophis lineolatus*	+	+	+					
13	Spotted whip snake *Hemorrhois ravergieri*	+		+	+				
14	Spotted desert racer *Platyceps karelinii*	+	+						
15	Dice Snake *Natrix tessellata*	+	+						

Notes: UzRDB– species/subspecies listed in the Red Data Book of Uzbekistan (2019) (CR – critically endangered; VU – vulnerable; NT – near-threatened); IUCN – species included in the Red List of the International Union for Conservation of Nature (VU - vulnerable; NT – near-threatened); CITES I, II – species listed in the appendices (I, II) to the Convention on International Trade in Endangered Species of Wild Fauna and Flora; Endemism: AF - Afghanistan, KZ – Kazakhstan; TM – Turkmenistan; KG – Kyrgyzstan; TJ – Tajikistan; UZ – Uzbekistan.

According to processed information, the author's personal data and two field survey results, currently, the Dzankeldy wind farm project area is inhabited by 2 amphibian species and 15 reptile species belonging to 7 families (Table 1). The total number of amphibian species comprises 66,6% of the total diversity of the amphibian fauna of Uzbekistan, reptiles – 24,2%. Among them, 4 species are included in the Red Book of the Republic of Uzbekistan (2019) (26,7% of the total number of species inhabiting the project area), 2 species are included in the Red List of the International Union for Conservation of Nature (IUCN Red List) (13,3% of total number of species inhabiting the project area) and 3 species – in the Appendices to the Convention on International Trade in Endangered Species of Wild Fauna and Flora (20% of the total number of species inhabiting the project area).

Spring survey (April 2021)

The first field trip to the survey points in the area of the Kuldzhuktau residual mountains was carried out from April 17 to 20, 2021. During the spring survey of the project area, 22 km of hiking routes (transect) were completed. The transects passed through pre-selected survey points and their 1 kilometer radius (Figure 4).

Reptile survey was carried out both during the day (Figure 5) and at night. Moreover, in some points that were identified as potential habitats of the Southern Even-fingered Gecko during the day, both day and night surveys were carried out, in places that were identified as not suitable biotope for the Southern Even-fingered Gecko, night records were not carried out.



The average night air temperature in April was 18 °C, the soil temperature was 17 °C, the air humidity was 35%. These values are not high enough for the reptile nocturnal survey.

During the survey of the territory, we recorded 11 reptiles species (17.7% of the total number of reptiles species), of which 3 species (27.3% of the number of species encountered) - Russian tortoise, Desert sand boa and Southern Even-fingered Gecko are included in the Red Book of the Republic of Uzbekistan, and two (18.2% of the number of species encountered) of them are included in the Red List of the International Union for Conservation of Nature (IUCN Red List).

The highest density of the Russian tortoise on the project territory during the Spring survey was recorded at Dj 13 point and amounted to 3.99 ind/ha. However, similar number of 2 tortoises per transect was observed at several other points: Dj 9, Dj 10, Dj 12 and Dj 14. The Russian tortoise was found at 8 points, which is 38% of the total number of observation points (21 points), most of which are located in the northern foothill part of the Kuldzhuktau mountains (Figure 6). It is worth noting that the Russian tortoise is not a numerous species throughout the project area.



The highest density of Southern Even-fingered Gecko on the project territory, during the first field trip, was recorded at 3 points: Dj 3, Dj 6, Dj 18 and amounted to 3 ind/ha on each of them. However, as mentioned above, the spring abundance and density indicators for this species can not be considered indicative, due to low night temperatures and small percentage of individuals coming to the surface (Figure 7).



In general, the reptiles' species composition is typical for this geographical area.

Table 2 Primary data and the density of reptiles at the accounting points in the area of the Kuldzhuktau outlier in the spring of 2021

No	Species	No. of recorded animals	Population density on the site, inds/ha	Biotope	Transect length	Date and time	Air temperature	Soil temperature	Humidity, %
Dj 1				Rubbly-clayey plain with depressions, Artemisia association	1 km	20.04.21	C24,9°	C30,9°	29%
1	*Phrynocephalus reticulatus* Reticulated toad-headed agama	3	1,5						
3	*Eremias intermedia* Aralo-Caspian racerunner	4	2						
Dj 2				Rubbly-clayey plain with cliffs and elevations, Artemisia-Ferula association	1 km	19.04.21	C29,8°	C38,4°	17%
1	*Trapelus sanguinolentus* Steppe agama	1	1						

Dj 3				Multicolour uplands, rubbly-clay depressions Artemisia association	1 km	19.04.21	C18,2°	C17,2°	22%
1	*Alsophylax laevis* Southern Even-fingered Gecko	2	3						
Dj 4				Rubbly-clayey plain with depressions, Artemisia association	1 km	20.04.21	C23,3°	C27,2°	30%
1	*Phrynocephalus reticulatus* Reticulated toad-headed agama	2	1						
2	*Trapelus sanguinolentus* Steppe agama	1	1						
3	*Eremias intermedia* Aralo-Caspian racerunner	2	1						
Dj 5				Rubbly-clayey plain, sparse wormwood and saxaul bushes	1 km	19.04.21	C24,3°	C32,7°	17%
1	*Phrynocephalus helioscopus* Sunwatcher toad-headed agama	1	0,5						
Dj 6				Multicolour uplands, rubbly-clay depressions Artemisia association	1 km	19.04.21	C18,0°	C18,6°	28%
1	*Alsophylax laevis* Southern Even-fingered Gecko	2	3						
Dj 8				Multicolour uplands, rubbly-clay depressions Artemisia association	1 km	19.04.21	C20,3°	C19,1°	22%
1	*Alsophylax laevis* Southern Even-fingered Gecko	1	1,3						
Dj 9				Hilly sandy foothills, sarzagan association	1 km	19.04.21	C29,0°	C37,4°	18%
1	*Testudo horsfieldii* Russian tortoise	2	0,89						
2	*Tenuidactylus fedtschenkoi* Turkestan thin-toed gecko	1	0,2						
3	*Trapelus sanguinolentus* Steppe agama	1	1						
4	*Eremias velox* Rapid Lizard	1	0,5						
Dj 10				Rubbly-clayey plain with depressions,	1 km	18.04.21	C29,0°	C44,8°	30%

				Artemisia association					
1	*Testudo horsfieldii* Russian tortoise	2	2,78						
2	*Trapelus sanguinolentus* Steppe agama	1	1						
Dj 11				Hilly sub-sandy foothill plain, in some places the sections are rubbly-sandy, Artemisia-saxaul formation, in in some places along sai (small water flow) Tamarix	1 km	19.04.21	C27,5°	C27,7°	18%
1	*Tenuidactylus fedtschenkoi* Turkestan thin-toed gecko	1	0,2						
2	*Trapelus sanguinolentus* Steppe agama	1	1						
3	*Eremias velox* Rapid Lizard	2	1						
Dj 12				Rubbly-sandy desert, sai (water flow) from the Kuldjuktau Mountains, Artemisia-Ferula association, Tamarix and Peganum harmala along sai	1 km	18.04.21	C23,5°	C24,3°	18%
1	*Testudo horsfieldii* Russian tortoise	2	0,85						
2	*Tenuidactylus caspius* Caspian Bent-Toed Gecko	1	0,2						
Dj 13				Hilly loamy plain, Artemisia-ferula association	1 km	18.04.21	C27,5°	C30,0°	17%
1	*Testudo horsfieldii* Russian tortoise	2	3,99						
2	*Eremias intermedia* Aralo-Caspian racerunner	2	1						
Dj 14				Clay foothills, Artemisia-ferrula association	1 km	18.04.21	C28,1°	C29,2°	18%
1	*Testudo horsfieldii* Russian tortoise	2	0,3						
2	*Trapelus sanguinolentus* Steppe agama	2	2						
Dj 15				Rubbly-sandy hummocky foothill desert, Artemisia - ferula association	1 km	18.04.21	C29,7°	C42,3°	18%

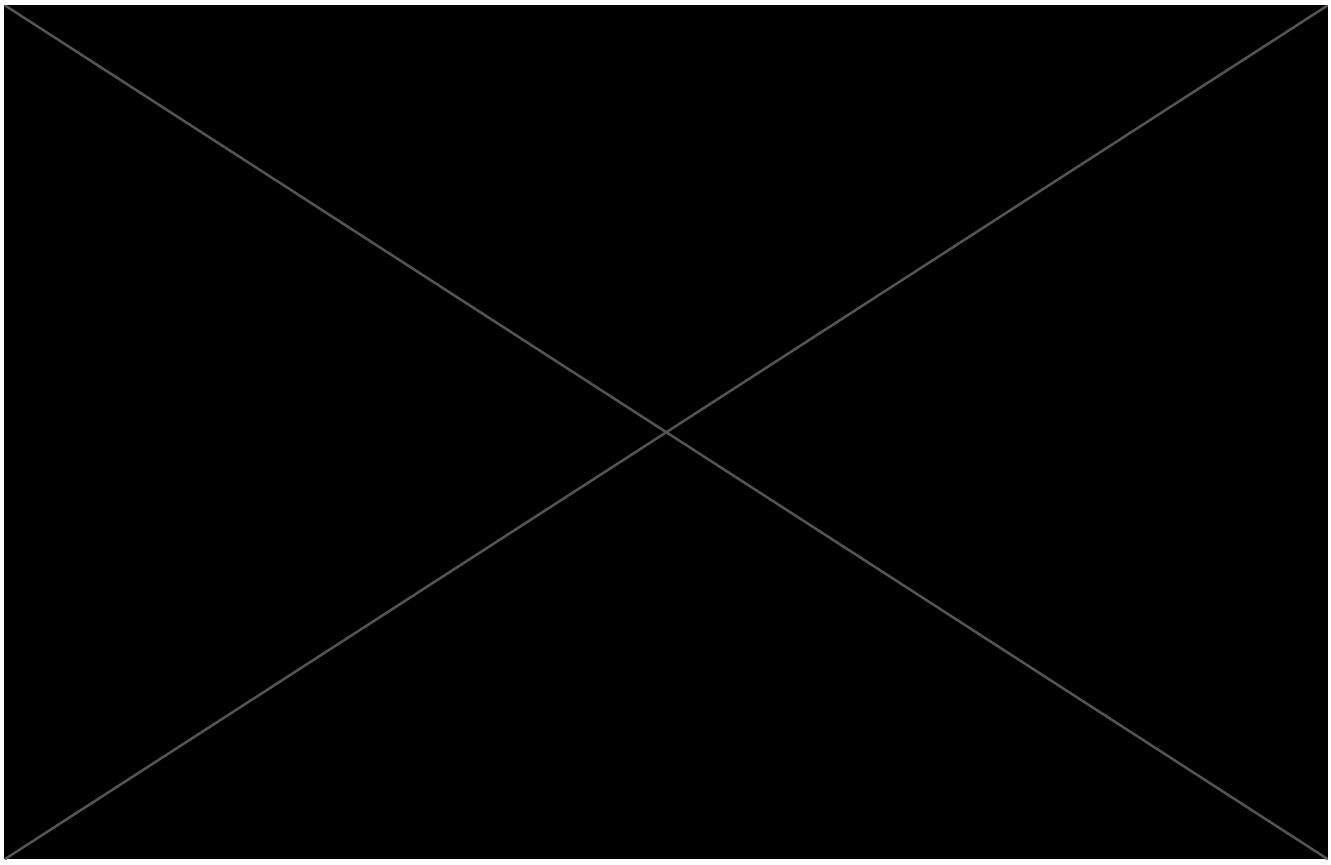
1	*Testudo horsfieldii* Russian tortoise	3 trace	–						
2	*Trapelus sanguinolentus* Steppe agama	1	1						
Dj 16				Rubbly-sandy foothills, Artemisia-ferula association	1 km	17.04.21	C25,4°	C27,9°	23%
1	*Testudo horsfieldii* Russian tortoise	3	1,4						
2	*Trapelus sanguinolentus* Steppe agama	1	1						
Dj 18				Rubbly plain with clay cliffs, Artemisia association	1 km	17.04.21	C17,6°	C16,4°	38%
1	*Alsophylax laevis* Southern Even-fingered Gecko	2	3						
Dj 19				Rubbly-sandy hummocky foothill desert, Artemisia - ferula association	1 km	18.04.21	C27,7°	C36,2°	21%
1	*Tenuidactylus caspius* Caspian Bent-Toed Gecko	1	0,4						
2	*Phrynocephalus reticulatus* Reticulated toad-headed agama	2	1						
3	*Trapelus sanguinolentus* Steppe agama	6	6						
4	*Eremias intermedia* Aralo-Caspian racerunner	2	1						
Dj 20				Rubbly plain, Artemisia-ferula association	1 km	18.04.21	C32,2°	C36,8°	24%
1	*Phrynocephalus reticulatus* Reticulated toad-headed agama	2	1						
2	*Trapelus sanguinolentus* Steppe agama	2	2						
3	*Eremias intermedia* Aralo-Caspian racerunner	1	0,5						
4	*Eremias lineolata* Striped Racerunner	1	0,2						
5	*Eryx miliaris* Desert sand boa	1	-						
Dj 21				Rubbly-sandy foothills, Artemisia-ferula association	1 km	17.04.21	C23,8°	C25,8°	26%
1	*Phrynocephalus reticulatus* Reticulated toad-headed agama	2	1						

Dj 22				Rubbly-sandy plains Artemisia-ferula association	1 km	18.04.21	C21,1°	C20,2°	40%
1	*Phrynocephalus reticulatus* Reticulated toad-headed agama	3	1,5						
Dj 23				Rubbly plain with depressions and chakalaks (large hillocks up to 1-3 m in height) Artemisia-Ferula association	1 km	18.04.21	C24,7°	C25,0°	32%
1	*Testudo horsfieldii* Russian tortoise	1	1,3						
2	*Phrynocephalus reticulatus* Reticulated toad-headed agama	2	1						
3	*Trapelus sanguinolentus* Steppe agama	1	1						
4	*Eremias intermedia* Aralo-Caspian racerunner	1	0,5						

It is worth noting that almost the entire southern foothill part of Kuldzhuktau is a potential habitat for the Southern Even-fingered Gecko (see points DJ 1, 2, 3, 4, 5, 6, 8, 11, 18, 19, 20, 21, 22, 23). On the contrary, most of the northern sub-mountain plain of Kuldzhuktau, as well as the outlier itself, is unsuitable habitat for this species. However, such rare and listed in the Red Book of the Republic of Uzbekistan species as: Russian tortoise, Caspian monitor, and Desert sand boa inhabit the entire area of the construction of the Dzankeldy wind farm.

Summer survey (June 2021)

The second field trip to the survey points in the area of the Kuldzhuktau residual mountains was carried out from June 19 to 22, 2021. The priority of this field visit was to conduct the quantitative assessment of Southern Even-fingered Gecko population at the points identified in spring as the most suitable. During the summer survey of the project area, 6 km of hiking routes (transect) were completed. The transects passed through pre-selected survey points and their 1 kilometer radius (Figure 8).



Reptile survey was carried out mainly at night – after sunset and before the night coolness, until about 2 am, when the activity of the Southern Even-fingered Gecko decreases (Figure 9). However, at some points, the survey was also conducted during the daytime.



The average night air temperature in June was 26-27°C, the soil temperature was 27-28°C, the air humidity was 20-25%. These values are ideal for the nocturnal reptile survey, including the Southern Even-fingered Gecko.

During the survey of the territory, we recorded 8 reptiles species (12,9% of the total number of reptiles species), of which 1 species (12,5% of the number of species encountered) - Southern Even-fingered Gecko is included in the Red Book of the Republic of Uzbekistan, and 1 species - Southern Even-fingered Gecko (12,5% of the number of species encountered) of them are included in the Red List of the International Union for Conservation of Nature (IUCN Red List). The variety of species for the second field visit turned out to be less than for the first, due to the narrow focus and specifics of the summer survey.

Table 3 Primary data and the density of reptiles at the accounting points in the area of the Kuldzhuktau outlier in the summer of 2021

No	Species	No. of recorded animals	Population density on the site, inds/ha	Biotope	Transect length	Date and time	Air temperature	Soil temperature	Humidity, %
Dj 1				Rubbly-clayey plain with depressions, Artemisia association	1 км	22.06.21	C24,1°	C25,3°	29%
1	*Alsophylax laevis* Southern Even-fingered Gecko	3	4						
Dj 2				Rubbly-clayey plain with cliffs and elevations, Artemisia-ferula association	1 км	22.06.21	C29,8°	C23,4°	17%
1	*Tenuidactylus caspius* Caspian Bent-Toed Gecko	1	-						
2	*Phrynocephalus helioscopus* Sunwatcher toad-headed agama	2	2,7						
Dj 3				Multicolour uplands, rubbly-clay depressions Artemisia association	1 км	19.06.21	C26,2°	C25,6°	18%
1	*Alsophylax laevis* Southern Even-fingered Gecko	4	5,3						
Dj 4				Rubbly-clayey plain with depressions, Artemisia association	1 км	22.06.21	C23,3°	C23,0°	30%
1	*Tenuidactylus caspius* Caspian Bent-Toed Gecko	2	2,4						
Dj 5				Rubbly-clayey plain, sparse sagebrush and saxaul bushes	1 км	22.06.21	C24,3°	C23,6°	17%
1	*Alsophylax laevis* Southern Even-fingered Gecko	2	2,7						
Dj 6				Multicolour uplands, rubbly-clay depressions Artemisia association	1 км	19.06.21	C25,9°	C24,6°	18%

1	*Trapelus sanguinolentus* Steppe agama	1	-						
Dj 8				Multicolour uplands, rubbly-clay depressions Artemisia association	1 км	19.06.21	C24,3º	C22,7º	18%
1	*Tenuidactylus fedtschenkoi* Turkestan thin-toed gecko	3	4,5						
Dj 18				Rubbly-clayey plain with cliffs and elevations, Artemisia association	1 км	21.06.21	C27,0º	C29,3º	17%
1	*Alsophylax laevis* Southern Even-fingered Gecko	10	13,3						
Dj 19				Rubbly-sandy hillock desert, Artemisia-saxaul association	1 км	22.06.21	C28,0º	C27,2º	18%
1	*Alsophylax laevis* Southern Even-fingered Gecko	12	16						
2	*Trapelus sanguinolentus* Steppe agama	2	-						
3	*Tenuidactylus caspius* Caspian Bent-Toed Gecko	3	4,7						
Dj 20				Rubbly plain, Artemisia-saxaul association	1 км	22.06.21	C25,5º	C25,3º	18%
1	*Alsophylax laevis* Southern Even-fingered Gecko	6	8,1						
2	*Hemorrhois ravergieri* Spotted whip snake	1	-						
Dj 21				Rubbly-sandy foothills, Artemisia-ferula association	1 км	21.06.21	C25,6º	C24,1º	18%
1	*Alsophylax laevis* Southern Even-fingered Gecko	4	5,3						
Dj 22				Rubbly plain with clay cliffs, Artemisia-saxaul association	1 км	22.06.21	C28,6º	C32,3º	17%
1	*Phrynocephalus reticulatus* Reticulated toad-headed agama	4	2,5						
2	*Eremias velox* Rapid Lizard	1	-						
Dj 23				Rubbly plain with depressions and chakalaks (large hillocks up to 1-3 m	1 км	21.06.21	C25,5º	C24,1º	18%

				in height) Artemisia-Ferula association					
1	*Alsophylax laevis* Southern Even-fingered Gecko	6	8,1						

The highest density of Southern Even-fingered Gecko on the project territory, during the summer field trip, was recorded at Dj 19 point and amounted to 16 ind/ha (Figure 10).

As a result, Southern Even-fingered Gecko was found at 8 survey points during the summer field trip, which is 38% of all the survey points on the project territory. However, it must be noted that we did not find Southern Even-fingered Gecko at several points on potentially suitable biotope due to bad weather conditions during the survey period, namely due to strong wind: the wind speed sometimes reached 15-18 m/s. The following points (on which we did not observe the gecko during the summer survey) are still potential for Southern Even-fingered Gecko: Dj 2, 4, 6, 8, 22, 10 and 11.



Figure 10 Southern Even-fingered Gecko on Dj 19 point in June 2021 (adult male)

In general, the reptiles' species composition is typical for this geographical area.

[redacted]

The first field visit was conducted in April 2021. April is the period of the highest activity of the Russian tortoise (*Testudo horsfieldii*), which is also listed in the Red List of the International Union for Conservation of Nature (IUCN Red List) as VU - vulnerable. However, April appeared to be not optimal for the gecko survey this year, since night temperatures were still quite low, and the weather in the desert is not stable at this time of the year. During this period, the very first individuals appear on the surface, while most are waiting for warmer weather. In connection with the above, the accounting of this species in April is not indicative. More information that is accurate was collected during

the summer survey, when an absolute number of individuals were active. As for the Caspian monitor (*Varanus griseus caspius*), the situation is almost the same as with the gecko, in April only some individuals were active. The Desert sand boa (*Eryx miliaris*) is active in both spring and summer, but this species can be observed in the daytime only in spring.

The second field visit was conducted in June 2021. In the summer months, it is almost impossible to find Russian tortoise on the territory, since this species has a period of aestivation (summer hibernation). Occasionally in summer, individual tortoises can be seen on the surface in those places where the green juicy grass is preserved. No such places were found on the project territory, as well as the tortoises themselves in the summer period. For other listed species, such as the Southern Even-fingered Gecko and Caspian monitor, summer is the period of the highest activity.

All 4 species are listed also in the Red Book of the Republic of Uzbekistan and were found in the project area near Ayak-agitma lake.

Table 4 List of reptile species inhabiting the Bash WF project area

№	Species	Species presence acc. to literary sources	Author's earlier personal data	April 2021 field expedition data.	June 2021 field expedition data	Endemism	Nature conservation status		
							UzRDB	IUCN	CITES
Family *Bufonidae* (toads)									
1	Turan Toad *Bufotes turanensis*	**+**	**+**	**+**		UZ, TJ, TM			
Family *Testudinidae* (tortoises)									
1	Russian tortoise *Testudo horsfieldii*	+	+	+			2 (VU)	VU	II
Family *Gekkonidae* (geckoes)									
2	Southern Even-fingered Gecko *Alsophylax laevis*	+			+	UZ, TM	VU:D	CR	
3	Comb-toed Gecko *Crossobamon eversmanni*	+				UZ, TJ, TM, KZ, IR, AF			
4	Caspian Bent-Toed Gecko *Tenuidactylus caspius*	+	+	+	+			LC	
5	Turkestan thin-toed gecko*Tenuidactylus fedtschenkoi*	+	+	+	+	UZ, TJ, TM, KZ			
6	Common Wonder Gecko *Teratoscincus scincus*	+	+	+		UZ, TJ, TM, KG, IR,CN			
Family *Agamidae* (agamas)									
7	Steppe agama *Trapelus sanguinolentus*	+	+	+	+				
8	Sunwatcher toad-headed agama *Phrynocephalus helioscopus*	+	+	+	+				

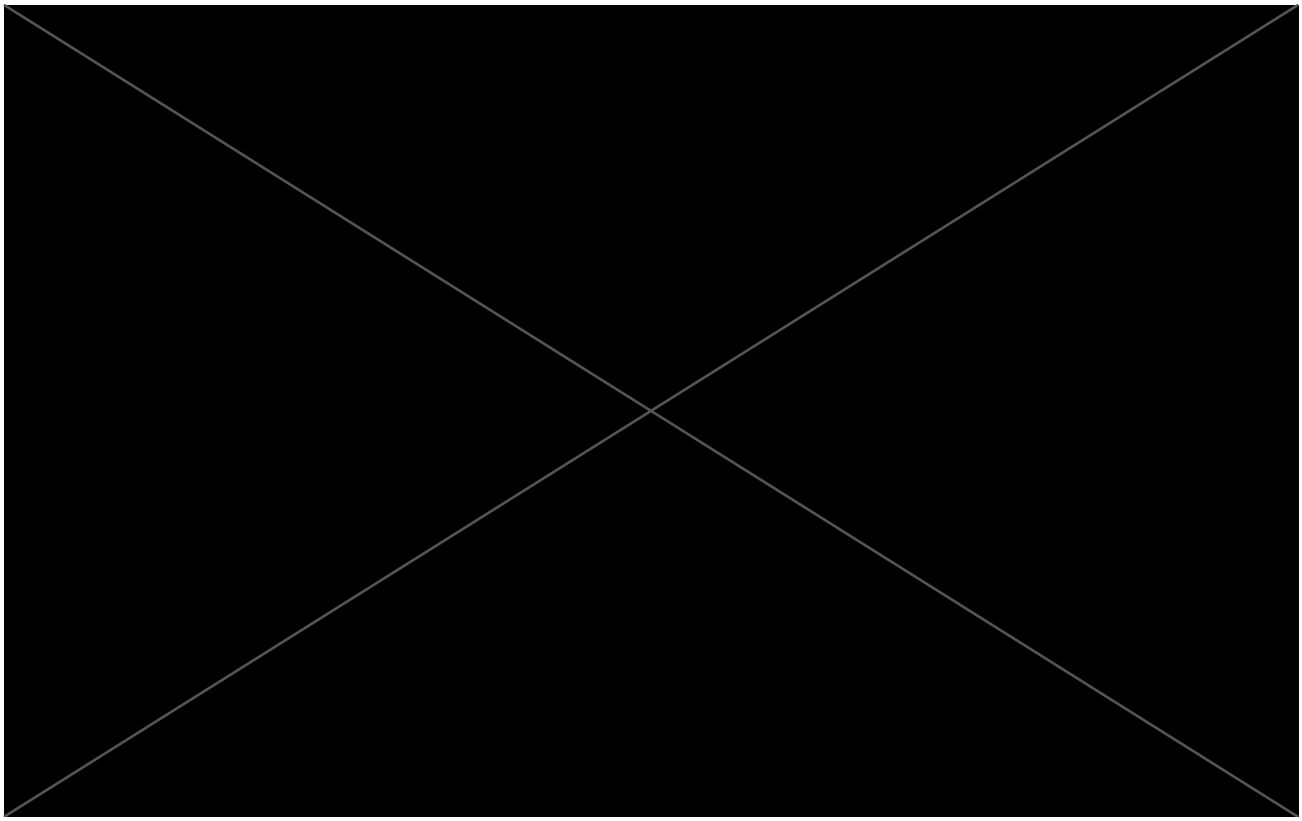
9	Lichtenstein's Toadhead Agama *Phrynocephalus interscapularis*	+	+	+		UZ, TM, KZ			
Family *Lacertidae* (true lizards)									
10	Rapid Lizard *Eremias velox*	+	+	+	+				
11	Aralo-Caspian racerunner *Eremias intermedia*	+		+					
12	Sand Racerunner *Eremias scripta*	+		+					
Family *Varanidae* (monitor lizards)									
13	Caspian Monitor *Varanus griseus caspius*	+	+	+			2 (VU:D)		I
Family *Boidae* (Boas)									
14	Desert sand boa *Eryx miliaris*	+		+			3 (NT)		II
Family *Colubridae* (colubrid snakes)									
15	Sand racer *Psammophis lineolatus*	+	+	+					
16	Spotted whip snake *Hemorrhois ravergieri*	+		+	+				
17	Spotted desert racer *Platyceps karelinii*	+	+	+					
18	Dice Snake *Natrix tessellata*	+	+						

Notes : UzRDB– species/subspecies listed in the Red Data Book of Uzbekistan (2019) (CR – critically endangered; VU – vulnerable; NT – near-threatened); IUCN – species included in the Red List of the International Union for Conservation of Nature (VU - vulnerable; NT – near-threatened); CITES I, II – species listed in the appendices (I, II) to the Convention on International Trade in Endangered Species of Wild Fauna and Flora; Endemism: AF - Afghanistan, KZ – Kazakhstan; TM – Turkmenistan; KG – Kyrgyzstan; TJ – Tajikistan; UZ – Uzbekistan.

According to processed information, the author's personal data and two field survey results, currently, the Bash wind farm project area is inhabited by 1 amphibian species and 18 reptile species belonging to 7 families (Table 4). The total number of amphibian species comprises 33,3% of the total diversity of the amphibian fauna of Uzbekistan, reptiles – 29,03%. Among them, 4 species are included in the Red Book of the Republic of Uzbekistan (2019) (22,2% of the total number of species inhabiting the project area), 2 species are included in the Red List of the International Union for Conservation of Nature (IUCN Red List) (11,1% of total number of species inhabiting the project area) and 3 species – in the Appendices to the Convention on International Trade in Endangered Species of Wild Fauna and Flora (16,7% of the total number of species inhabiting the project area).

Spring survey (April 2021)

The first field trip to the survey points in the area of the Ayak-agitma lake was carried out from April 20 to 22, 2021. During the spring survey of the project area, 14 km of hiking routes (transect) were completed. The transects passed through pre-selected survey points and their 1 kilometer radius (Figure 10).



Reptile survey was carried out during the daytime, since the night temperature was too low for reptile activity. The situation was worsened by a strong gusty wind. Wind speed reached 16-18 m/s. However, during the daytime surveys, points on suitable for Southern Even-fingered Gecko biotope were examined for the possibility of conducting surveys in the summer.

The average night air temperature in April was 14 °C, the soil temperature was 11-12 °C, the air humidity was 38%. These values are not high enough for the reptile nocturnal survey.

During the survey of the territory, we recorded 7 reptiles species (11,3% of the total number of reptiles species), of which 3 species (42,8% of the number of species encountered) - Russian tortoise, Desert sand boa and Caspian monitor are included in the Red Book of the Republic of Uzbekistan, and one (14,3% of the number of species encountered) of them is included in the Red List of the International Union for Conservation of Nature (IUCN Red List).

Table 5 Primary data and the density of reptiles at the observation points in the area of Lake Ayak-Agitma in the spring of 2021

No	Species	No. of recorded animals	Population density on the site, inds/ha	Biotope	Transect length	Date and time	Air temperature	Soil temperature	Humidity, %
NB 1				Loamy plain, Artemisia-Calligonum association,	1 km	20.04.21	C30,3°	C32,3°	21%

				Peganum harmala and Ferula					
1	*Testudo horsfieldii* Russian tortoise	2	0,8						
2	*Trapelus sanguinolentus* Steppe agama	1	-						
NB 2				Loamy plain, Artemisia-Calligonum association, Peganum harmala and Ferula	1 km	20.04.21	C33,4°	C35,6°	19%
1	*Testudo horsfieldii* Russian tortoise	2	1,6						
2	*Eremias velox* Rapid Lizard	6	8,7						
NB 3				Small-hill sands, Artemisia-Calligonum- Ferula association	1 km	21.04.21	C19,3°	C29,0°	37%
1	*Testudo horsfieldii* Russian tortoise	2	3,1						
2	*Trapelus sanguinolentus* Steppe agama	1	-						
NB 4				Fixed hilly sands, Artemisia--Calligonum- Ferula association	1 km	21.04.21	C18,7°	C23,2°	22%
1	*Testudo horsfieldii* Russian tortoise	4	3,03						
2	*Trapelus sanguinolentus* Steppe agama	1	-						
NB 5				Fixed hilly sands, Artemisia--Calligonum- Ferula association	1 km	21.04.21	C19,3°	C23,7°	23%
1	*Trapelus sanguinolentus* Steppe agama	2	1,8						
NB 6				Clay hilly plain crossed by ravines Artemisia association	1 km	20.04.21	C28,2°	C33,8°	20%
1	*Testudo horsfieldii* Russian tortoise	2	0,22						
2	*Trapelus sanguinolentus* Steppe agama	2	2,3						
3	*Eremias velox* Rapid Lizard	1	-						
4	*Eryx miliaris* Desert sand boa	1	-						

NB 7				Clay plain, Artemisia association	1 km	20.04.21	C28,7°	C34,7°	20%
1	*Trapelus sanguinolentus* Steppe agama	1	-						
NB 8				Fixed hilly sands, Artemisia-association	1 km	21.04.21	C23,5°	C31,5°	20%
1	*Testudo horsfieldii* Russian tortoise	13	3,6						
2	*Eremias velox* Rapid Lizard	2	3,1						
3	*Varanus griseus* Caspian Monitor	1	0,06						
NB 9				Clay plain, Artemisia association	1 km	21.04.21	C21,7°	C35,1°	31%
1	*Testudo horsfieldii* Russian tortoise	2	0,5						
2	*Eremias velox* Rapid Lizard	3	4,7						
NB 10				Clay hilly plain crossed by ravines, wormwood association	1 km	20.04.21	C27,1°	C28,0°	22%
0									
NB 11				Clay plain, Artemisia-Saxaul association	1 km	21.04.21	C23,1°	C33,6°	19%
1	*Testudo horsfieldii* Russian tortoise	2	1,6						
2	*Phrynocephalus helioscopus* Sunwatcher toad-headed agama	2	2,7						
NB 12				Clay hilly plain, Artemisia association	1 km	20.04.21	C22,7°	C19,4°	24%
0									
NB 13				Fixed hilly sands, Artemisia-Saxaul association	1 km	21.04.21	C19,1°	C29,3°	22%
1	*Testudo horsfieldii* Russian tortoise	6	2,6						
NB 14				Clay plain, Artemisia-Ferula association	1 km	21.04.21	C16,5°	C26,0°	41%
1	*Eremias velox* Rapid Lizard	2	3,1						
2	*Psammophis lineolatus* Sand racer	1	-						

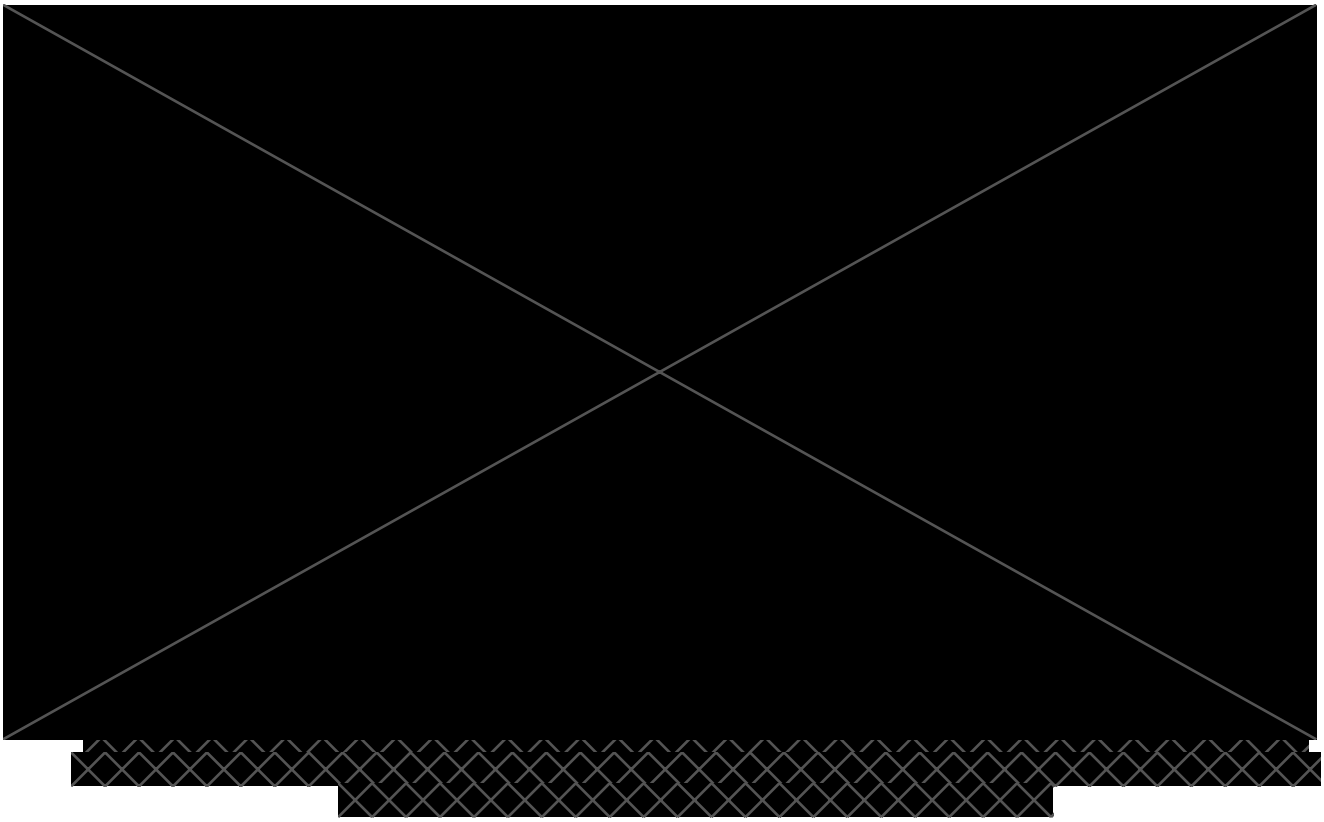
The highest density of the Russian tortoise on the project territory during the Spring survey was recorded at NB 8 point and amounted to 3.6 ind/ha. However, similar number of 2 tortoises per transect was observed at several other points: NB 3, NB 4 and NB 13. The Russian tortoise was found at 9 points, which is 64,3% of the total number of observation points (14 points). It is worth noting that the Russian tortoise is not a numerous species throughout the project area.

The points located along the chinks of the Ayak-Agitma depression were identified as the most promising points for the summer Southern Even-fingered Gecko survey.

In general, the reptiles' species composition is typical for this geographical area.

Summer survey (June 2021)

The second field trip to the survey points in the area of the Ayak-Agitma lake was carried out from June 22 to 24, 2021. The priority of this field visit was to conduct the quantitative assessment of Southern Even-fingered Gecko population at the points identified in spring as the most suitable. During the summer survey of the project area, 13 km of hiking routes (transect) were completed. The transects passed through pre-selected survey points and



Reptile survey was carried out mainly at night – after sunset and before the night coolness, until about 2 am, when the activity of the Southern Even-fingered Gecko decreases.

The average night air temperature in June was 27°C, the soil temperature was 28°C, the air humidity was 20%. These values are ideal for the nocturnal reptile survey, including the Southern Even-fingered Gecko.

However, the windy weather did not allow us to find many Southern Even-fingered Gecko. The wind speed reached 10-12 m/s.

Table 6 Primary data and the density of reptiles at the accounting points in the area of Lake Ayakagitma in the summer of 2021

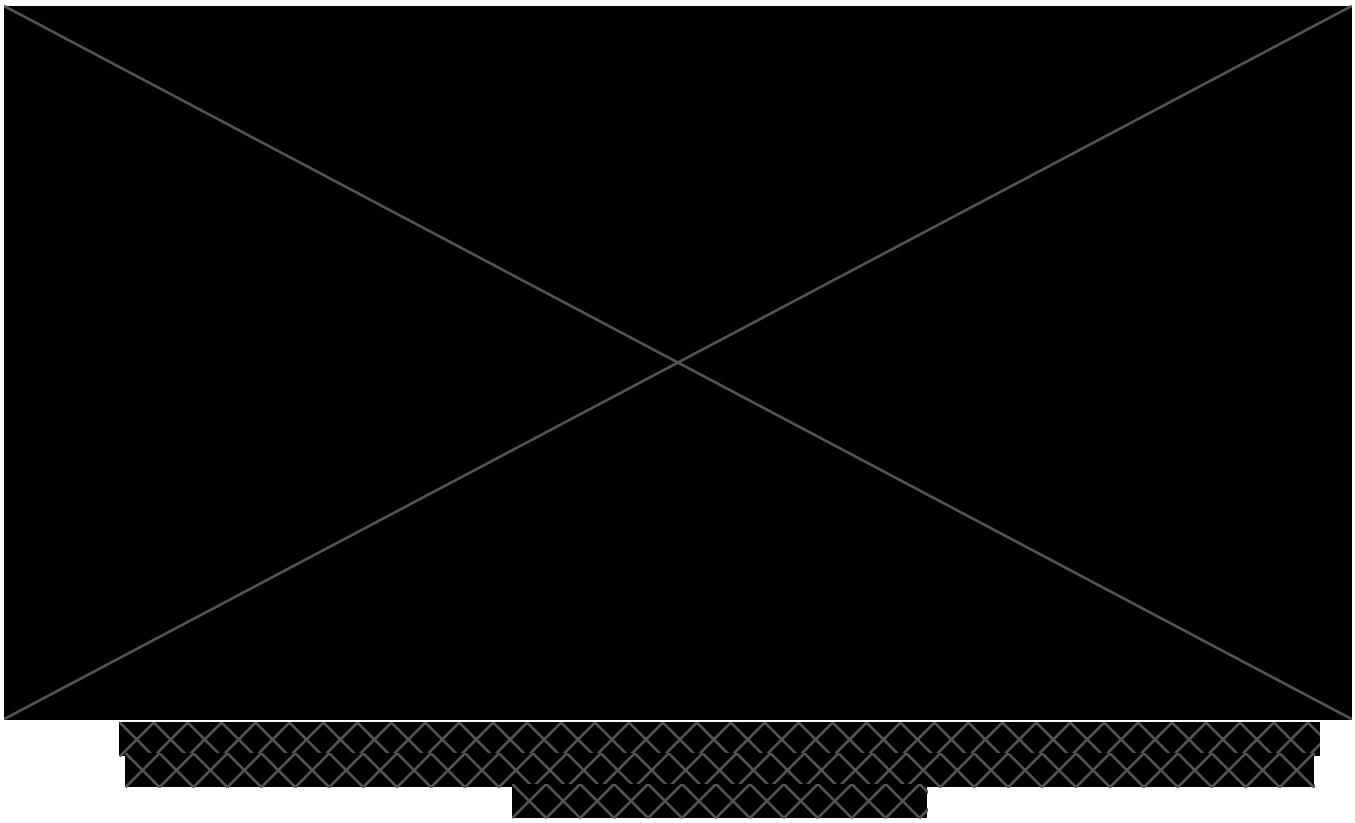
No	Species	No. of recorded animals	Population density on the site, inds/ha	Biotope	Transect length	Date and time	Air temperature	Soil temperature	Humidity, %
NB 1				Loamy plain, Artemisia-- Calligonum- Ferula association	1 km	22.06.21	C30,3°	C32,3°	21%
0									
NB 2				Loamy plain, Artemisia- Calligonum association, Peganum harmala and Ferula	1 km	22.06.21	C33,4°	C35,6°	19%
0									
NB 6				Clay hilly plain crossed by ravines, Artemisia association	1 km	24.06.21	C28,2°	C33,8°	20%
0									
NB 10				Clay hilly plain crossed by ravines, Artemisia association	1 km	24.06.21	C27,1°	C28,0°	22%
0									
NB 12				Clay hilly plain crossed by ravines, Artemisia association	1 km	23.06.21	C22,7°	C19,4°	24%
0									
NB 15 levis				Clay hilly plain crossed by ravines, Artemisia association	1 km	23.06.21	C22,7°	C24,8°	19%
1	*Alsophylax laevis* Southern Even-fingered Gecko	1	1,3						

During the survey of the territory, we recorded 1 reptiles species - Southern Even-fingered Gecko - (1,6% of the total number of reptiles species), which is included in the Red Book of the Republic of Uzbekistan (100% of the number of species encountered), and included in the Red List of the International Union for Conservation of Nature (IUCN Red List) (100% of the number of species encountered). The variety of species for the second field visit turned out to be less than for the first, due to the narrow focus and specifics of the summer survey.

Herpetological survey along planned Dzhankeldy-Bash OHTL

During the construction of new power lines, there are great risks that some populations of rare and endemic species may be destroyed, in this regard, it is necessary to conduct detailed field studies for such populations.

The field trip to the survey points in the area along planned Dzhankeldy-Bash OHTL was carried out from June 19 to 25, 2021. During the summer survey of the project area, 13 km of hiking routes (transect) were completed. The transects passed through pre-selected survey points and their 1 kilometer radius (Figure 13).



The main purpose of this field trip was to identify the areal of Southern Even-fingered Gecko population on the project territory. In the summer months, it is almost impossible to find Russian tortoise on the territory, since this species has a period of aestivation (summer hibernation). Occasionally in summer, individual tortoises can be seen on the surface in those places where the green juicy grass is preserved. No such places were found on the project territory, as well as the tortoises themselves in the summer period. However, we found many burrows of this species at many survey points. For other listed species, such as the Southern Even-fingered Gecko and Caspian monitor, summer is the period of the highest activity.

Table 7 List of reptile species inhabiting the project area along planned Dzhankeldy-Bash OHTL

№	Name of species	The presence acc. to literary sources	Author's earlier personal data	June 2021 field expedition data	Endemism	Endemism		
						UzRDB	IUCN	CITES
Family Bufeniode (toads)								
1	Turan Toad *Bufotes turanensis*	+	+		UZ, TJ, TM			
Family *Testudinidae* (tortoises)								
1	Russian tortoise *Testudo horsfieldii*	+	+	+		2 (VU)	VU	II
Family *Gekkonidae* (geckoes)								
2	Southern Even-fingered Gecko *Alsophylax laevis*	+		+	UZ, TM	VU:D	CR	
3	Comb-toed Gecko *Crossobamon eversmanni*	+			UZ, TJ, TM, KZ, IR, AF			
4	Caspian Bent-Toed Gecko *Tenuidactylus caspius*	+	+	+			LC	
5	Turkestan thin-toed gecko*Tenuidactylus fedtschenkoi*	+	+		UZ, TJ, TM, KZ			
6	Common Wonder Gecko *Teratoscincus scincus*	+	+	+	UZ, TJ, TM, KG, IR,CN			
Family *Agamidae* (agamas)								
7	Steppe agama *Trapelus sanguinolentus*	+	+	+				
8	Sunwatcher toad-headed agama *Phrynocephalus helioscopus*	+	+					
9	Lichtenstein's Toadhead Agama *Phrynocephalus interscapularis*	+	+		UZ, TM, KZ			
Family *Varanidae* (monitor lizards)								
10	Rapid Lizard *Eremias velox*	+	+	+				
12	Sand Racerunner *Eremias scripta*	+						
Family *Varanidae* (monitor lizards)								
13	Caspian Monitor *Varanus griseus caspius*	+	+	+		2 (VU:D)		I
Family *Boidae* (Boas)								
14	Desert sand boa *Eryx miliaris*	+				3 (NT)		II
Family *Colubridae* (colubrid snakes)								
15	Sand racer *Psammophis lineolatus*	+	+					

16	Spotted whip snake *Hemorrhois ravergieri*	+						
17	Spotted desert racer *Platyceps karelinii*	+	+					

Notes : UzRDB– species/subspecies listed in the Red Data Book of Uzbekistan (2019) (CR – critically endangered; VU – vulnerable; NT – near-threatened); IUCN – species included in the Red List of the International Union for Conservation of Nature (VU - vulnerable; NT – near-threatened); CITES I, II – species listed in the appendices (I, II) to the Convention on International Trade in Endangered Species of Wild Fauna and Flora; Endemism: AF - Afghanistan, KZ – Kazakhstan; TM – Turkmenistan; KG – Kyrgyzstan; TJ – Tajikistan; UZ – Uzbekistan.

According to processed information, the author's personal data and the field survey results, currently, the project area along planned Dzankeld-Bash OHTL is inhabited by 1 amphibian species and 17 reptile species belonging to 7 families (Table 7). The total number of amphibian species comprises 33,3% of the total diversity of the amphibian fauna of Uzbekistan, reptiles – 27,4%. Among them, 4 species are included in the Red Book of the Republic of Uzbekistan (2019) (23,5% of the total number of species inhabiting the project area), 2 species are included in the Red List of the International Union for Conservation of Nature (IUCN Red List) (11,7% of total number of species inhabiting the project area) and 3 species – in the Appendices to the Convention on International Trade in Endangered Species of Wild Fauna and Flora (17,6% of the total number of species inhabiting the project area).

Reptile survey was carried out both during the day and at night. Moreover, in some points that were identified as potential habitats of the Southern Even-fingered Gecko during the day, both day and night surveys were carried out, in places that were identified as not suitable biotope for the Southern Even-fingered Gecko, night records were not carried out. Nocturnal survey was carried out after sunset and before the night coolness, until about 2 am, when the activity of the Southern Even-fingered Gecko decreases.

The average night air temperature was 22 ^{o}C, the soil temperature was 20 ^{o}C, the air humidity was 17%. These values are not high enough for the reptile nocturnal survey.

Since most of the project area runs along the highway, it was decided that in addition to the transect survey along planned OHTL, we would record the roadkill on the highway No. 4P61. So for 79.5 km of this highway, we found 2 young Caspian monitors (Figure 14), 2 Common Wonder Geckos and 4 Steppe agamas.



Table 8 Primary data and the density of reptiles at the survey points along planned Dzankeld-Bash OHTL in the summer of 2021

No	Species	No. of recorded animals	Population density on the site, inds/ha	Biotope	Transect length	Date and time	Air temperature	Soil temperature	Humidity, %
PL 1				Sub-sand hilly plain, Artemisia saxaul association	1 km	25.06.21	C34,1°	C53,6°	16%
1	*Testudo horsfieldii* Russian tortoise	4 holes	-						
2	*Trapelus sanguinolentus* Steppe agama	6	8,9						

PL 2				Clay plain, Artemisia-Ferula association	1 km	25.06.21	C34,4º	C52,4º	16%
1	*Eremias velox* Rapid Lizard	4	5,7						
PL 3				Sub-sand hilly plain, Artemisia saxaul association	1 km	25.06.21	C34,8º	C48,1º	16%
0									
PL 4				Sub-sand hilly plain, Artemisia saxaul association	1 km	25.04.21	C33,7º	C47,2º	16%
2	*Trapelus sanguinolentus* Steppe agama	1	-						
PL 5				Semi-fixed hilly sands, Artemisia saxaul -ferula association	1 km	19.06.21	C40,0º	C55,3º	16%
1	*Testudo horsfieldii* Russian tortoise	1 hole	-						
2	*Trapelus sanguinolentus* Steppe agama	2	2,8						
3	*Varanus griseus caspius* Caspian Monitor	1	0,06						
PL 6				Sub-sandy hilly plain crossed by ravines and clay-rubbly uplands, Artemisia association	1 km	25.06.21	C24,7º	C22,5º	18%
1	*Alsophylax laevis* Southern Even-fingered Gecko	7	9,3						
2	Common Wonder Gecko *Teratoscincus scincus*	20	16,3						
PL 7				Clay hilly plain crossed by ravines, Artemisia-Saxaul-Sazkazgan association	1 km	25.06.21	C21,5º	C19,7º	17%
1	*Alsophylax laevis* Southern Even-fingered Gecko	4	5,2						
2	*Testudo horsfieldii* Russian tortoise	14 holes and 2 shells	-						
3	*Trapelus sanguinolentus* Steppe agama	3	4,3						
PL 8				Clay hilly plain, Artemisia-Tamarix association	1 km	25.06.21	C20,8º	C19,3º	17%
1	*Alsophylax laevis* Southern Even-fingered Gecko	6	8,1						

2	*Trapelus sanguinolentus* Steppe agama	3	4,3						
PL 9				Clay plain, Artemisia association	1 km	19.06.21	C36,7º	C42,8º	16%
1	*Trapelus sanguinolentus* Steppe agama	1	-						
2	*Eremias velox* Rapid Lizard	1	-						
PL 10				Small-hill sands, Artemisia-Calligonum- Ferula association	1 km	19.06.21	C35,4º	C39,5º	17%
1	*Testudo horsfieldii* Russian tortoise	Ruined egg clutch							
2	*Trapelus sanguinolentus* Steppe agama	2	2,7						
3	Common Wonder Gecko *Teratoscincus scincus*	trails	-						
PL 11				Fixed hilly sands, Artemisia-ferula association	1 km	20.06.21	C31,2º	C48,2º	16%
1	*Trapelus sanguinolentus* Steppe agama	1	-						
PL 12				Small-hill sands, Artemisia-Calligonum- Ferula association	1 km	20.06.21	C31,4º	C46,0º	16%
1	*Varanus griseus caspius* Caspian Monitor	1	0,01						
PL 13				Small-hill sands, with depressions Artemisia-Calligonum- Ferula association	1 km	20.06.21	C31,5º	C43,6º	16%
1	*Tenuidactylus caspius* Caspian Bent-Toed Gecko	1	-						
2	*Trapelus sanguinolentus* Steppe agama	3	4,1						
3	*Varanus griseus caspius* Caspian Monitor	1	0,025						

During the survey of the territory, we recorded 7 reptiles species (11,3% of the total number of reptiles species), of which 3 species (42,8% of the number of species encountered) - Russian tortoise, Caspian Monitor and Southern Even-fingered Gecko are included in the Red Book of the Republic of Uzbekistan, and two (28,6% of the number of species encountered) of them are included in the Red List of the International Union for Conservation of Nature (IUCN Red List).

The highest density of Southern Even-fingered Gecko on the project territory was recorded at PL 6 point and amounted to 9.3 ind/ha (Figure 15).



Since Russian tortoise is in a state of aestivation in the summer months, the presence of the latter on the project territory was determined by the remains and traces of the species vital activity (burrows, etc.) (Figure 16).

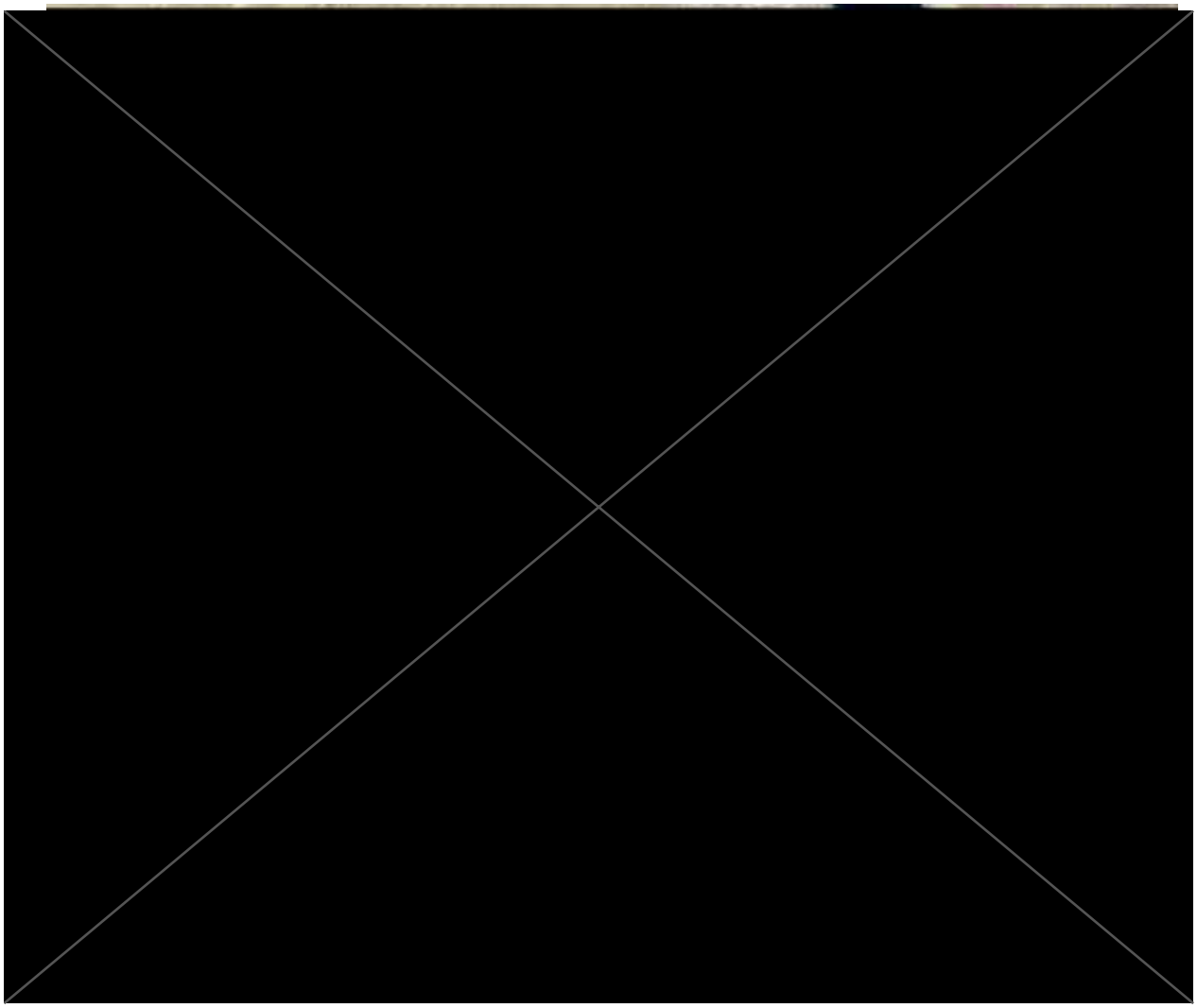


Figure 16. The burrow of the Russian tortoise at the PL 6 point in Summer 2021

In general, the reptiles' species composition is typical for this geographical area.

Herpetological survey along planned Bash-Karakul OHTL

The field trip to the survey points in the area along planned Bash-Karakul OHTL was carried out from May 5 to 7, 2021. The transects passed through pre-selected survey points and their 1 kilometer radius (Figure 17).



As a result of the field trip, 8 species of reptiles were recorded on the project territory, of which 2 species – the Russian tortoise and Caspian Monitor, are rare and threatened species listed in the Red Book of the Republic of Uzbekistan (2019). The most of the encountered reptiles are typical psamobionts. It is worth noting that the main part of the project area passes through agricultural lands, and no potential habitats for the Southern Even-fingered Gecko were identified throughout the project area.

Table 9 List of reptile species inhabiting the project area along planned Bash-Karakul OHTL

№	Species	Species presence acc. to literary sources	Author's earlier personal data	May 2021 field expedition data	Endemism	Nature conservation status		
						UzRDB	UzRDB	UzRDB

Family Bufonidae (toads)								
1	Turan Toad *Bufotes turanensis*	+	+		UZ, TJ, TM			
Family *Testudinidae* (tortoises)								
1	Russian tortoise *Testudo horsfieldii*	+	+	+		2 (VU)	VU	II
Family *Gekkonidae* (geckoes)								
2	Comb-toed Gecko *Crossobamon eversmanni*	+			UZ, TJ, TM, KZ, IR, AF			
3	Caspian Bent-Toed Gecko *Tenuidactylus caspius*	+	+				LC	
4	Turkestan thin-toed gecko *Tenuidactylus fedtschenkoi*	+	+		UZ, TJ, TM, KZ			
5	Common Wonder Gecko *Teratoscincus scincus*	+	+	+	UZ, TJ, TM, KG, IR,CN			
Family *Agamidae* (agamas)								
6	Steppe agama *Trapelus sanguinolentus*	+	+	+				
7	Sunwatcher toad-headed agama *Phrynocephalus helioscopus*	+						
8	Lichtenstein's Toadhead Agama *Phrynocephalus interscapularis*	+		+	UZ, TM, KZ			
9	Secret Toadhead Agama *Phrynocephalus mystaceus*	+						
Family *Lacertidae* (true lizards)								
10	Rapid Lizard *Eremias velox*	+	+	+				
11	Sand Racerunner *Eremias scripta*	+	+	+				
12	Reticulate Racerunner *Eremias grammica*			+				
Family *Varanidae* (monitor lizards)								
13	Caspian Monitor Varanus *griseus caspius*	+	+	+		2 (VU:D)		I
Family *Boidae* (Boas)								
14	Desert sand boa *Eryx miliaris*	+				3 (NT)		II
Family *Colubridae* (colubrid snakes)								
15	Sand racer *Psammophis lineolatus*	+	+					
16	Spotted whip snake *Hemorrhois ravergieri*	+	+					
17	Spotted desert racer *Platyceps karelinii*	+	+					
18	Diadem Snake *Spalerosophis diadema*	+	+					
Family *Viperidae*								
19	Saw-scaled Viper, Phoorsa *Echis multisquamatus*	+	+					

Notes: UzRDB– species/subspecies listed in the Red Data Book of Uzbekistan (2019) (CR – critically endangered; VU – vulnerable; NT – near-threatened); IUCN – species included in the Red List of the International Union for Conservation

of Nature (VU - vulnerable; NT – near-threatened); CITES I, II – species listed in the appendices (I, II) to the Convention on International Trade in Endangered Species of Wild Fauna and Flora; Endemism: AF - Afghanistan, KZ – Kazakhstan; TM – Turkmenistan; KG – Kyrgyzstan; TJ – Tajikistan; UZ – Uzbekistan.

According to processed information, the author's personal data and the field survey results, currently, the project area along planned Bash-Karakul OHTL is inhabited by 1 amphibian species and 19 reptile species belonging to 8 families (Table 9). The total number of amphibian species comprises 33,3% of the total diversity of the amphibian fauna of Uzbekistan, reptiles – 30,6%. Among them, 3 species are included in the Red Book of the Republic of Uzbekistan (2019) (15,8% of the total number of species inhabiting the project area), 1 species is included in the Red List of the International Union for Conservation of Nature (IUCN Red List) (5,2% of total number of species inhabiting the project area) and 3 species – in the Appendices to the Convention on International Trade in Endangered Species of Wild Fauna and Flora (15,8% of the total number of species inhabiting the project area).

Table 10 Primary data and the density of reptiles at the survey points along planned Bash-Karakul OHTL in the spring of 2021

№	Species	Number	Density in/ ha	Biotope	Route length	Date and time	Air temperature	Soil temperature	Humidity %
VP 1				Sandy desert/ Waterbody	1 km	05.05.21	C34,1°	C42,6°	25%
1	*Eremias grammica* Reticulate Racerunner	1	1						
VP 2				Saline land Alhagi, Harmala, Capparis, Salsola association	1 km	05.05.21	C34,4°	C42,4°	21%
1	*Trapelus sanguinolentus* Steppe agama	1	1						
2	*Eremias grammica* Reticulate Racerunner	2	4,9						
3	*Varanus griseus caspius* Desert Monitor	1	0,1						
VP 3				Fixed sands. Sheep cot.	1 km	05.05.21	C34,8°	C38,3°	19%
1	*Trapelus sanguinolentus* Steppe agama	4	4,6						
2	*Eremias grammica* Reticulate Racerunner	2	3,3						

3	*Eremias scripta* Sand Racerunner	2	6,2						
4	*Eremias velox* Rapid Racerunner	1	1						
5	*Varanus griseus caspius* Desert Monitor	1	0,7						
VP 4				Sandy desert. Sheep cot. Vegetation is sparse.	1 km	05.05.21	C33,7°	C37,8°	19%
1	*Testudo horsfieldii* Central Asian tortoise	2 traces	-						
2	*Teratoscincus scincus* Common Wonder Gecko	12	12						
3	*Phrynocephalus interscapularis* Lichtenstein's Toadhead Agama	10	20						
4	*Eremias velox* Rapid Racerunner	2	3,3						
5	*Varanus griseus caspius* Desert Monitor	1	0,1						
VP 5				Old quarry with water	1 km	06.05.21	C32,0°	C35,6°	26%
1	*Eremias velox* Rapid Racerunner	2	3,3						
VP 6				Agricultural zone	1 km	06.05.21	C28,7°	C36,5°	24%
1	*Eremias grammica* Reticulate Racerunner	2	3,3						
VP 7				Developed zone	1 km	06.05.21	C28,5°	C36,7°	23%
1	*Eremias velox* Rapid Racerunner	2	3,3						
VP 8				Sandy desert	1 km	06.05.21	C27,8°	C35,3°	22%
0									
VP 9				Sandy desert	1 km	06.05.21	C33,7°	C43,8°	21%
1	*Testudo horsfieldii* Central Asian tortoise	3 traces	-						
2	*Trapelus sanguinolentus* Steppe agama	1	1						
3	*Phrynocephalus interscapularis* Lichtenstein's Toadhead Agama	3	7,2						
4	*Eremias scripta* Sand Racerunner	1	1						

5	*Eremias velox* Rapid Racerunner	1	1						
VP 10				Sandy desert/ Waterbody	1 km	06.05.21	C33,4º	C38,5º	28%
0									
VP 11				Sandy desert. Saxaul association	1 km	07.05.21	C31,2º	C45,4º	19%
1	*Trapelus sanguinolentus* Steppe agama	2	3,3						
2	*Eremias grammica* Reticulate Racerunner	1	1						
3	*Eremias scripta* Sand Racerunner	2	4,9						
4	*Varanus griseus caspius* Desert Monitor	1	0,1						
VP 12				Sandy desert. Artemisia association.	1 km	07.05.21	C31,4º	C43,0º	22%
1	*Testudo horsfieldii* Central Asian tortoise	1	0,01						
2	*Trapelus sanguinolentus* Steppe agama	3	2,3						
3	*Teratoscincus scincus* Common Wonder Gecko	1 egg	-						
4	*Eremias scripta* Sand Racerunner	1	3,1						
VP 13				Sandy desert Saxsaul. Alhagi, Salsola association	1 km	07.05.21	C31,5º	C45,7º	22%
1	*Trapelus sanguinolentus* Steppe agama	1	1						
2	*Eremias scripta* Sand Racerunner	2	3,3						
VP 14				Agricultural zone. In the fields of alfalfa and wheat Tamarix association	1 km	07.05.21	C23,7º	C29,1º	26%
1	*Trapelus sanguinolentus* Steppe agama	1	1						
2	*Eremias velox* Rapid Racerunner	1	1						
VP 15				Developed zone	1 km	07.05.21	C22,5º	C28,7º	24%
0									

RARE SPECIES OF REPTILES INHABITING THE PROJECT TERRITORIES

Family *TESTUDINIDAE*

Russian tortoise
Testudo horsfieldii (Gray, 1844)



Figure 18 Russian tortoise. Photo by T. V. Abduraupov.

The Russian tortoise is a vulnerable species endemic to Central Asia, whose numbers are decreasing. It is included in the IUCN Red List [VU] and the Red Book of the Republic of Uzbekistan 2(VU) (2019) and listed in Appendix II of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES).

This species is endemic to Central Asia, where it inhabits lowlands and foothills (except drifting sands). In addition to Southern Kazakhstan, Turkmenistan, Uzbekistan, Kyrgyzstan and Tajikistan, it is distributed in Northern and Eastern Iran, Afghanistan, North-western China and Northern Pakistan (Ananyeva et al., 1998; Bogdanov, 1960, 1965).

Carapace length is up to 286.4 mm. The carapace is flat, slightly serrated at the rear edge. The indentation on its front edge is not deep. Each of the front paws has four claws. The forearm is covered with six to seven transverse rows of tile-like mails. On the back of the thigh there are several horny tubercles concentrated in one group. The horny mails of the carapace are usually monochromatic, yellowish or brownish-olive, sometimes with wide black spots, more pronounced on the plastron.

It inhabits both sandy and clayey deserts, plains, mountain slopes, depressions and valleys, gorges and mountain steppe up to 1,150 m above sea level (Dal, 1936, 1937). Rarely lives on agricultural lands – on the edges of irrigated and unirrigated fields, in

vegetable gardens and orchards. Avoids places with dense grass cover, as well as areas grazed intensively by livestock.

This is a strictly diurnal species. In hot weather, it can be observed only in the morning and before sunset. In the middle of the day, animals hide from the heat in temporary shelters under shrubs, where they half burrow into the soil, into the holes of rodents or those dug by themselves. During the day, tortoises are capable of covering from 120 m to 2 km. At night they burrow into shallow pits, sometimes remaining on the surface of the ground.

After the winter diapause, tortoises appear on the surface in March—early April, in warm winters and in the south of the range – in February. Mating begins a few days after their emergence. The breeding season is extended from late March to late May. Newly emerged tortoises with a shell 30—50 mm long remain under the ground during the winter and usually appear on the surface next spring.

They grow slowly. Tortoises become mature at the age of 10—13 years, when their carapaces reach 11 cm in length. In natural environment, they can live for at least 30 years.

In June, when ephemeral vegetation dries, the Russian tortoise enters a period of estivation (summer dormancy), for which it digs holes up to 1 m long. In deserts tortoises disappear by the end of May, but in the mountains or on irrigated lands, single individuals may be recorded in June and even July. Much more often, estivation flows into hibernation (winter dormancy).

In certain areas in the southern piedmont plains of Tamdytau and the eastern piedmont plains of Dzhetymtau (Navoi region), the population density averaged 11.7 individuals/ha, with a maximum of up to 15.6 inds./ha; in the pebbly-gravelly-loamy piedmont plain – 12.31 inds./ha (avg. 7.63 ± 5.92 inds./ha); in the rest of the area it was rare. In the rugged rocky areas of low mountains (Aitymtau Mountains) the tortoise occurs mainly along valleys. The highest population density of the species is 4.14 individuals/ha, which was recorded in a gently sloping valley with eroded loamy slopes (Bondarenko, 1994).

In the steppe between Tamdy and Ayakuduk – 29.2 inds./ha were recorded – 26.4♂: 50.5♀: 23.1 juv (Vashetko, Nuridjanov et al., 2010).

The number of tortoises is subject to significant fluctuations (Bogdanov, 1965), which depend on winter and spring meteorological conditions, as well as the abundance of food in biotopes where the animals live. The cultivation of virgin lands, livestock grazing and the use of natural habitats by humans significantly impact the population.

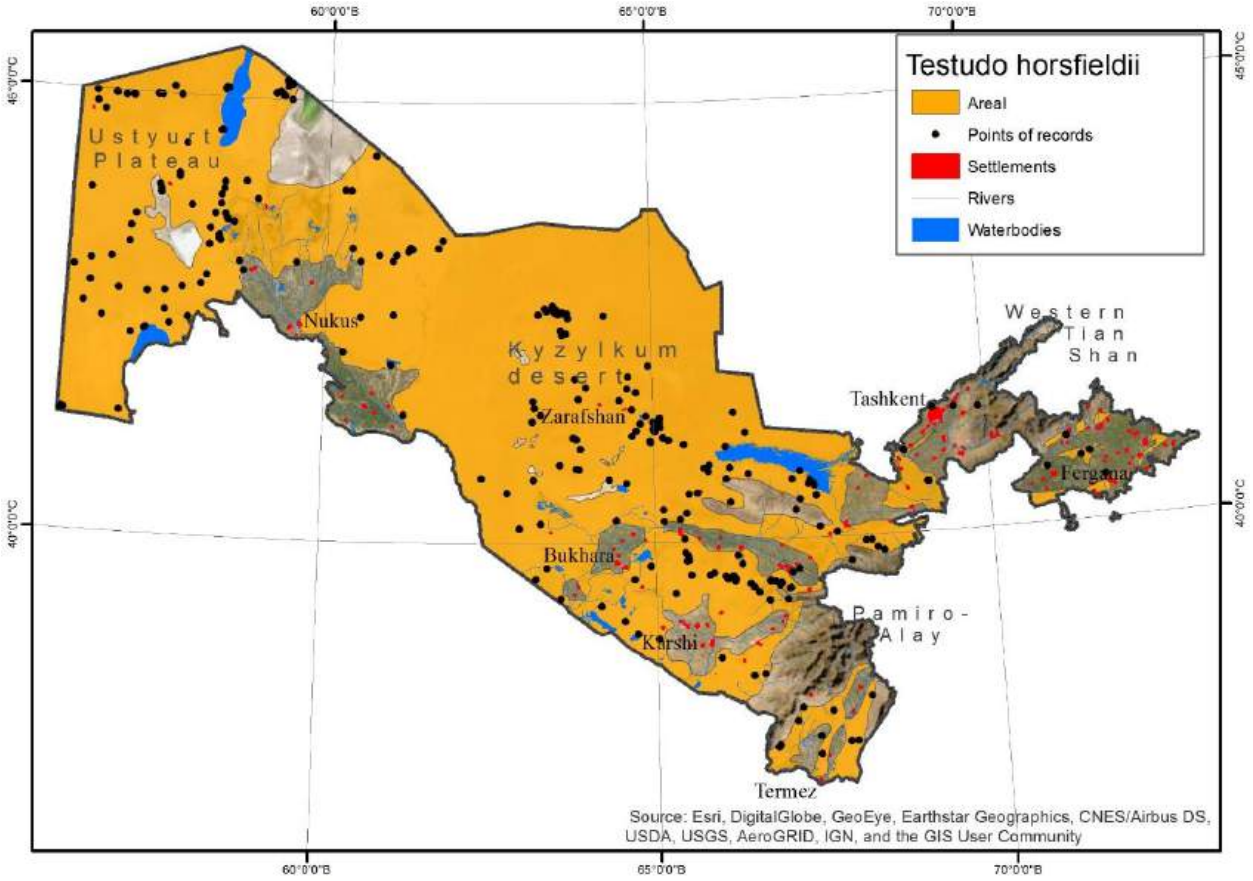


Figure 19 Map of the areal and known locations of the Russian tortoise in various regions of the Republic of Uzbekistan

Family *GEKKONIDAE*

Southern Even-fingered Gecko
Alsophylax laevis Nikolsky, 1907



Figure 20 Southern Even-fingered Gecko. Photo by T. V. Abduraupov.

This is a vulnerable, declining, sporadically distributed endemic species. Listed in the IUCN Red List [CR] and in the Red Book of the Republic of Uzbekistan 2 (VU: D) (2019). Endemic to Uzbekistan and Turkmenistan.

Length of the body with the head: male – up to 31 mm, female – up to 33 mm (Figure 14). The head and body are slightly flattened from top to bottom. There are 16—20 scales across the forehead between the centers of the eyes. The upper side of the body is yellowish with a grey tint, with four indistinct, dark transverse, sometimes interrupting stripes on the back; similar stripes can be seen on the upper surface of the limbs and tail; in immature individuals the stripes are more contrasting. A wide dark longitudinal stripe extends from the tip of the muzzle across the eyes as far as the nape. There is a transverse stripe on the back of the head.

The Southern Even-fingered Gecko occurs on takyr with sparse vegetation, where completely barren and flat areas alternate with areas where short saltwort, clusters of wormwood and camel thorn and weak meadow grass plants grow.

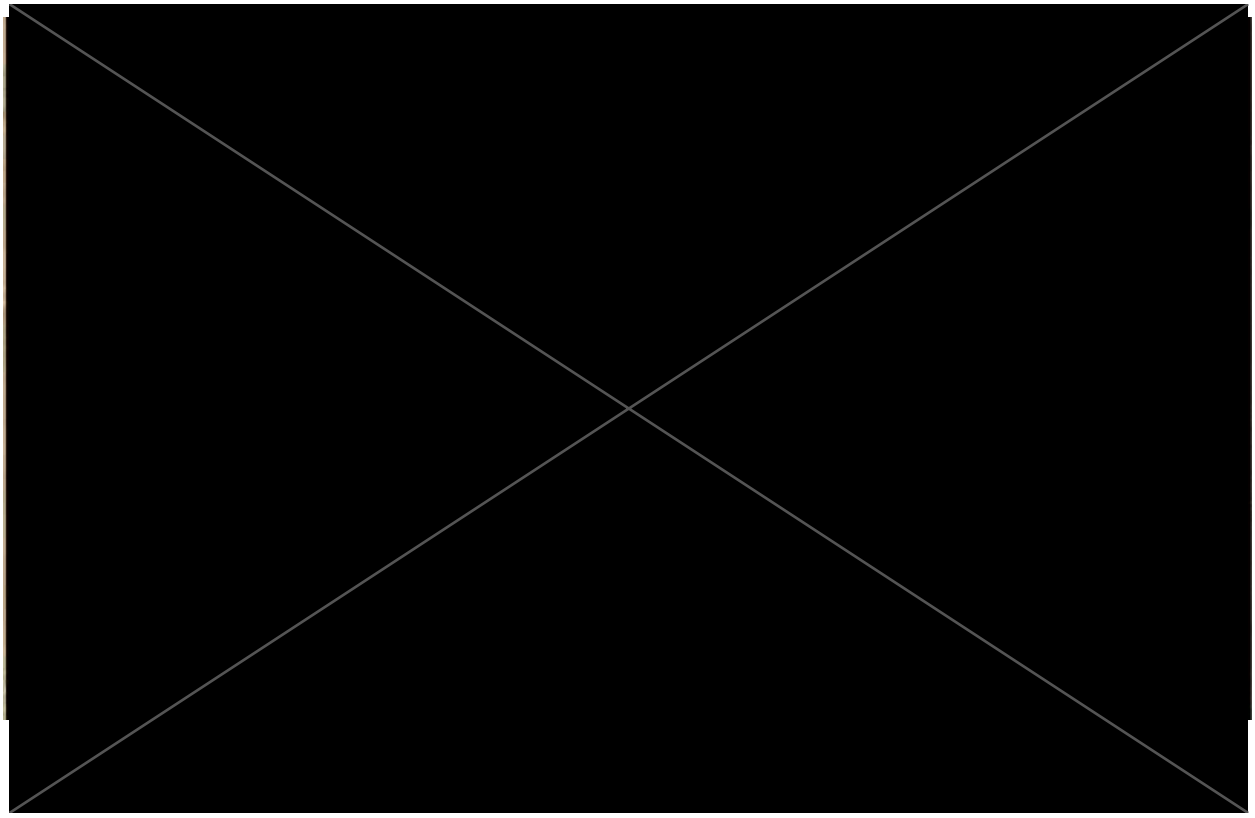
In the 1970s, there were from 0.3 (Ayakagytma depression) to 1,600 individuals (Kuldzhuktau sky island) recorded on 1 hectare in local populations; by now it has disappeared from many known habitats, while in others the number has sharply decreased (Bogdanov, 1992).

Southern Even-fingered Gecko is active from March to October at night, while during the day it hides in cracks in the ground, in its burrow or the hole of an insect or some other lizard. Mating takes place in March—April. In one season (from May to August) females produce 1–2 clutches each consisting of 1–2 eggs. The first young under 1 year of age

are observed from mid-July; they become mature after wintering. It feeds on small insects and arachnids.

O. P. Bogdanov (1992) recorded Southern Even-fingered Gecko in the central part of Kyzylkum, near the Kuldzhuktau residual mountains and along the escarpments of the Ayakagytma depression. We recorded this species in small numbers at the foot of the Lau-Lau elevation: during a 3-hour night transect we encountered only 2 individuals. We also found one individual near a railway, at the Moilisay station not far from Uchkuduk.

Quite numerous mosaic populations were observed by us near the settlements of Dzhankeldy and Kalaata in the southern foothill part of the Kuldzhuktau outlier. In this part of the range, the number of Southern Even-fingered Gecko reaches up to 12-16 ind/ha. Also, almost the same populations exist north-east of the Kuldzhuktau outlier, near the Karakata depression – 9-10 ind/ha. According to our data, the number of Southern Even-fingered Geckos on the slopes of the Ayak-Agitma depression is quite low – 1.3 ind/ha.



Family *VARANIDAE*

Caspian Monitor
Varanus griseus caspius (Eichwald, 1831)



Figure 22 Caspian Monitor. Photo by T. V. Abduraupov.

Rare species. UzRDB (2019): 2 (VU:D).

The largest lizard in Uzbekistan and neighboring countries. The length of the body with the head is up to 520 mm. The upper side of the body is greyish-brown, yellowish-brown or reddish-brown, with numerous dark dots and specks. On the upper side of the neck there are two or three longitudinal brown stripes, and on the back and tail there are several transverse stripes of the same colour. In youngsters, the stripes are very pronounced, they are black or almost black.

After hibernation, the first individuals appear relatively late – in early to mid-April. Active all day throughout April. In May, they are active in the morning and evening hours. They go into hibernation in September-October. Often the Caspian Monitor has an estivation in summer, which gradually turns into winter hibernation. They begin estivating in late June—early July.

It inhabits mainly fixed and semi-fixed sands, clay and stony-gravelly soils, visits solonchaks. Sometimes it is found in the foothills of sky islands up to 1,000 m above sea level. M. Andrushko (1953) recorded the species in the central part of Kyzylkum. T. Z. Zakhidov (1938) reports that the Caspian Monitor often occurs in the northern part of the Kenimeh desert.

According to an oral report of the surveyor of the Houbara Bustard Breeding Center in the Bukhara region, Dr. John Burnside, Caspian Monitor is quite often found around the remnants of Kuldzhuktau, especially in the vicinity of the villages of Dzhankeldy and

Kalaata. We have also repeatedly observed it in the area of the Kuldzhuktau, Bukantau and Auminzatau residual mountains, as well as in the vicinity of Ayak-Agitma Lake in 2012, 2014 and 2019.

Family *BOIDAE*

Desert sand boa
Eryx miliaris (Pallas, 1773)



Figure 23 Desert sand boa. Photo by T. V. Abduraupov.

Desert sand boa is a near-threatened, sporadically distributed subspecies, included in the Red Data Book of the Republic of Uzbekistan (2019) with the status 3(NT); also included in Appendix II of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES).

A medium-size snake. Females reach 720 mm in length, males are somewhat smaller – 550-580 mm. Tail length – 50-70 mm. The tail is short and blunt.

It lives mainly in sand deserts, where it prefers drifting and semi-fixed dunes, as well as more or less loose soils in deserts and semi-deserts with wormwood-saltwort communities and saltwort populations. It is less common on takyrs with patches of vegetation near sands and on relatively hard loess and clay soils, near ruins, on the slopes of gullies and at the borders of irrigated lands. Often occurs near colonies of Gerbils, whose burrows it uses to shelter. It is able to plunge into the sand quickly, head first, and "swim" under its surface, leaving a characteristic trail in the form of a serpentine bulge. The upward-looking eyes allow the Desert sand boa to examine the surface without raising its head above the sand.

Active from April to October. In the hot season, it leads a nocturnal and crepuscular lifestyle. It uses the holes of rodents as a refuge, therefore it often settles in colonies of Gerbils. The breeding season is in late March. In June-July, the female gives birth to 4—10 babies up to 12—14 cm long. It feeds on lizards, rodents and small birds.

M. N. Bogdanov (1882) encountered this species in the sands of the Kyzylkum desert. A. M. Andrushko (1953) recorded it in the central part of the desert, and T. Z. Zakhidov

(1938) – in the Kenimeh desert. Kh. S. Salikhbayev caught this snake in the Shafrikan forestry enterprise (leskhoz) near Barat-Kuduk (Bogdanov 1960).

In the 1950s, up to 20 individuals from the local population were recorded on a three-hour transect in Bukhara region (Shafrikan leskhoz).

In 2014 and 2016 our team recorded the Desert sand boa in the central part of the Kyzylkum desert, in the Yamankum sands, where it inhabits semi-fixed dunes. The average density of this species during the period of the highest activity in the Yamankum sands is 0.3–0.4 ind/ha. The average density of the Desert sand boa during the period of the highest activity in this area is 0.2-0.3 ind/ha. We have repeatedly observed it near the Ayak-Agitma depression and near the settlements of Kalaata and Dzhankeldy.

Currently, the population is rapidly decreasing due to increased poaching (the species is used in traditional medicine), high export and cultivation of lands.

SUMMARY TABLES

Table 11 List of reptile species found on the Dzankeldy WF project area

	NAME OF SPECIES		IUCN /RDB STATUS	TOTAL NO. OBSERVED	
	LATIN	ENGLISH		SPRING	SUMMER
1	*Testudo horsfieldii*	Russian tortoise	VU/ 2 (VU)	17	-
2	*Alsophylax laevis*	Southern Even-fingered Gecko	CR/2(VU:D)	7	47
3	*Tenuidactylus caspius*	Caspian thin-toed gecko	LC/-	2	6
4	*Tenuidactylus fedtschenkoi*	Turkestan thin-toed gecko	LC/-	2	3
5	*Trapelus sanguinolentus*	Steppe Agama	-/-	18	3
6	*Phrynocephalus helioscopus*	Sunwatcher toad-headed agama	-/-	1	2
7	*Phrynocephalus reticulatus*	Reticulated toad-headed agama	LC/-	11	4
8	*Eremias intermedia*	Aralo-Caspian racerunner	LC/-	12	-
9	*Eremias lineolata*	Striped racerunner	LC/-	1	-
10	*Eremias velox*	Rapid racerunner	-/-	3	1
11	*Eryx miliaris*	Desert sand boa	-/3(NT)	1	
12	*Hemorrhois ravergieri*	Spotted whip snake	-/-	-	1

Table 12 List of reptile species found on the Bash WF project area

	NAME OF SPECIES		IUCN /RDB STATUS	TOTAL NO. OBSERVED	
	LATIN	ENGLISH		SPRING	SUMMER
1	*Testudo horsfieldii*	Russian tortoise	VU/ 2 (VU)	35	-
2	*Alsophylax laevis*	Southern Even-fingered Gecko	CR/2(VU:D)	-	1
3	*Trapelus sanguinolentus*	Steppe Agama	-/-	8	-
4	*Phrynocephalus helioscopus*	Sunwatcher toad-headed agama	-/-	2	-
5	*Eremias velox*	Rapid racerunner	-/-	14	-
6	*Varanus griseus*	Caspian Monitor	-/2(VU:D)	1	-
7	*Eryx miliaris*	Desert sand boa	-/3(NT)	1	-
8	*Psammophis lineolatus*	Sand racer	-/-	1	-

Table 13 List of reptile species found on the project area along planned Dzhankeldy-Bash OHTL

	NAME OF SPECIES		IUCN /RDB STATUS	TOTAL NO. OBSERVED
	LATIN	ENGLISH		
1	*Testudo horsfieldii*	Russian tortoise	VU/ 2 (VU)	19 holes
2	*Alsophylax laevis*	Southern Even-fingered Gecko	CR/2(VU:D)	17
3	*Tenuidactylus caspius*	Caspian thin-toed gecko	LC/-	1
4	*Teratoscincus scincus*	Common Wonder Gecko	-/-	20
5	*Trapelus sanguinolentus*	Steppe Agama	-/-	22
6	*Eremias velox*	Rapid racerunner	-/-	5
7	*Varanus griseus*	Caspian Monitor	-/2(VU:D)	3

Table 14 List of reptile species found on the project area along planned Bash-Karakul OHTL

	NAME OF SPECIES		IUCN /RDB STATUS	TOTAL NO. OBSERVED
	LATIN	ENGLISH		
1	*Testudo horsfieldii*	Russian tortoise	VU/ 2 (VU)	5 traces, 1 in.
2	*Teratoscincus scincus*	Common Wonder Gecko	-/-	12
3	*Trapelus sanguinolentus*	Steppe Agama	-/-	13
4	*Phrynocephalus interscapularis*	Lichtenstein's Toadhead Agama	-/-	13
5	*Eremias grammica*	Reticulate racerunner	LC/-	8
6	*Eremias scripta*	Sand racerunner	LC/-	6
7	*Eremias velox*	Rapid racerunner	-/-	9
8	*Varanus griseus*	Caspian Monitor	-/2(VU:D)	4

CONSTRUCTION-RELATED THREATS

1. The development of natural habitats for many species of reptiles (including rare ones) may cause the population loss, especially populations of narrow-area endemics, such as Southern Even-fingered Gecko;
2. Animals (insects, amphibians, reptiles, birds, mammals) can get into the pit and trenches dug for the construction purposes, which can lead to their injury and death. These trenches are especially dangerous for the Russian tortoise;
3. Changing the existing relief will lead to partial loss of the habitats for animals inhabiting the project area;
4. If the construction work is begun in the winter season, part of the population of reptiles (including rare ones) being in hibernation in the ground may die;
5. Linear structures connected to the construction site will also pose threat to the life of most reptiles, especially Russian tortoise and Caspian Monitor.

RECOMMENDATIONS

Safety and environmental protection must be priorities in any activity, for which it is necessary, after assessing potential threats, in this case to biodiversity, to make efforts to carry out activities aimed at minimizing potential damage. In this regard, we recommend the following actions:

1. Seasonality of work. The construction work must take into consideration the reptiles' activity features. That is, it is advisable that all construction work should be carried out at a time when all reptiles came out of hibernation (winter dormancy). In this period, reptiles do not have permanent burrows and can leave the construction site in advance. If the works begins in the hibernation period, underground wintering chambers can be damaged and then the reptile is doomed to death.
2. Construction works must be carried out strictly within the territory designated for the purpose.
3. All trenches must be levelled (filled with earth) after the termination of the construction; trenches should not be used as barriers to protect the territory, so that animals should not be captured there.
4. When the construction stage is over, it is necessary to monitor regularly populations of terrestrial animals in the existing research sites within the project territory.
5. The so-called 'closed zones' (protected with a fence) must be organized in the territory of the objects, where no activity should be allowed. This territory should be representative from the point of view of the biotope and the presence of a protected species. It would serve both a buffer zone of the object and, at the same time, a kind of protected area where animals can live undisturbed.
6. Creation/support of a reptile's nursery, with the function of rehabilitation and breeding of rare species, such as Southern Even-fingered Gecko and Russian tortoise. After the construction work, it is possible to resettle these animals back to

the reclaimed areas from the nursery. This nursery could help in preserving rare narrow-area endemic reptile species.

7. It is necessary to conduct large-scale work to study the current state of populations and the boundaries of the areal of the Southern Even-fingered Gecko throughout Uzbekistan.
8. The Russian tortoises must be removed from the construction site to nearby areas with similar biotopes. Moreover, after the removal, the construction site must be enclosed in a solid corrugated metal fence to prevent the tortoises' possible returning to the construction site.

REFERENCES

1. Ананьева Н.Б., Боркин Л.Я., Даревский И.С., Орлов Н.Л. Земноводные и пресмыкающиеся. Энциклопедия природы России. - М.: ABF, 1998.
2. Андрушко А.М., Эколого-фаунистический очерк пресмыкающихся центральной части пустыни Кызылкум, Вестник ЛГУ, 1953, № 7.
3. Богданов М. Н., Очерки природы Хивинского оазиса и пустыни Кызылкум. Ташкент, 1882.
4. Богданов О.П. Фауна Узбекской ССР. Ч.1. Земноводные и пресмыкающиеся. – Ташкент: Изд-во АН УзССР, 1960. – 260с.
5. Богданов О. П. Экология пресмыкающихся Средней Азии. Ташкент: Наука, 1965. - 257 с.
6. Богданов О. П. Пресмыкающиеся // Редкие животные Узбекистана. Энциклопедический справочник. - Ташкент: Гл. ред. энциклопедий, 1992. С. 303-371.
7. Бондаренко Д. А. Распределение и плотность населения среднеазиатской черепахи в Центральных Кызылкумах (Узбекистан) // Бюл. Моск. о-ва испытателей природы. Отд. биол. 1994. Т. 99, вып. I. С. 22-26.
8. Бондаренко Д.А., Челинцев Н.Г. Сравнительная оценка различных способов маршрутного учета пустынных пресмыкающихся // Бюл. МОИП, 1996. Отд. биол. Т. 101, вып. 3. С. 26-35.
9. Бондаренко Д.А., Перегонцев Е.А. Распространение среднеазиатской черепахи Agrionemis horsfieldii (Gray, 1844) в Узбекистане (ареал, региональное и ландшафтное распределение, плотность населения) // Современная герпетология. 2017. Т. 17, вып. 3/4. С. 124 – 146.
10. Вашетко Э.В., Нуриджанов А.С., Митропольский М.Г., Сударев В.О. Количественный учет среднеазиатской черепахи (Agrionemys horsfieldii Gray) в местах промыслового вылова. // Вестник «Тинбо». Ташкент: Истиклол, 2010. № 2. С. 52-54.
11. Гуломов П., Вахобов Х., Баратов П., Маматкулов М. Физическая география Средней Азии и Узбекистана. «O‘qituvchi». Ташкент, 2013.
12. Даль С.К., Позвоночные низовьев реки Зеравшан. Труды УзГУ, т. VII, Самарканд, 1936.
13. Даль С. К. К Экологии наземных позвоночных систем Заравшанской долины. Труды УзГУ, т. 10. Самарканд, 1937. – с. 167-176.
14. Динесман Л. Г., Калецкая М. Л. Методы количественного учета амфибий и рептилий // Методы учета и географическое распределение наземной фауны. М.: Изд-во АН СССР. 1952. С. 329 -341.
15. Захидов Т.З. Биология рептилий Южных Кызылкум и хребта Нуратау // Труды САГУ, серия VIII, зоология, вып. 54. Ташкент, 1938.
16. Красная Книга Республики Узбекистан, II том: Животные; под редакцией Ж.А. Азимова. Т., 2019. - 374 с.
17. Кузякин А. П. Зоогеография СССР // Учен. зап. Моск. обл. пед. ин-та им. Н. К. Крупской. 1962. Т. 109, вып. 1. С. 3 – 182.
18. Макеев В. М., Божанский А.Т. Методические подходы к изучению численности рептилий // Редкие и малоизученные животные Туркменистана. Ашхабад: Ылым, 1988. С. 117-127.

19. Никольский А. М. Фауна России и сопредельных стран. Пресмыкающиеся (Reptilia). Т. I. Chelonia и Sauria. Пг.: Типография Императ. Академии Наук. 1915. 532 с.
20. Султанов Г.С., Персианова Л.А. Зоологические исследования в Средней Азии. - Ташкент: Фан, 1982, 239 с.
21. Хорошхин А. П., Сборник статей, касающихся до Туркестанского края, СПб., 1876.
22. Щербак Н.Н. Ящурки Палеарктики. - Киев: Наукова думка, 1974. 296 с.
23. Щербак Н. Н. Количественный учет // Руководство по изучению земноводных и пресмыкающихся. Киев: «Наукова думка», 1989. С. 121-125.
24. Югай Р. Л. История развития географических и картографических представлений о пустыне Кызылкум (с древнейших времен до середины XIX в.): Автореферат дис. на соискание ученой степени кандидата географических наук / Ташк. гос. ун-т им. В. И. Ленина. —Ташкент: [б. и.], 1964. - 21 с.
25. Юнусов Н., Григорьянц А, Гончаров Г., Шульгина Н., Тальских В., Митропольская Ю., Тожибаев К., Царук О. Пятый национальный доклад Республики Узбекистан о сохранении биологического разнообразия. Ташкент, 2015. - 58 с.
26. IUCN Red List of Threatened Species. Version 2019.1. www.iucnredlist.org
27. Vashetko E.V., Khodjaev A.F., Nuridjanov A.S., Chikin Yu.A.. Resources of Testudo horsefieldii in Uzbekistan. // Congress of Testudo. Gonfaron, France, 2001.
28. http://www.reptile-database.org/data/Reptile_checklist_2019_07.xlsx.
29. www.cites.org

Juru Energy

Entomological Survey report

Report Title	Entomological Survey report
Scope	INVERTEBRATES
Areas Covered	BASH WF / BASH TO KARAKOL OHTL
Seasons Covered	SPRING 2021
Notes	

Juru Energy

Entomological survey

BASH WIND FARM PROJECT:

CLIENT: 5 CAPITALS

Date: June 2021

Askar Akhmedov

Juru Energy Ltd.

Suite 1, One George Yard, London

United Kingdom, EC3V 9DF

T: +44 207 859 4028

Contents

Introduction....4
Survey methodology....7
Physiographical characteristics of the survey areas....8
Vegetation....8
Results....9
Conclusions and recommendations....13
Appendix 1....14
Bibliography....18

Introduction

Studies of the regional entomofauna were launched in the second half of the 19th century by researchers and travellers A. P. Fedchenko and O. A. Fedchenko, who made large collections of plants and insects in the Kyzylkum desert. Descriptions of a number of new species and information on the distribution of representatives of the Kyzylkum entomofauna can be found in A. P. Fedchenko's Trip to Turkestan series (1871—1873).

The studied area of Bash WF is located in the south-west of the Kyzylkum desert, Bukhara Province.

In 1923-1931, the entomofauna of Bukhara Province was studied by V. V. Yakhontov.

In 1934-1937, entomologists V. N. Nevsky and A. A. Bekuzin from the Central Asian State University organised a zoological expedition to the Kanimeh steppe (south-eastern part of Kyzylkum). The data they collected was used by V. P. Nevsky to write his work Entomofauna of the Kanimeh Desert («Энтомофауна Кенимехской пустыни») (1953). The author described 250 insect species and their associations with specific biotopes and plants.

M. P. Sosnina (1958) and B. V. Korniyenko (1962, 1963, 1967, 1971) provided information on the insects of the Karnabchul clayey desert adjoining South-Western Kyzylkum. The deepest research was made by Yu. V. Sinadsky (1959, 1963, 1964, 1968), who studied insects damaging Central Asian desert forests, including those in Kyzylkum. His works summaries data on insects' species composition, ecology and biology.

In 1962-1963, a team of researchers from the Severtsov Institute of the Evolutionary Morphology and Ecology of Animals, Academy of Sciences of the USSR, headed by Academician M. S. Gilyarov, studied the zoology of soils in the Ayakguzhumdy area. The findings were published in articles by B. M. Mamayev (1966), F. N. Pravdin (1965), M. S. Gilyarov and B. M. Mamayev (1964, 1967).

In 1965-1966, a team of entomologists from the Institute of Zoology, Academy of Sciences of the USSR, worked in the Kyzylkum desert and gathered large amounts of data on various groups of insects. Since 1966, M. I. Falkovich was studying the ecology and economic significance of lepidopterans in the territory of the Kyzylkum desert station. He identified over 600 insect species, studied trophic links in about 250 and described a number of new species in the families Coleophondae. Scytridae and Geometridae (1969, 1970, 1972). I. L. Sukhareva (1972) published materials on the owlet moths of Kyzylkum.

The most comprehensive work covering the insect fauna of the region is «Entomofauna of South-Western Kyzylkum» (A. G. Davletshina et al. 1979). In 1962—1964 the authors made research into the part of the desert between the Shafirkan village and Dzhankeldy in the west, the Mingbulak depression in the north and Tamdybulak in the east. The route ran along the sky islands of Kuljuktau, Auminzatau, the southern portion of Bukantau, Tamdytau, and the Mingbulak, Karakata and Ayakagitma depressions.

In 1974—1975, in the north and north-east of the western portion of the Kyzylkum desert the survey covered the villages of Ayakagytma and Dzhankeldy, Karakata depression, the towns of Zeravshan and Tamdybulak, in the south – Alat District of Bukhara Province and the Karakul Reserve, which is the southernmost point of the South-Western Kyzylkum.

According to the authors, this territory was inhabited by 1,100 species from 16 genera and 108 families, 3 of which are included in the Red Data Book of Uzbekistan: *Hypermnestra helios* Nickerl, 1846 (NT), *Satanas gigas* Eversmann,1855 (VU: R), *Reduvius fedtschenkianus* Oshanin, 1871 (VU: R).

The collection of papers Insects as Components of the Saxaul Forest Biocoenosis (Mamayev et al., 1975) on insects' species composition, ecology and their biocoenotic relations with plants was a great contribution to the study of the entomofauna of desert forest biocoenoses. The work reveals insects' evolution and distribution patterns in man-planted saxaul woods.

G. M. Dlussky made big research into the ants of the desert in 1960—1970, which resulted in the monograph Ants of the Desert (Dlussky 1981).

The entomofauna of specific desert plants was studied in subsequent years – saxaul (Nurmuratov, 1971), Calligonum (Yelyubayev, 1974), sagebrush (Moiseyeva, 1965, Korniyenko, 1967), sand acacia (Soitova, 1974) and other.

In April 2014, May 2015 and September 2017, 3 joint Russian-Uzbek expeditions were organised as part of an international cooperation agreement between the Karshi and Nizhny Novgorod State Universities to inventory the entomofauna of certain regions of Uzbekistan. The results of the first expedition, including the itinerary with the coordinates of locations where the material was collected, were published in a special issue of the 'Эверсманния' (Eversmannia) magazine (Anufriyev, Rahimov, 2015 and other). The same issue contains an article describing 24 ant species (Mokrousov, Zryanin, 2015).

In 2017, A. G. Blummer described a new species in the Kyzylkum desert – *Uranembia rivkusi* Blyummer.

However, in general, desert entomocoenoses are not studied properly. There are no comprehensive, generalising works on or full lists of Central Asian desert insects.

Based on the desktop study 11 insect species listed in the Red Data Book of Uzbekistan were identified as possible on the studied territory and adjacent areas.

Order – Heteroptera

1. *Reduvius fedchenkianus* Oshanin, 1871 (VU:R)

Order – Hymenoptera

Family – Sphecidae

2. *Fedtschenkia indigotea* Radoszkowski, 1886 (EN)
3. *Chlorion regae* F.Smith, 1873 (VU:R)
4. *Prionyx macula lugens* Kohl, 1890 (VU:R)

5. *Prionyx nigropenctinatus* (Taschenberg, 1869) (VU:R)
6. *Eremochares mirabilis* (Gussakovskij, 1928) (VU:R)

Family – Crabronidae

7. *Larra transcaspica* F.morawitz, 1894 (VU:R)
8. *Laphyragogus kohlii* (Bingham, 1896) (VU:R)

Order – Lepidoptera

Family – Noctuidae

9. *Catocala remissa* Staudinger, 1891(VU:D)

Family – Papilionidae

10. *Hypermnestra helios* Nickerl, 1846 (NT)

Order – Diptera

Family – Asilidae

11. *Satanas gigas* Eversmann,1855 (VU:R)

Survey methodology

Transect and area surveys were used in this study. Transects were employed for noticeable and easily identifiable large-size species, such as mantis, various beetles, butterflies and dragonflies, as well as their nests (wasps, ants). Transects were 1 km long and 2 m wide. One of the varieties of transect – current recording method – was used in complex topographies. In this case, the 1-kilometre-long line was divided into two 500-metre or five 200-metre sections, depending on the terrain. As they moved along a transect, researchers recorded in their notebooks every insect that could be identified right on the spot. In addition, insects along the transects were caught using a net. All transects were recorded with the help of GPSs.

Since often it is impossible to identify reliably the species of an insect without examining it with a microscope or magnifying glass, the insects were caught with the help of special traps for identification.

After the expedition, the material that could not be identified in the field was identified at the entomology laboratory at the Institute of Zoology, Academy of Sciences of Uzbekistan, with the help of a binocular digital microscope.

Physiographical characteristics of the survey areas

The studied area is located in the south-west of the Kyzylkum desert. The desert is a unique physiographical region spreading over the interfluvial area between the Amudarya and Syrdarya in Uzbekistan. In the north-west it is bordered by the Aralkum desert and Aral Sea, in the north-east by the Syrdarya river, in the east by the spurs of the Tien Shan and Pamir-Alai and in the south-west by the Amudarya.

The study area encompasses the low sky islands of Kuljuktau in the west and south and Ayakagytma depression as far as to the Bashagytma spring in the east. The territory is a flatland with fixed and semi-fixed sands and piedmont plains covered with gypsum deserts. Sand ridges and hillocks are fixed with vegetation. Depressions between the ridges are occupied by takyrs.

Accumulative temperatures in the growing season are quite high in the area, while relative humidity in the daytime in July is never above 20%, usually ranging within 15-16%. About 45% of annual precipitation falls in spring.

Because of low precipitation, very dry air and high temperatures in summer, the soil dries up somewhat earlier than in more humid regions of Uzbekistan. Nevertheless, due to a lower wilting point, the drought on sandy and sandy-loamy soils affects vegetation less than in loamy and clayey areas.

Vegetation

The vegetation in the studied area is highly diverse. One of the typical plants is the semi-shrub sagebrush *Artemisia*. Sagebrush associations occupy large areas of the gypsum desert on the piedmont plains of the Kuljuktau area. The sand cover is favourable for the distribution of bindweed, *Astragalus* and saltwort (*Salsola arbuscula, Salsola orientalis*) associations. Sandy areas feature *Aristida*, *Calligonum*, *Ammodendron, Haloxylon persicum, Carex physodes, Astragalus*, *Ephedra* and similar plants. *Tamarix, Haloxylon persicum* and *Salsola* associations develop on the bottoms of depressions near bodies of water (wells).

Intense overgrazing in the desert leads to strong changes in the numbers and composition of natural biocoenoses. *Peganum harmala* develops actively on heavily overgrazed areas.

Results

The entomological survey was conducted from 19 to 21 April on the project territory of Bash WF and from 3 to 6 May 2021 along OHTL from Bash WF to Karakul substation, by A. G. Akhmedov, a researcher from the Entomology laboratory at the Institute of Zoology, Academy of Sciences of the Republic of Uzbekistan.

All the recorded insect species have the status of 'not listed'.

12 locations were surveyed on the project territory of Bash WF (Figure 1). The results of the survey are presented in the Table 1.

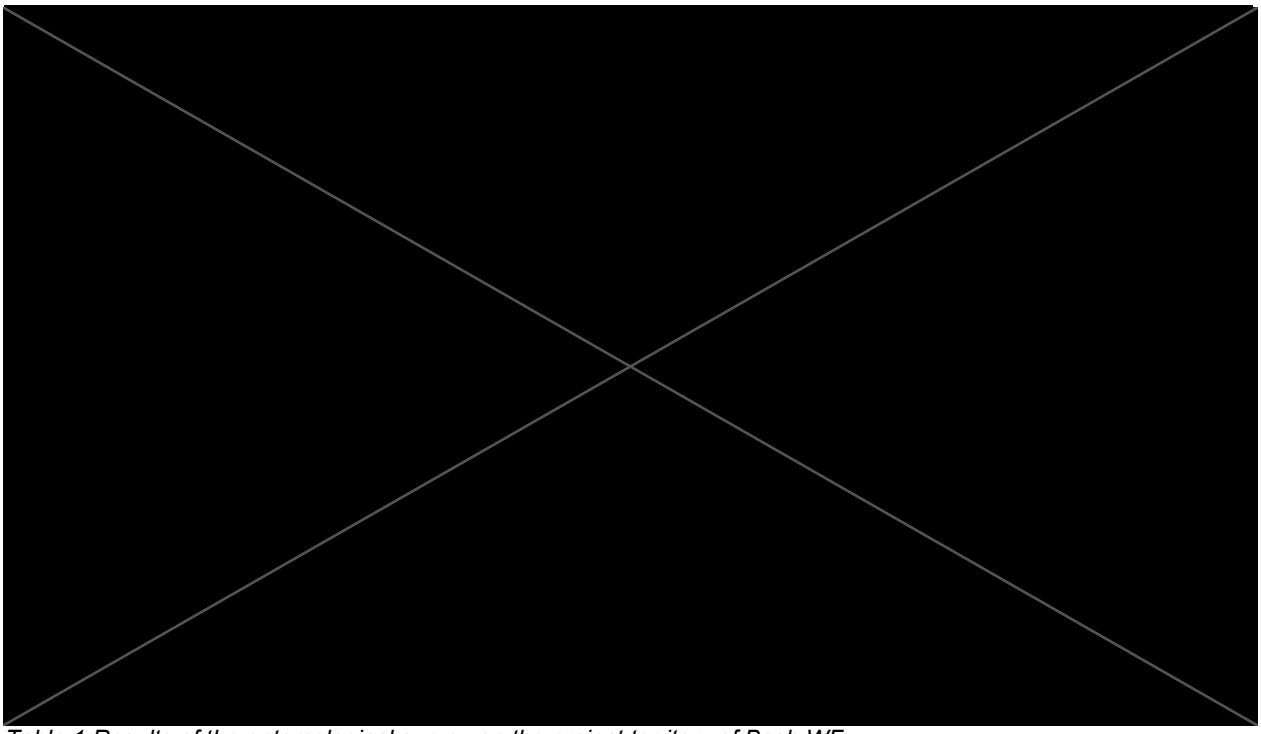


Table 1 Results of the entomological survey on the project territory of Bash WF

No. of monitoring location	Coordinates	Biotope	Recorded species
Location 1		Gravelly-clayey plain	Cataglyphis cinnamomea
Location 2		Gravelly-clayey plain	Zero records because of very strong wind
Location 3		Sand hillocks	Cataglyphis pallidula Trichomyrmex sp. Lixus hirticollis
Location 4		Sand hillocks	Cataglyphis pallidula Cataglyphis oxiana
Location 5		Clayey plain	Cataglyphis cinnamomea
Location 6		Gravelly-clayey plain	Tetramorium schneideri Anacanthotermes turkestanicus
Location 7		Gravelly-clayey plain	Theone costipennis

	[redacted]		Messor variabilis Anacanthotermes turkestanicus
Location 8		Gravelly-clayey plain	Cataglyphis cinnamomea Pieris rapae
Location 9		Gravelly-clayey plain	Cataglyphis cinnamomea Sarathropus depressus Vespa orientalis Chrysoperla carnea
Location 10		Gravelly-clayey plain	Zero records because of a very strong wind
Location 11		Gravelly-clayey plain	Cataglyphis cinnamomea Sarathropus depressus Menecleonus sp.
Location 12		Gravelly-clayey plain	Plagiolepis pallescens Messor variabilis Polistes watii

15 locations were surveyed along planned OHTL from Bash WF to Karakul substation (Figure 2). Due to the sparse vegetation in the area and the prevalence of windy weather throughout the survey, the recorded entomofauna was very poor. The results of the survey are presented in the Table 2.



Figure 2 Studied locations along planned OHTL from Bash WF to Karakul substation

Table 2 Results of the entomological survey along the projected power line from Bash to Karakul substation

No. of monitoring location	Coordinates	Biotope	Recorded species, including from the Red Data Book
Location 1	4[redacted]	Clayey plain	Lopezus fedtschenkoi Bombylius sp. Cataglyphis pallidula
Location 2	[redacted]	Clayey plain	Cataglyphis setipes Monomorium kusnezovi Tapinoma erraticum
Location 3	[redacted]	Fixed sands	Menecleonus sp. Hyalomma asiaticum
Location 4	[redacted]	Sand hillocks and dunes	Nighttime records Reduvius sp. Lopezus fedtschenkoi Aeschna sp. Mesobuthus eupeus Lycosa sp. Pimelia sp. Adesmia sp. Cataglyphis oxiana Tetramorium schneideri
Location 5	[redacted]	Fixed sands adjoining fields	Cataglyphis oxiana Adesmia sp. Musca domestica
Location 6	[redacted]	Anthropogenic fields	Клопы miridae Eurydema ornata Chironomus sp. Vespa orientalis Polistes watii Messor laboriosus Cataglyphis aenescens Camponotus turkestanicus Monomorium kusnezovi Tapinoma erraticum Apis mellifera Hyalomma asiaticum Numerous small unidentifiable dipterans. Locust larvae unidentifiable at early developmental stages.
Location 7	[redacted]	Anthropogenic	-

	[redacted]	landscape near road	
Location 8	[redacted]	Sand hillocks	Nighttime records Reduvius sp. Lopezus fedtschenkoi Lioponera desertorum (rare species endemic to Uzbekistan and Turkmenistan) Cataglyphis pallidula Camponotus xerxes Hyalomma asiaticum Lycosa sp.
Location 9	[redacted]	Sand hillocks	Julodis variolaris Adesmia sp. Cataglyphis pallidula
Location 10	[redacted]	Fixed sands adjoining canal	Chironomus sp. Polistes watii
Location 11	[redacted]	Fixed sands adjoining canal	Messor laborisus Crematogaster subdentata Vespa orientalis
Location 12	[redacted]	Fixed sands	Anacanthotermes turkestanicus Hyalomma asiaticum Cataglyphis palludila
Location 13	[redacted]	Fixed sands	Anacanthotermes turkestanicus Hyalomma asiaticum Julodis variolaris Camponotus xerxes Cataglyphis aenescens Vespa orientalis Polistes watii Pimelia sp. Sympetrum
Location 14	[redacted]	Sandy area adjoining fields	Vespa orientalis Pieris brassicae Messor laboriosus Cataglyphis aenescens Cataglyphis setipes Musca domestica Apis mellifera
Location 15	[redacted]	Anthropogenic landscape	Vespa orientalis Cataglyphis aenescens

Conclusions and recommendations

The recorded entomofauna was typical for this area. The most common species in all biotopes were darkling beetles and ants, as well as *Anacanthotermes turkestanicus*. The highest insect diversity was recorded on flowering plants (Ferula, Astragalus, Ammodendron). There were numerous records of various small dipterans and hymenopterans, which were impossible to identify in the field. Other common arthropods included tarantula and *Scolopendra cingulata*. In April, when nighttime temperatures were low and winds were quite strong, the insect species diversity was low. In early May the species diversity was somewhat higher. The only endemic species was *Lioponera desertorum*: we recorded males of this endemic of Uzbekistan and Turkmenistan. No species listed in the Red Book of Uzbekistan or IUCN Red List were found.

In general, we do not see any potential threat to the entomofauna on the construction site, but, nevertheless, we recommend that the construction work have as little impact on the site as possible.

Table 3 Summary table for Bash WF

	INVERTEBRATES	
	TAXONOMIC ORDER	NO. OF SPECIES
1	Hymenoptera	11
2	Coleoptera	5
3	Diptera	2
4	Lepidoptera	1
5	Hemiptera	2
6	Araeae	1
7	Scorpiones	1
8	Scolopendromorpha	1
9	Bllatodae	1

Table 4 Summary table for Bash-Karakul OHTL

	INVERTEBRATES	
	TAXONOMIC ORDER	NO. OF SPECIES
1	Hymenoptera	13
2	Coleoptera	13
3	Diptera	4
4	Bllatodea	1
5	Hemiptera	5
6	Araeae	1
7	Scorpiones	1
8	Scolopendromorpha	1
9	Lepidoptera	3

Appendix 1



Baby scorpion



Reduvius sp.



Reduvius sp.



Location 5, 40°11'40.99" 64°11'52.91



Collecting insects



Camponotus xerxes



Bombyliidae

Bibliography

1. Бей-биенко. Фауна СССР. Кожистокрылые. Издательство АН СССР. - Москва,1936. -240 с.

2. Бей-биенко. Фауна СССР. Таракановые. Издательство АН СССР. - Москва 1950. -342 с.

3. Бекузин А.А. Особенности состава богомоловых г. Ташкента // Вопр. биол., экол. и регуляции численности животных в условиях антропоген.воздействия. Ташкент. 1989. –С. 32–35.

4. Бекузин А.А.К изучению фауны прямокрылых насекомых (Orthopteroidea) горного Чирчикского района // Труды ТашГУ. Науч. тр. Биология. - Ташкент. Вып. 334. 1968. - С.91-101.

5. Голуб В.Б. Негробов О.П. Методика сбора и хранения наземных беспозвоночных.- Воронеж 1998. -28 с.

6. Давлетшина А.Г. и др. Энтомофауна Юго-Западного Кызылкума Ташкент: Фан УзССР, 1979. — 128 с.

7. Жужиков Д. П. Термиты СССР. — М.: Изд-во Моск. гос. ун-та, 1979. — 225 с.

8. Йофф И.Г, Скалон О.И. Определитель блох Средней Азии и Казахстана. -М. «Медицина». 1965. -350 с.

9. Кириченко А.Н. Настоящие полужесткокрылые СССР. Фауна России и сопредельных стран. -М-Л.: Издательство АН СССР 1951.-165 с.

10. Линдт И.И. К Фауне богомолов (Mantoidea) Бадагшана (Таджикистан) // Зоология и паразитология труды. Т. XXIV 1963. - С. 3-20.

11. Линдт И.И. Новый вид богомола (Mantoidea, Mantidae) из Гиссарской долины (Таджикистан) //Доклады Академии наук Таджикской ССР Т. IV №3. 1961. - С. 53-58.

12. Линдт И.И. О систематической правомерности Amblythespis turcomaniae Sauss. (Mantoidea) с описанием новых форм // Известие Академии наук Таджикской ССР. Отд. биол. наук. № 2 (67). 1977. - С. 3 - 14.

13. Лопатин И.К. Листоеды Средней Азии и Казахстана. Наука. - Ленинград. 1977. - 257 с

14. Мищенко Л.Л. Таракановые – Blattodea, богомоловые – Mantodea, привиденьевые – Phasmodea, прыгающие прямокрылые – SaltatoriaOrthoptera (sens. str.) и кожистокрылые – Dermaptera пустынь СССР. // Рефераты науч.-исслед. работ отд. биол. наук АН СССР за 1944г.:. М.-Л., изд. АН СССР. 1945. 124-125

15. Никольская М.Н. Осы-блестянки южного склона Гиссарского хребта. // Ущелье Кондара. - М.-Л, 1951. - С. 175-180.

16. Попов В.В. Пчелиные (Hymenoptera, Apoidae) Средней Азии и их распределение по цветковым растениям. // Труды ЗИН, 1967. Т.38, С. 16-32.

17. Попов В.В. Пчелиные. // Ущелье Кондара. - М.-Л, 1951. - С. 158-174.

18. Правдин Ф.Н. Экологическая география насекомых Средней Азии. Ортоптероиды. // М., Наука. 1978. - С-31-35.

19. Проценко А.И. Пластинчатоусые жуки Киргизии. - Фрунзе. 1968. -160 с.

20. Радзивиловская М.А. Энтомофауна изеня и других вводимых в культуру пастбищных растений. Автореф. канд. биол. наук. - Ташкент, 1967. - 23 с.

21. Хамраев А.Ш и др. Разработка ново тактики борьбы с термитами-опаснейшими биоразрушителями материалов и сооружений // Доклад Международной науч.-практ. конф. 23-25 апреля 2003. – Ташкент, - С.79-83.

22. Хамраев А.Ш., Азимов Ж.А,. Кучкарова Л.С ва б. Ҳашаротлар экологияси. Чўлпон номидаги НМИУ. Тошкент, 2014. 142-б.

23. Шванч Б.Н. Курс общей энтомологии. “Наука” – Москва, 1949. – 900 с.

24. Юлдашев Э. Бракониды Джизакской области // Эколого-фаунистические комплексы членистоногих Узбекистана. - Ташкент: Фан, 1984. С. 148-160.

25. Яхонтов В.В., Давлетшина А.Г., Васенкова В.М., Коршин П.Н. Типичные и массовые насекомые Голодной степи // Животный мир Голодной степи, - Ташкент, 1962. - С. 41- 109.

26. Christian Schmid-Egger, Kees van Achterberg, Rainer Neumeyer, Jérôme Morinière, Stefan Schmidt. Revision of the West Palaearctic *Polistes* Latreille, with the descriptions of two species – an integrative approach using morphology and DNA barcodes (Hymenoptera, Vespidae) ZooKeys 713: 53–112 (2017). doi: 10.3897/zookeys.713.11335

27. Paknia O., Radchenko A.G., Alipanah H., Pfeifer M. A preliminary checklist of the ants (Hymenoptera: Formicidae) of Iran // Myrmecol. News, 2008. - Vol. 11. - P. 151–159.

28. Seifert B., Schultz R. A taxonomic revision of the *Formica subpilosa* Ruzsky, 1902 group (Hymenoptera: Formicidae) // Myrmecological News, 2009. - Vol. 12. – P. 67–83