“ACBK Centre for Conservation Biology” LLP

Biodiversity baseline field surveys within Mirny Project to identify the level of biodiversity value, main direct or indirect impacts to the local flora and fauna that could result from the proposed Project and determine possible mitigation measures during April 2023-April 2024

Final report

for April 2023 – May 2024

Almaty, 2024

Content

Introduction

The work was carried out by "ACBK Centre for Conservation Biology " LLP in accordance with the agreement with Total Eren No. 01 dated April 12, 2023 "**Biodiversity baseline field surveys within Mirny Project to identify the level of biodiversity value, main direct or indirect impacts to the local flora and fauna that could result from the proposed Project and determine possible mitigation measures during April 2023-April 2024**".

Research had to be conducted in accordance with International Finance Corporation (IFC) Performance Standards (PS), Equator Principals IV, National Legislative Requirements of Kazakhstan, Bird Life South Africa Guidance.

This interim report summarizes the information obtained from field surveys in the project area in April 2023 – May 2024. Two project areas were surveyed in 2023 - "northern area" (Area 1) and "southern area" (Area 2).

In autumn 2024, the turbine layout was changed and, accordingly, the scheme of surveys and field surveys had to be changed. Since winter 2023/2024, observations have been conducted based on the new layout scheme. Thus, for objective reasons, the requirement to conduct an annual cycle of observations at each point was not met.

The initial area for the survey as of April 2023 and the turbine layout as of autumn 2023 are shown in Fig. 1.

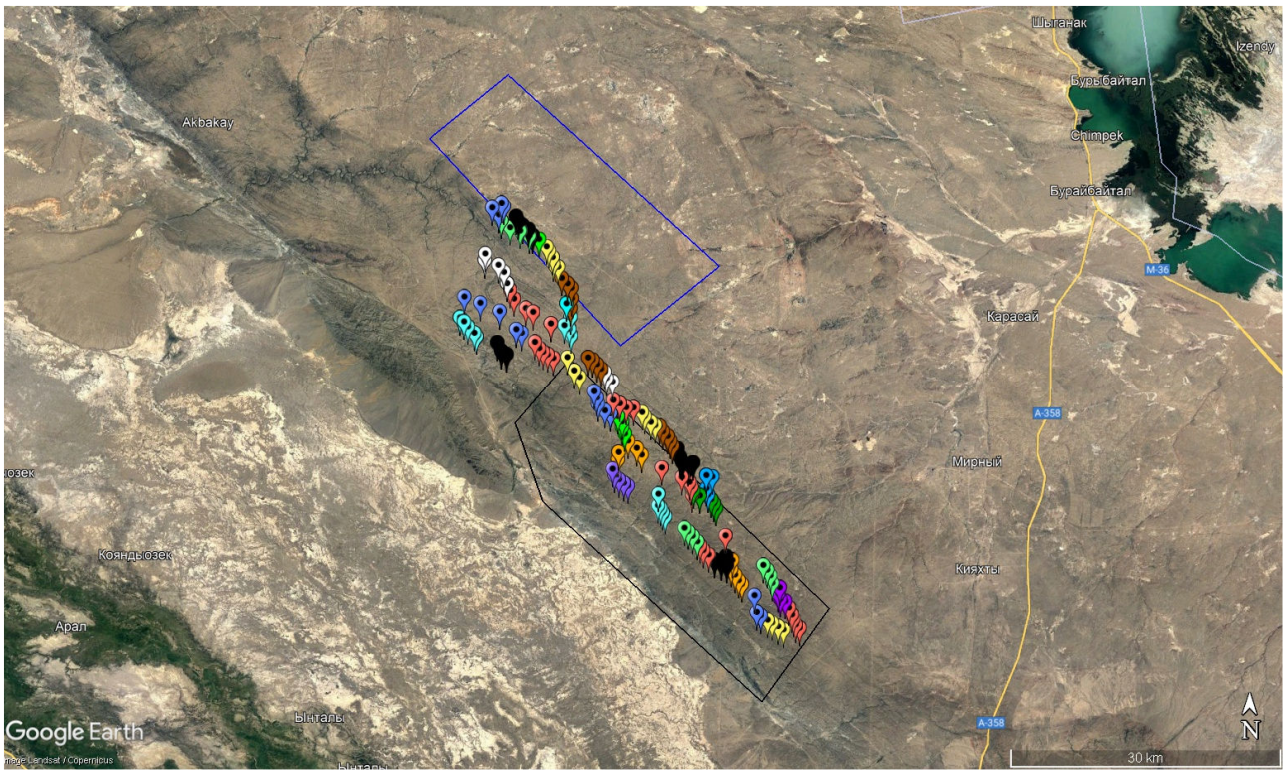


Fig. 1. Initial survey sites (rectangles) and wind turbine layout plan as of autumn 2023.

For different biodiversity components, in accordance with different data collection methods and different requirements for the volume of material, the degree of coverage was different. The survey periods for the biodiversity components are presented in Table 1.

Table 1. Coverage of two turbine layout options by different types of studies

Species / Taxonomic group	2023 (first turbine layout)	2024 (changed turbine layout)
Argali	May 7 – November 16, 2023	December 20, 2023 – May 6, 2024
Bats	June 12 - July 4, 2023	April 24, 2024 – May 2012, 2024
Plants	June 12 – June 18, 2023	March 15, 2023 – May 12, 2024
Birds, migrating or locally moved (VP)	May 7 – November 16, 2023	December 20, 2023 – May 6, 2024
Birds, breeding (nests and transects)	April 20 – August 7, 2023	March 15 – May 12, 2024
Turtles	May 7 – July 2, 2023	March 15 – May 12, 2024
Other species	May 7 – November 16, 2023	December 20, 2023 – May 6, 2024

More detailed information on the coverage of the territory by observations is presented in the sections on the relevant scope of work.

The information is presented by the directions in which research was conducted, according to the Terms of Reference for the project.

1 General characteristics of the territory

Terrain and vegetation

The project area as a whole includes rubble piedmont plains and loamy plains with sparse saxaul forests, turning into xerophytic low mountains. The site lies entirely in the landscape zone of deserts.

Most of the northern section is occupied by plains with wormwood-saltwort vegetation and areas of saxaul forests. The southern area captures part of the Shu-Ilei low-mountain massif, which is a system of gentle ridges with leveled surfaces, sharply limited by steep slopes, and canyon-like valleys along watercourses. In the mountains, shrub thickets of meadowsweet (*Spiraea sp*.) and others are well developed; an abundance of cereals, legumes, and onions is characteristic, providing excellent food conditions for both ungulates and birds. Along the river beds, the most typical are *Haloxylon aphyllum, Tamarix sp., Atriplex caragana, Eurotia ceratoides, Nitraria schoberi, Artemizia sp., Limonium sp*, etc.

Preliminarily, in the course of field work in April-May, 5 main types of habitats were identified:

- xerophytic rocky low mountains
- outputs of flat granite slabs
- valley saxaul forests
- sagebrush and sagebrush deserts on gently undulating plains
- gently sloping solonchak depressions on the plains.

Descriptions and classification of habitats will be refined after the analysis of satellite images with the allocation of ecosystem contours and ground verification with the participation of geobotanist.

Presence of wetlands

Area 1 has a small brackish water river near vantage point N11 (ST29 in the field table); a transect was also laid there (transect 11 in the table). Water spills have been noted near the road - apparently, temporary drying up; all waders recorded by us were observed near them. In the Area 2, a number of low-water rivers that dry up in summer are noted. Above one of them, a habitable Saker Falcon nest was found on a rock. In dry areas, a large amount of salt remains.

Presence of power lines

There are no power lines in the project territory. There are sections of lines not far from the sites. On the first day of the survey of the southern area, on the way to it, a section of the power line was surveyed, no dead birds were found. At the same time, several nests on metal supports were noted (the nests of a crow and a long-legged buzzard; points are in the general table of species encountered, dated May 2).

2 Bird surveys

Bird surveys were conducted in the April 2023 – May 2024 (Table 2).

Table 2. Timing and participants of bird studies

N	Dates	Participants
1	23.04.2023 – 01.05.2023	Schneider E., Pulikova G., Kaptenkina A.
2	02.05.2023 – 12.05.2023	Karyakin I., Kaptenkina A., Shiryaev O.
3	12.06.2023 – 04.07.2023	Khrokov A., Satimetov S.
4	26.07.2023 – 07.08.2023	Khrokov A., Kittibayev B., Berdeshov A., Tkachev A.
5	10.09.2023 – 23.09.2023	Khrokov A., Satimetov S.
6	30.09.2023 – 29.10.2023	Amirekul K., Satimetov S., Salemgareev R., Timoshenko G.
7	05.11.2023 – 16.11.2023	Amirekul K., Satimetov S.
8	20.12.2023 – 22.12.2023	Khrokov A., Satimetov S.
9	23.01.2024 – 27.01.2024	Khrokov A., Kisebaev T., Amirekul K.
10	27.02.2024 – 01.03.2024	Khrokov A., Satimetov S., Amirekul K.
11	15.03.2024 – 24.03.2024	Khrokov A., Satimetov S., Kisebayev T.
12	27.03.2024 – 11.04.2024	Amirekul K., Satimetov S., Pushkov A.
13	13.04.2024 – 06.05.2024	Khrokov A., Satimetov S., Amirekul K., Skorintsev V., Kaptenkina A., Pushkov A.

The purpose of the field surveys was to conduct an ornithological survey of the project and adjacent territories, where the construction of a wind farm is planned. The surveys of the territory consisted in the search for nests of rare and endangered species of birds; the registration of birds on the migration was carried out, and the registration of birds at the vantage points (the longest and permanent part of the work). Additionally, findings of amphibians, reptiles and mammals were recorded, and, if possible, photographs of animals were taken. Some of the plant species were photographed.

The work was carried out entirely according to the methodology described in the Birds and Wind-Energy Best-Practice Guidelines (Compiled by: A.R. Jenkins, C.S. van Rooyen, J.J. Smallie, J.A. Harrison, M. Diamond, H.A. Smit-Robinson and S. Ralston).

During the field visit, a visual survey of landscapes, flora of higher plants and fauna of vertebrates of two planned sites for the placement of WPPs and the surrounding territory was carried out. Points for stationary observations (vantage points) were selected in both areas in April 2023, and then the placement was changed in December 2023 in accordance with new layout of turbines.

2.1 Spring: April-May 2023

2.1.1 Selection of vantage points

According to the methodological recommendations and the Terms of Reference, points for stationary observations (vantage points) were selected at each area. The number of points on the areas had to be at least 20 in order to ensure the maximum possible coverage of the territory (at least 75%). The points were chosen taking into account accessibility, sufficient visibility, and the need to cover different types of landscapes. Considering that this was the first trip to the territory,

the choice of points required quite a lot of time. For all points during the primary processing of materials, continuous numbering was made. On Area 1, it doesn't match what was done in the field, but this isn't technically a problem.

Photographs of the surrounding area were taken from the points.

Area 1

20 points were selected, some of which were used for observations (see below). The numbers of points that will be used for further work begin with the letter “N”.

Area 2

A total of 25 points were selected, in the numbers of which the letter “S” is present. At the same time, 13 of them are basic, 4 are additional (“Add”), and 9 are supposed to be used only in spring (“Spring” points). This is due to the fact that migratory birds gain height when approaching mountains, using ascending air currents, so it is advisable to conduct observations from the side of the main direction of approach. In spring, this is the southwestern edge of the site, in autumn - the northeast.

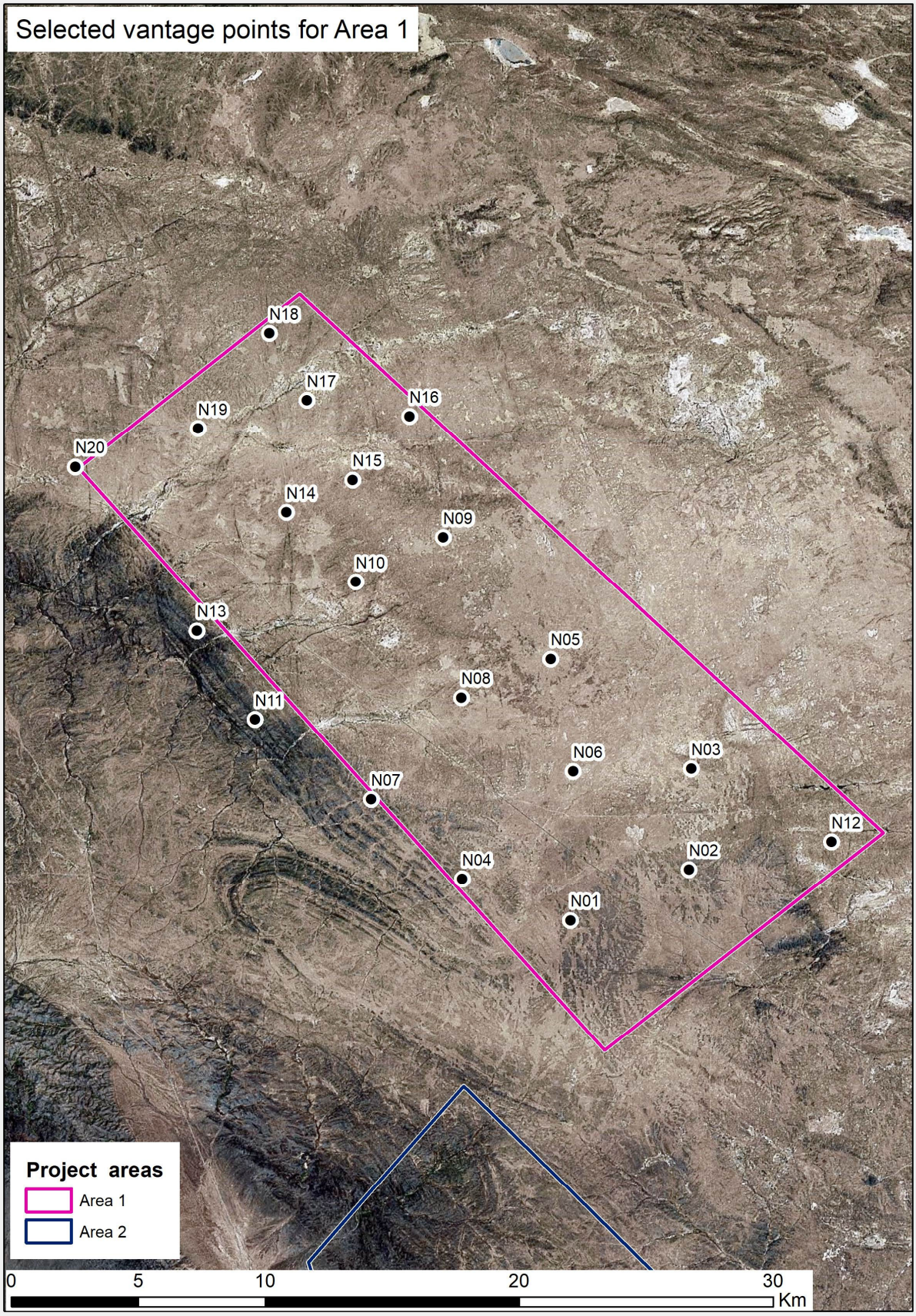


Fig. 2. Selected vantage points for Area 1.

Fig. 3. Selected vantage points for Area 2.

2.1.2 Ornithofauna

In total, during the spring work, 99 species of birds from 14 orders were noted, with 94 species on Areas 1 and 2, and 5 species on crossings between the areas or near human settlements (see Annex).

At the same time, 54 species were recorded on Area 1 (northern), 34 of which (63%) nest or may potentially nest there. On Area 2 (southern), 66 species were recorded, 52 of which (79%) were observed or may be nesting.

Thus, the nesting fauna of site 2 is obviously richer, which is easily explained by the greater diversity of ecosystems in this area.

Among the species encountered, 15 are included in the Red Data Book of the Republic of Kazakhstan and 6 species have the status of threatened (NT and above) in the IUCN Red List. At the same time, 5 species are in both lists, 10 are included only in the Red Data Book of the Republic of Kazakhstan, and one is only in the number of threatened species in the IUCN. Another globally threatened species was noted outside the sites. In the context of the areas, on Area 1 (northern), 9 species from the RDB RK, 3 globally threatened, were noted; on the Area 2 - 10 and 4 species, respectively.

2.1.3 Birds of prey

A total of 31 habitable nests of birds of prey were found in the project area.

These are 21 inhabited nests of Long-legged Buzzard; 5 nests of the **Golden Eagle** (the species is listed in the Red Data Book of the RK); 2 inhabited **Saker Falcon** nests (RDB of the RK); 2 occupied nests of the **Steppe Eagle** (RDB of the RK); 1 **Short-toed Eagle** (RDB of the RK) nest with dead clutch.

A huge number of old nests of birds of prey were also found, which indicates that earlier there were many more birds in the area. The decline in the number of birds of prey is associated with a depression in the number of rodents, which has been going on in most of southern Kazakhstan since 2017 (which is also confirmed by local residents). During the entire period of field work, only two small colonies of the great gerbil were recorded. A large number of not so old empty colonies have also been found, which indicate that until recently gerbils lived here. Consequently, the food base for birds of prey has become very scarce. Many predators feed on small birds, and some of them on turtles. Under each nest of Long-legged Buzzard we found old turtle shells (according to Karyakin I., Long-legged Buzzards feed only on turtles crushed by cars). After examining residential and old nests of Golden Eagles, it can be concluded that Golden Eagles feed exclusively on turtles, since all nests and even the entire surrounding area were littered with fragments of shells, both fresh and old. This indicates a lack of other prey. Obviously, for the same reason, many Golden Eagles do not breed, but simply stay in pairs on their territory.

During mammal surveys in May, one living nest of Short-toed Eagle *(Circaetus gallicus*), one habitation site of Saker Falcon (*Falco cherrug*, non-breeding territorial bird), 10 nesting sites of Long-legged Buzzard were found.

Data on observations and their localization are presented in tables 3 and 4 and in figures 4 - 7.

Table 3. Observations of birds of prey and traces of their presence in Area 1 in April-May 2023 (observations showing nesting are marked in green, observations showing passage or status is unclear in blue, old nests are without color).

№ of observation	N	E	Date	Species	Latin name	Remarks
1	44.874811	73.482009	23.04.2023	Steppe Eagle	Aquila nipalensis	Old nest on the rock. Roosting site.
2	44.880348	73.485652	23.04.2023	Long-legged Buzzard	Buteo rufinus	Old nest of Long-legged Buzzarda on saxaul at a height of 2.5 m in the upper third
3	44.879315	73.486481	23.04.2023	Long-legged Buzzard	Buteo rufinus	Old nest on saxaul at a height of 3 m in the upper third
4	44.882178	73.495866	23.04.2023	Accipitridae, unclear species	Accipitridae sp.	Old nest on saxaul at a height of 2 m in the upper third. Possible, Long-legged Buzzard.
5	44.882959	73.494647	23.04.2023	Accipitridae, unclear species	Accipitridae sp.	Very old nest. Height 1.7 m. Middle third of saxaul. Possible Long-legged Buzzard.
6	44.885083	73.505472	23.04.2023	Steppe Eagle	Aquila nipalensis	Old nest on stones at upper third of the slope of small hill
7	44.934232	73.253976	24.04.2023	Long-legged Buzzard	Buteo rufinus	Old nest of Long-legged Buzzard on saxaul at height 2 m. Upper third.
8	44.934096	73.243665	25.04.2023	Long-legged Buzzard	Buteo rufinus	Old nest on saxaul at a height of 4 m in the upper third
9	44.93325	73.24832	25.04.2023	Long-legged Buzzard	Buteo rufinus	Living fresh-built nest at the height 2 m in the upper third of saxaul. 1 egg. The pair is nearby. The nest is small.
10	44.93571	73.244755	25.04.2023	Long-legged Buzzard	Buteo rufinus	Old nest on saxaul at a height of 3.5 m in the upper third
11	44.935409	73.258864	25.04.2023	Long-legged Buzzard	Buteo rufinus	Ruins of a nest on saxaul in the middle, at height 1.6 m
12	44.994833	73.205868	25.04.2023	Long-legged Buzzard	Buteo rufinus	Old but visited nest on saxaul, height 1 m, in the middle
13	44.994863	73.206393	25.04.2023	Long-legged Buzzard	Buteo rufinus	Old but visited nest on saxaul, height 1.5 m, in the middle
14	44.99378	73.200441	25.04.2023	Long-legged Buzzard	Buteo rufinus	Fresh-built nest on saxaul, 1.5 m, in the upper third. Down-feather. 1 sub-adult in the area.
15	44.997369	73.2016	25.04.2023	Long-legged Buzzard	Buteo rufinus	Old nest on saxaul at a height of 3 m in the upper third. Last tear egg-shell.
16	44.996998	73.229481	25.04.2023	Long-legged Buzzard	Buteo rufinus	Ruins of nest on saxaul, 0,5 m, lower third.
17	44.997825	73.23595	25.04.2023	Long-legged Buzzard	Buteo rufinus	Old nest on saxaul at a height of 1.5 m in the middle third
18	44.999029	73.245184	25.04.2023	Long-legged Buzzard	Buteo rufinus	Old but visited best on saxaul, 1.7 m, in the middle third. 1 down-

						feather. Nearby, “sketch” of nest on saxaul, 4 m, upper third
19	44.998733	73.249876	25.04.2023	Long-legged Buzzard	Buteo rufinus	Old nest on saxaul at a height of 1.5 m in the middle third
20	45.022749	73.201974	25.04.2023	Long-legged Buzzard	Buteo rufinus	Visited empty nest on saxaul. Down feathers, excrements
21	45.021609	73.213362	25.04.2023	Long-legged Buzzard	Buteo rufinus	Old nest on saxaul
22	44.967867	73.133286	25.04.2023	Long-legged Buzzard	Buteo rufinus	Visited empty nest on saxaul.
23	44.99234	73.23314	26.04.2023	Long-legged Buzzard	Buteo rufinus	Old nest
24	44.9924	73.25078	26.04.2023	Long-legged Buzzard	Buteo rufinus	Empty nest, 2 cold eggs. No birds.
25	44.779818	73.502953	26.04.2023	Long-legged Buzzard	Buteo rufinus	Old nest on saxaul
26	44.900506	73.261019	26.04.2023	Long-legged Buzzard	Buteo rufinus	Old nest on saxaul
27	44.902178	73.254169	26.04.2023	Long-legged Buzzard	Buteo rufinus	Old nest on saxaul
28	44.903168	73.253997	26.04.2023	Long-legged Buzzard	Buteo rufinus	Old nest on saxaul
29	44.904772	73.23553	26.04.2023	Long-legged Buzzard	Buteo rufinus	Old nest on saxaul
30	44.907108	73.230239	26.04.2023	Long-legged Buzzard	Buteo rufinus	Old nest on saxaul . Under the nest, there is a nest of Great Grey Shrike with 4 eggs
31	44.909522	73.234718	26.04.2023	Long-legged Buzzard	Buteo rufinus	Old nest on saxaul
32	44.899245	73.239585	26.04.2023	Long-legged Buzzard	Buteo rufinus	Living nest on saxaul. Female went from the nest. Male is at the site.
33	44.899118	73.251731	26.04.2023	Sparrowhawk	Accipiter nisus	1 female on passage
34	44.940642	73.217166	27.04.2023	Short-toed Eagle	Circaetus gallicus	Old nest on saxaul . Under the nest, there are feathers of young Short-toed Eaglea. Collected.
35	44.93953	73.21934	27.04.2023	Short-toed Eagle	Circaetus gallicus	Old nest on saxaul
36	44.932677	73.231754	27.04.2023	Long-legged Buzzard	Buteo rufinus	Old nest on saxaul
37	44.928239	73.23671	27.04.2023	Long-legged Buzzard	Buteo rufinus	Old nest on saxaul
38	44.934764	73.23517	27.04.2023	Long-legged Buzzard	Buteo rufinus	Old nest on saxaul.
39	44.935246	73.23348	27.04.2023	Long-legged Buzzard	Buteo rufinus	Destroyed old nest on saxaul
40	44.934206	73.232957	27.04.2023	Long-legged Buzzard	Buteo rufinus	Old nest on saxaul
41	44.932699	73.218118	27.04.2023	Long-legged Buzzard	Buteo rufinus	Basis of a nest on saxaul
42	44.999524	73.177276	27.04.2023	Accipitridae, species is unknown	Accipitridae sp.	Old nest at a tree, height 4 m

43	44.999927	73.176582	27.04.2023	Accipitridae, species is unknown	Accipitrida e sp.	Old nest at Asian Poplar (Turanga), 6 m height
44	45.020438	73.199673	27.04.2023	Long-legged Buzzard	Buteo rufinus	Old nest on saxaul
45	45.021532	73.223118	27.04.2023	Long-legged Buzzard	Buteo rufinus	Old nest on saxaul.
46	45.020858	73.220754	27.04.2023	Long-legged Buzzard	Buteo rufinus	Old nest on saxaul. Last-year egg-shell
47	45.020364	73.221424	27.04.2023	Long-legged Buzzard	Buteo rufinus	Old nest on saxaul
48	45.019578	73.225355	27.04.2023	Long-legged Buzzard	Buteo rufinus	Old nest on saxaul
49	45.02858	73.218882	27.04.2023	Long-legged Buzzard	Buteo rufinus	Destroyed old nest on saxaul
50	45.031731	73.226595	27.04.2023	Long-legged Buzzard	Buteo rufinus	Destroyed old nest on saxaul
51	45.03175	73.226823	27.04.2023	Long-legged Buzzard	Buteo rufinus	Old nest on saxaul
52	45.031204	73.248332	27.04.2023	Long-legged Buzzard	Buteo rufinus	Visited old nest on saxaul. 1 adult bird is nearby
53	45.027472	73.243644	27.04.2023	Long-legged Buzzard	Buteo rufinus	Old nest on saxaul
54	45.03056	73.241245	27.04.2023	Long-legged Buzzard	Buteo rufinus	Visited old nest on saxaul
55	45.028792	73.238474	27.04.2023	Long-legged Buzzard	Buteo rufinus	Destroyed old nest on saxaul. Old egg-shell.
56	44.982699	73.142547	30.04.2023	Long-legged Buzzard	Buteo rufinus	2 ad (pair) of Long-legged Buzzard
57	44.93075	73.25689	25.04.2023	Long-legged Buzzard	Buteo rufinus	Old nest on saxaul
58	44.982319	73.134601	28.04.2023	Short-toed Eagle	Circaetus gallicus	Flew from saxaul and went to the sky up to 300 m.
59	44.981873	73.137222	28.04.2023	Short-toed Eagle	Circaetus gallicus	Live nest on saxaul. 1 egg.
60	45.019533	73.185767	28.04.2023	Goshawk	Accipiter gentilis	1 ad on passage at height 7 m
61	44.974252	73.135961	28.04.2023	Black Kite	Milvus migrans	Flying along saxaul forest, at 20 m height
62	44.858826	73.322509	29.04.2023	Marsh Harrier	Circus aeruginosu s	1 female on passage, height 5 m
63	44.868554	73.253303	29.04.2023	Short-toed Eagle	Circaetus gallicus	2 ad went in 300 m from VP 7, at 300-500 m height. From SW to NE.
64	44.898251	73.187623	30.04.2023	Pallid Harrier	Circus macrourus	1sad flying SE at height 10 m.
65	45.000648	73.220616	30.04.2023	Long-legged Buzzard	Buteo rufinus	Old nest on saxaul
66	45.001792	73.238793	30.04.2023	Long-legged Buzzard	Buteo rufinus	Base for nest on saxaul, the pair is here
67	45.003316	73.239226	30.04.2023	Long-legged Buzzard	Buteo rufinus	Living nest on saxaul; 3 eggs.
68	45.000349	73.243987	30.04.2023	Goshawk	Accipiter gentilis	1 adult male flew E at a height of 0.5 m
69	44.938813	73.232408	30.04.2023	Long-legged Buzzard	Buteo rufinus	Old nest on saxaul
70	44.963667	73.175314	01.04.2023	Long-legged Buzzard	Buteo rufinus	Living nest on saxaul.
71	44.906018	73.247215	01.04.2023	Common Buzzard	Buteo buteo	Flying low along the road

72	44.834518	73.47774	01.04.2023	Golden Eagle	Aquila chrysaetos	1 ad or sad
73	44.768097	73.529426	01.04.2023	Long-legged Buzzard	Buteo rufinus	1 ad
74	44.695253	73.683552	26.04.2023	Golden Eagle	Aquila chrysaetos	1 ad
75	44.880627	73.509432	23.04.2033	Short-toed Eagle	Circaetus gallicus	1 ad at a saxaul
76	44.845031	73.28818	29.04.2023	Steppe Eagle	Aquila nipalensis	Old nest on saxaul
77	44.982509	73.1418	30.04.2023	Booted Eagle	Hieraaetus pennatus	1 ad on passage, at height 10 m.
78	44.884089	73.197207	28.04.2023	Long-legged Buzzard	Buteo rufinus	2 old nests of Long-legged Buzzarda at the rock massive along a river.
79	44.899632	73.239649	26.04.2023	Long-legged Buzzard	Buteo rufinus	Old nest on saxaul
80	44.902284	73.252888	26.04.2023	Long-legged Buzzard	Buteo rufinus	Old nest on saxaul. 1 ad is nearby
81	44.936281	73.203367	27.04.2023	Long-legged Buzzard	Buteo rufinus	Living nest at a saxaul. Female is incubating the eggs. Male is not far.
82	44.820465	73.466635	01.04.2023	Golden Eagle	Aquila chrysaetos	Living nest of Golden Eagle and the rock.
83	44.820687	73.467029	01.04.2023	Golden Eagle	Aquila chrysaetos	2 old nests at the rock.
84	44.824952	73.474156	01.04.2023	Steppe Eagle	Aquila nipalensis	Old nest at low rock at a hill.
85	44.827363	73.473537	01.04.2023	Steppe Eagle	Aquila nipalensis	Old nest at a rock
86	44.88081	73.50327	23.04.2023	Long-legged Buzzard	Buteo rufinus	Old nest on saxaul. Female is incubating.
87	44.881368	73.499372	23.04.2023	Long-legged Buzzard	Buteo rufinus	Old nest on saxaul
88	44.884238	73.531554	23.04.2023	Long-legged Buzzard	Buteo rufinus	Living nest on saxaul. Female is incubating. Male is flying not far
89	44.969845	73.129554	25.04.2023	Long-legged Buzzard	Buteo rufinus	Living nest on saxaul. Female is incubating.
90	44.93787	73.207495	27.04.2023	Long-legged Buzzard	Buteo rufinus	Old nest on saxaul
91	44.965547	73.205342	27.04.2023	Long-legged Buzzard	Buteo rufinus	Living nest on saxaul. Female is incubating.
92	44.96625	73.20009	27.04.2023	Long-legged Buzzard	Buteo rufinus	Visited old nest on saxaul
93	45.019614	73.196821	25.04.2023	Long-legged Buzzard	Buteo rufinus	Old nest on saxaul
94	45.0152	73.18829	27.04.2023	Long-legged Buzzard	Buteo rufinus	Old nest on saxaul
95	45.03162	73.23984	27.04.2023	Long-legged Buzzard	Buteo rufinus	Ruins of nest on saxaul
96	44.98318	73.07995	28.04.2023	Long-legged Buzzard	Buteo rufinus	Living nest on saxaul. 2 eggs. Female is incubating
97	44.977552	73.113572	28.04.2023	Long-legged Buzzard	Buteo rufinus	Old nest on saxaul
98	45.000447	73.173239	27.04.2023	Accipitridae bird	Accipitridae sp.	Old nest on saxaul
99	44.97259	73.20007	01.05.2023	Hobby	Falco subbuteo	1 ad flew up from the ground and flew to the east

100	44.92266	73.18054	30.04.2023	Golden Eagle	Aquila chrysaetos	Feathers of Golden Eagle at roost at the top of the hill
101	44.92266	73.18054	30.04.2023	Kestrel	Falco tinnunculus	1 ad flew southward at a height of 15 m
102	44.99774	73.26924	30.04.2023	Sparrowhawk	Accipiter nisus	an adult flew westward at a height of 2 m
103	45.00066	73.2692	30.04.2023	Long-legged Buzzard	Buteo rufinus	1 ad flying at a height of 50 m
104	44.982699	73.142547	30.04.2023	Sparrowhawk	Accipiter nisus	1 ad flew NE at a height of 8 m
105	44.93849	73.24793	25.04.2023	Common Buzzard	Buteo buteo	1 ad hunting
106	44.90643	73.30555	24.04.2023	Marsh Harrier	Circus aeruginosus	1 ad female. Height 10 m, to SW
107	44.90643	73.30555	24.04.2023	Long-legged Buzzard	Buteo rufinus	1 ad. Height 20 m, to SW
108	44.92406	73.32937	24.04.2023	Common Buzzard	Buteo buteo	1 ad from NW to SE at a height of 30 m

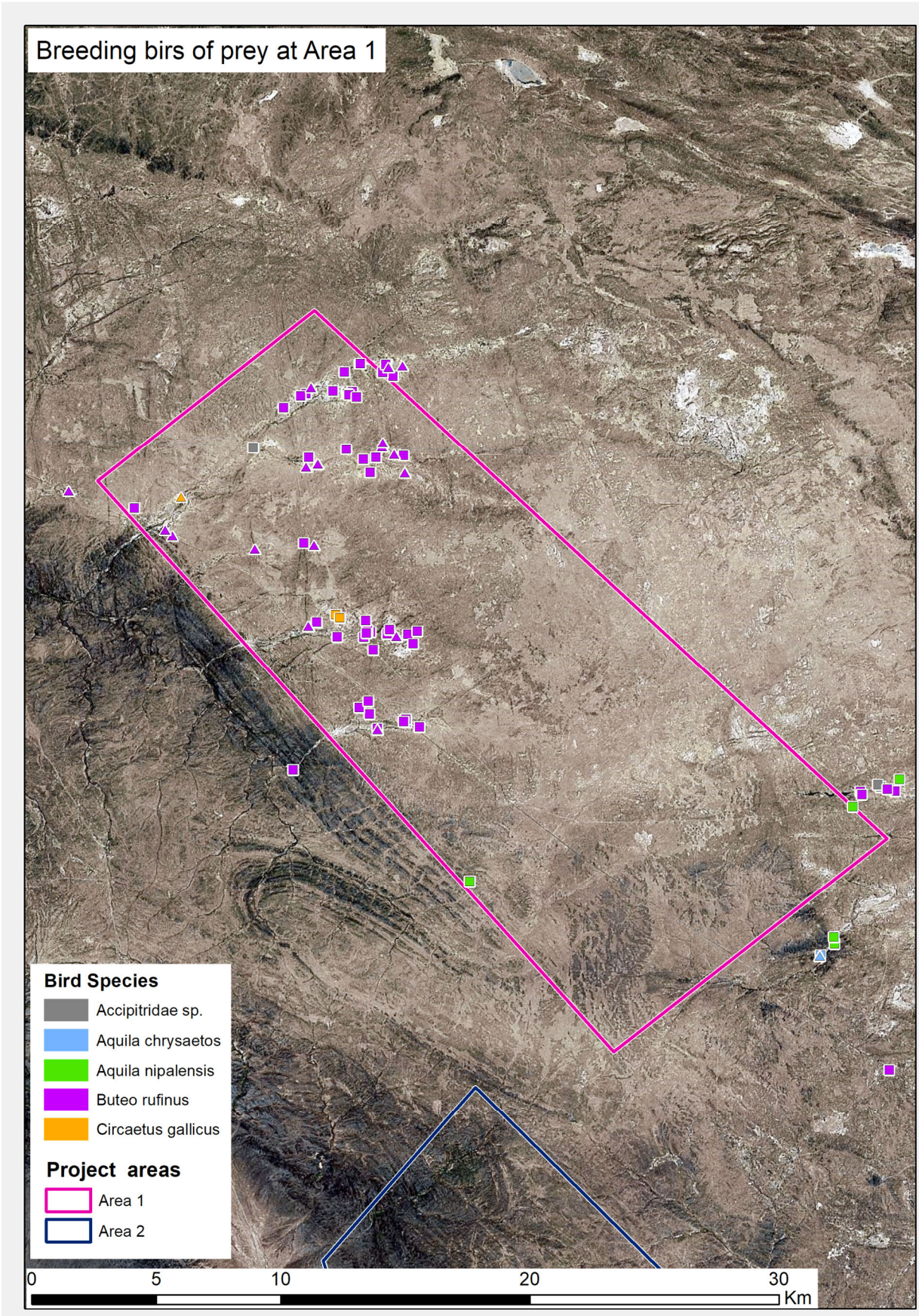


Fig. 4. Location of nests or nesting pairs of birds of prey in and near Area 1 (squares - old nests, triangles - inhabited nests or nesting pairs)

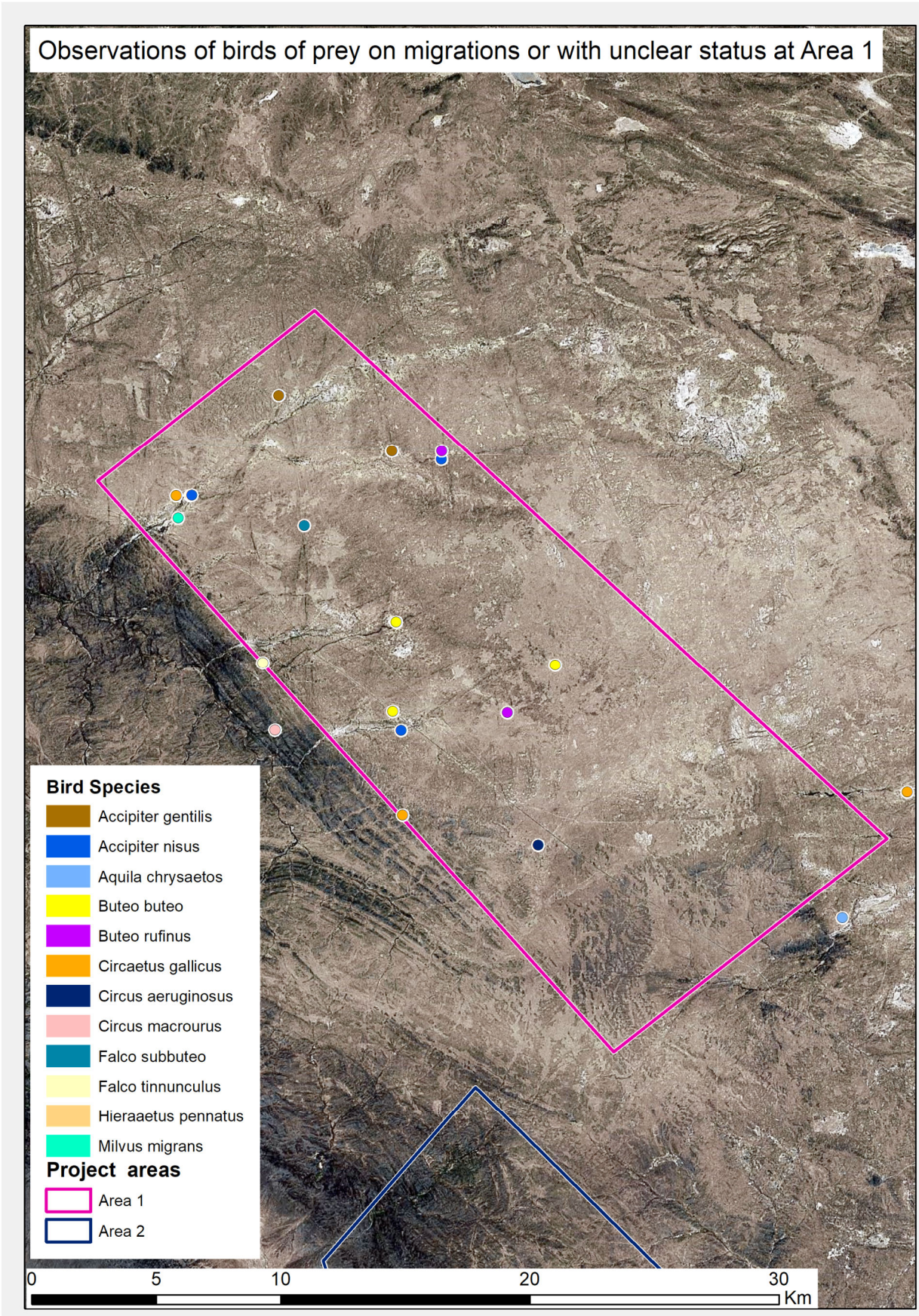


Fig. 5. Observations of birds of prey migratory or of unclear status in and near Area 1

Table 4. Observations of birds of prey and traces of their stay in and near Area 2 in April-May 2023 (observations showing nesting are marked in green, observations indicating passage or status is unclear in blue, old nests without color).

№ of observation	N	E	Date	Species	Latin name	Remarks
1	44.33564	73.71314	02.05.2023	Long-legged Buzzard	Buteo rufinus	Living nest on top of a concrete pylon of a power line, a young or hybrid female
2	44.3794649	73.7138765	02.05.2023	Long-legged Buzzard	Buteo rufinus	Living nest of Long-legged Buzzard on concrete pylon of a power line
3	44.4041024	73.7144191	02.05.2023	Hobby	Falco subbuteo	Pair of Hobby near old nest of raven on concrete pylon of a power line
4	44.4041024	73.7144191	02.05.2023	Kestrel	Falco tinnunculus	Pair of kestrel near next pylon
5	44.4041024	73.7144191	02.05.2023	Kestrel	Falco tinnunculus	Pair after 3 pylons
6	44.5273389	73.715431	02.05.2023	Long-legged Buzzard	Buteo rufinus	1 sad
7	44.42913	73.71222	02.05.2023	Golden Eagle	Aquila chrysaetos	Living nest of Golden Eagle on a rock shelf near river (2 nests side by side, old and living). Female flew fron the nest in 300 m. In the nest there is at least one downy chick
8	44.5005467	73.6741717	02.05.2023	Long-legged Buzzard	Buteo rufinus	Old nest on saxaul at road-side
9	44.47017	73.63092	02.05.2023	Long-legged Buzzard	Buteo rufinus	Old nest on saxaul at road-side
10	44.4850733	73.6526917	02.05.2023	Long-legged Buzzard	Buteo rufinus	Living empty nest on saxaul at road-side
11	44.4840565	73.6508386	02.05.2023	Long-legged Buzzard	Buteo rufinus	Old nest of Long-legged Buzzard on saxaul
12	44.4833282	73.6499382	02.05.2023	Long-legged Buzzard	Buteo rufinus	Old nest of Long-legged Buzzard on saxaul
13	44.4701667	73.630915	02.05.2023	Long-legged Buzzard	Buteo rufinus	Old nest of Long-legged Buzzard on saxaul
14	44.4314587	73.5773224	03.05.2023	Long-legged Buzzard	Buteo rufinus	Old nest of Long-legged Buzzard on rock-shelf
15	44.4314587	73.5773224	03.05.2023	Long-legged Buzzard	Buteo rufinus	Old nest at the same rock, in lower part
16	44.4328358	73.577385	03.05.2023	Long-legged Buzzard	Buteo rufinus	Old nest of Long-legged Buzzard on the top of a rock, 8 m
17	44.4297	73.57156	03.05.2023	Steppe Eagle	Aquila nipalensis	Old nest on the top of a rock

18	44.42866	73.57099	03.05.2023	Steppe Eagle	Aquila nipalensis	Living, repaired, but abandoned nest of eagle
19	44.44424	73.55991	03.05.2023	Steppe Eagle	Aquila nipalensis	Old nest on rock-shelf, 4 m
20	44.4490538	73.5530101	03.05.2023	Long-legged Buzzard	Buteo rufinus	Old nest on rock-shelf, 2 m
21	44.45005	73.55544	03.05.2023	Long-legged Buzzard	Buteo rufinus	Old nest of Long-legged Buzzard on rock-shelf
22	44.46375	73.54408	03.05.2023	Golden Eagle	Aquila chrysaetos	Old nest of Golden Eagle on rock-shelf
23	44.4642	73.54138	03.05.2023	Golden Eagle	Aquila chrysaetos	Living nest of Golden Eaglea on rock-shelf. 1 egg squeaks
24	44.46214	73.54082	03.05.2023	Golden Eagle	Aquila chrysaetos	Old nest of Golden Eagle on rock-shelf
25	44.41814	73.60666	03.05.2023	Steppe Eagle	Aquila nipalensis	Old nest of steppe eagle, 1 ad nearby
26	44.41814	73.60666	03.05.2023	Kestrel	Falco tinnunculus	1 female
27	44.41814	73.60666	03.05.2023	Shikra	Accipiter badius	1 sad + 1 ad
28	44.41814	73.60666	03.05.2023	Kestrel	Falco tinnunculus	1 bird
29	44.41814	73.60666	03.05.2023	Steppe Eagle	Aquila nipalensis	1 ad
30	44.41814	73.60666	03.05.2023	Steppe Eagle	Aquila nipalensis	1 ad
31	44.4053831	73.5973967	03.05.2023	Eagle (unclear species)	Aquila sp.	Old nest on saxaul. Remains of hare under the nest. Possible - Imperial Eagle nest.
32	44.45191	73.5429	03.05.2023	Steppe Eagle	Aquila nipalensis	Recently repaired but abandoned nest. On a rock-shelf, 1.5 m
33	44.4724067	73.5038967	03.05.2023	Imperial Eagle	Aquila heliaca	Immature Imperial Eagle is trying fly over the mountains opposite the wind
34	44.4934751	73.4943693	03.05.2023	Golden Eagle	Aquila chrysaetos	A crumbling nest
35	44.50292	73.50634	03.05.2023	Golden Eagle	Aquila chrysaetos	Old destroyed nest
36	44.7043118	73.8553305	04.05.2023	Small falcon (unclear species)	Falco sp.	Living nest in the crow nest on a concrete pylon of power line
37	44.7411595	73.8619922	04.05.2023	Long-legged Buzzard	Buteo rufinus	Living nest of Long-legged Buzzarda on saxauls, at least 2 nestlings
38	44.52182	73.52838	04.05.2023	Golden Eagle	Aquila chrysaetos	Old nest on rock-shelf. Some tortoises freshly broken by eagle
39	44.51229	73.54254	04.05.2023	Golden Eagle	Aquila chrysaetos	Old nest on a rock-shelf, 2 m
40	44.524437	73.5106249	04.05.2023	Golden Eagle	Aquila chrysaetos	Old nest on a rock-shelf
41	44.54382	73.47628	04.05.2023	Steppe Eagle	Aquila nipalensis	Old nest on a rock, 2.5 m

42	44.5661855	73.4561823	04.05.2023	Long-legged Buzzard	Buteo rufinus	Old nest on a rock in half-niche, 10 m
43	44.56377	73.45924	04.05.2023	Long-legged Buzzard	Buteo rufinus	Living nest of Long-legged Buzzarda on a rock-shelf, 5 m. Male and female are on the nest.
44	44.56257	73.45991	04.05.2023	Long-legged Buzzard	Buteo rufinus	Old destroyed nest on a rock-shelf, 1.5 m
45	44.588305	73.4315409	05.05.2023	Golden Eagle	Aquila chrysaetos	Old nest on a rock-shelf, 2 m; upper part of the mountain
46	44.588305	73.4315409	05.05.2023	Kestrel	Falco tinnunculus	1ad at a height of 10 m
47	44.588305	73.4315409	05.05.2023	Sparrowhawk	Accipiter nisus	Possible – Shikra. Height 6 m
48	44.6103749	73.4840446	05.05.2023	Long-legged Buzzard	Buteo rufinus	Old nest on saxaul
49	44.6104366	73.4850945	05.05.2023	Long-legged Buzzard	Buteo rufinus	Living nest on saxaul, 2 m. Female on the nest.
50	44.6051	73.37963	05.05.2023	Golden Eagle	Aquila chrysaetos	Old nest in half-niche on the rock, upper third; 8 m
51	44.6051	73.37963	05.05.2023	Crested Honey Buzzard	Pernis ptilorhynchus	1 male; height of 300 m
52	44.60744	73.39275	05.05.2023	Golden Eagle	Aquila chrysaetos	Empty nest in niche on 1\3 of the rock, 3 m. 1 egg died. Diet: plenty of tortoise, scull of desert fox (corsac), 3 bones of hare and 1 shoulder of Long-legged Buzzard
53	44.586773	73.416735	05.05.2023	Golden Eagle	Aquila chrysaetos	Old nest in niche of a rock, 3 m; upper third of the mountain.
54	44.586773	73.416735	05.05.2023	Shikra	Accipiter badius	1 bird flew northward at 5 m height
55	44.5981217	73.3691232	05.05.2023	Long-legged Buzzard	Buteo rufinus	Old nest of Long-legged Buzzard on rock-shelf, upper third, 7 m. 1 adult nearby.
56	44.5981217	73.3691232	05.05.2023	Shikra	Accipiter badius	1ad flew northward at a height of 4-5 m
57	44.5758822	73.3584985	05.05.2023	Long-legged Buzzard	Buteo rufinus	Living nest in niche of rock, 3 m. Female is on the nest, male nearby
58	44.5684	73.37204	05.05.2023	Steppe Eagle	Aquila nipalensis	Old nest on a rock outcrop
59	44.56514	73.38495	05.05.2023	Golden Eagle	Aquila chrysaetos	Occupied empty nest in niche of the rock, 5 m. Near the river. 2 ad nearby
60	44.56245	73.38677	05.05.2023	Golden Eagle	Aquila chrysaetos	Old nest in half-niche of the rock, approx. in the middle.
61	44.5576986	73.3902529	05.05.2023	Long-legged Buzzard	Buteo rufinus	Living nest of Long-legged Buzzard on rock-shelf, 5 m. In the old nest of Golden

						Eagle. Female is on the nest.
62	44.5576986	73.3902529	05.05.2023	Golden Eagle	Aquila chrysaetos	Above the nest of Long-legged Buzzard, the old nest of Golden Eagle
63	44.5576986	73.3902529	05.05.2023	Golden Eagle	Aquila chrysaetos	Old nest
64	44.5795817	73.3532418	05.05.2023	Long-legged Buzzard	Buteo rufinus	Old nest on a single rock on rock-shelf, 1 m
65	44.59964	73.33662	05.05.2023	Saker	Falco cherrug	Living nest of Saker in a niche of the rock in old nest of Long-legged Buzzard, 40 m. At least 3 nestlings. Male and female are nearby
66	44.6054084	73.339588	06.05.2023	Long-legged Buzzard	Buteo rufinus	Living nest on rock-shelf, 6 m. Male and female on the nest.
67	44.6066767	73.3161353	06.05.2023	Long-legged Buzzard	Buteo rufinus	Old nest
68	44.6066767	73.3161353	06.05.2023	Golden Eagle	Aquila chrysaetos	Roost
69	44.61105	73.31867	06.05.2023	Golden Eagle	Aquila chrysaetos	Old nest on the rock-shelf, 2 m.
70	44.6073699	73.3141888	06.05.2023	Golden Eagle	Aquila chrysaetos	Old nest on the rock-shelf, 5 m
71	44.60714	73.31281	06.05.2023	Golden Eagle	Aquila chrysaetos	Visited old nest in half-niche in the middle of a mountain. 2 m. 2 ad nearby.
72	44.6108414	73.294358	06.05.2023	Eagle (unclear species)	Aquila sp.	Old nest on a rock
73	44.6121016	73.2891501	06.05.2023	Steppe Eagle	Aquila nipalensis	Old nest at the rocky outcrop
74	44.63817	73.2925	06.05.2023	Golden Eagle	Aquila chrysaetos	Destroyed nest on the rock-shelf, 2 m. Used as a roost; down-feathers, a lot of tortoises, one snake, one chukar
75	44.63486	73.29246	06.05.2023	Golden Eagle	Aquila chrysaetos	A pair of Golden Eagle at the rock; no nest
76	44.63486	73.29246	06.05.2023	Barbary Falcon	Falco pelegrinoides	1 sad attacked Golden Eagle
77	44.63486	73.29246	06.05.2023	Shikra	Accipiter badius	1 ad flew at 10 m height
78	44.63486	73.29246	06.05.2023	Kestrel	Falco tinnunculus	1 ad flew at 50 m height.
79	44.66772	73.26889	06.05.2023	Kestrel	Falco tinnunculus	Breeding in old nest of Golde Eagle in a niche of a rock
80	44.6683833	73.269075	06.05.2023	Saker	Falco cherrug	Nest with dead clutch of 3 eggs in old nest of raven in niche of a rock. 9 m.
81	44.66813	73.2699267	06.05.2023	Golden Eagle	Aquila chrysaetos	Old nest on a rock, 3 m. Used by kestrel.
82	44.6750511	73.2613356	06.05.2023	Golden Eagle	Aquila chrysaetos	Old nest on a rock, 5 m.

83	44.6788241	73.2559961	07.05.2023	Steppe Eagle	Aquila nipalensis	Old nest on a rock, 8 m
84	44.6868417	73.252155	07.05.2023	Steppe Eagle	Aquila nipalensis	Very old nest on a rock near the top of the hill.
85	44.69341	73.24406	07.05.2023	Long-legged Buzzard	Buteo rufinus	Living nest of Long-legged Buzzard at the rock-shelf, 4 m. 3 eggs. Male and female here.
86	44.7036566	73.2425357	07.05.2023	Long-legged Buzzard	Buteo rufinus	Old nest on rock-shelf, and one more nest nearby
87	44.7075517	73.2455083	07.05.2023	Long-legged Buzzard	Buteo rufinus	Old nest on a rock-shelf, 3.5 m
88	44.7075517	73.2455083	07.05.2023	Steppe Eagle	Aquila nipalensis	3 migrating; 1 of them flew up to 100 m and then went north-eastward
89	44.7075517	73.2455083	07.05.2023	Steppe Eagle	Aquila nipalensis	1 ad flew up to 50 m and then went northward
90	44.7075517	73.2455083	07.05.2023	Steppe Eagle	Aquila nipalensis	1 bird flew up to 200 m
91	44.7075517	73.2455083	07.05.2023	Kestrel	Falco tinnunculus	1 ad
92	44.7075517	73.2455083	07.05.2023	Hobby	Falco subbuteo	2 migrating
93	44.706158	73.247745	07.05.2023	Kestrel	Falco tinnunculus	last year nest
94	44.6803983	73.2385983	07.05.2023	Golden Eagle	Aquila chrysaetos	very old nest; 2 adult birds not far; a lot of old broken shells of tortoises
95	44.7179233	73.2373567	07.05.2023	Long-legged Buzzard	Buteo rufinus	1 ad flew up at a height of 20 m
96	44.7179233	73.2373567	07.05.2023	Steppe Eagle	Aquila nipalensis	1 ad flew up northward at a height of 100 m
97	44.7229955	73.2405035	07.05.2023	Golden Eagle	Aquila chrysaetos	Old nest on a rock, 5 m
98	44.7233014	73.2470004	07.05.2023	Golden Eagle	Aquila chrysaetos	Old nest on the rock niche (2 constructions one above another), 4 m
99	44.7233014	73.2470004	07.05.2023	Hobby	Falco subbuteo	1 ad flew at a height of 50 m
100	44.72993	73.26003	07.05.2023	Long-legged Buzzard	Buteo rufinus	Old nest on rock-shelf, 6 m
101	44.7287097	73.2591131	07.05.2023	Golden Eagle	Aquila chrysaetos	Living nest on rock-shelf, 8 m. 2 eggs. Female flew off in 10 m
102	44.7287097	73.2591131	07.05.2023	Common Buzzard	Buteo buteo	1 ad
103	44.7441717	73.2840433	08.05.2023	Common Buzzard	Buteo buteo	1 ad flew from saxaul woodland to hills
104	44.7447217	73.2795967	08.05.2023	Sparrowhawk	Accipiter nisus	1 male attacked rose starlings
105	44.747335	73.2759283	08.05.2023	Steppe Eagle	Aquila nipalensis	Old nest of the rockt outcrop, 0.2 m
106	44.747769	73.2753654	08.05.2023	Steppe Eagle	Aquila nipalensis	Old nest on rock, 3 m

107	44.7554983	73.3014133	08.05.2023	Long-legged Buzzard	Buteo rufinus	visited old nest on saxaul
108	44.7565433	73.303632	08.05.2023	Long-legged Buzzard	Buteo rufinus	Old nest on saxaul
109	44.7574044	73.3058602	08.05.2023	Long-legged Buzzard	Buteo rufinus	Old nest on saxaul, 2 m
110	44.7576309	73.3061998	08.05.2023	Long-legged Buzzard	Buteo rufinus	Old destroyed nest on saxaul, 2.5 m
111	44.6673314	73.329471	08.05.2023	Long-legged Buzzard	Buteo rufinus	Old nest on rock, 6 m
112	44.6535313	73.3016385	08.05.2023	Golden Eagle	Aquila chrysaetos	empty nest on rock-shelf, 20 m. 1 adult bird nearby
113	44.6532369	73.3004848	08.05.2023	Golden Eagle	Aquila chrysaetos	Old nest on rock
114	44.6401337	73.3315002	08.05.2023	Golden Eagle	Aquila chrysaetos	2 adult Golden Eagles, attacked 3-year-old Golden Eagle
115	44.6194913	73.3538287	08.05.2023	Steppe Eagle	Aquila nipalensis	Old nest at rocky outcrop
116	500 m back on the track		08.05.2023	Kestrel	Falco tinnunculus	1 male
117	44.6151641	73.3587691	08.05.2023	Steppe Eagle	Aquila nipalensis	Old nest on rocky outcrope
118	44.6119717	73.3717067	08.05.2023	Long-legged Buzzard	Buteo rufinus	Old nest on saxaul, 1.5 m
119	44.6106521	73.3744361	08.05.2023	Long-legged Buzzard	Buteo rufinus	Old nest on saxaul, 2 m
120	44.5713134	73.4025875	08.05.2023	Long-legged Buzzard	Buteo rufinus	Old nest on saxaul, 1.8 m
121	44.563833	73.3849424	08.05.2023	Golden Eagle	Aquila chrysaetos	Old nest on rosk-shelf, 8 m
122	44.5348921	73.4565367	08.05.2023	Steppe Eagle	Aquila nipalensis	Old nest on rocky outcrop, 2 m
123	44.5348921	73.4565367	08.05.2023	Golden Eagle	Aquila chrysaetos	2-year bird near old nest of steppe eagle
124	44.537575	73.4375517	08.05.2023	Golden Eagle	Aquila chrysaetos	Old nest on rock-shelf, 5 m
125	44.4339233	73.5052533	08.05.2023	Crested Honey Buzzard	Pernis ptilorhynchus	20 birds flying at a height of 10 to 50 m
126	44.372897	73.5046509	08.05.2023	Imperial Eagle	Aquila heliaca	Old nest on a tree
127	44.51975	73.44489	09.05.2023	Long-legged Buzzard	Buteo rufinus	Old nest on a rock, 1 m
128	44.52237	73.44417	09.05.2023	Long-legged Buzzard	Buteo rufinus	Occupied empty nest on rock, 5 m. 2 adults are there
129	44.52237	73.44417	09.05.2023	Long-legged Buzzard	Buteo rufinus	Old nest on rock
130	44.53339	73.42901	09.05.2023	Golden Eagle	Aquila chrysaetos	Old nest on rock-shelf, 5 m. Visited. 1 adult bird nearby
131	44.53339	73.42901	09.05.2023	White-tailed Eagle	Haliaeetus albicilla	1 ad near dry river-bed
132	44.54849	73.40395	09.05.2023	Long-legged Buzzard	Buteo rufinus	Old nest on rock, 1 m
133	44.54849	73.40395	09.05.2023	Long-legged Buzzard	Buteo rufinus	Very old nest on rock-shelf
134	44.54849	73.40395	09.05.2023	Golden Eagle	Aquila chrysaetos	1 ad near old nest of Long-legged Buzzard
135	44.7302217	73.21023	10.05.2023	Long-legged Buzzard	Buteo rufinus	1 ad flew ay a height 100 m

136	44.7360894	73.2096887	10.05.2023	Kestrel	Falco tinnunculus	In old nest of Saker (before it was nest of raven) on rock, 15 m. Now it is used by Kestrel.
137	44.733354	73.217428	10.05.2023	Kestrel	Falco tinnunculus	Nest in an old nest of Saker. 15 m.
138	44.7347757	73.2113425	10.05.2023	Golden Eagle	Aquila chrysaetos	Old nest on rock. 18 m.
139	44.7347757	73.2113425	10.05.2023	Kestrel	Falco tinnunculus	2 pairs on rock with old nest of Golden Eagle
140	44.7347757	73.2113425	10.05.2023	Black Kite	Milvus migrans	Flying northward at a height of 300 m
141	44.7347757	73.2113425	10.05.2023	Sparrowhawk	Accipiter nisus	1 ad at height of 200 m
142	44.7625	73.21498	10.05.2023	Golden Eagle	Aquila chrysaetos	1 ad
143	44.7625	73.21498	10.05.2023	Steppe Eagle	Aquila nipalensis	Pair attacked a Golden Eagle
144	44.7625	73.21498	10.05.2023	Steppe Eagle	Aquila nipalensis	old nest on the ground on a hill
145	44.7677265	73.2313992	10.05.2023	Long-legged Buzzard	Buteo rufinus	Old nest on saxaul
146	44.7772086	73.1749895	10.05.2023	Golden Eagle	Aquila chrysaetos	Old nest on rock
147	44.7855445	73.1765036	10.05.2023	Golden Eagle	Aquila chrysaetos	Old nest on rock, 10 m
148	44.7850166	73.1755806	10.05.2023	Golden Eagle	Aquila chrysaetos	Old nest on rock, 8 m
149	44.7877287	73.1692971	10.05.2023	Golden Eagle	Aquila chrysaetos	Old nest on rock, 5 m
150	44.7877287	73.1692971	10.05.2023	Golden Eagle	Aquila chrysaetos	1 immature, about 4-years-old
151	44.7905168	73.166907	10.05.2023	Golden Eagle	Aquila chrysaetos	Old nest on rock, 6 m
152	44.7905168	73.166907	10.05.2023	Golden Eagle	Aquila chrysaetos	2 ad
153	44.7815476	73.1258031	10.05.2023	Long-legged Buzzard	Buteo rufinus	Old nest on rock, 2 m
154	44.7854116	73.1133039	10.05.2023	Long-legged Buzzard	Buteo rufinus	Living nest on rock, 6 m. At least 3 nestlings
155	44.7867184	73.1106875	10.05.2023	Long-legged Buzzard	Buteo rufinus	Old nest on rock, 8 m
156	44.7867184	73.1106875	10.05.2023	Sparrowhawk	Accipiter nisus	1 female
157	44.8702374	72.9813742	10.05.2023	Long-legged Buzzard	Buteo rufinus	Old nest on rock, 12 m
158	44.8676801	72.988237	10.05.2023	Long-legged Buzzard	Buteo rufinus	Old nest on rock, 4 m
159	44.8643396	73.0003697	11.05.2023	Long-legged Buzzard	Buteo rufinus	Old nest on rock, 4 m
160	44.8641699	73.0015926	11.05.2023	Long-legged Buzzard	Buteo rufinus	Old nest on rock, 4 m
161	44.8640972	73.0025864	11.05.2023	Golden Eagle	Aquila chrysaetos	Old nest on rock, 6 m

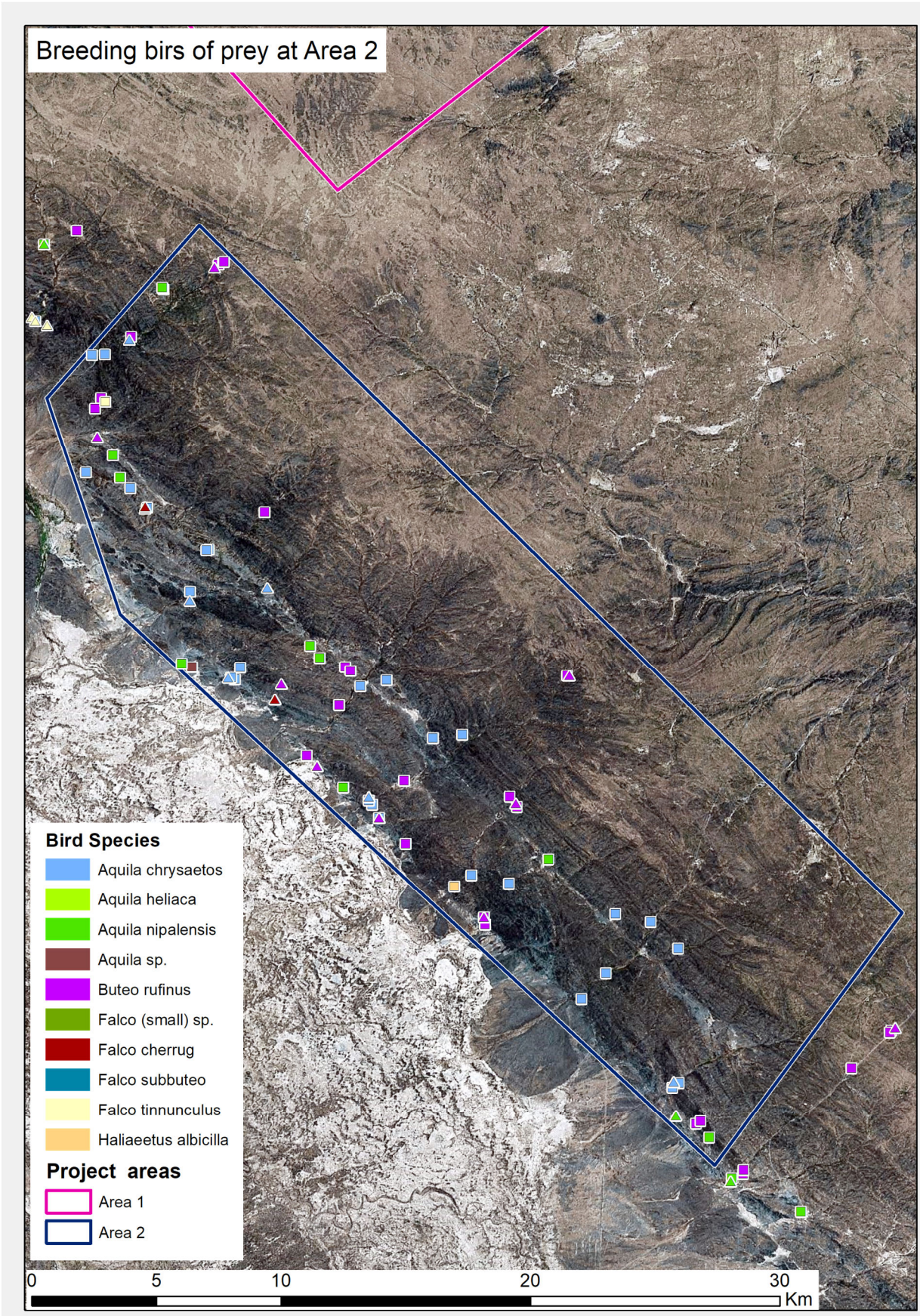


Fig. 6. Location of nests or nesting pairs of birds of prey in and near Area 2 (squares - old nests, triangles - inhabited nests or nesting pairs)

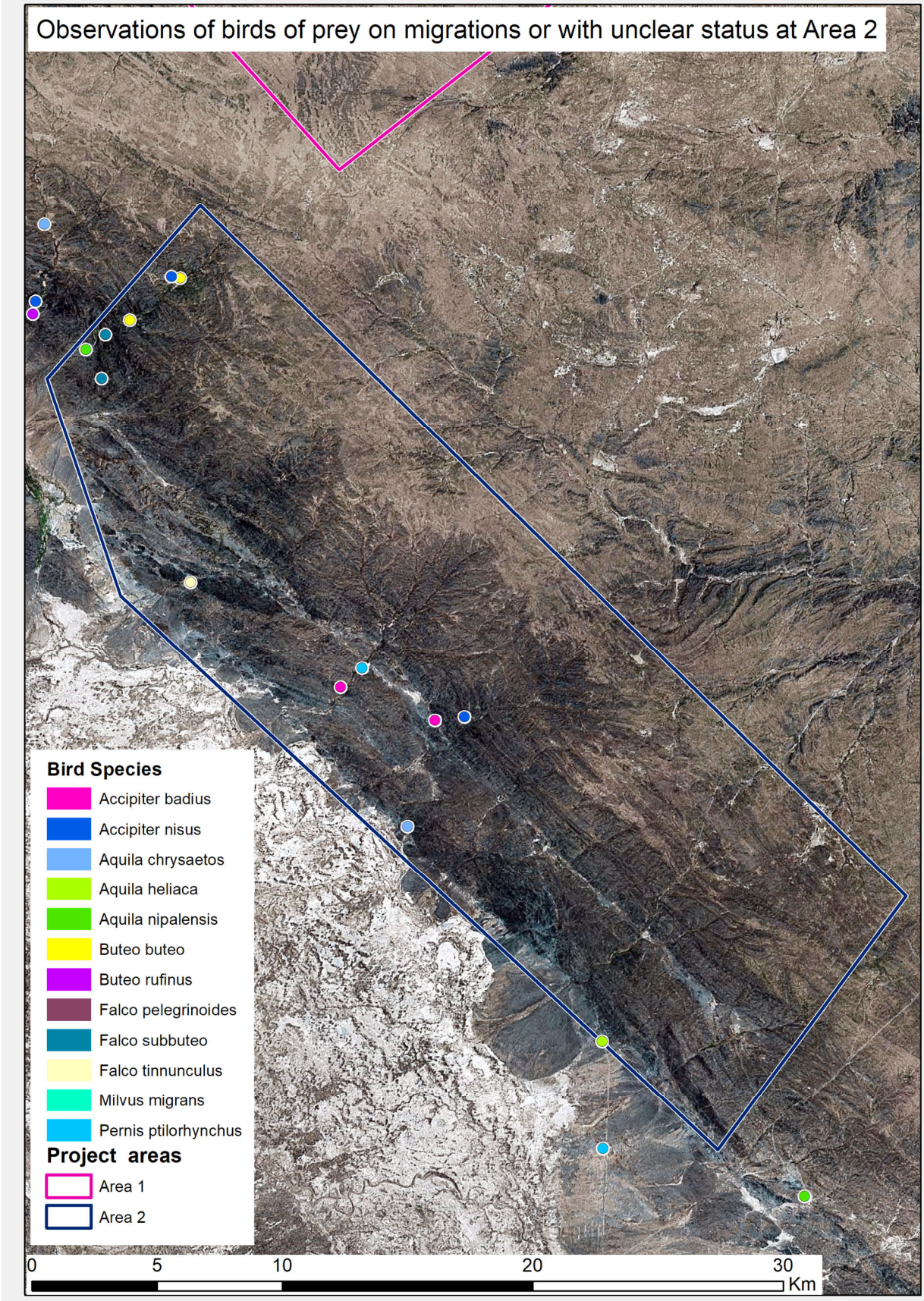


Fig. 7. Observations of birds of prey migratory or of unclear status in and near Area 2

2.1.4 Other rare and large bird species

In addition to birds of prey, special attention was paid to other rare species from the Red Data Book of the Republic of Kazakhstan or threatened to varying degrees in the IUCN Red List. There are seven such species in total. Data on their observations are presented in tables 3 and 4 and in figures 7 and 8.

It should be noted that the Black Stork was obviously recorded on the migration, as were the White Pelicans and cranes of an indefinite species. Black-bellied Sandgrouse, Pallas's Sandgrouse, Little Bustard, Houbara are nesting species in the territory. True, this cannot be firmly confirmed for the Little Bustard, but its breeding in the Shu-Ilei mountains has been proven somewhat to the south.

Table 5. Observations of rare bird species (except raptors) at Area 1 in April 2023 (species from RDB of KZ are indicated in bold)

№ of observation	N	E	Date	Species	Latin name	Remarks
11	45.030944	73.226522	27.04.2023	**Black Stork**	*Ciconia nigra*	1 bird from W to E, at a height 400-500 m
12	44.928618	73.237216	27.04.2023	**Black-bellied Sandgrouse**	*Pterocles orientalis*	2 birds
13	44.867886	73.372317	24.04.2023	**Houbara**	*Chlamydotis macqueenii*	1 bird flew off
16	44.921635	73.179649	30.04.2023	**White Pelican**	*Pelecanus onocrotalus*	1 bird (in 100 NW) tried to cross mountain in NE direction, but was afraid of observer and sit down on a mountain
17	44.870896	73.442736	24.04.2023	**Little Bustard**	*Tetrax tetrax*	Male flew off the road
18	44.979664	73.144723	30.04.2023	**Crane (indefinite)**	*Grus sp.*	31 bird flying up at a height of 200 m

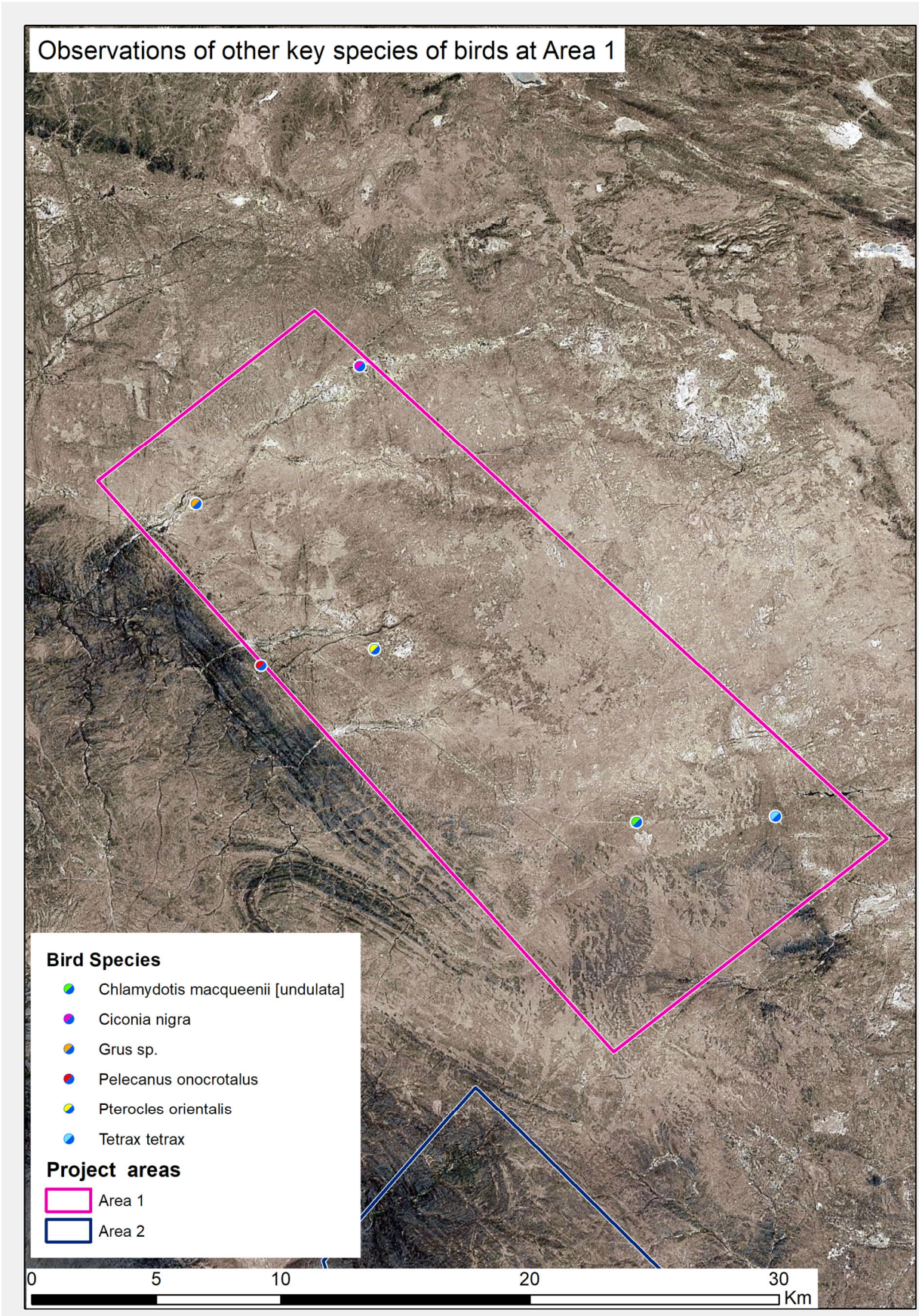


Fig. 8. Observations of rare bird species (except raptors) at Area 1 in April 2023

Table 6. Observations of rare bird species (except raptors) at Area 2 in May 2023

№ of observation	N	E	Date	Species	Latin name	Remarks
1	44.24156	73.7707233	02.05.2023	Little Bustard	*Tetrax tetrax*	male
2	44.24156	73.7707233	02.05.2023	Black-bellied Sandgrouse	*Pterocles orientalis*	1
10	44.4174632	73.5805707	03.05.2023	Black-bellied Sandgrouse	*Pterocles orientalis*	2 birds
11	44.45191	73.5429	03.05.2023	Black-bellied Sandgrouse	*Pterocles orientalis*	2 birds + 2
13	44.4115102	73.5881132	04.05.2023	Pallas's Sandgrouse	*Syrrhaptes paradoxus*	4 birds; 1 pair with chicks
14	44.4115102	73.5881132	04.05.2023	Black-bellied Sandgrouse	*Pterocles orientalis*	1+2+4
18	44.554915	73.3163633	05.05.2023	Black-bellied Sandgrouse	*Pterocles orientalis*	
19	44.5796261	73.3370061	06.05.2023	Pallas's Sandgrouse	*Syrrhaptes paradoxus*	11 birds; at least 2 broods
20	44.5796261	73.3370061	06.05.2023	Black-bellied Sandgrouse	*Pterocles orientalis*	4 birds
21	44.6121016	73.2891501	06.05.2023	Black-bellied Sandgrouse	*Pterocles orientalis*	6 birds
23	44.6788241	73.2559961	07.05.2023	Black-bellied Sandgrouse	*Pterocles orientalis*	2+2+2
30	44.7441717	73.2840433	08.05.2023	Black-bellied Sandgrouse	*Pterocles orientalis*	1 pair
32	44.7447217	73.2795967	08.05.2023	Houbara	*Chlamydotis macqueenii*	female diverted
40	44.54849	73.40395	09.05.2023	Black-bellied Sandgrouse	*Pterocles orientalis*	2+2+3+2
59	44.8892768	73.0391466	11.05.2023	White Pelican	*Pelecanus onocrotalus*	Weak pelican was found in the steppe; it could not fly. It was caught and carried to Balkhash lake where was released

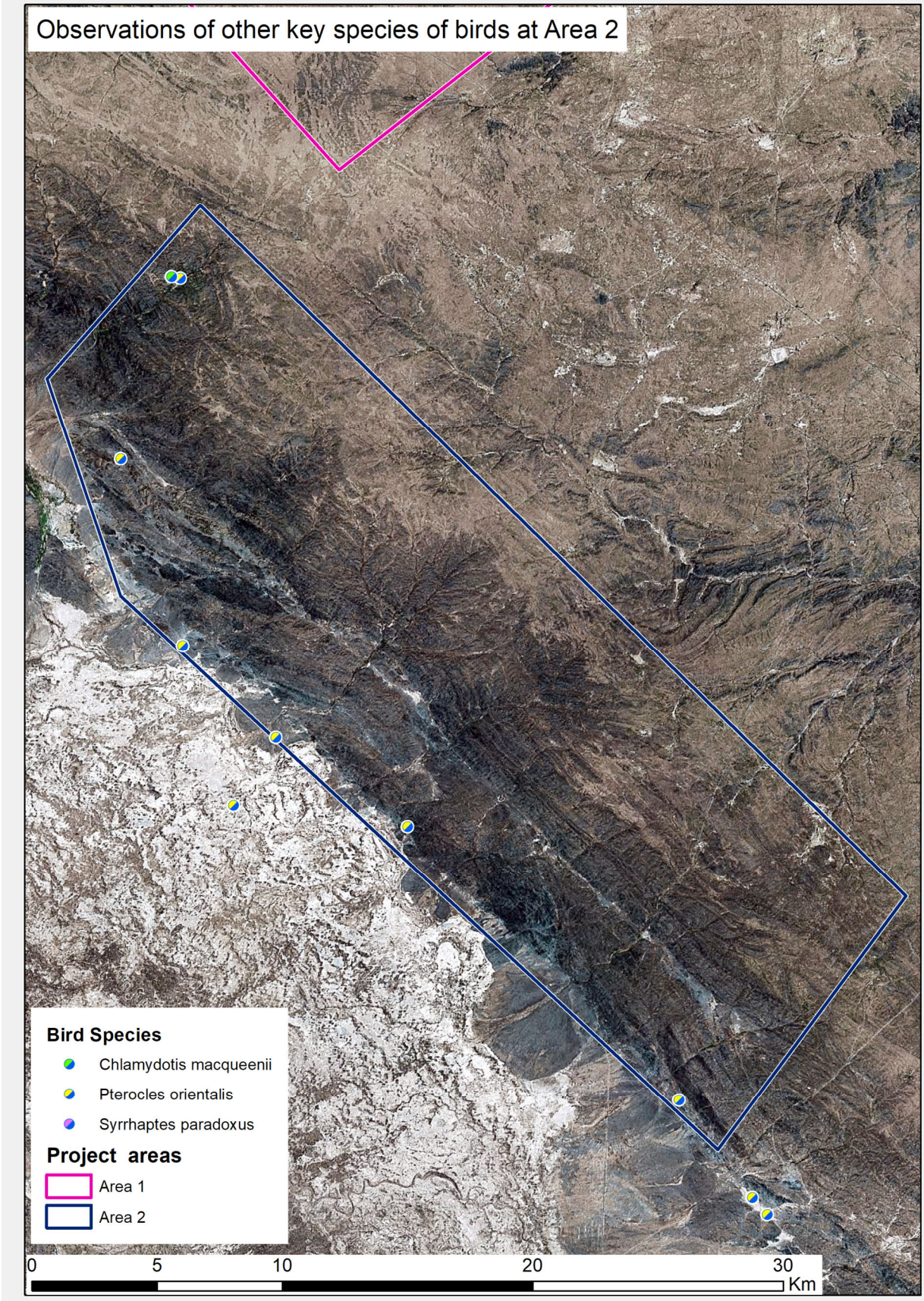


Fig. 9. Observations of rare bird species (except raptors) at Area 2 in May 2023

In addition to these data, a group of teriologists noted 3 sightings of **Little Bustards** (*Tetrax tetrax*), apparently in nesting areas, and 4 sightings of **Black-bellied Sandgrouse** (*Pterocles orientalis*, 2-3 birds in each case) in May. A passage aggregation of Crested Honey Buzzard (*Pernis ptylorhynchos*) numbering at least 25 individuals was noted.

All information will be combined in the final maps and analysis.

2.1.5 Migrations of birds across the territory, local movements, population density

During the first trip, as noted above, there was an acquaintance with the territory, the choice of observation (vantage) points, etc. At the same time, since the passage was already ending, but nesting of birds of prey was in full swing, it was decided to focus on this very significant group of birds. This was especially important because in April-May we managed to involve Igor Karyakin, one of the best specialists in birds of prey in the post-Soviet countries, and there was a good chance to get the most out of his work.

Therefore, transect counts as such and counts with vantage points were carried out only at Area 1 in April (when the passage was still underway). In May, when the main work was going on at Area 2, the nests were mapped primarily for birds of prey. At the same time, records of all bird species encountered were kept during the entire stay of groups of ornithologists in the project territory.

Complete survey data with vantage points are presented in Annex 2, data of transect surveys - in Excel spreadsheets on Google Drive.

Photos taken during the work, as well as tracks and waypoints in kmz and kml format are available via Google Drive.

The summary results of observations of the ornithological group (including those included in the tables in the text of the report) are also presented in Excel spreadsheet on Google Drive.

Despite the late start of work and the practical end of the spring migration, it can be stated that a significant number of different birds fly through this area. At different times we met both large and small flocks of birds. Crested Honey Buzzards, Hobbies, White-tailed Eagles, White Pelicans and a large number of passerine species were observed on the migration. Birds of prey fly quite low in this area (this was clearly seen in the example of Crested Honey Buzzards). At the southern area, large flocks of Rose Starlings were recorded - up to 1000 individuals; see Excel spreadsheets on Google Drive. For this species in this area, the construction of a wind farm is likely to be a critical factor.

These conclusions were made both on the basis of the results of observations at the points, and in the course of transect counts and any other observations at the sites.

2.2 Summer: June-August 2023

The objectives of the field survey of the project area in June-early July 2023 were:

- study of the species composition and accounting of the number of birds of prey nesting in the project area in the summer;
- study of the species composition and accounting of the number of passerines and other bird species (other than birds of prey) nesting in the project area during the summer period;
- general assessment of the state of biodiversity.

The work was carried out in accordance with the methodology described in the Birds and Wind-Energy Best-Practice Guidelines (Compiled by: A.R. Jenkins, C.S. van Rooyen, J.J. Smallie, J.A. Harrison, M. Diamond, H.A. Smit-Robinson and S. Ralston).

The same methodology, after additional consultations with Rhys Ballman and clarifications, was used further until the end of the project, i.e. until May 2024. At the selected 40 points, both stationary observations and walking transects were carried out (Fig. 10).

Stationary observations were carried out during the daytime, in the period 06.00-12.00; 15.00-21.00. Walking transects were carried out around 10 am, lasted on average up to half an hour, with an average distance traveled of about 500-600 m.

Fig. 10. Stationary observations at VP N14

In addition, observations were made from vehicles when moving across the project area.

Simultaneously with the study of birds, incidental data collection was conducted on mammals (especially ungulates) and reptiles.

The results of the field studies are presented in Excel tables.

Bird of prey

The analysis of the obtained data allows us to judge the distribution of nesting predators in the project area. First of all, we note the species composition of birds of prey in the project area – all the expected species were recorded in one way or another, including the “Red Book” species and the species from the IUCN list (see appendices). The most common species, as expected, was the long-legged buzzard (*Buteo rufinus*) (Fig. 11, 12).

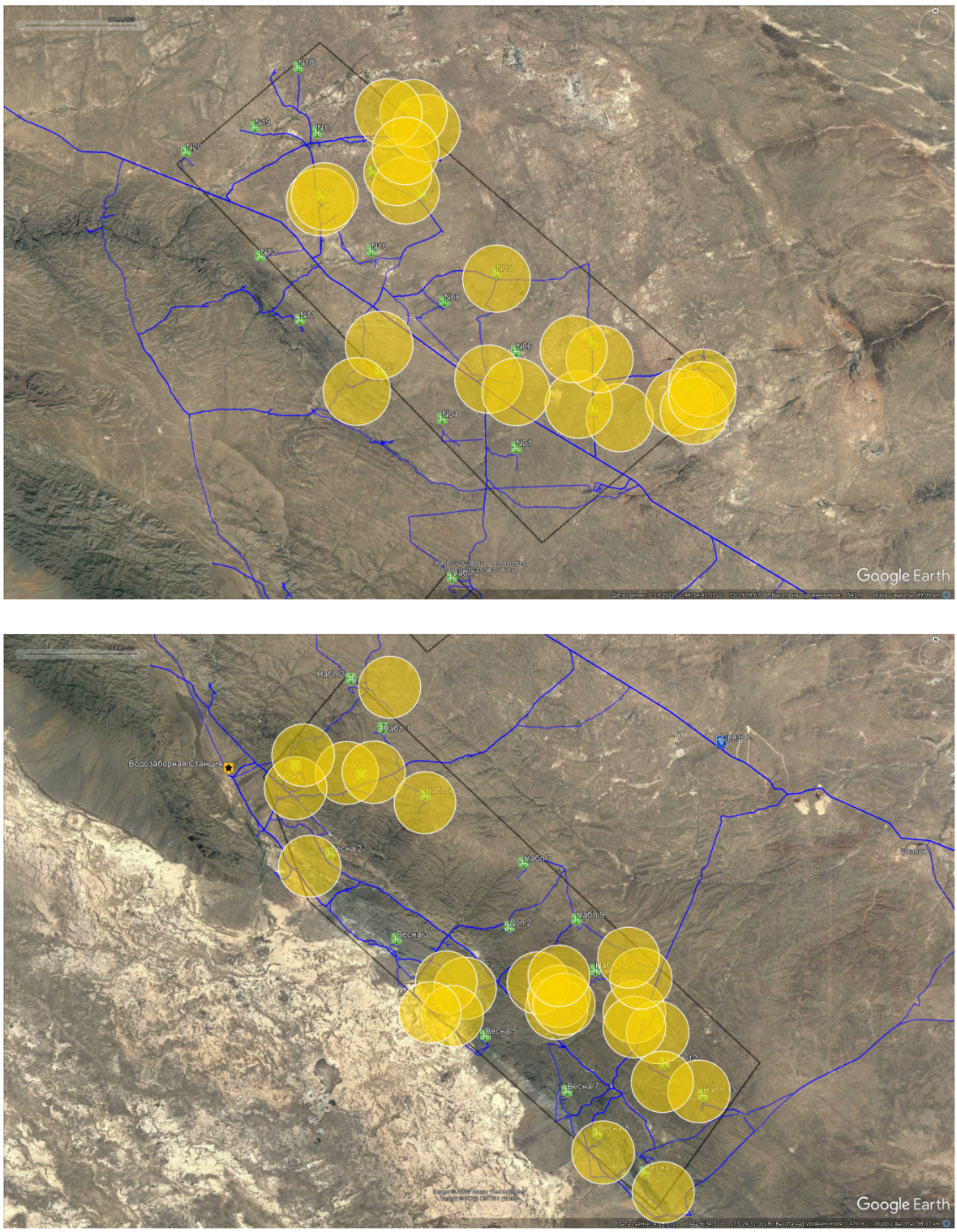


Fig. 11, 12. Distribution of the long-legged buzzard (Buteo rufinus) in the project area

It can also be said with confidence that the golden eagle (*Aquila chrysaetos*) is a common species for the southern project site (Fig. 13, 14).

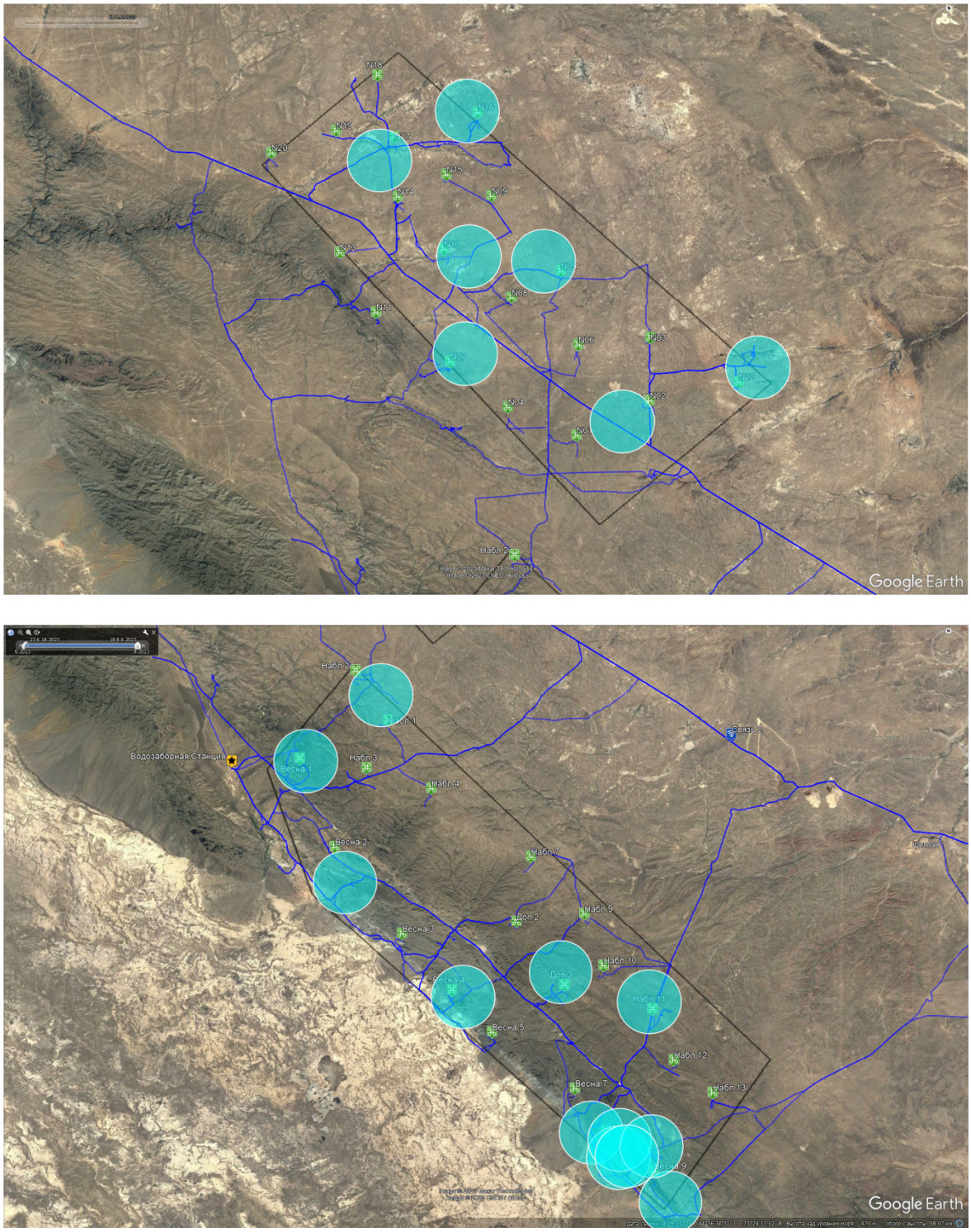


Fig. 13, 14. Distribution of golden eagle (Aquila chrysaetos) in the project area

At the beginning of July, most of the fledglings were already hunting independently. Based on the results of examining the nests of some predators (long-legged buzzard, golden eagle), one can roughly judge the diet of predators in this region. These are turtles (in April-May), rodents (jerboas, voles, gerbils) and other small mammals (young hares). Most of the large predators were observed during the hunt, a smaller part at rest, near and/or on the nests. At the same time, during the hunting period, the birds soared on average at heights from 70 to 200 m.

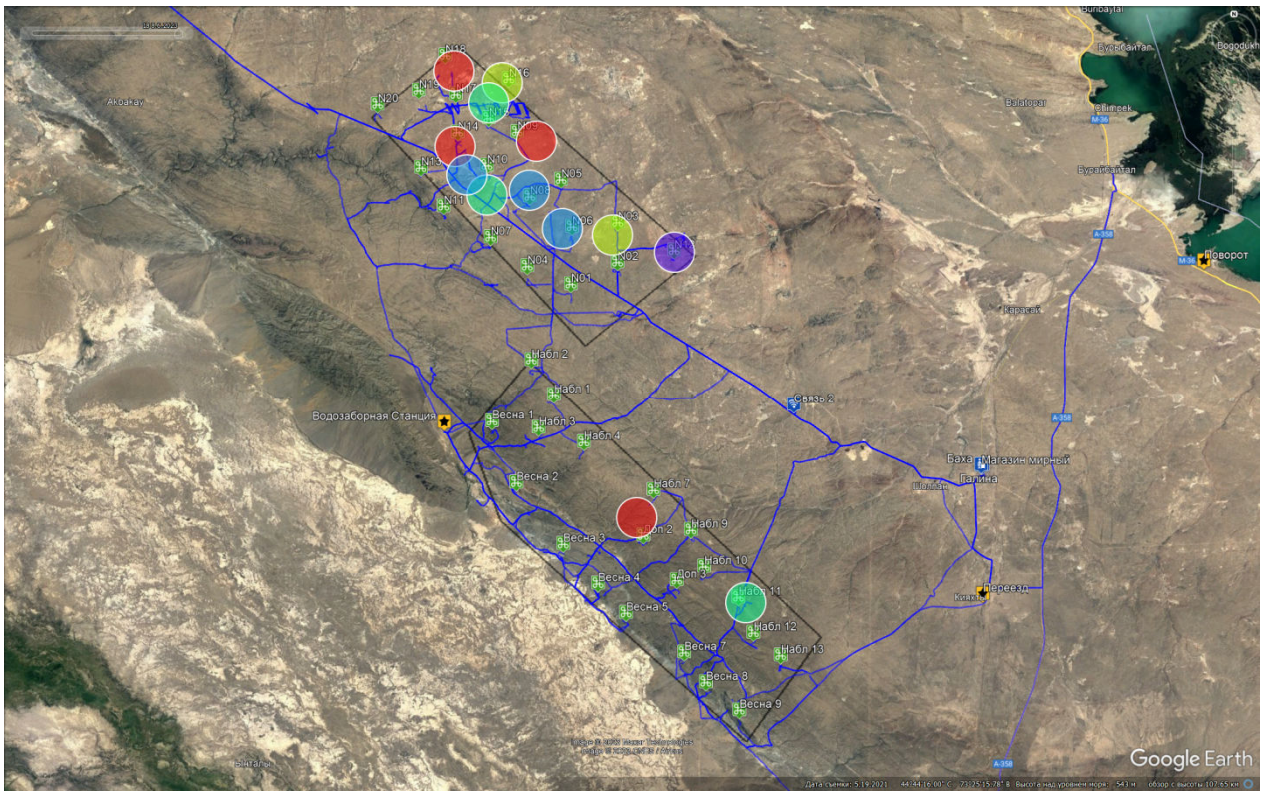


Fig. 15. Observations of other birds of prey (steppe eagle , imperial eagle , short-toed eagle , hen harrier , black kite) in the project area

Small passerines and other species

In most cases, the tables with the results of counts for these groups do not contain the flight altitude. In such cases, the birds flew at a height of 1-10, maximum - up to 20 m. The tables in Excel are provided in Google-drive.

Local movements of waterbirds

An interesting conclusion based on the results of field observations was the identification of local migratory routes of waterbirds (gulls, ducks, see Excel tables), most likely between the Shu river and Balkhash lake (judging by the direction of flight). There are at least two flyways affecting two project sites at once (western part), and one flying route affecting the central part of the southern site (Fig. 16). At the same time, flying over the southern site, and taking into account the more “sharp” mountainous terrain, the birds flew low (up to 30 m), and they flew over the northern site mainly at a significant height (70-100 m). Taking into account the number of migratory birds, their density and species composition, it is quite possible to assume that these routes are active for most of the nesting and, possibly, the migration period. In any case, this possibility should be taken into account in the future.

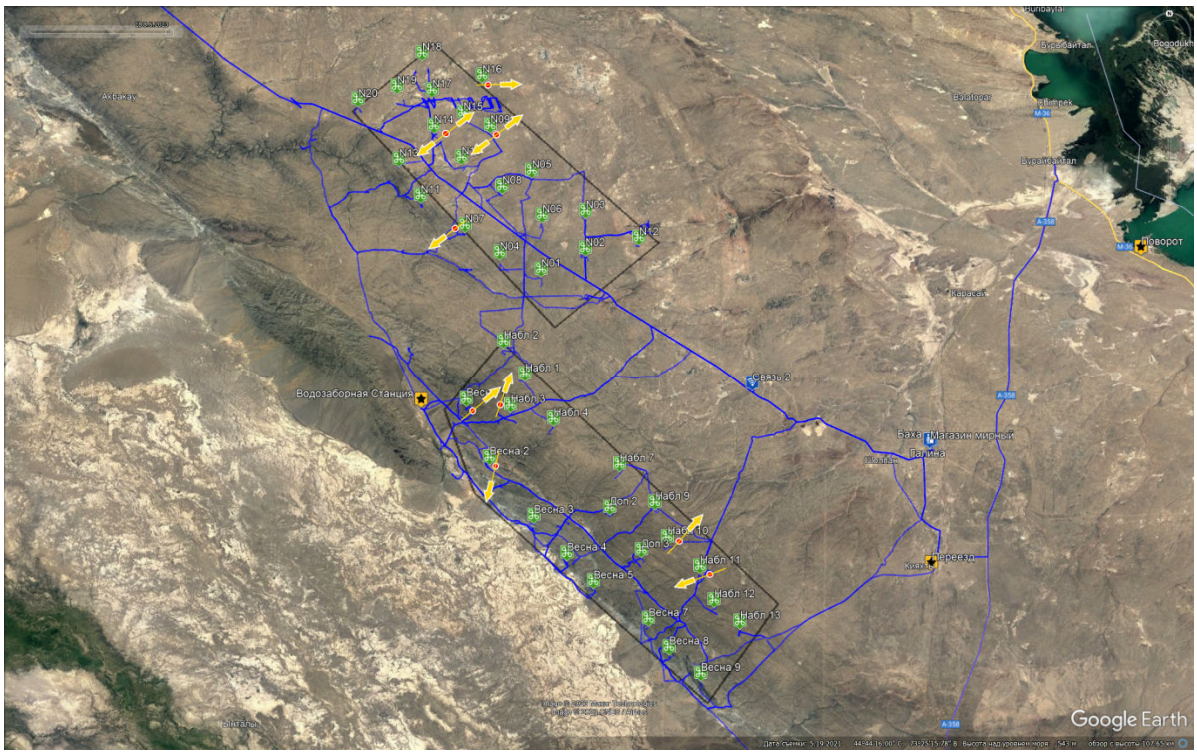


Fig. 16. Local movements of waterbirds ( )

2.3 Autumn: September – November 2023

Scope and some peculiarities of the work

Field surveys were done during 3 periods, in September, October and November, to cover autumn migration period as much as possible. Field survey work was carried out in the project area adjacent to the route Mirny - Akbakai village (partially the territory of the Zhusandala State Nature Reserved Zone, Andasai State Nature Sanctuary (Fig. 17), i.e. in the same areas as in previous months.

Work in September was carried out jointly with a group responsible for collecting information on the distribution of bats and installing camera traps in the project area.

As in the summer period, autumn stationary observations were carried out at 40 points of two project sites considered for the installation of wind turbines (Fig. 2, 3).

Due to the decrease in daylight hours in the autumn, the time frame for stationary surveys compared to surveys in the summer period has been changed: September observations took place according to the summer "scheme" (06.30 -12.30; 13.30-19.30); October observations up to the third quarter of October took place according to a 9-hour pattern (08.00-13.00; 14.00-18.00); surveys at the end of October and November surveys occupied a 3-4 hour period of the day (on average 12.00-16.00).

Route observations were carried out during movements between stationary observation points. The results of field research are presented in Excel tables in Annex 1 and 2.

Below, there are some comments and observations.

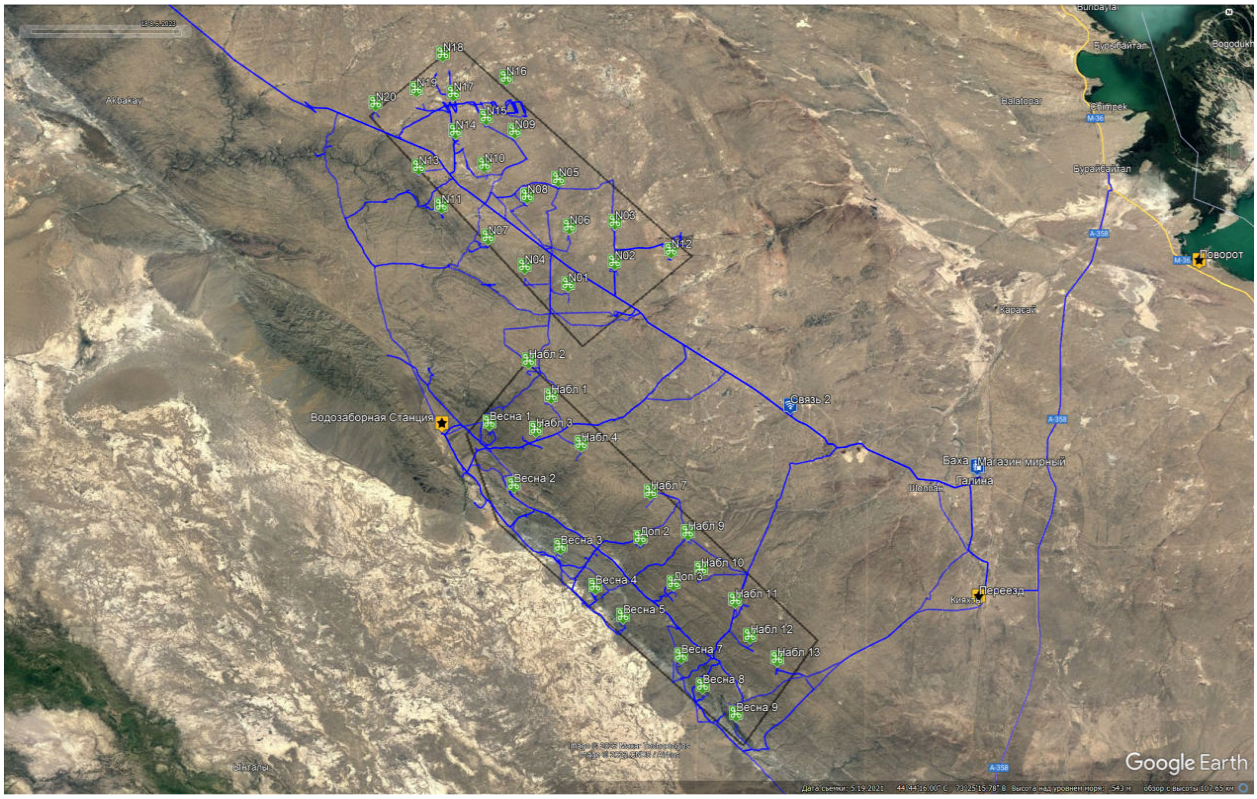


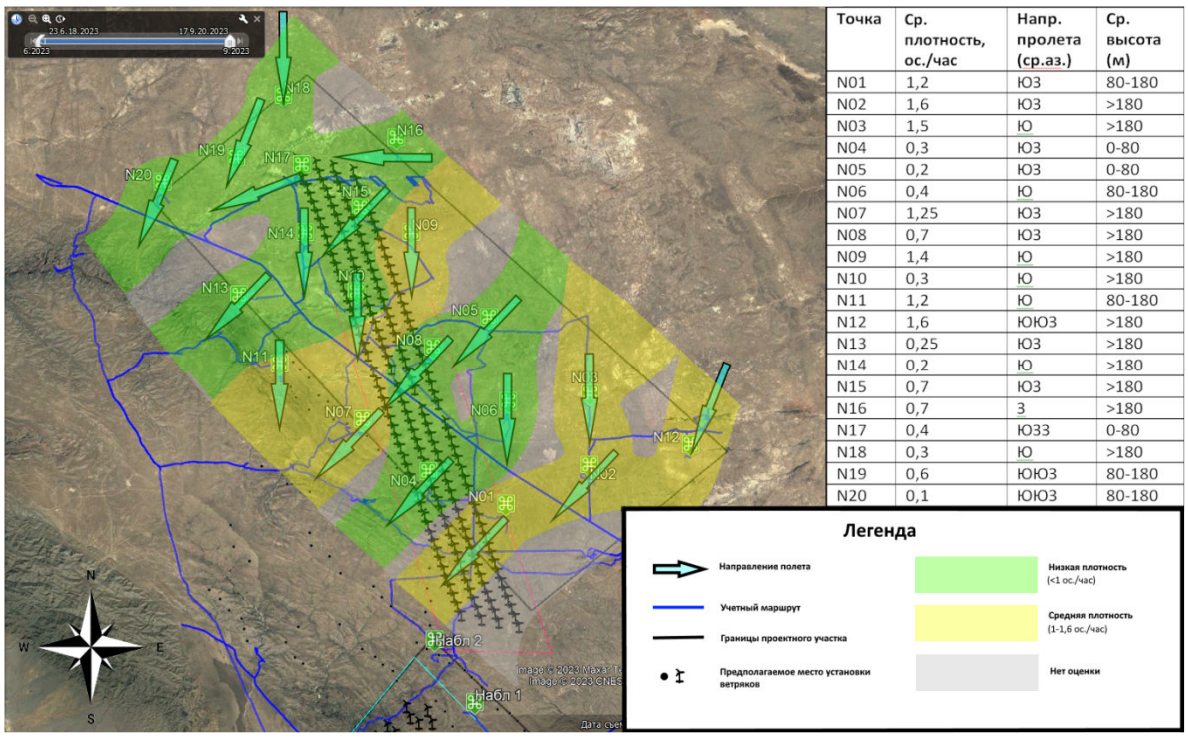
Fig. 17. Map of the project area with the route of the survey

Species composition of raptors

In addition to the raptor species already recorded earlier during the nesting (summer) period (long-legged buzzard *Buteo rufinus*; golden eagle *Aquila chrysaetos*; common kestrel *Falco tinnunculus*), the species list of birds recorded during the autumn migration period, as expected, turned out to be much wider. To a large extent the passage of a number of birds of the *Accipitridae* family was observed - the steppe eagle *Aquila nipalensis*, short-toed eagle *Circaetus gallicus*, harriers (pallid harrier *Circus macrourus*, hen harrier *Circus cyaneus*, Montagu's harrier *Circus pygargus*), black kite *Milvus migrans*, white-tailed eagle *Haliaeetus albicilla*, common buzzard *Buteo buteo*; and a number of birds of the *Falconidae* family - merlin *Falco columbarius*, hobby *Falco subbuteo*, saker falcon *Falco cherrug*. Scavengers were observed sporadically - griffon vulture *Gyps fulvus* and black vulture *Aegypius monachus*.

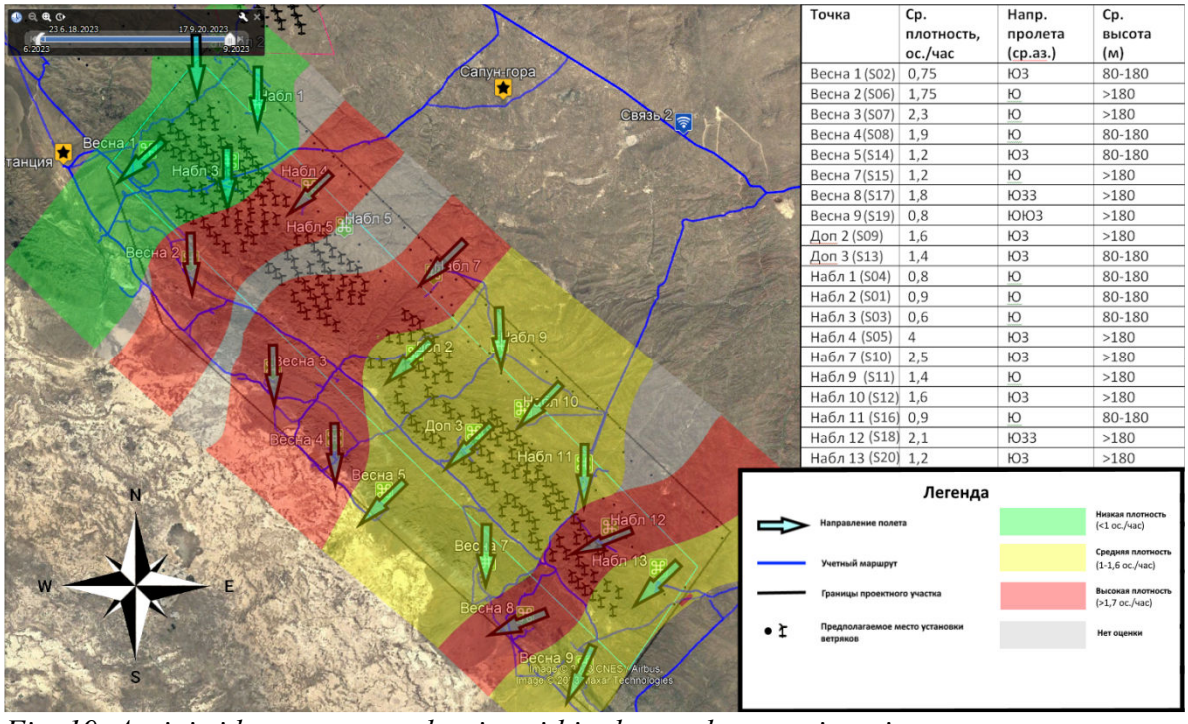
Density

The initially processed data allows one to judge, to some extent, the density of movement of migratory raptors in certain ranges of distances and altitudes. For example, in terms of the number of *Accipitridae* seen per hour, one can estimate the average flight load of the northern and southern project areas (Fig. 18, 19).



Точка	Ср. плотность, ос./час	Напр. пролета (ср.аз.)	Ср. высота (м)
N01	1,2	ЮЗ	80-180
N02	1,6	ЮЗ	>180
N03	1,5	Ю	>180
N04	0,3	ЮЗ	0-80
N05	0,2	ЮЗ	0-80
N06	0,4	Ю	80-180
N07	1,25	ЮЗ	>180
N08	0,7	ЮЗ	>180
N09	1,4	Ю	>180
N10	0,3	Ю	>180
N11	1,2	Ю	80-180
N12	1,6	ЮЮЗ	>180
N13	0,25	ЮЗ	>180
N14	0,2	Ю	>180
N15	0,7	ЮЗ	>180
N16	0,7	З	>180
N17	0,4	ЮЗЗ	0-80
N18	0,3	Ю	>180
N19	0,6	ЮЮЗ	80-180
N20	0,1	ЮЮЗ	80-180

Fig. 18. Density of Accipitridae movement within the northern project site



Точка	Ср. плотность, ос./час	Напр. пролета (ср.аз.)	Ср. высота (м)
Весна 1 (S02)	0,75	ЮЗ	80-180
Весна 2 (S06)	1,75	Ю	>180
Весна 3 (S07)	2,3	Ю	>180
Весна 4 (S08)	1,9	Ю	80-180
Весна 5 (S14)	1,2	ЮЗ	80-180
Весна 7 (S15)	1,2	Ю	>180
Весна 8 (S17)	1,8	ЮЗЗ	>180
Весна 9 (S19)	0,8	ЮЮЗ	>180
Доп 2 (S09)	1,6	ЮЗ	>180
Доп 3 (S13)	1,4	ЮЗ	80-180
Набл 1 (S04)	0,8	Ю	80-180
Набл 2 (S01)	0,9	Ю	80-180
Набл 3 (S03)	0,6	Ю	80-180
Набл 4 (S05)	4	ЮЗ	>180
Набл 7 (S10)	2,5	ЮЗ	>180
Набл 9 (S11)	1,4	Ю	>180
Набл 10 (S12)	1,6	ЮЗ	>180
Набл 11 (S16)	0,9	Ю	80-180
Набл 12 (S18)	2,1	ЮЗЗ	>180
Набл 13 (S20)	1,2	ЮЗ	>180

Fig. 19. Accipitridae movement density within the southern project site

As you can see, the flight load of the surveyed areas of the northern project site is on average two times lower than the flight load on the territory of the southern project site (0.745 ind./hour and 1.5375 ind./hour, respectively). On the territory of the northern project site, there are two passage branches 6-8 kilometers wide with an average passage density (1-1.6 individuals/hour), which in particular cases (according to the recorded directions of flight of individuals) one way or another lead to southwest. There are also two flight corridors of low flight density (<1 ind./hour) with a southwest direction. On the territory of the southern project site, there

are 2 high-density flight corridors (>1.7 ind./hour) with a south-southwest direction, in addition to two medium-density flight corridors (SW) and one low-density flight corridor (S).

Several versions of the explanation for the higher concentration of *Accipitridae* during the autumn migration period on the territory of the southern project site are being considered. It is especially necessary to highlight two factors that are closely related to each other - the features of the topography of the southern project site, which forces migratory predators to concentrate in certain distance latitudes and change the height of flight, as well as the presence of a significant supply of food resources closer to the lowland of the river Chu, which are identified by field observations and recorded. It is worth noting that for a reasonable selection of areas for installing wind turbines, according to the methodology, an assessment of the density of passage is not enough - an analysis of modeling data of possible collisions of birds during migration is necessary.

During the autumn period of stationary census of migratory birds, no local movements of wetland birds were observed, unlike those in the summer.

As during summer stationary surveys, the observations of large mammals - goitered gazelle (*Gazella subgutturosa*) and argali (*Ovis ammon*) - were repeatedly recorded. In general, the observations were recorded within pre-existing distribution boundaries.

Lists of species of birds recorded at the vantage points in the autumn as well as results of counts from vantage points in September-November are provided in separate Excel-files.

2.4 Winter: December 2023 – February 2024

Scope and peculiarities of work

It was decided to carry out the winter field surveys of the project area in several stages (three), in order to ensure more or less uniform seasonal coverage and get the general picture of winter situation. Short winter trips were done in December, January, February (table 2).

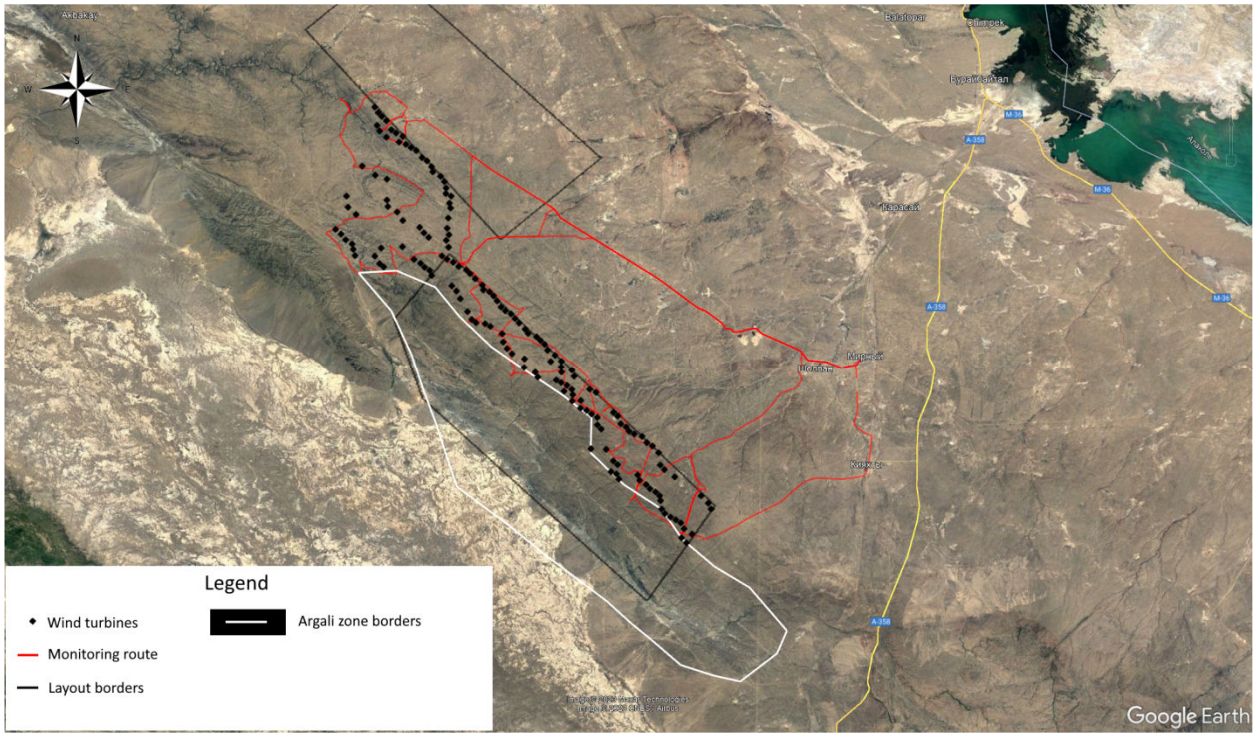


Fig. 20. Map and routes of project sites, December

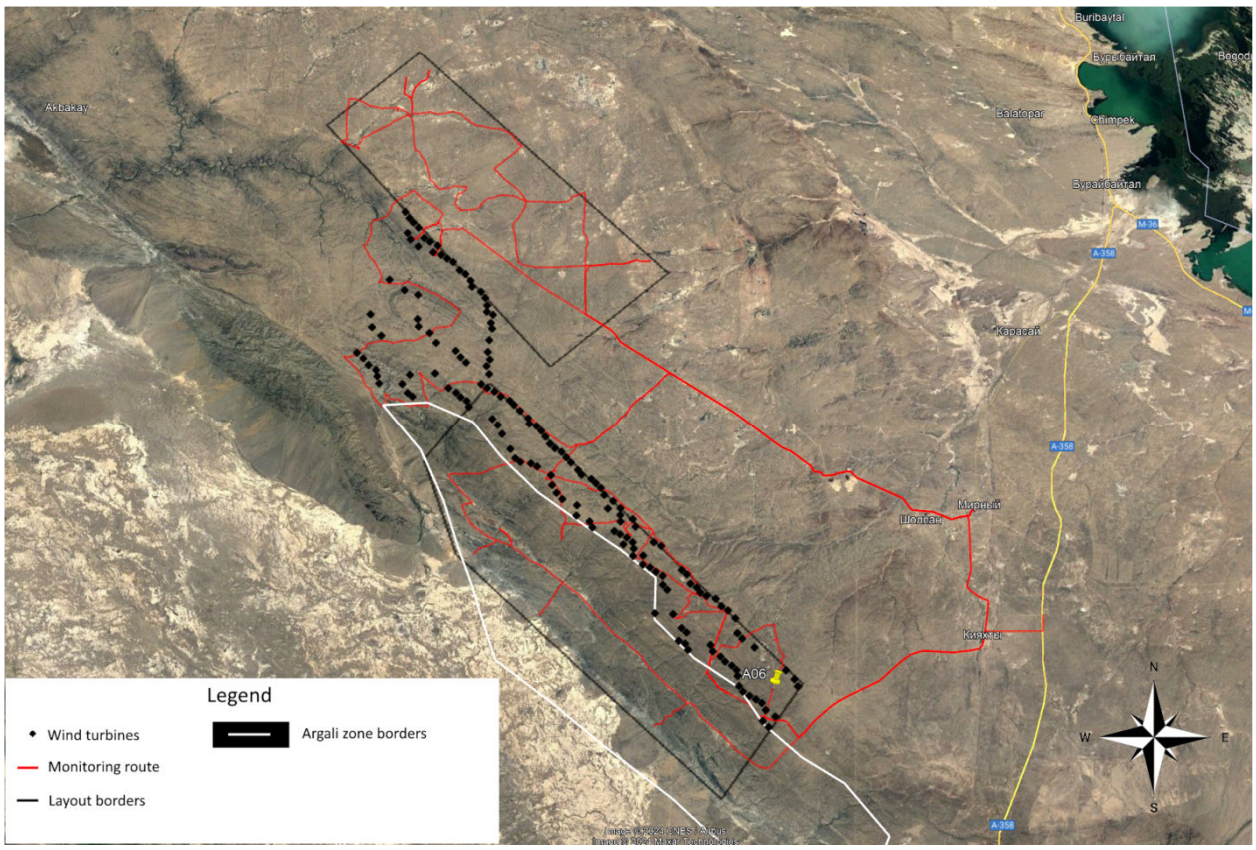


Fig. 21. Map and routes of project sites, January

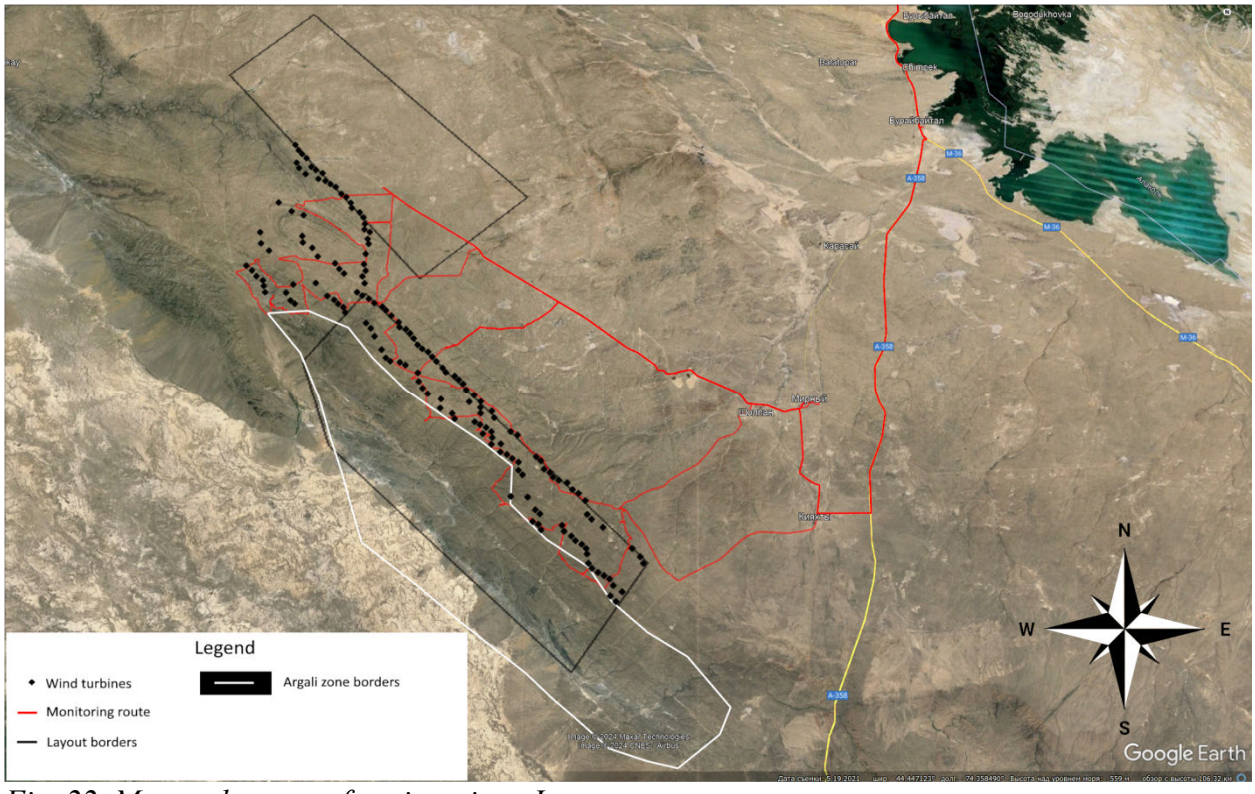


Fig. 22. Map and routes of project sites, January

Field research was carried out taking into account the proposed autumn adjustment of the location of wind turbines, with routes both on the previous and new proposed sites (Fig. 20, 21, 22).

Observations in winter, in the absence of bird migrations and their sharply depleted fauna, were carried out according to a different pattern than in other seasons of the year. Observations with vantage points did not make sense, so they did not exist. The main objective of the work was only to clarify the general situation with the bird population at this time of year, collect information on wintering rare species, as well as simultaneously collect data on mammals.

Monitoring work **in December** was carried out for three days, from 9.00 to 17.00. In total, before the trip, 23 points were identified for walking transect surveys, and they were worked out; the rest of the territory was covered by route observations. Each walking transects took an average of 15 minutes (2 people participated), covering a distance of 400-600 m.

Monitoring work **in January** was carried out for four days, from 9.00 to 17.00. A total of 40 points (23 of December and 17 additional) were identified for walking transect surveys, and they were worked out; the rest of the territory was covered by route observations. Each transect took an average of 15 minutes (2 people participated), covering a distance of 400-600 m. In addition, vehicle surveys were carried out for the northern site, and for the southern part of the southern site (the so-called "argali zone").

Thanks to the presence of snow, traces of mammals and some birds were clearly visible and recorded. In addition, information was collected from workers, farmers, etc. encountered.

Monitoring work **in February** was carried out for four days, from 9.00 to 17.00. A total of 27 points were identified for walking transect surveys, they were worked out, the rest of the territory was covered by route observations. The decrease in the number of walking transects in February was due to weather conditions (there was not snow cover everywhere to search for animal tracks). As compensation, the length of vehicle surveys was increased. In addition, due to a car breakdown (a broken winter tire), it was decided not to visit the impassable northern site and the southern part of the southern site for safety reasons. Each transect took an average of 10 minutes (3 people participated), covering a distance of 300-500 m. In addition, vehicle surveys were carried out for the northern site and the southern part of the southern site (the so-called "argali zone").

The full results of the field research are given in the Excel table in Annex.

Brief describing of the results

December

Almost throughout the entire survey route, footprints of tolai hare (*Lepus tolai*) were observed, both along the road track and on transects. The second most common were fox footprints (*Vulpes vulpes*). Traces of small rodents (*Rodentia.; Microtus arvalis*) were occasionally encountered. Traces of unidentified mustelids (*Mustelidae*), canids (*Canidae*), and wild boar (*Sus scrofa*) were found sporadically. Drillers working during the period of route observations on the ground observed **goitered gazelles** (*Gazella subgutturosa*, transect T13). It was not possible to confirm this by checking the presence of footprints, since there was no snow cover at the observation site. But, most likely, there really was an observation, because in the summer goitered gazelles were also seen near this territory, and in December good forage supply remained.

When performing three transect surveys, there were traces of **argali** (*Ovis ammon*; T04, T21, T22, Fig. 3), judging by the footprints - in the number of individuals from two to four on each transect. It can be assumed that on transects T04, T21 and T22, argali move widely throughout the territory - there were many traces and there are some rocky massifs there.

Wintering grounds of **golden eagle** (*Aquila chrysaetos*), long-legged buzzard (*Buteo rufinus*), and short-eared owl (*Asio flammeus*) were confirmed. A falcon (*Falco sp.*) was spotted, but the species could not be identified due to weather conditions. A flock of chukars was seen towards the southern end of the southern platform. Of the passerines, only a few species of larks

(*Melanocorypha yeltoniensis, Melanocorypha leucoptera, Melanocorypha calandra, Alaudidae*) were observed, with a predominance of the calandra lark (*Melanocorypha calandra*).

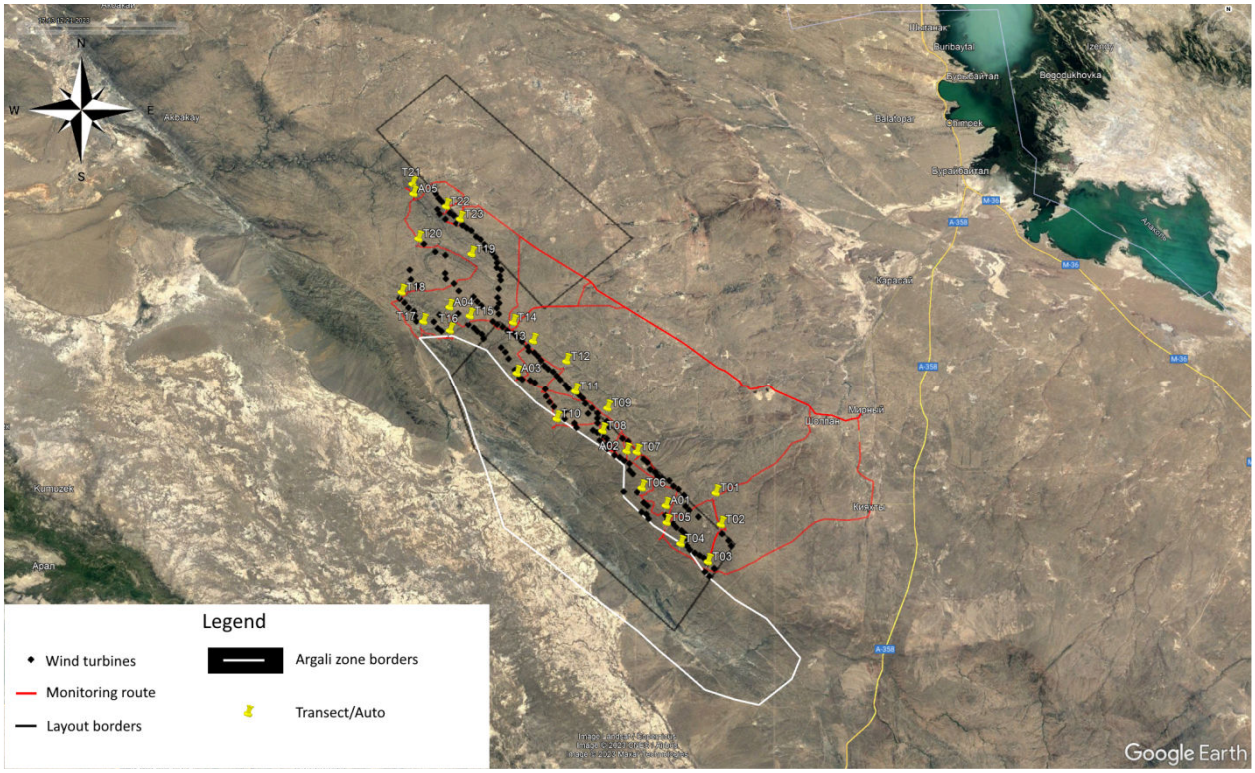


Fig. 23. Location of transect and automobile routes, December

January

As in December, during the January surveys, footprints of tolai hare (*Lepus tolai*) were seen throughout the route surveys, both along the road track and on transects. 5 individuals were visually observed. The second most common were fox footprints (*Vulpes vulpes*). 6 individuals were visually observed. Traces of small rodents (*Rodentia; Microtus arvalis*) were quite common. Traces of unidentified mustelids (*Mustelidae*), canids (*Canidae*) and wild boar (*Sus scrofa*) were encountered several times.

During the January surveys, **goitered gazelles** (*Gazella subgutturosa*, transect T29, 2 individuals) were visually observed, and numerous footprints were found (T02, about 9 individuals).

When carrying out transect and vehicle surveys, traces of **argali** (*Ovis ammon*, A01-A03, T17, T22, T23; Fig. 3) were encountered, judging by the footprints - in the number of individuals from two to six to seven on each transect. Two individuals were observed visually on transect T16. On transects T22-T23, argali, apparently, regularly and widely move throughout the territory - there were many footprints. It might make sense to discuss expanding the safe zone for argali.

The wintering grounds of the **golden eagle** (*Aquila chrysaetos*) and the rough-legged buzzard (*Buteo rufinus*) were confirmed. A flock of chukars (A04) was seen on the southern part of the southern platform. Of the passerines, as in December, only a few species of larks (*Melanocorypha yeltoniensis, Melanocorypha leucoptera, Melanocorypha calandra, Alaudidae*) were observed, with a predominance of the calandra lark (*Melanocorypha calandra*).

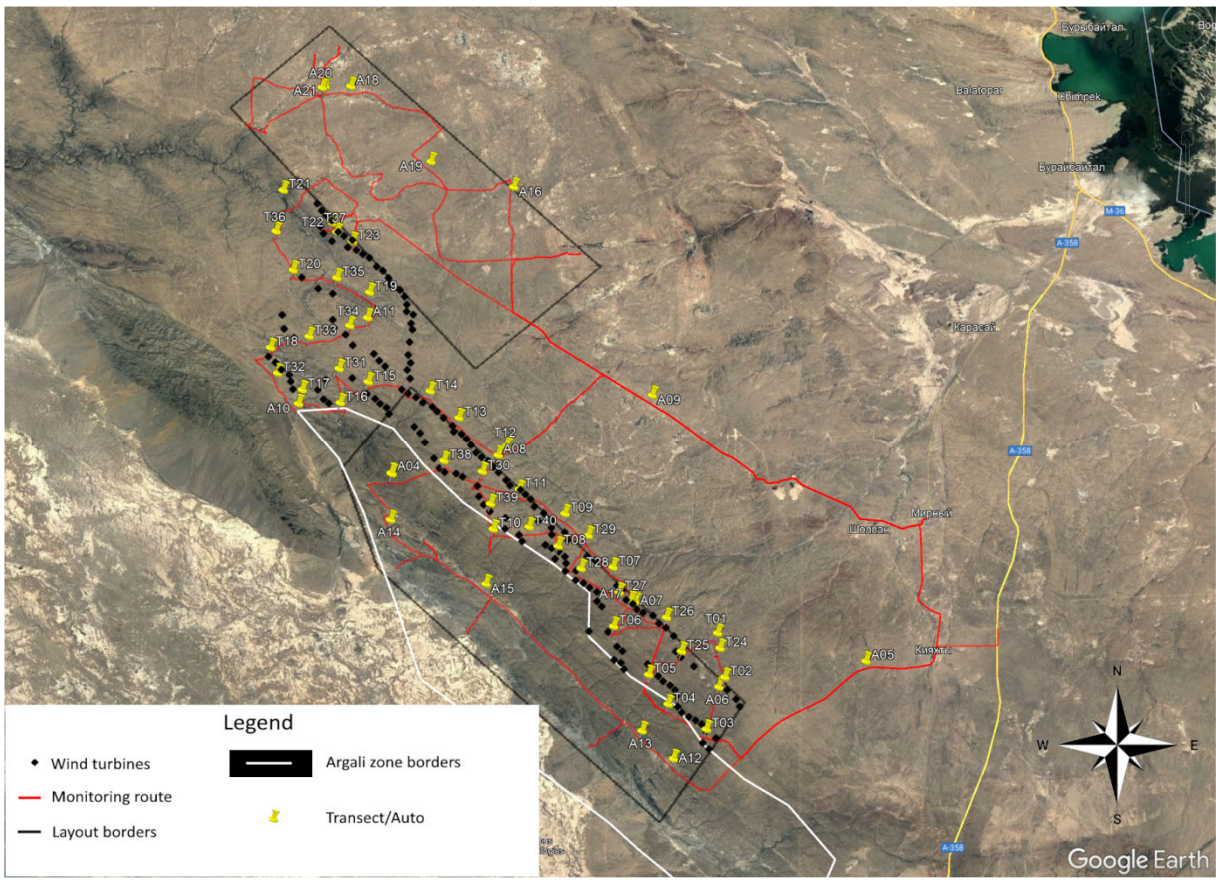


Fig. 24. Location of transect and automobile routes, January

February

As before, during the February surveys, tracks of a hare (*Lepus tolai*) were seen throughout the route surveys, both along the road track and on transects. 2 individuals were visually observed. The second most common were fox tracks (*Vulpes vulpes*). 3 individuals were visually observed. Traces and burrows of small rodents (*Rodentia sp.; Microtus arvalis, Ellobius talpinus*) were relatively common. Great gerbils (*Rhombomys opimus*), 5 individuals, were observed twice by direct observation. Large tracks of canids (*Canidae*) were encountered several times.

When carrying out transect and vehicle surveys, traces of **argali** (*Ovis ammon*, A03, A13, A16, T04, T09, T16, T34) were repeatedly encountered, judging by the tracks - in the number of individuals from two to six to seven on each transect. Four individuals were observed visually at observation point A13.

The wintering of **golden eagles** (*Aquila chrysaetos*) and rough-legged buzzard (Buteo lagopus) were again confirmed. In addition, there seemed to be a trend towards the beginning of spring migration - in comparison with the rest of the winter period, a large number of buzzards (*Buteo rufinus*) were observed; and the white-tailed eagle (*Haliaeetus albicilla*), which does not winter in the study area, was observed twice. At points T31, A10 and A14, 3 flocks of chukars were seen. At point A22, seven Pallas's sandgrouse (*Syrrhaptes paradoxus*) were seen, which may also symbolize the beginning of spring migrations. Of the passerines, as before, wintering species of larks (*Melanocorypha yeltoniensis, Melanocorypha leucoptera, Melanocorypha calandra, Eremophila alpestris*) were observed, with a predominance of the calandra lark (*Melanocorypha calandra*). There were a few rare sightings of redpoll (*Acanthis flammea*), twite (*Linaria flavirostris*), Turkestan tit (*Parus bokharensis*), little owl (*Athene noctua*) - although in general the presence of these species at this time of year is quite common.

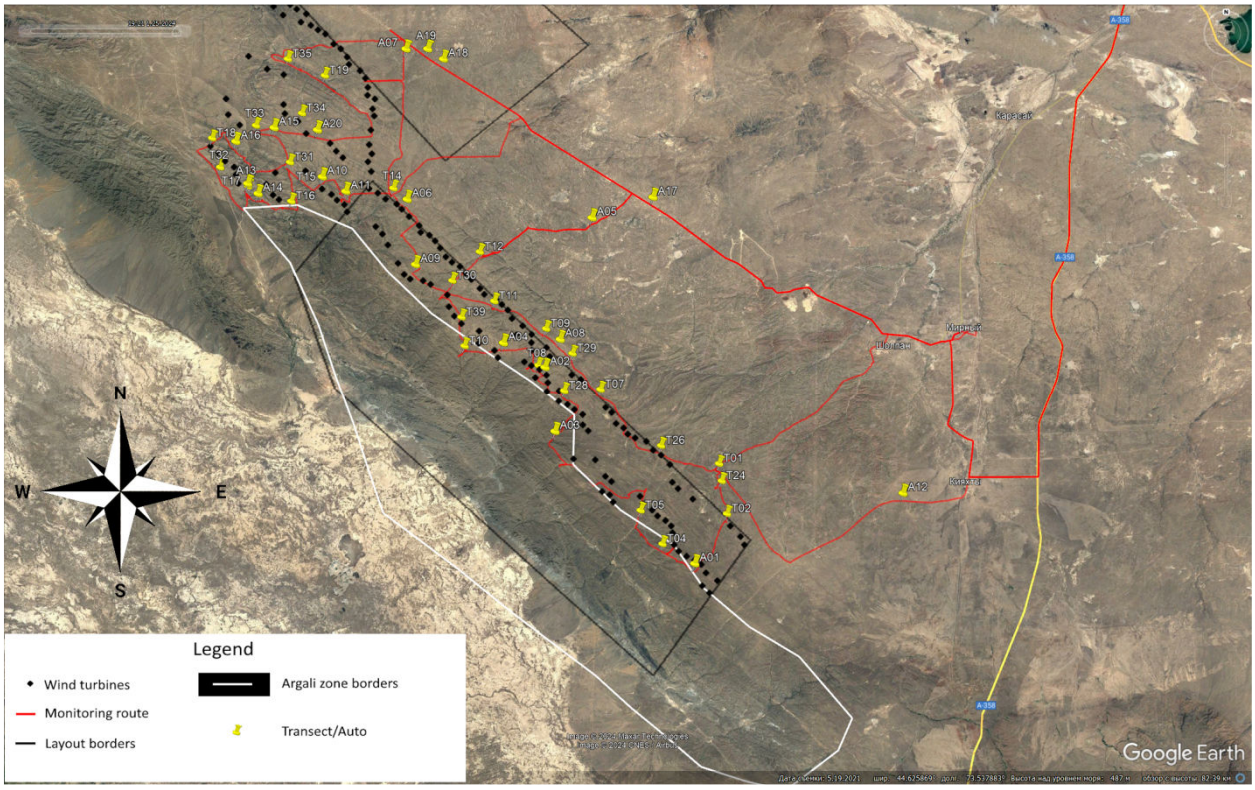


Fig. 25. Location of transect and automobile routes, January

Brief conclusion

The winter bird population of the site, due to its lack of food and shelter at this time of year, is very poor. During two trips, only 9 species were recorded. These are three species of birds of prey, chukar, gray partridge, little owl and larks. Of the rare species, only the **golden eagle** was found.

At the end of February, the number of species increases due to the beginning of the movement of birds to breeding areas - 14 species have already been noted, including the **Pallas's sandgrouse**, the **white-tailed eagle**, and the **golden eagle**, which are listed in the Red Data Book of the Republic of Kazakhstan.

Regular movements in any directions or migrations were not noted; all of these are birds wintering in the region, making local feeding movements depending on the weather and the availability of food.

In February, migrations as such – that is, directed flight – have not yet been observed.

2.5 Spring: March – May 2024

Scope and peculiarities of work

The work was carried out in three stages (Table 2), from the beginning of the active spring migration to its end. It was completed on May 6; by this time, the migration of key groups in the south of Kazakhstan - birds of prey, bustards, cranes, etc. - ends, and only a few late-arriving passerines continue to fly in small numbers.

From April 13 to May 6, two groups of counters worked simultaneously.

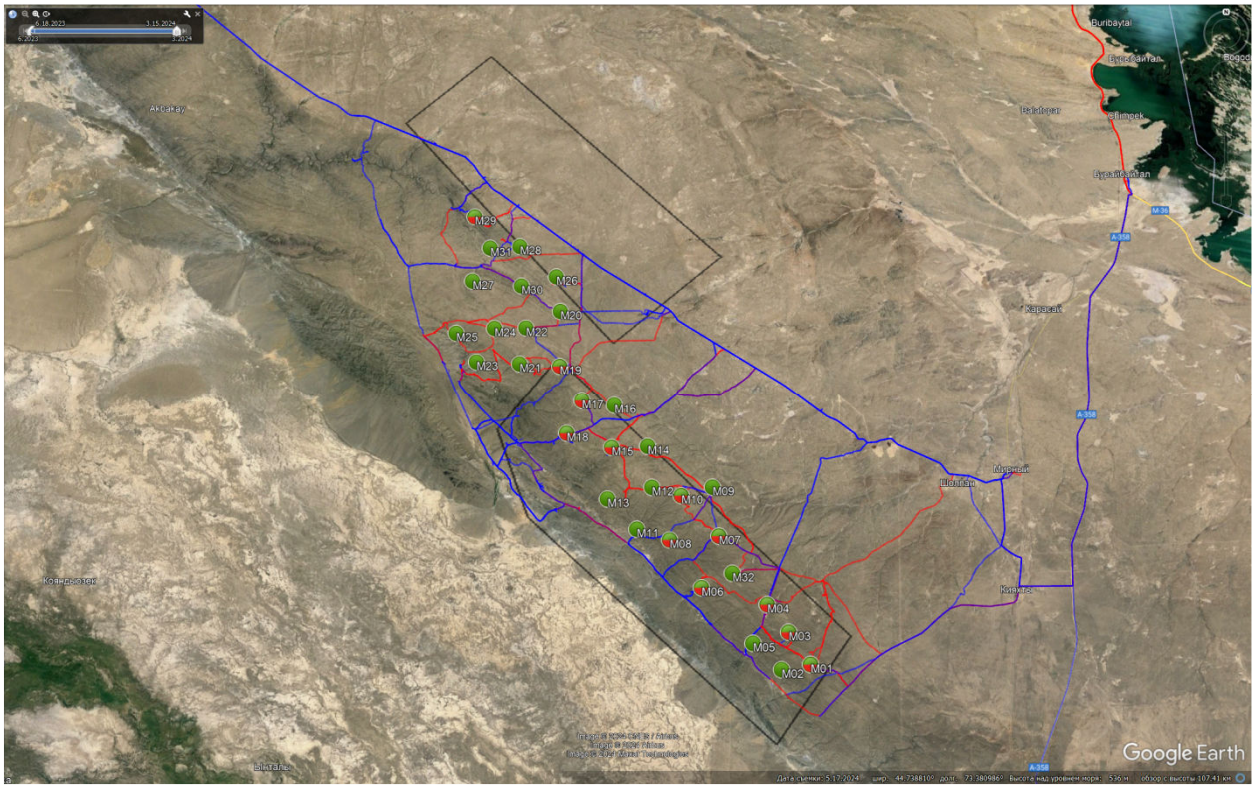


Fig. 26. Map of project sites

The survey area and vantage points were established in accordance with the new wind station layout proposed for autumn 2023. The vantage points partially overlapped with the previously existing points of the southern site (Fig. 3). Accordingly, the spring stationary observations of 2024 were carried out at 32 points. Due to the gradual increase in daylight hours in the spring, March observations took place on average from 09.00-10.00 to 16.00-17.00; April observations from 07.00-08.00 to 17.00-18.00, May observations from 06.00-07.00 to 18.00-19.00. Route observations were carried out during movements between stationary observation points.

The results of the field studies are presented in Excel tables.

Species composition of birds of prey

In addition to nesting species (long-legged buzzard *Buteo rufinus*, golden eagle *Aquila chrysaetos*, common kestrel *Falco tinnunculus*), a fairly active flight of a number of migratory birds of prey was observed - steppe eagle (*Aquila nipalensis*), short-toed eagle (*Circaetus gallicus*), harriers - pallid (*Circus macrourus*), hen (*Circus cyaneus*), Montagu's (*Circus pygargus*), marsh (*Circus aeruginosus*), as well as black kite (*Milvus migrans*), white-tailed eagle (*Haliaeetus albicilla*), common buzzard (*Buteo buteo*), sparrowhawk (*Accipiter nisus*), hobby (*Falco subbuteo*), saker falcon (*Falco cherrug*). Scavengers were noted singly - griffon vulture (*Gyps fulvus*) and black vulture (*Aegypius monachus*), honey buzzards - common (*Pernis apivorus*) and crested (*Pernis apivorus*), osprey (*Pandion haliaetus*), imperial eagle (*Aquila heliaca*).

Density of migration of birds of prey

The processed data allow us to judge to some extent the density of migration of migratory predators in certain ranges of distances and heights. For example, by recalculating the number of individuals of the Falconiformes order seen per hour and per km2, we can estimate the average migration load of the studied territory (Table 7; Fig. 27, 28).

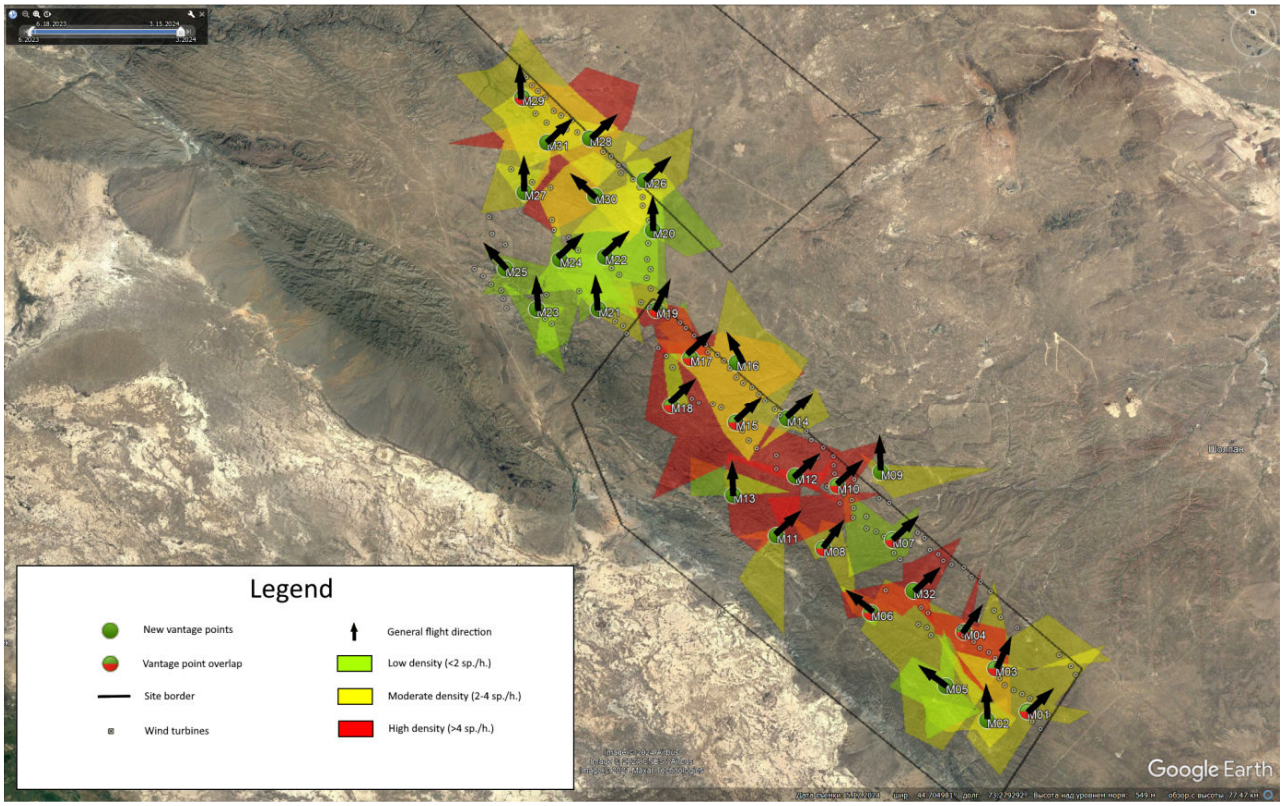


Fig. 27. Flight density by indicator ind./hour

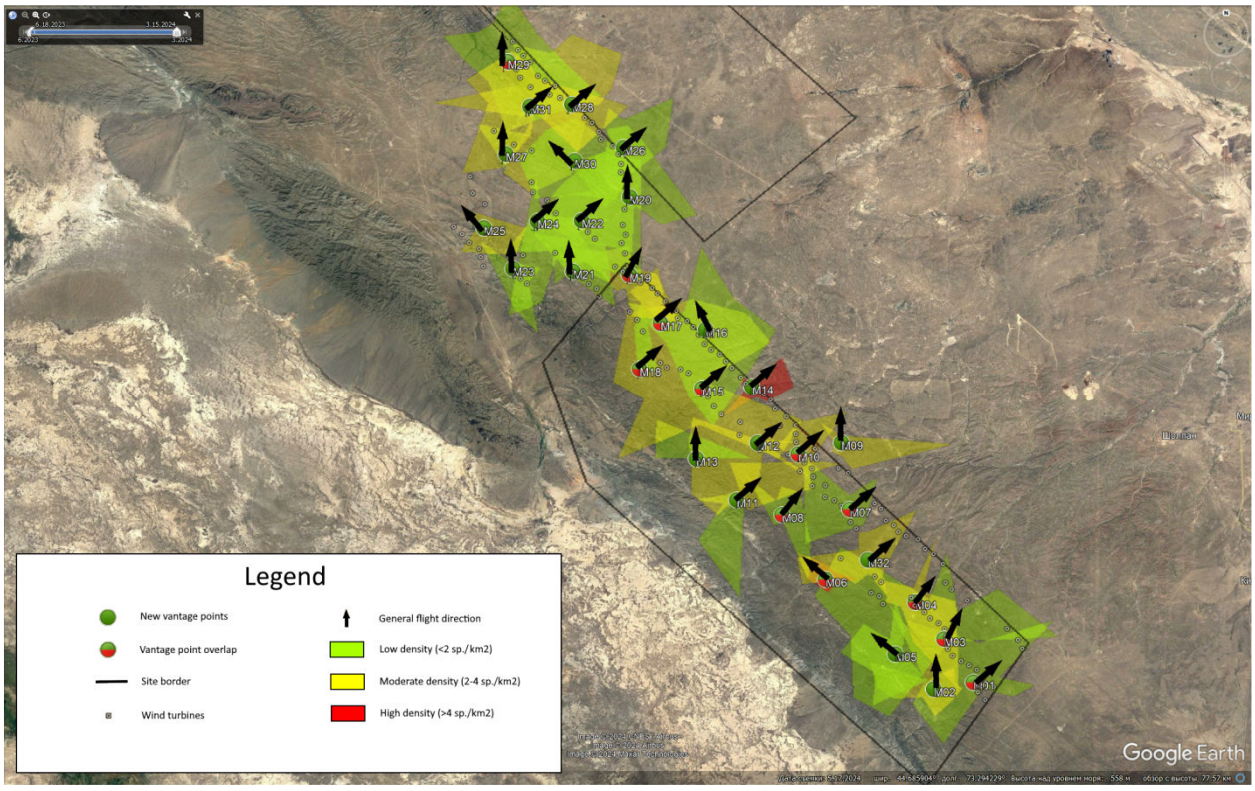


Fig. 28. Flight density by indicator ind./km^2

Table 7. Density of flying birds of prey by various indicators (ind./hour, ind./km2)

Number of VP	Total number of counted birds, ind.	Main flight direction	Number of birds in an hour	Observation area, km^2	Number of birds for 1 km^2
M01	31	NE	2,6	38,5	0,8
M02	42	N	3,5	16,02	2,6
M03	47	NNE	3,9	84,83	0,6
M04	65	NE-NNE	5,4	21,39	3,0
M05	23	NW	1,9	17,96	1,3
M06	18	NW	1,5	4,54	4,0
M07	10	NE	0,8	17,92	0,6
M08	24	NE-NNE	2,0	12,63	1.9
M09	24	N	2,0	11,16	2,2
M10	63	NE	5,3	23,46	2,7
M11	24	NE	2,0	14,42	1,7
M12	55	NE	4,6	26,66	2,1
M13	4	N	0,3	9,63	0,4
M14	30	NE	3	7,1	4,2
M15	51	NE	4,3	25,44	2,0
M16	25	NW	2,1	52,59	0,5
M17	18	NE	1,5	5,58	3,2
M18	9	NE	0,8	4,86	1,9
M19	49	NE-NNE	4,1	16,96	2,9
M20	23	N	1,9	45,23	0,5
M21	25	N	2,1	13,14	1,9
M22	17	NE	1,4	54,53	0,3
M23	18	N	1,5	9,31	1,9
M24	21	NE	1,8	26,53	0,8
M25	22	NW	1,8	9,29	2,4
M26	45	NE	3,8	24,80	1,8
M27	4	N	0,3	4,66	0,9
M28	88	NE	7,3	36,66	2,4
M29	33	N	2,8	46,54	0,7
M30	27	NW	2,3	32,00	0,8
M31	32	NE	2,7	16,57	2.0
M32	54	NE	4,5	19,06	2,8

The observation area is the area of the polygon, the corner points of which are the most distant azimuths of the encountered birds from the observation point. As can be seen, the figures highlight certain ranges of points and polygons, where, in general, an average (2-4 ind./hour; 2-4 ind./km^2) and high (>4 ind./hour; >4 ind./km^2) density of migratory raptors was observed (range M01-M01, M32; range M10-M19; range M27-M31), thus forming wide migration corridors. The ranges of points and polygons with a low (<2 ind./hour; <2 ind./km^2) density of migratory raptors (range M07-M08; range M21-M25) are also highlighted, which may represent gaps between the main migration corridors, the ranges of which are indicated above. The main direction of flight can be considered the northeast - it is dominant (59%). The average range of heights of migratory birds is 20-200 m above the ground.

For a reasonable approval of territories for the installation of wind turbines and recommendations for measures to mitigate the impact, according to the methodology, it is not enough to only assess the density of the flight - it is necessary to analyze the data of modeling possible collisions of birds during the flight.

Species composition of waterbirds

During spring stationary observations, migration as such was noted for pelicans (white pelican *Pelecanus onocrotalus* and dalmatian *Pelecanus crispus*), whooper swan (*Cygnus cygnus*), black-headed gull (*Chroicocephalus ridibundus*), caspian tern (*Hydroprogne caspia*), ruddy shelduck (*Tadorna ferruginea*), common merganser (*Mergus merganser*), great egret (*Ardea alba*), and caspian gull (*Larus cachinnans*). In addition, local movements of waterbirds were noted, mainly movements of terns - gull-billed tern (*Gelochelidon nilotica*) and common tern (*Sterna hirundo*). The main direction of flight can be considered to be the northeast, and for local movements - the northeast and southwest, which corresponds to the geographical location of large wetlands - Lake Balkhash and the Chu River valley. The average range of flight altitudes for pelicans, ducks and herons is from 100 m to 1 km; gulls and terns - up to 100 m above the ground.

Other birds and mammals

Among other interesting bird species recorded during spring work are the demoiselle crane (*Anthropoides virgo*), houbara bustard (*Chlamydotis macqueenii*), desert raven (*Corvus ruficollis*), black-tailed godwit (*Limosa limosa*), black-winged pratincole (*Glareola nordmanni*), little owl (*Athene noctua*).

A wolf (Canis lupus) was seen. During previous trips, the wolf was not visually observed, but tracks and a voice were noted. As during other seasonal stationary surveys, encounters with large mammals were repeatedly recorded - goitered gazelle (Gazella subgutturosa) and argali (Ovis ammon). In general, encounters were recorded within the existing distribution boundaries.

2.6 Brief conclusion on birds

In the area of research and proposed placement of wind turbines, the habitation or passage of a number of rare species of various bird groups, as well as fairly active passage of common and widespread species, have been confirmed.

The main habitat of rare species of birds of prey (golden eagle, saker falcon) is the southern site, from most of which the planned wind turbines have been removed based on the results of spring and summer 2023; an important habitat of argali is also located there.

In the spring of 2024, observations were already carried out taking into account the changed arrangement of wind stations. Thus, the final location at the time of completion of work under this agreement is not covered by the annual observation cycle.

When continuing the work, which will be necessary because of this, special attention should be paid to the identified areas with an increased density of migratory birds, as well as to areas where regular local movements of waterbirds occur in summer. Obviously, this will require equipping wind turbines with bird proximity detectors to temporarily stop them, special painting of wind turbine blades and other standard measures recommended in such cases.

Obviously, the greatest impact - apart from the risk of collisions with wind turbines, which should be assessed - will be on nesting birds, especially sensitive raptors, during construction, due to a strong local disturbance factor. During operation, the disturbance factor will be relatively low.

Note that specific recommendations for points can be given at the end of the annual cycle of work on the new arrangement of wind turbines, as well as after calculating the risk of collisions for each installation.

3 Study of mammals

3.1 Methods

The following data collection methods were used.

1. Research using camera traps.

Camera traps are automatic cameras equipped with motion and temperature sensors. The cameras are triggered when an animal appears in the sensor's field of view. Two models of Bushnel cameras were used.

Camera traps were installed at 19 points, 14 of them were exposed for almost a full year - from May 2023 to the end of April - May 2024, three - from May to September 2023 and two - from September 2023 to May 2024. Camera placement points represented several of the most characteristic and typical habitats for the project area: (a) slopes and ridges of small hills with rock outcrops and rock ruins, bearing petrophyte-desert vegetation; (b) leveled, gently undulating watersheds covered by zonal black-fawn and grey-wormwood communities of northern deserts, usually with outcrops of flat granite slabs associated with the only available temporary watering holes (which is important for identifying mammals); (c) valley saxaul forests, within which both saxaul forests of the tugai type were examined along the beds of temporary watercourses, as well as open edges with a zonal desert lower layer (usually sulphur-teresken); (d) valley rock outcrops.

Locations of camera traps (Table 8) are shown in fig. 29.

Table 8. Places of deployment of camera-traps

№	Site_name	Camera	N_grad	N_min	N_sec	E_grad	E_min	E_sec	Date	Height a.s.l., m
1	Mayzharylgan	101	44	27	59,1	73	33	37,1	09.05	507
2	Koyzharylgan-1	8	44	33	53,5	73	27	38,1	09.05	483
3	Koykakty	42	44	35	55,4	73	21	58,1	10.05	458
4	Orynbay	80	44	38	5,1	73	17	34,6	10.05	413
5	Orynbay-togay	47	44	38	11,6	73	17	31	10.05	388
6	Shengeldy	100	44	43	6,3	73	14	51	11.05	501
7	Sarybulaksay	83	44	45	52,8	73	10	12,4	11.05	472
8	Turlubay	72	44	57	6,9	73	1	39,4	11.05	447
9	Akshaysay	65	44	2	7,1	73	10	9,4	12.05	508
10	Sulyukshi	109	44	59	12,5	73	17	33,2	12.05	522

11	Tasbulak	31	44	55	18,2	73	8	33,4	12.05	484
12	Molaly	110	44	50	19,5	73	14	44	13.05	531
13	Karakuduk	12	44	48	39,4	73	24	15	13.05	528
14	Tastapak	106	44	52	50,4	73	29	8	13.05	521
15	Karasay	26	44	40	19,9	73	29	26,5	14.05	480
16	Alatagyl	7	44	44	59,2	73	27	26	14.05	551
17	Bezvodniy	105	44	56	25,4	73	26	3	15.05	527

Basic information about the operation of the cameras necessary for assessing the counting force is given in Table 9.

Table 9. Basic information about the operation of camera traps.

Habitat	Hills with rocks, stony slopes and tops	Gently rolling and flat plains covered with zonal deserts	Dry valley saksaul woodlands	Rocks on valley slopes
Total number of trail cameras	5	3	6	5
Number of trail cameras worked year round (from May 2023 to April-May 2024)	4	3	3	3
Number of trail cameras worked from May 2023 to September 2023 only	1	-	3	-
Number of trail cameras worked from September 2023 to April-May 2024 only	-	-	-	2
Total counting effort, trap-day	1788	1073	1284	1499
Total number of photos taken	14828	13615	147762	11376
Mean number of photos per a camera (rounded to whole numbers)	2966	4538	24627	498

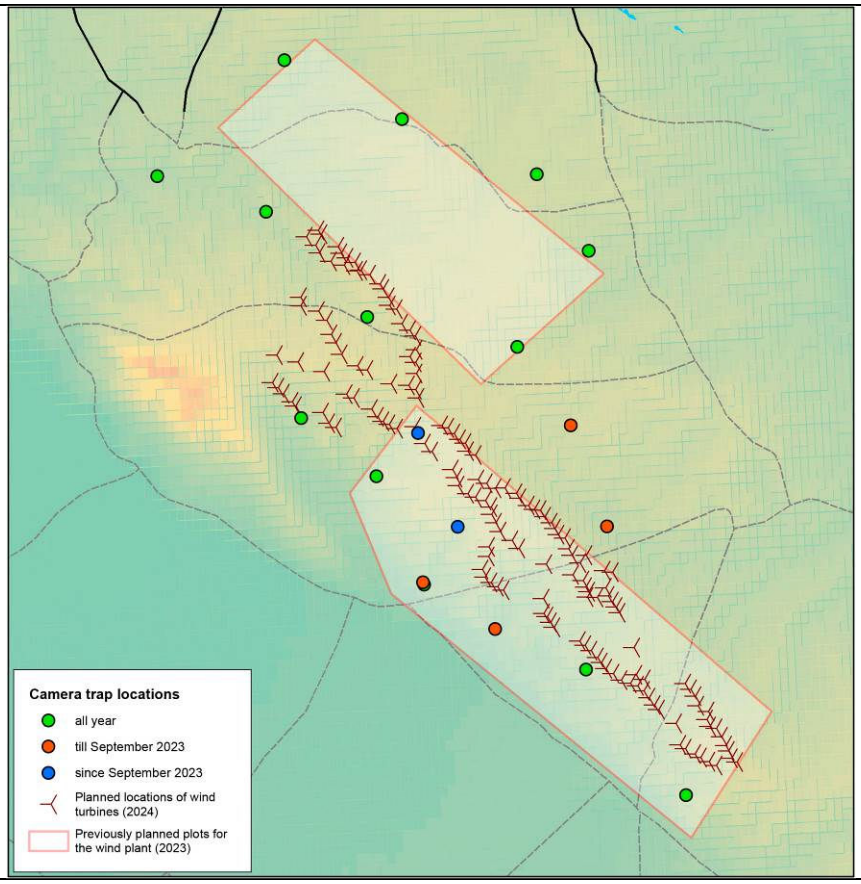


Fig. 29. Camera traps locations on the project area.
Green dots – worked year round, September 2023 till April-May 2024
Red dots – May 2023 till September 2023
Blue dots – September 2023 till April-May 2024

2. Visual observations and acoustic recordings on road routes with regular stops.

In May, June, September 2023 and April-May 2024, day and night (first half of the night, after sunset) automobile routes were carried out throughout the project area. The work was carried out in a 4-WD UAZ-vehicle. The routes were carried out on dirt roads (occasionally also on roads with improved surfaces). The project area has a fairly dense network of such roads, which made it possible to cover it with automobile routes more or less evenly, covering all the main types of habitats. The daily routes were combined with periodic stops for walking surveys, usually combined with the installation and checking of camera traps, the installation and removal of ultrasonic detectors for bat surveys, and other work. Night routes included regular stops every 500 m, during which animal voices were recorded (if available). Night routes were combined with recording of ultrasonic signals from bats (see separate report).

Basic information about road routes is given in Table 10.

Table 10. The road routes summary in May 2023 – May 2024

	May 2023	June 2023	September 2023	April-May 2024
Days working	8		16	22
Total route driven in the	573	1539	1380	2237

project area, kilometers				
– Including total kilometers after sunset	-	285	296	330
Total time on day-time routes, hours				128
Total time on routes after sunset, hours	-	40	38	55

3.2 Results

3.2.1 General

During our work during the year, the presence of 19 species of mammals was confirmed in the project area (Table 11). Of these, 2 species of ungulates are included in the Red Book of the Republic of Kazakhstan and the List of Rare and Endangered Species of Animals of the Republic of Kazakhstan, and one species (great gerbil) is of particular importance for predatory animals and birds as the main food item.

Table 11. Mammals encountered in the project area during the 2023-2024 survey, excluding bats. Characteristics of occurrence: + rare (single occurrences); ++ common on routes and/or recorded in at least 30% of camera traps in this type of habitat; +++ very common along routes and/or recorded in at least 80% of camera traps in this habitat type.

#	Habitat	Hills with rocks, stony slopes and tops	Gently rolling and flat plains covered with zonal deserts	Dry valley saksaul woodlands	Rocks on valley slopes
	Species richness	8	12	13	6
1	Argali – *Ovis ammon karelinii*	+++	-	-	+++
2	Goitered Gazelle – *Gazella gracilicornis (= G. subgutturosa)*	+	+++	++	-
3	Siberian Roe Deer – *Capreolus pygargus*	-	-	(+)	+
4	Boar – S*us scrofa*	-	-	++	-
5	Wolf – *Canis lupus*	+	-	-	-
6	Golden Jackal – *Canis aureus*	-	-	+	-

7	Fox – *Vulpes vulpes*	+++	+++	+++	+++
8	Steppe Fox – *Vulpes corsac*	-	+	-	-
9	Asiatic Steppe Cat – *Felis lybica ornata*	++	+	+++	++
10	Asiatic Badger – *Meles leucurus*	-	+	++	-
11	Tolai Hare – *Lepus tolai*	++	+++	++	+
12	Желтый суслик – *Spermophilus fulvus**	-	+	+	-
13	Great Gerbil – *Rhombomys opimus*	++	++	++	-
14	Midday Jird – *Meriones meridianus*	-	+	+	-
15	Great Jerboa – *Allactaga major*	-	+	-	-
16	Small Five-toed Jerboa – *Scarturus elater*	+	++	+	-
17	Grey Dwarf Hamster – *Nothocricetulus migratorius*	-	+	+	+
18	House Mouse – *Mus musculus*	-	+	-	-
19	Long-eared Hedgehog – *Hemiechinus auritus*	-	+	-	-

** The species was not found in the project area, but was found in close proximity to it.*

According to the generally accepted methodology (Palmer et al. 2018), the relative abundance of species (Relative Abundance Index) was estimated by the dynamic density, which was defined as the number of independent registrations of a species by a camera trap per 100 days of operation. Registrations with a 30-minute interval were considered independent.

For this report, only data for the first six months of camera operation, from May to September 2023, were used, since sorting of images is carried out manually and takes a long time. However, a preliminary review of winter images showed that adding data for the second half of the year will not change the obtained picture for the four main habitats identified above. The species composition of mammal assemblages and the nature of the distribution of species by abundance remained largely unchanged.

The results, summarized for the entire observation period (May-September) and for 4 habitats, are presented in the graph (Figure 1). Only the 8 most abundant species are shown; species recorded in the entire sample less than three times are not included.

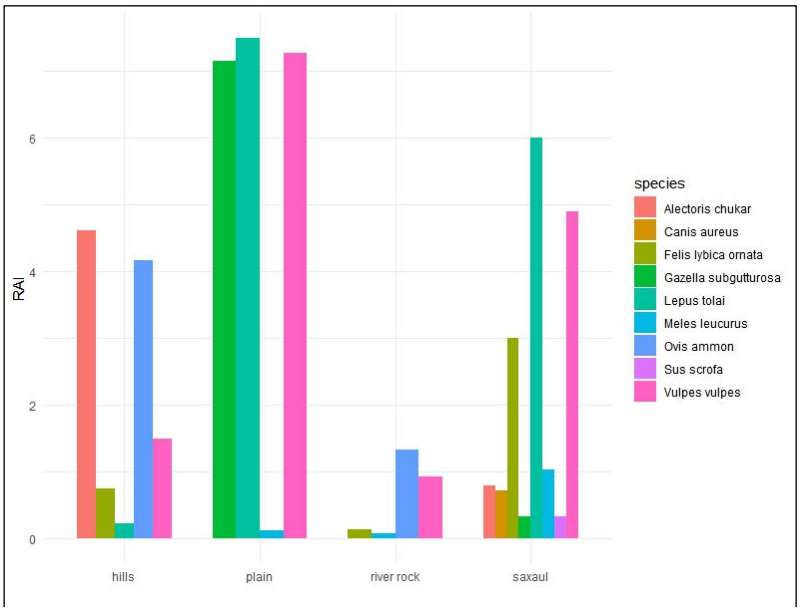


Figure 30. Assemblage composition and dynamic density of the most abundant mammal species recorded by camera traps in the period May till September per four habitats. Additionally included one bird, Alectoris chukar, as an extremely abundant species in the hill habitat.
RAI, Relative Abundance Index, measures the relative abundance per 100 days of camera capture for each species (Palmer et al. 2018).

As can be seen from the graph and Table 11, the valley saxaul forests were characterized by the highest species richness (13 mammal species were recorded, including 7 with high abundance). The lowest species richness was found in the riverine rock outcrops, where only 6 species were found, but 4 of them were among the most abundant. The same number of abundant species were recorded in the desert on the gently undulating plain, but the overall species richness in this habitat is significantly higher and is only slightly inferior to that of the saxaul forests (12 species), despite the fact that it was on the plain that the maximum abundance indicators were recorded for all the compared habitats and for all species. In the low hills, 4 abundant species were also found with a species richness of 8 species. The only mammal species that reaches a sufficiently high abundance in all habitats is the common fox. At the same time, in two habitats - the flat desert and valley saxaul forests - it is one of the dominant species, second only to the hare in relative abundance. Obviously, such indicators reflect not so much the high true density (number) of the fox, as its high motor activity, which is associated with the peculiarities of its hunting behavior.

In fact, the second predator represented everywhere is the steppe cat - it was also noted in all 4 habitats. But its abundance is distributed sharply unevenly: the cat turned out to be one of the most common species in saxaul forests, moderately abundant in small hills, but very few and rare in the other two habitats. In particular, in the flat deserts, camera traps recorded a single meeting of this animal only in winter, so it is not reflected in the graph.

For a similar reason, the graph does not show the hare encounter in the riverine cliffs. The tolai hare reaches a very high dynamic density in the flat deserts and saxaul forests (it is the most abundant mammal species there), but is rare and small in the other two habitats.

A characteristic feature of habitats with a sharp relief and rocks is the presence of argali. In the low hills, it turned out to be the most abundant species. Only in the saxaul forests were jackals (in fact, only by one camera trap) and wild boars (with a low density, however, it was

recorded in three points) recorded. The goitered gazelle is abundant in the flat desert, but with a low dynamic density it was also encountered in the saxaul forests. The badger was encountered in three habitats, nowhere reaching high abundance.

It is possible to estimate the seasonal distribution of the abundance and/or activity of mammals by the number of camera trap records. As can be seen from the graph (Figure 31), it varied depending on the habitat. In the lowland areas, the greatest abundance and/or activity was observed in September, in the lowland deserts – from mid-June to August, in the valley saxaul forests – in May-June.

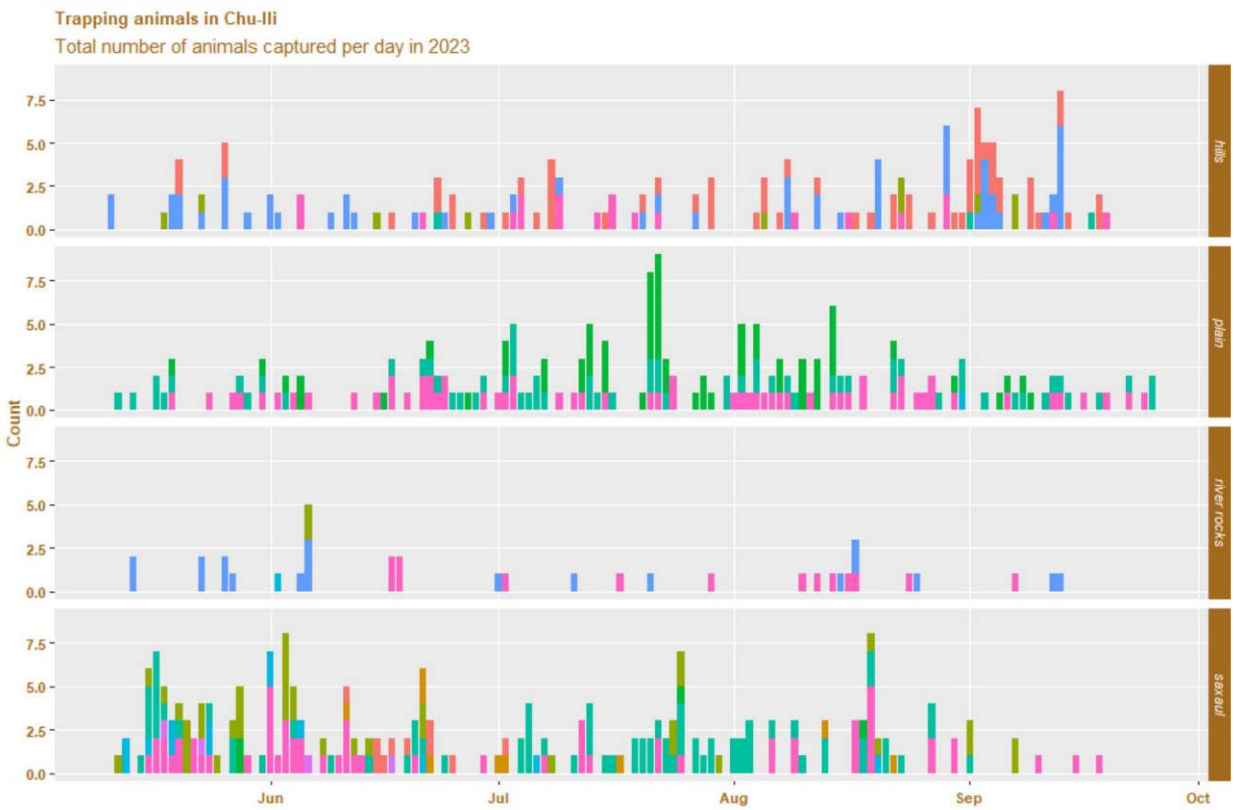


Figure 31. Seasonal distribution of the mammal species per 4 habitats from May to September. For the color designation see Fig. 30.

3.2.2 Characteristics of certain mammal species that require special attention

The project area is inhabited by two species of mammals listed in the Red Book of the Republic of Kazakhstan (2010) and the List of Rare and Endangered Species of Animals of the Republic of Kazakhstan (approved by Resolution of the Government of the Republic of Kazakhstan dated October 31, 2006 N 1034 as amended by the Resolution of the Government of the Republic of Kazakhstan dated 07.11.2012 No. 1413). These are two species of artiodactyls - **mountain sheep (argali)** and **goitered gazelle**.

Argali. The Tien Shan subspecies of argali (*Ovis ammon karelinii*) lives in the project area (Fig. 32).

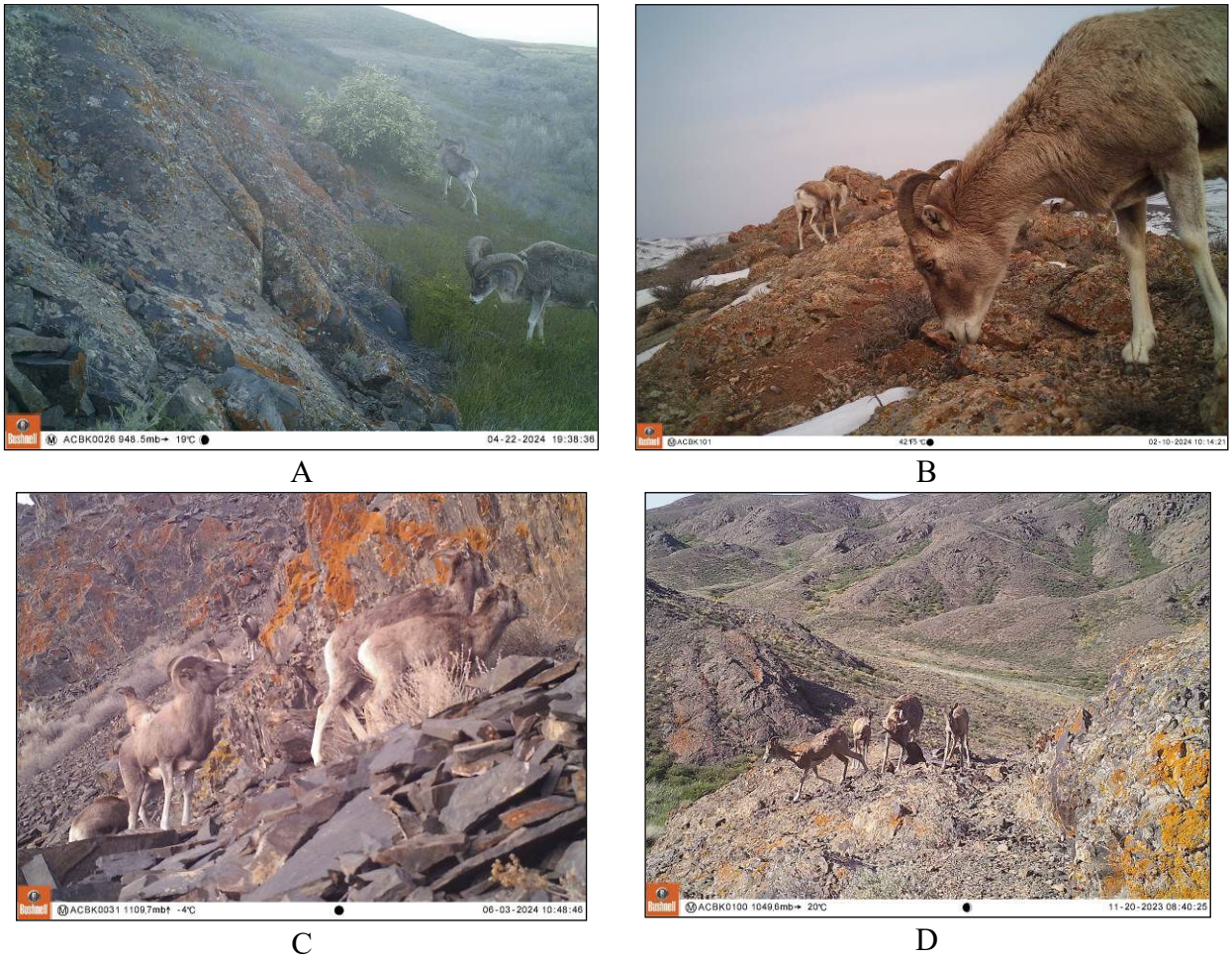


Fig. 32. Some camera trap records of Argali in the project area.
A – Adult males, B – part of a family group (male and female), C – a herd including males, females and youngsters (7 animals are visible), D – female with youngsters.

It is included in the Red Book of the Republic of Kazakhstan as a declining species (category 2). Argali were recorded by 9 camera traps. In particular, it was recorded in all camera traps operating in the small hills of Koizharylgan and Mayzharylgan, and in 80% (4 out of 5) of camera traps installed in the valley rocks. In total, in all these camera traps during the year of operation, 105 visits to argali were recorded, a significant part of which were in groups of 2 to 6 animals. In addition, argali were visually observed over the course of the year and/or their traces (droppings, trails, beds) were noted at 73 points in the same two types of habitats. The distribution of argali registration places in the project area is presented on Fig. 33.

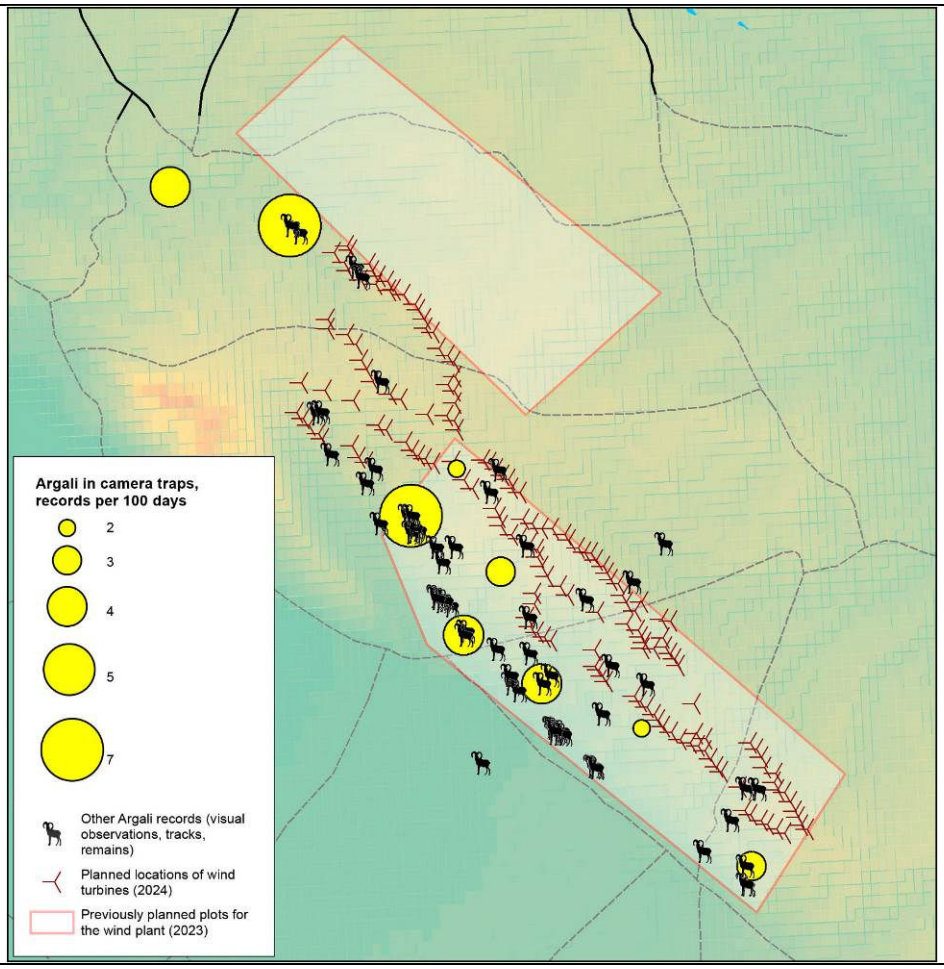


Fig. 33. Records of Argali in the project area, May 2023 – May 2024.

Argali were found in the project area in all seasons of the year. Moreover, the occurrence in the summer season (from April to October) is noticeably higher than in the winter season (November-March), which apparently reflects a general decrease in the activity of animals during the cold period. No differences in the general distribution of the population in the summer and winter seasons were identified - the areas of summer and winter occurrences on the ground are not separated (Fig. 34).

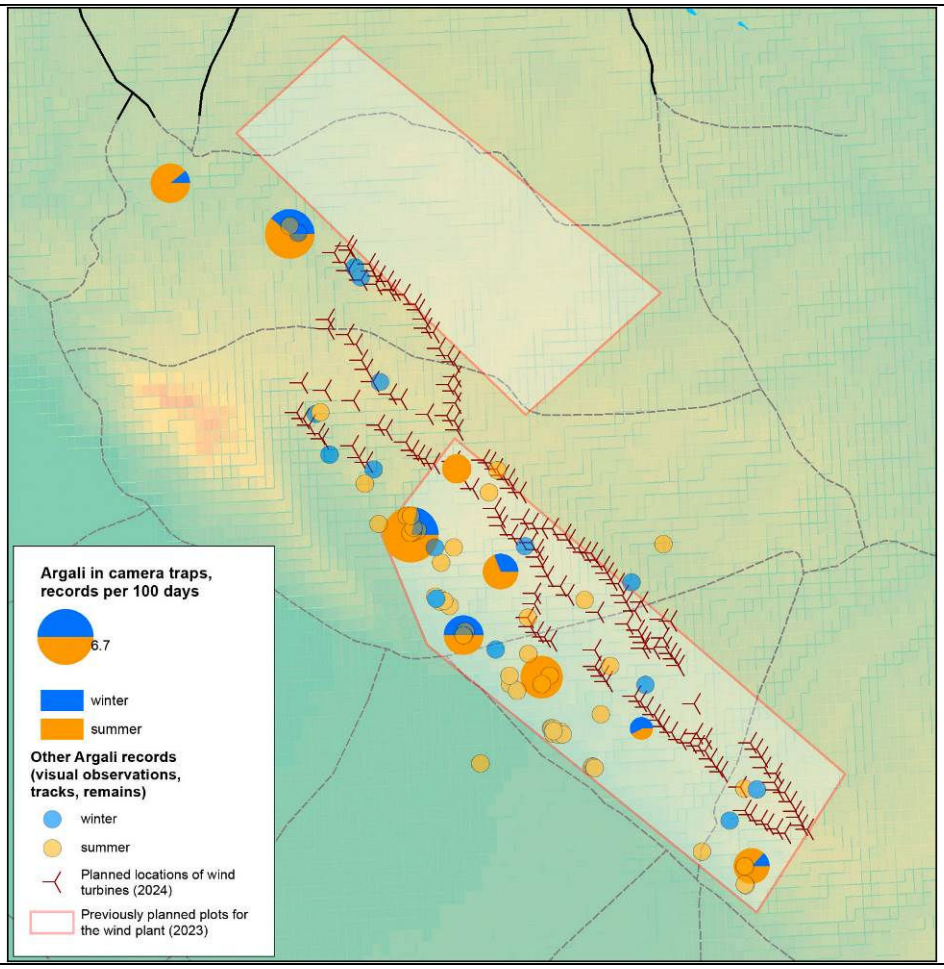


Fig. 34. Winter (November-March) and summer (April-October) records of Argali in the project area.

In the project area, all age and sex groups of argali were recorded, including females with lambs (Fig. 32). The earliest sightings of lambs date back to May 19-20. Judging by their estimated age, lambing took place (in 2023) in the second or third ten days of April.

Based on the completed registrations of argali, we mapped the area occupied by its group in the project area. It is known that argali living in low dry mountains with desert vegetation, are characterized by relatively high mobility. During the season they do not make long-distance directed movements (migrations), but actively move within an area up to 5 km across (for females with lambs) and more (for males) - during grazing, to watering holes and for rest, and back to places grazing (Fedosenko, Kapitonov, 1983; Berber, 2007). Based on this, a buffer was built around each argali meeting point in the form of a circle with a radius of 3 km. We consider the totality of these buffers as an approximate habitat area for argali in the surveyed territory. As can be seen on the map (Fig. 35), argali inhabit predominantly the small hilly part of the project area. In particular, this area includes almost the entire Southern project area, while the flat Northern area is practically not inhabited by argali.

The total area of argali habitat in the project area is approximately 850 km^2.

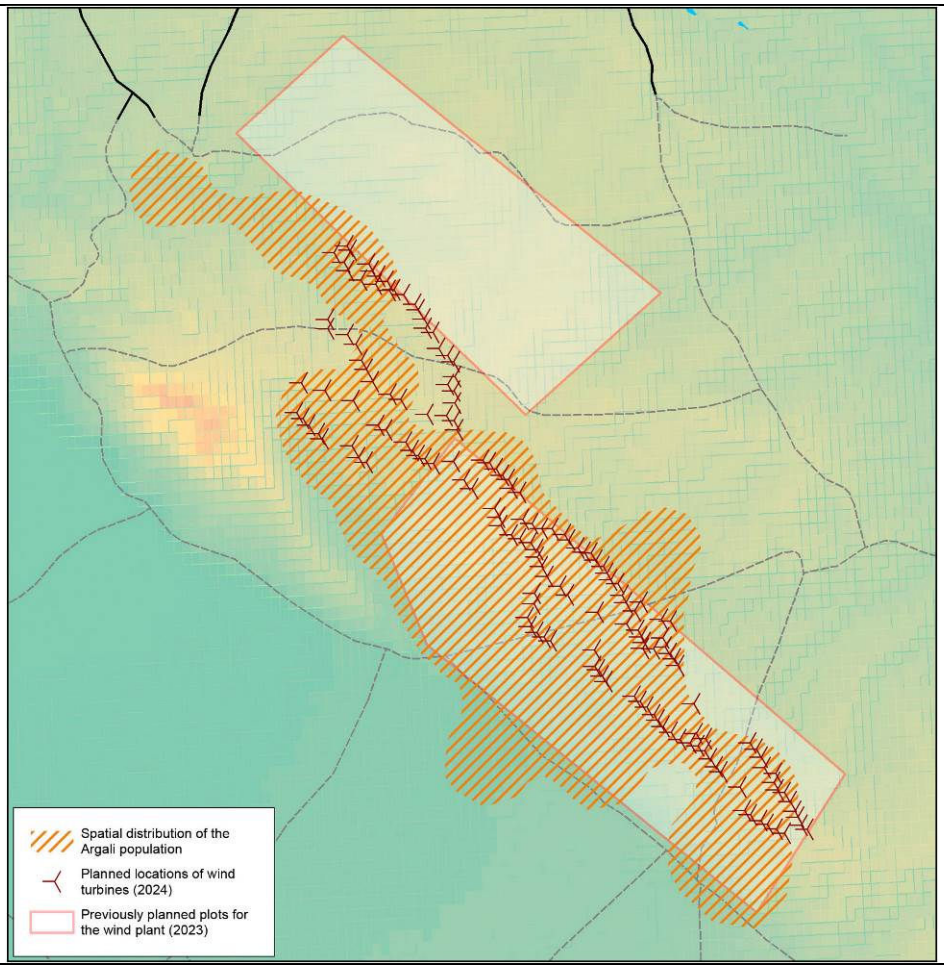


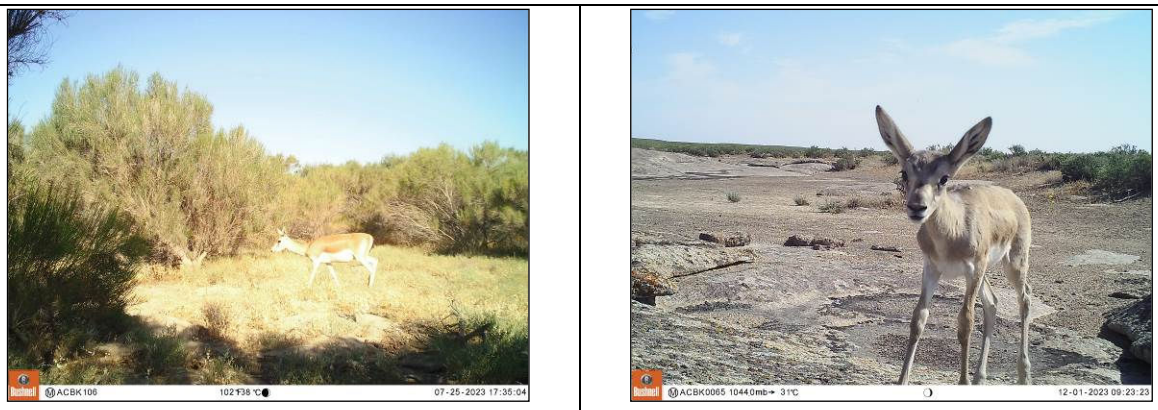
Fig. 35. Estimated distribution of Argali population on the project area, based on the records.

Goitered gazelle. The gazelle living in Kazakhstan belongs to the subspecies *Gazella subgutturosa gracilicornis*; recently it has been accepted to consider it as a separate species - the Turkmen gazelle, *Gazella gracilicornis*.

The gazelle is listed in the Red Book of the Republic of Kazakhstan as a rare species (category 3). In the project area, the gazelle was recorded in 5 camera traps (Fig. 36). In addition, 54 sightings of the goitered gazelle and finds of its tracks (actual tracks, droppings) were noted.

A

B



C D

Fig. 36. Some camera trap records of Goitered Gazelle in the project area.
A – Adult male, B – group of females, C – female in the saksaul woodland, D – youngster (date is incorrect).

The maximum occurrence was observed in the biotopes of wormwood deserts on flat and gently undulating plains (recorded in all camera traps installed there), less - in valley saxaul forests (recorded in 2 of 6 camera traps). In addition to these biotopes, goitered gazelle has also been recorded in less dissected "rear" areas of small hills. The distribution of goitered gazelle registration places in the project area is presented on Fig. 37.

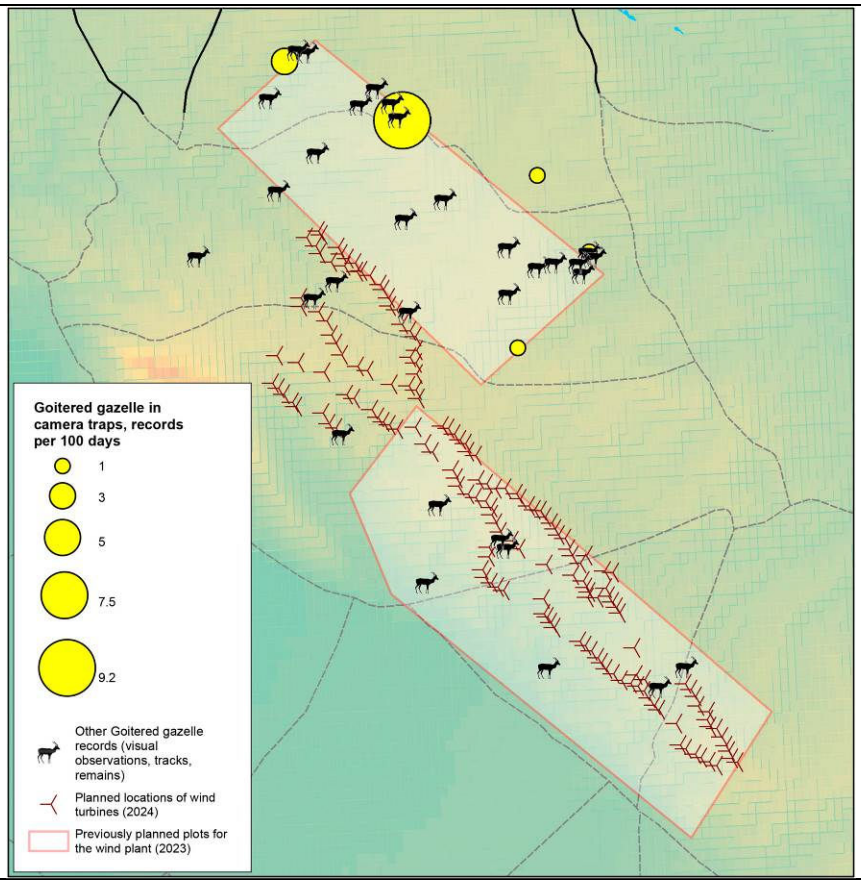


Fig. 37. Records of Goitered Gazelle in the project area, May 2023 – May 2024.

Unlike argali, goitered gazelle makes regular seasonal migrations. The vast majority of sightings in the project area occur during the warm season, from April to October, while winter sightings are very few (Fig. 38).

According to literary information, goitered gazelles, which live in the summer in the east of Betpak-Dala, winter in the Moyynkum sands; longer-distance seasonal migrations, up to 500 km, in the southern and southwestern direction are also known for this population group (Zhevnerov et al., 1983).

The project area in a broad sense also refers to the east of Betpakdala. It is possible to assume that goitered gazelles from here migrate for the winter to the Moyynkum sands or further to the southwest. However, reliable direct data on the direction and range of migrations of this group are currently missing. Based on the results of our research, we can only confirm that the gazelle inhabits the project area mainly in the summer, while only a few individuals remain for the winter.

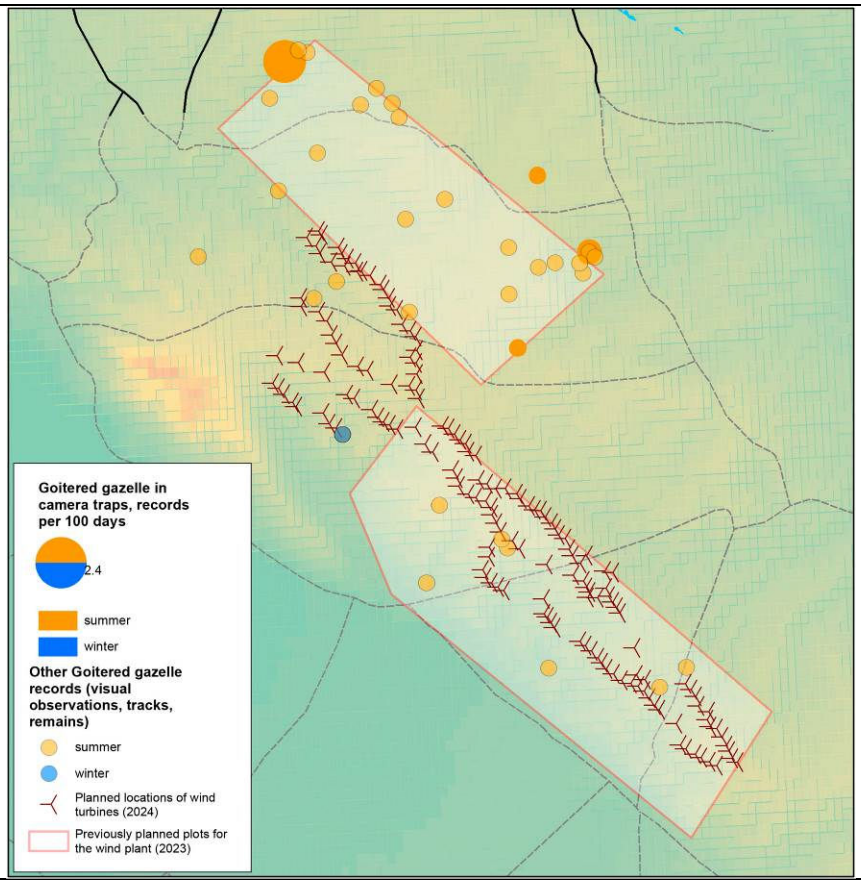
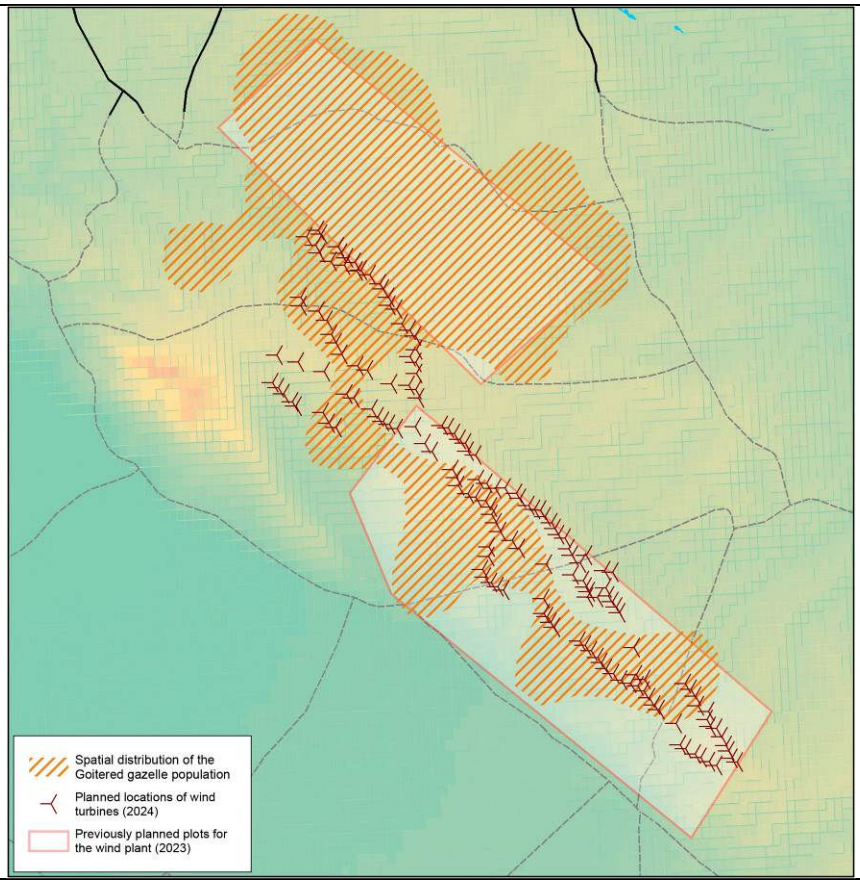


Fig. 38. Winter (November-March) and summer (April-October) records of gazelle in the project area.

All age and sex groups of goitered gazelle, including underyearlings, were recorded in the project area (Fig. 36). Similar to what was done for argali, the habitat area of the goitered gazelle in the project area was outlined (Fig. 39). To a greater extent, this species is typical for the Northern project site. Encounters in the Southern area is confined mainly to valley saxaul forests and, in general, to wide, well-developed valleys with floodplain terraces.

The area of the gazelle habitat in the project territory is approximately 950 km^2.



Map 39. Estimated distribution of goitered gazelle population on the project area, based on the records.

Great gerbil. A massive burrowing rodent that forms large colonies. Due to its high population size and density, the absence of hibernation and the relatively high availability of animals for predators, the great gerbil is a key prey for almost all four-legged predators of the medium-sized class - from the steppe polecat and polecat to the fox and, probably, the jackal. Due to its large numbers and lifestyle, which involves storing food for the winter, the great gerbil has a significant impact on vegetation during years of high abundance. Being a widespread species with high burrowing activity, the great gerbil also plays the role of a key "ecological engineer" in desert ecosystems, comparable in its influence on the soil only with the mole vole that lives there.

For the functioning of the wind farm, the great gerbil in the project area is of particular importance: the abundance and nesting density of large birds of prey, the main risk objects of the wind farm, directly depend on its size and population status. In particular, this applies to all species of real eagles and saker falcon. There is no other mammal species capable of having such an impact in the project area.

In 2022, the great gerbil population was depressed, its numbers were extremely low, and most of its burrows were empty. In 2023, the population was recovering. In 2024, its numbers are quite high; previously uninhabited burrows are populated by gerbils. The greatest density of habitat for the great gerbil within the project area is found in the valley saxaul forests and trails of hill slopes in the small hills (Southern project area). The presence of this species on the gently undulating plain (Northern project area) is of a focal nature.

3.2.3 Estimated project impact

Wind turbines have been identified as a viable alternative energy source with minimal environmental impact. However, the selection of sites for wind-power plants often raises significant conservation concerns regarding biodiversity. Wind turbines have emerged as a significant threat to migratory birds, with documented incidents of birds colliding with turbine blades in various regions worldwide. The impact on terrestrial mammals (other than bats) is less known (Helldin et al. 2012; Schöll & Nopp-Mayr 2021; Kumara et al. 2022).

Several studies indicate that certain mammal species avoid sites with wind turbines, even if the sites were preferable before the wind farm establishing (Łopucki et al. 2017; Schöll & Nopp-Mayr 2021; Kumara et al. 2022; Smith et al. 2020; Milligan et al. 2023). It specifically concerns on wild ungulates, including different Antelope species such as Pronghorn *Antilocapra americana* (Smith et al. 2020; Milligan et al. 2023), Indian Antelope (Blackbuck) *Antilope cervicapra*, Indian Gazelle (Chinkara) *Gazella bennettii*, and Four-horned Antelope *Tetracerus quadricornis* (Kumara et al. 2022). Other ungulates studied were Cervidae, specifically the semidomestic Reindeer *Rangifer tarandus* (reviewed in: Tolvanen et al. 2023) and the European Roe Deer *Capreolus capreolus* (Veiberg and Pedersen, 2010 in: Keehn & Feldman 2018; Łopucki et al. 2017; Klich et al. 2020). In every case, the deer were avoiding wind farms. Evidently, no data exist for wild sheep.

Ungulates are affected both at the construction stage of wind farms and during their operation. Apparently, the main factors at play are: direct destruction and disturbance of habitats during construction, and during the operation of the wind farm – disturbance of animals by noise and movement of blades during turbine operation, increased frequency of human visits to the area (both due to turbine maintenance and simply due to the appearance of roads to the wind farm in previously inaccessible places), and deterioration of the protective conditions of the area due to the fact that turbine noise prevents animals from hearing predators in advance (Helldin et al. 2012; Łopucki et al. 2017; Keehn & Feldman 2018). Rows of turbines and associated infrastructure become an obstacle to ungulate migration (Milligan et al. 2023). Wind farm operations may affect terrestrial animals both in wind farm interiors and in some buffer zones around the edge of turbines which can extend up to 1 km and even to 15 km (one case).

The impact on other non-flying mammals has been studied even less. In general, published data show that the most noticeable effect of wind farm construction is on larger animals – ungulates and carnivores, while communities and populations of small mammals (rodents, insectivores) remain virtually unchanged (Álvares et al. 2011, 2017; Ferrão da Costa et al. 2018; Łopucki & Mróz 2016; Łopucki et al. 2017; Łopucki & Perzanowski 2018; Keehn & Feldman 2018; Tolvanen et al. 2023). At the same time, wind farms can significantly affect the local distribution and behavior of rodents (Rabin et al. 2006). In particular, avoidance of wind farms both during construction and operation has been shown for wolves (Álvares et al., 2011, 2017; Ferrão da Costa et al. 2018). The literature has repeatedly noted an increase in the occurrence of scavengers (including the red fox, jackal) in the territory of wind farms, which is associated with their use of the carcasses of birds that die on wind turbines (Smallwood et al. 2010). However, quantitative studies have not yet revealed this effect (Keehn & Feldman 2018). Among the large and medium-sized animals studied in Europe, the red fox showed the least sensibility to wind turbines (although this species also responds significantly negative) (Łopucki et al. 2017).

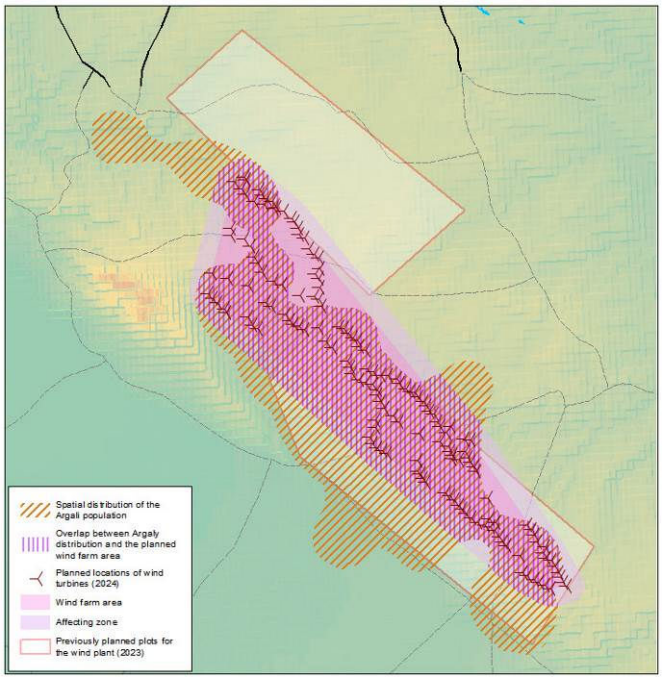
Forecast of impacts on mammals in the project area

We assume that the argali and goitered gazelle will suffer the most from the construction of the wind farm, the former in particular, as a species that is sedentary in the affected area, unlike the goitered gazelle, which spends only part of the year in the project area (albeit the most important for its life cycle). However, if a wind farm is built in the area planned for early 2024, the impact on the goitered gazelle may be more complex, as it is associated not only with the

destruction of habitats and disturbance of animals, but also with the disruption of the seasonal migration route in the southwest direction.

A quantitative assessment of the impact on the argali and goitered gazelle populations is not possible at this stage. However, we can estimate what part of the habitat area occupied by these species will be affected by the planned wind farm based on the outlined contours of these areas and using information on the locations of wind turbines planned for early 2024. It is necessary to distinguish between two zones of influence on the population: (a) the territory occupied directly by the wind turbines and the infrastructure facilities between them, and (b) the wind farm influence zone. In zone (a), the habitats of ungulates will be partly completely destroyed during construction, and partly significantly disturbed. Subsequently, during the operation of the wind farm, the use of even the remaining habitats by animals will be physically difficult, and it is most likely that this entire zone as a habitat for ungulates will be completely lost. To estimate the area and contour of this zone, it is realistic to use a minimum convex polygon accommodating all planned wind turbines. In zone (b), the habitats of ungulates will not physically change or will only be slightly disturbed, but the proximity of construction work and then operating wind turbines will make the territory unsuitable for ungulates, so that its preference for them will decrease. They may not leave this zone completely, but they will use it to a lesser extent and in a different mode than before the wind farm appeared. As shown above, the formation of such an influence zone was detected in almost all the studied cases. The width of this zone is not known in advance, as a rule, not less than 1 km, often significantly more. For calculations, we used a conservative estimate of 2 km.

Argali. Under the above assumptions, approximately half of the total argali habitat in the project area will be directly affected – 49%, 420 km^2. The zone of influence covers another slightly less than 20% of the habitat area, 160 km^2 (Fig. 40). Thus, it can be expected that as a result of the wind farm, the argali habitat in the project area will be reduced by half and the suitability and preference of habitats will be significantly reduced, possibly to the point of avoidance, in another 40% of the remaining area. With such indicators, the consequences for argali can rightly be considered close to catastrophic and demand special measures for effective mitigation.



Map 40. Expected spatial effects of the planned wind farm on the Argali habitats and population (zone of direct impact and indirect affecting zone).

Goitered gazelle. The expected impact on this species is lower. The zone of direct impact on the goitered gazelle habitat covers almost a third of its habitat in the project area – 30%, 290 km^2. The zone of influence will affect 10-12% of the habitat, about 110 km^2 (Fig. 41). However, the negative effect on the goitered gazelle will also be quite significant – about 40% of its current habitat in the project area will be lost or significantly deteriorated.

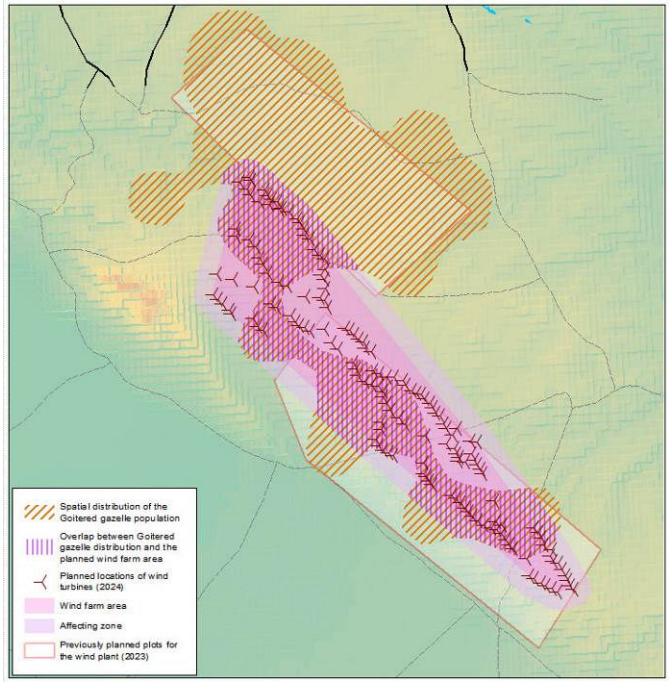


Fig. 41. Expected spatial effects of the planned wind farm on the goitered gazelle summer habitats and population (zone of direct impact and indirect affecting zone).

It should be noted that argali and goitered gazelle are species listed in the Red Book of the Republic of Kazakhstan and, according to the law, require special protection.

Other ungulates (roe deer and wild boar) will be affected to a lesser extent. Their numbers are low in the project area, and their distribution is extremely uneven (spotty), which does not allow for a correct forecast.

Presumably, a noticeable negative effect will be observed for large and medium-sized predators, including wolves, corsac foxes, steppe cats and badgers. Jackals and foxes will probably be affected to the least extent from this guild. A weak positive effect is also possible for the latter two, since both are highly opportunistic in nutrition, including readily consuming carrion, and are extremely flexible in relation to environmental conditions. Wind turbines will be a source of increased bird mortality, the corpses of which these canines can pick up even directly under the rotating blades. The impact on small mammals, including common rodent species, including the great gerbil, will likely be limited to the construction period. In particular, a small positive effect can be expected for the great gerbil in the future, due to the emergence of a large number of soil piles, trenches, slopes and other similar objects as a result of construction, which represent the preferred substrates for the construction of burrows by this species. An increase in the density of great gerbil settlements on the territory of the wind farm during its operation will lead to an increase in the occurrence of large birds of prey, which, accordingly, will become a factor in increasing their mortality from collisions with turbine blades.

3.3 Recommendations

1. In order to minimize the negative impact on the population groups of the Tien Shan argali and goitered gazelle, it is advisable to completely transfer the planned wind farm to the territory of the Northern project site or adjacent territories within the same landscape of saltwort-gray wormwood desert gently rolling and gently undulating plateaus. Accordingly, it is recommended to completely exclude the development of the low-hill landscape in the Southern site and adjacent territories. In this case, the negative impact on the population group of argali, which lives mainly in the low-hill landscape, will be minimized.

The negative impact on the goitered gazelle group will even increase territorially, but will not lead to its irreparable disruption, since (a) the goitered gazelle's habitat in the project area is not limited to the desert plateau only, it also inhabits the low hills (where it uses the valleys and gentle hills of the "rear" part of the low hill strip) – if these habitats are not affected by construction, the goitered gazelle will survive in them; (b) goitered gazelle migrations, according to literary data, are directed mainly to the southwest from the summer habitat area (to Moiynkum and further) – this direction will remain open for the group surviving in the Southern section, but if the wind farm is located, on the contrary, in this section and around it in the low hill strip, the migration route of the group living in the Northern section will be disrupted over a large area, which may lead to degradation, and possibly even the disappearance of the goitered gazelle group in the Northern section.

2. Regardless of the choice of the location, the construction and operation of the wind farm should be carried out using the best available technologies and design solutions that minimize disturbance to the habitats of argali and goitered gazelle, and, if possible, other mammals.

3. Planning construction and adjustment works by seasons (months) will reduce the inevitable harm to mammals. For most of their species, spring and the first half of summer are the time of birth and raising offspring. During this period, it is desirable to minimize the work, and in the most sensitive areas (in particular, in the habitats of argali, if they cannot be excluded from the developed territory) - to completely stop. In this case, it is also necessary to take into account the specificity of the seasonal distribution of the abundance and activity of mammals in different habitats. Work affecting valley saxaul forests should, if possible, be reduced to the period from mid-June to August inclusive (taking into account the above about the spring months - in fact, from April to August). A similar recommendation for small hills (if the wind farm territory is not moved beyond their boundaries) is to minimize work from April to mid-July (the breeding and raising of offspring period) and in September (the period of increased animal activity).

4. A significant part of the impact on the population of non-flying mammals (as well as reptiles and amphibians) during the operation of the wind farm is associated not with the turbines themselves, but with the increase in transport accessibility and the appearance of a road network on the territory. To reduce the impact, it is recommended to close access to the road network on the territory of the wind farm, allowing their use only for servicing the wind farm.

5. If the entire territory of the wind farm (or a significant part of it) is to be fenced to prevent unauthorized persons from entering, it is recommended to use a metal deer fence (game fence) with different opening sizes: 400×300 mm two bottom and two upper rows + 50×300 mm all the middle rows, 19 horizontal wires in total, fixed knots, 2000 mm height. Such wire mesh allows non-traumatic entry of medium-sized mammals, up to the size of a goitered gazelle, but is an effective barrier for larger animals and humans. This will reduce the negative effect of the fence as an obstacle to the movement of animals, in particular, as an obstacle to the migration route of goitered gazelles (but it should be taken into account that the operating wind generators themselves can scare away goitered gazelles and will hinder migration).

6. As discussed above, one of the consequences of wind farm construction may be an increase in the density of great gerbil settlements on its territory, which will entail, as a consequence, an increased risk of collisions with wind turbine blades and death of large birds of

prey. To prevent this risk, it is recommended that, upon completion of construction, the number and area of objects that are attractive for the construction of great gerbil burrows - piles of soil, unfilled trenches, uncompacted slopes, etc. be minimized. In particular, it is recommended to fill the slopes with a layer of crushed stone at least 10 cm deep - this will significantly reduce their attractiveness to great gerbils. We do not recommend active control of great gerbils using chemical methods, since the negative effect on ecosystems in this case may exceed the benefit from reducing the risk of death of birds of prey.

7. Regardless of the choice of site and technological solutions, some harm will still be caused to populations of large mammals, especially ungulates and carnivores, some of their habitats will be irretrievably lost and some will be significantly disrupted. To compensate for this negative impact, it is recommended to ensure the conservation of similar habitats and species outside the area disrupted by the wind farm. This approach is known as biodiversity offset (BBOP 2012a, b; Jenner & Balmforth 2015; Droste et al. 2022). Its purpose is to ensure a net-gain (also earlier referred to as net-no-lost) effect on biodiversity from the development project. It is usually considered as the last chance to reduce biodiversity loss from the implementation of an industrial project when all other options for preventing or mitigating negative effects have been exhausted, according to the mitigation hierarchy (1 – avoidance, 2 – minimization, 3 – restoration, and 4 – compensation) principle, which is commonly used as a procedure to ensure a net-gain in biodiversity (Droste et al. 2022). In this case, it is clearly impossible to avoid or mitigate negative consequences for a number of species, including the Tien Shan argali and goitered gazelle, so we recommend considering the possibility of investing in ensuring the protection of these species in a compensatory conservation area. In the immediate vicinity of the project area, there are two protected areas of national significance - the Andasai Nature Sanctuary and the South Kazakhstan Reserved Zone, where there are similar habitats and the ungulate species under consideration also live. It seems most appropriate to provide permanent (for the duration of the wind farm operation) support for one of these protected areas, or to initiate and support the allocation of part of them to a new protected area of a higher status (for example, the creation of a new zoological sanctuary instead of part of the territory of a protected area). In this case, the key condition for support should be ensuring the effective conservation of habitats and populations of argali and goitered gazelle in an area no smaller than that which will be lost for these species due to the creation of a wind farm.

4 Bat surveys

In this part of the report, we provide information on the organization of monitoring of bats (Mammalia, Chiroptera) at the sites of Mirny wind farms in 2023 during the breeding period (June-early July). The need for intensive survey of large areas in a short time determined the choice of research methods, which were based on remote counting of bats using echolocation signals at stationary points and transects spaced apart in space. It was critical to carry out such intensive studies in a short timeframe that the use of an all-terrain vehicle not only for moving between stationary survey points, but also for direct surveys at night on transects, including those laid along difficult terrain. As an additional method, a survey of potential diurnal roosts of bats was used.

In addition to the study during this period, data collection was later carried out using **stationary detectors at meteorological masts (3 detectors),** which included autumn and spring migrations of bats.

In addition, data was collected using a mobile detector during all mammal studies and another stationary detector, which was installed at night at the campsites of the field team.

This resulted in a huge amount of material, the processing of which takes time, which was underestimated when planning the reporting deadlines. This report presents data from the initial

field survey with the participation of a highly qualified bat specialist, as well as the main conclusions obtained from the processing of the detector data.

The full report on bats is provided in a separate volume.

4.1 The composition of the team and the distribution of work responsibilities

Vasenkov Denis (Ph.D., Russia, Moscow) – general coordination and planning of work on bat counts, setting up detectors, installing detectors at ground counting points, GPS-reference of stationary survey points and transects, survey of potential bat refuges, identification of bats, photographing, data processing, reporting.

Tomilenko Andrey (Russia, Novosibirsk) – development and testing of routes for transects, coordination of logistics, driving and maintenance of a cross-country vehicle, providing food for the group in the field, surveying potential bat shelters, photographing.

Devyaterikov Nikita (Kazakhstan, Almaty) - high-altitude work on meteorological towers: installation of detectors, photographing.

4.2 Brief description of the study sites and potential species composition of bats (Mammalia, Chiroptera)

The two surveyed sites where the Mirny wind farms are supposed to be built are located in the desert zone in the Zhambyl region to the west of Lake Balkhash (Fig. 42). The dimensions of each site are approximately 40*10 km. The site landscape varies. To the north, there is a flatter area (“area C” – “flat”), with a smaller elevation difference (Fig. 43) compared to the southern area (“area A” – “mountainous”), where the relief is more rugged (Fig. 44) .

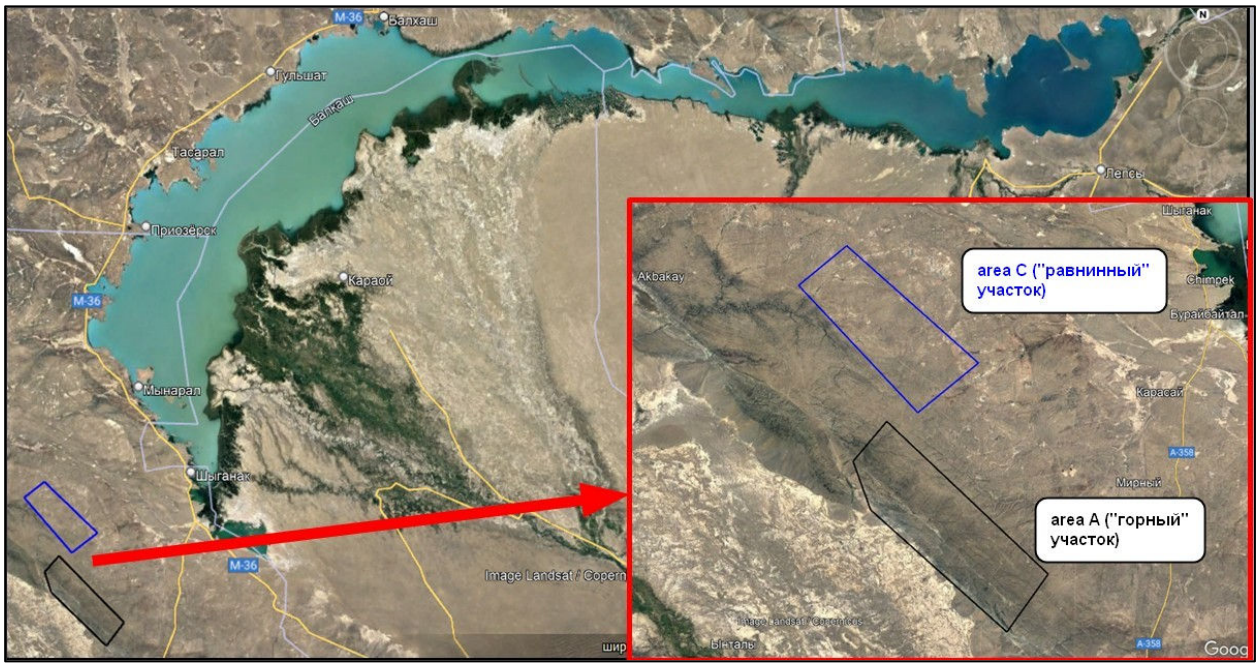


Fig. 42. Location of sites where data on the distribution of bats southwest of Lake Balkhash (Zhambyl region) were collected.

Fig. 43. Typical relief of a flat area ("area C").

Fig. 44. Typical relief of a mountainous area ("area A").

Differences in relief cause different distribution density of potential daytime shelters for bats on the sites. On the northern, flat area, almost exclusively man-made structures can be used as shelters by bats: bridges and drainage tunnels, as well as cracks and blockages of stones in stone quarries (Fig. 45). On the southern, mountainous site, cracks in numerous natural outcrops of parent rocks can act as shelters for bats (Fig. 46).

Fig. 45. Potential bat shelters in the northern flat area: drainage tunnels under the road (left), blockages of stones in stone quarries (right)

Fig. 46. Potential natural habitats for bats in the southern "mountainous" area - fissures in numerous outcrops of source rocks.

Access to water at the sites is limited during the summer. During the research (second half of June), the rivers and streams on the territory of the sites were almost dry. Only in some places small temporary reservoirs with an open water surface remained (Fig. 47).

Fig. 47. A shallow waterbody with open water surface in the southern "mountain" area.

The combination of arid conditions, desert biotopes, topography, remoteness from human settlements determines the poor potential species composition of bats in the study areas. Analysis of the literature (Mammals of Kazakhstan, 1985), taking into account modern taxonomy data, showed the potential habitation on the territory of the sites during the breeding period of the following species of bats belonging to the family *Vespertilionidae*:

1. *Myotis davidii*,
2. *Pipistrellus pipistrellus*,
3. *Hypsugo savii*,
4. *Eptesicus serotinus*,
5. *Vespertilio murinus*.

Because In the area of the surveyed sites, an intensive study of bats has not been previously carried out, then it is impossible to completely exclude the registration of other species, as well as their passage during spring and autumn seasonal migratory flights.

4.3 Research methods

Bats were counted in summer for 16 days (from June 18 to July 3). The time of the counts was timed to coincide with the critical period for bats from the second half of June to the beginning of July. At this time, breeding females gather in brood colonies for the time of birth, and then rearing cubs that are not yet able to fly (Borisenko, 2000). At this time, the ability of females to change shelters is limited, and the biotopes in the vicinity of shelters should provide the opportunity for females to feed effectively in the last stages of pregnancy and during milk feeding until the young fledge.

The need to survey large areas in a short time determined the choice of research methods, the main of which was the remote counting of bats using echolocation signals (Barataud, 2015) at stationary points and transects. As an additional method, a survey of potential diurnal roosts of bats was used. Remote accounting is based on the registration of ultrasonic echolocation signals emitted for orientation in space by all species of bats living in Kazakhstan. The distance at which

an ultrasonic signal can be recorded by a detector depends on the bat species and varies from 100–150 m for the most “long-range” species to 10–20 m for the “quietest” species (Barataud, 2015). Such a relatively small distance of registration of bats required us to disperse as many points of registration of ultrasonic signals as possible over the surveyed sites and to combine two methods of counting: counting at stationary points and counting on transects.

4.3.1 Audio accounting on transects

This type of census was carried out on a cross-country vehicle on transects about 13 km long (Fig. 7), relatively evenly distributed over both census sites (4 transects per site). Before the night survey, each transect along country roads was preliminarily surveyed in the daytime, both in the plains and in the mountains, to assess the possibility of safe passage along it at night. When conducting surveys, in order to level the influence of weather conditions and the direction on the results, each transect was passed in opposite directions on two different days (Table 12).

Chiroptera signals were recorded using the Echo Meter program through a mobile ultrasonic detector Echo Meter Touch 2 Pro (Wildlife Acoustics Inc., USA) connected to a smartphone. The detector was tuned to register ultrasonic signals with frequencies up to 128 kHz. To exclude the influence of the noise produced by the car on the quality of audio recordings, the latter were made during stops on the transect every 500 m. At each stop, the car engine was turned off, after which the mobile detector, oriented upwards, was switched on to record ultrasonic signals for 3 minutes (Fig. 48).). Thus, on each transect 13 km long, audio recordings were made at 27 reference points (including the starting point) for 3 minutes, i.e. the total detector operating time per transect was 81 minutes, or 162 minutes per transect run twice on different days. Counting on the transects began 40–80 minutes after sunset (the sun set at about 21:00 local time). The duration of work on transects (recording at survey points + time for movement between them) was about 2.5-3 hours, and surveys on transects ended between midnight and 1 a.m.

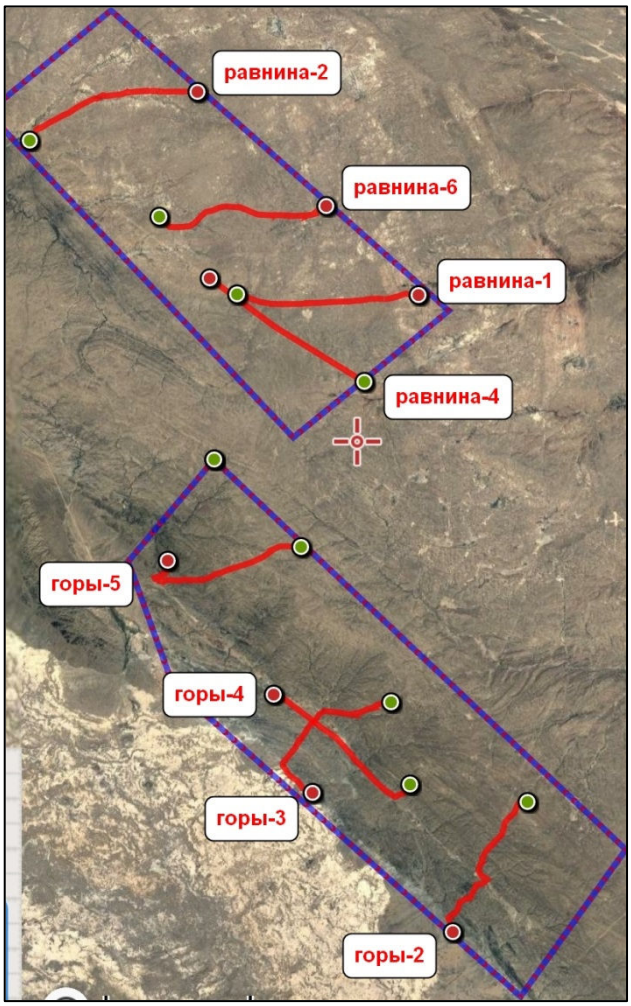


Fig. 48. Transects of accounting for the activity of bats using a mobile detector

Fig. 49. Accounting of bats using a mobile detector on the transect (photo by A.A. Tomilenko).

Table 12. Dates of counts by a mobile detector on transects

Date	Transect ID	Date	Transect ID	Date	Transect ID
18.06.2023	Plane-4	24.06.2023	Mountains -3	30.06.2023	Mountains-5
19.06.2023	Plane -6	25.06.2023	Mountains -2	01.07.2023	Mountains-4
20.06.2023	Plane - 2	26.06.2023	Mountains -1	02.07.2023	Plane -2
21.06.2023	Plane -1	27.06.2023	Plane -6	03.07.2023	Plane -4
22.06.2023	Mountains-5	28.06.2023	Mountains-2		
23.06.2023	Mountains-4	29.06.2023	Mountains-3		

4.3.2 Audio accounting at stationary points

This type of accounting was carried out using four stationary detectors "Song Meter SM4BAT FS" (Wildlife Acoustics Inc., USA). The detector installation points were relatively randomly distributed over the sites (Fig. 50; Annex). We tried to raise the remote microphones of the detectors at the counting points as high as possible, using low trees or telescopic folding stands 2 to 5 m high (Fig. 51). On mountain slopes, the microphone was fixed in stones, oriented away from smooth surfaces (Fig. 52). All this was supposed to reduce extraneous noise on the records, both from insects and reflected signals from large smooth surfaces (Barataud, 2015).

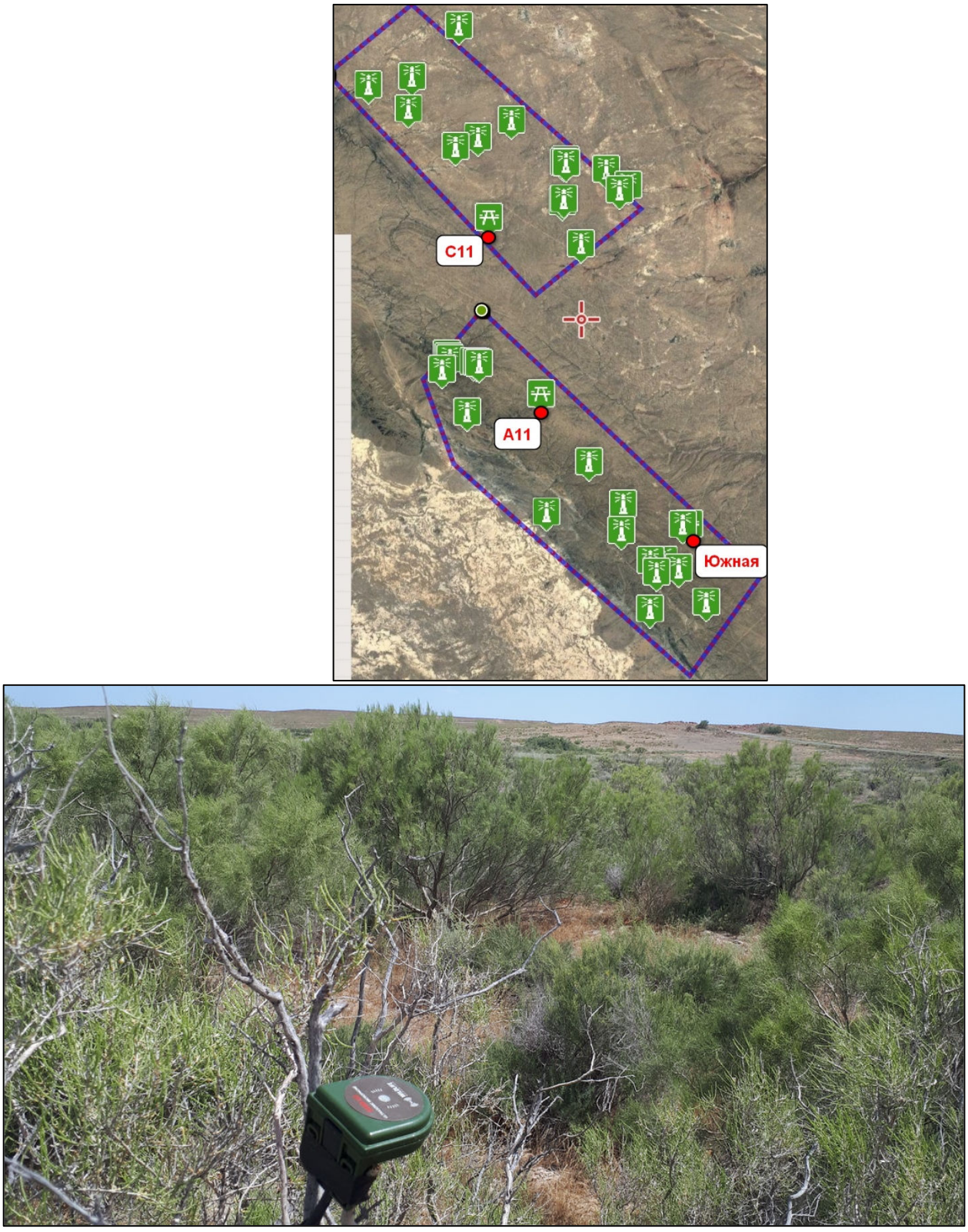


Fig. 50. Points of accounting by stationary detectors (red circles - meteorological towers).

Fig. 51. Options for placing microphones of stationary detectors outside the mountain slopes (above - the detector microphone is fixed on the top of a small tree; below - the microphone is raised on telescopic stands 2-5 m high).

All stationary detectors were tuned to record ultrasonic signals with a frequency of up to 128 kHz from sunset to sunrise. One detector (labeled "A01") operated daily at new locations from June 18th to July 3rd. The rest of the detectors were rearranged between counting points from June 19 to June 30 and worked on each from 1 to 3 days (Table 13).

Table 13. Dates of audio recordings at stationary points.

Date	Detector A01, № of point	Detector A02, № of point	Detector A03, № of point	Detector A04, № of point
18.06.2023	Camp 2023-06-18	not installed	not installed	not installed
19.06.2023	A01 2023-06-20 12:30	A02 2023-06-19	A03 2023-06-19	A04 2023-06-19
20.06.2023	A01 2023-06-20 20:32			
21.06.2023	A01 2023-06-21			
22.06.2023	A01 2023-06-22	A02 2023-06-22	A03 2023-06-22	A04 2023-06-22
23.06.2023	A01 2023-06-23	A02 2023-06-23	A03 2023-06-23	A04 2023-06-23
24.06.2023	A01 2023-06-24			
25.06.2023	A01 2023-06-25			
26.06.2023	A01 2023-06-26	A02 2023-06-26	A03 2023-06-26	A04 2023-06-26
27.06.2023	A01 2023-06-27	A02 2023-06-27	A03 2023-06-27	
28.06.2023	A01 2023-06-28	A02 2023-06-28	A03 2023-06-28	A04 2023-06-28
29.06.2023	A01 2023-06-29			
30.06.2023	A01 2023-06-30	A02 2023-06-30	A03 2023-06-30	not installed
01.07.2023	A01 2023-07-01	Meteomast "Southern"	Meteomast A11	Meteomast C11
02.07.2023	A01 2023-07-02			

Fig. 52. A variant of hidden placement of a microphone (marked with a red arrow) of a stationary detector in stones on mountain slopes (on the left - before the detector was masked by stones, on the right - after masking).

On July 1, 3 detectors (marked "A02", "A03", "A04") were installed on three meteorological towers in the vicinity of the surveyed sites at heights of about 50 m (Fig. 53). They are set to “sleep” mode until August 10th, after which they should be activated and record the audio signals of bats in August to monitor the activity of bats at the beginning of the autumn migration period.

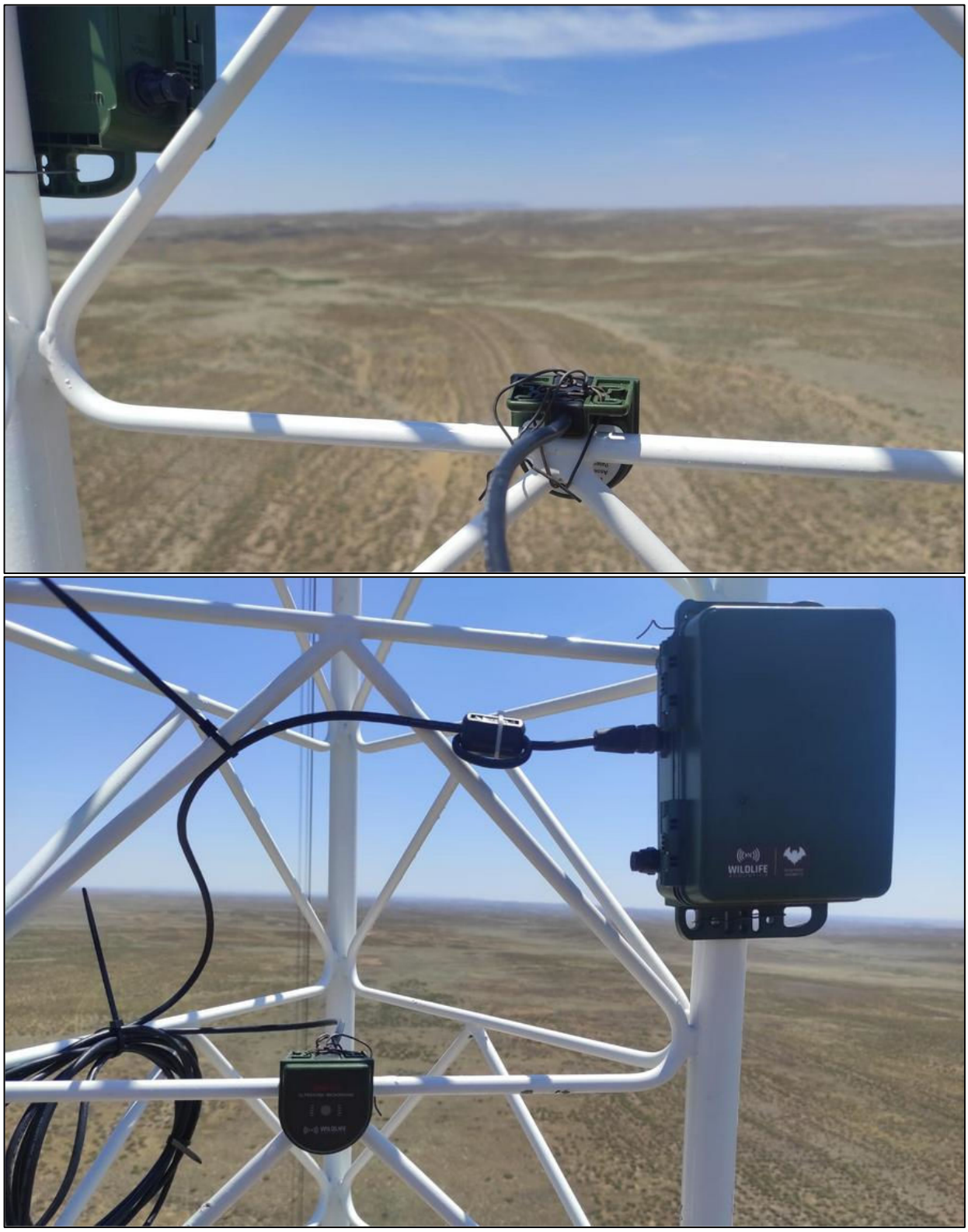


Fig. 53. Stationary detector at a height of 50 m on a meteorological tower (photo by N.A. Devyaterikov; top - panoramic view of the microphone counting sector, bottom - general view of the detector and microphone placement).

4.3.3 Accounting in shelters

In addition to the work on counting bats on night transects, as well as rearranging detectors and reconnaissance of routes for transects during the daytime, we conducted a survey of potential refuges for bats in culverts (bridges and drainage tunnels) under the asphalt road in the northern "flat" section (Fig. 54). Cracks and cavities inside engineering structures accessible for inspection were examined (Fig. 55), which could potentially be shelters for bats.

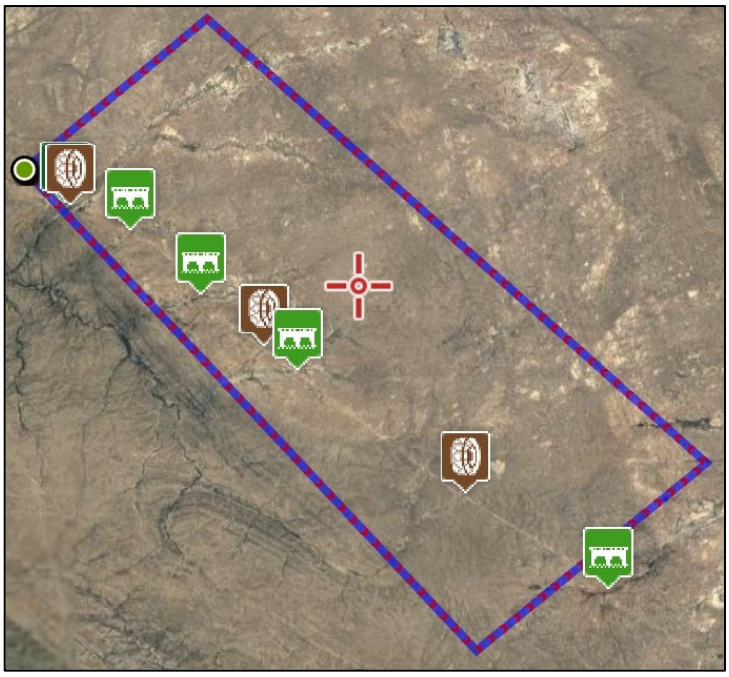


Fig. 54. A map of the location of culverts along the road on a flat area that can potentially be used by bats as daytime shelters (green icons - bridges, brown icons - drainage tunnels).

Fig. 55. Bridge, the cavities inside which can serve as shelters for bats.

In total, 8 tunnels and bridges were checked in the northern section and at its borders. When bats were found, they were photographed, their approximate number was counted, and, if possible, individual animals were taken out for morphometric measurements, photographing, and clarifying the species definition “in hands”. After measurements, inspection and photographing, the animals were immediately released at the place of capture.

4.4 Data collected during the reporting period

4.4.1 Audio accounting on transects

During the reporting period, the total length of the survey transects was about 208 km (8 transects of 13 km in two repetitions), along which 432 survey points were located (with a step of 0.5 km) with the inclusion of a mobile detector at each point for 3 minutes. The total duration of transect surveys was almost 22 hours (1296 minutes). During this time, 2219 audio files were recorded with a total volume of about 4.2 GB (see Table 14).

Table 14. Quantity of recorded audio files on transects.

Date	Transect ID	Records, Mb	Files
18.06.2023	Plain-4	641	305
19.06.2023	Plain -6	128	80
20.06.2023	Plain-2	247	134
21.06.2023	Plain-1	93	65
22.06.2023	Mountain-5	186	110
23.06.2023	Mountain-4	221	116
24.06.2023	Mountain-3	181	101
25.06.2023	Mountain-2	395	196
26.06.2023	Plain-1	163	95
27.06.2023	Plain-6	215	115
28.06.2023	Mountain-2	200	110
29.06.2023	Mountain-3	246	130
30.06.2023	Mountain-5	190	110
01.07.2023	Mountain-4	256	127
02.07.2023	Plain-2	386	181
03.07.2023	Plain-4	511	244
In total:		**4259**	**2219**

4.4.2 Audio accounting at stationary points

During the reporting period, stationary detectors were installed at 38 registration points, 3 of which are meteorological towers (see Annex). In total, stationary detectors recorded data for 52 detector days, not taking into account the time spent by three detectors on meteorological towers. During this time, 20009 audio files were recorded with a total size of about 61 GB (see Table 15).

Table 15. Volume of recorded audio files at stationary points *(data for autumn 2023 and for spring 2024 are not included, all the data are provided in a separate volume)*

Date	Detector №1		Detector №2		Detector №3		Detector №4	
	Records, Mb	Files	Records, Mb	Files	Records, Mb	Files	Records, Mb	Files
18.06.2023	131	48	not installed		not installed		not installed	
19.06.2023	59	29	2270	883	5670	1968	4750	1356
20.06.2023	70	34						
21.06.2023	85	36						
22.06.2023	1880	698	3930	1251	1140	454	362	159
23.06.2023	416	184	9560	2939	14200	3569	111	49
24.06.2023	161	65						
25.06.2023	155	65						
26.06.2023	199	91	126	59	35	15	1980	785
27.06.2023	35	15	1090	452	2170	844		
28.06.2023	4	2	996	426	8010	2707	264	99
29.06.2023	66	35						
30.06.2023	44	21	698	318	20	10	not installed	
01.07.2023	694	318	detector on meteo-mast, data not collected		detector on meteo-mast, data not collected		detector on meteo-mast, data not collected	
02.07.2023	40	19						
03.07.2023	14	6						
In total:	**4053**	**1666**	**18670**	**6328**	**31245**	**9567**	**7467**	**2448**
In total for all detectors:							**61435**	**20009**

4.4.3 Accounting in shelters

As a result of a survey of potential shelters, only one species of bats, the steppe bat (*Myotis davidii* (Peters, 1869)), was found. Adult individuals of both sexes and calves not yet capable of independent flight were found (Fig. 56, 57). A survey of potential shelters showed the presence of brood colonies of bats in 4 shelters (three bridges and one culvert tunnel). At the time of the check, the total estimated number of brood colonies of the steppe bat dispersed between shelters in the bridges was about 120 individuals (~60 adults and the same number of young).

Fig. 56. Male bat (Myotis davidii) found inside a road bridge.

Fig. 57. Adult females and juveniles of the steppe bat (Myotis davidii) from a brood colony in a cavity inside a road bridge.

4.5 Conclusion

As noted above, the full results of the data analysis are given in a separate volume. Note that the area of the potential construction of the Mirny wind farm contains brood colonies of the steppe bat (*Myotis davidii*).

Ultrasonic calls of at least 6 bat species were found in the project area: *Eptesicus serotinus, Hypsugo savii, Myotis davidii, Nyctalus noctula, Pipistrellus pipistrellus, Vespertilio murinus*. The most common species in the wind farm area are *Vespertilio murinus, Eptesicus serotinus, Nyctalus noctula* according to passive detectors operating at a height of 50 m on meteorological masts. The calls of other species were much less frequent. Unfortunately, due to the poor study of bats in Kazakhstan (the last large-scale work was conducted more than 40 years ago), not all ultrasonic calls of bats could be attributed to species whose ranges extend to the project area. In order to clarify the species affiliation of ultrasonic calls that could not be attributed to known species, it is recommended to conduct captures of bats in places of their concentration in the spring to clarify the species identification. There are some temporary reservoirs (streams, depressions filled with water) that are located on the project area in spring. These reservoirs may attract bats and they may fly there on at low altitude. So, bats may be caught there for species identification while at other times they fly at high altitude. This will allow for captures using mist nets and clarifying the bat species composition.

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 Kazakhstan (2010) does not include species of bats registered on the territory of the planned wind farm. 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 bat species.

But bats, whose calls have been recorded at the site, have a risk of collision with the wind turbine. The three most abundant species at height 50 m (*Vespertilio murinus, Eptesicus serotinus, Nyctalus noctula*) have medium to high collision risk (Roemer et al., 2017; Wellig et al., 2018).

According to numerous studies conducted in Europe, these species often die when wind turbines are in operation if no efforts are made to reduce their mortality. Bats reproduce very slowly, producing 1-2 cub per year, which is why they cannot quickly restore their populations after their reduction as a result of any negative impacts (natural disasters or human activity). As measures to reduce bat mortality, two options have been tested that significantly reduce the mortality of these animals with minimal losses for electricity generation. The first option includes the use of special devices increase of the cut-in wind speed and / or feathering of blades during low wind speed conditions when bats approach (e.g. SMART system from Wildlife Acoustics - SMART System | Wildlife Acoustics).

The potential negative impact of wind turbines on bats (death from collisions, barotrauma) in the project area can be minimized if automated ultrasonic detectors to estimate the activity and identity of bats in the zone of highest mortality risk at wind turbine will be used in order to formulate mitigation schemes, such as increased curtailment speeds to prevent casualties (Voigt et al., 2021).

The second option involves increasing of the cut-in wind speed from the standard 3 m/s to 6 m/s during the critical time for bats (warm season from April to October). This radically reduces the mortality of bats from the operation of wind turbines and at the same time has an insignificant effect on electricity generation.

The economic damage from such stops will be minimal, because high bats activity in the project area 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.

5. Reptiles and amphibians survey

5.1 Methods

The study of amphibians and reptiles was not a special task. Encounters of these animals were noted on automobile and pedestrian routes during the study of mammals and birds. Amphibians were noted based on visual observations and voice, reptiles – based on visual observations. Information on routes is contained in the corresponding subsections of the Mammals and Birds sections.

5.2 Results

The only amphibian species encountered in the area was Perrin's green toad, *Bufotes perrinii* (Fig. 58). This species was recently isolated from the collective species *Bufotes gr. viridis* and is known to be a typical inhabitant of the desert spaces of Central Asia (Dufresn et al. 2019). In the spring season, Perrin's green toad was encountered throughout the project area, and was especially numerous near temporary watercourses in the low-hill part. At this time, adult individuals were recorded both visually (encounters on foot and car routes) and by singing (noted in almost all visited valleys) (Photo A). Tadpoles of this toad were also noted in the spring (Photo B).

A

B

Fig 58. Perrine's Green Toad Bufotes perrinii in the project area.
A – Adult during a breeding period. B – Tadpoles in brackish pool in a spring streambed.

Ten species of reptiles from three orders were encountered: 1 species of turtle, 4 species of lizards and 5 species of snakes (Table 16).

Table 16. Reptiles encountered in the project area during the surveys in 2023-2024.

#	Habitat	Hills with rocks, stony slopes and tops	Gently rolling and flat plains covered with zonal deserts	Dry valley saksaul woodlands	Rocks on valley slopes
	Species richness				
1	Central Asian Tortoise – *Agrionemys (Testudo) horsfieldi*	++	+	+++	+
2	Steppe Agama – *Trapelus sanguinolentus*	+	-	+	-
3	Такырная круглоголовка – *Phrynocephalus helioscopus*	-	+	-	-
4	Разноцветная ящурка – *Eremias arguta*	-	+	+	-
5	Быстрая ящурка – *Eremias velox*	-	+	+	-
6	Восточный удавчик – *Erix tataricus* *	-	+	-	-
7	Водяной уж – *Natrix tesselata*	+	-	-	-
8	Узорчатый полоз – *Elaphe dione*	+	-	-	-
9	Стрела-змея – *Psammophys lineolatus*	+	-	-	+
10	Обыкновенный щитомордник – *Gloydius halys*	+	-	-	-

* The species was not encountered in the project area, but was found in close proximity to it.

Rare species of reptiles and amphibians have not been found. The Steppe Tortoise *Testudo horsfieldi* has VU status on the IUCN Red List, and the tortoise and *Eryx miliaris* are included in Annex II of CITES.

A characteristic feature of the entire territory, except for rocky areas, is the relatively high abundance of the Steppe Tortoise (on average 10 sightings per day with a run of 20-120 km/day). At the same time, many Steppe Tortoises were also encountered in April, but some of them also did not come out of hibernation on May 2 (several buried tortoises were noted, obviously not yet coming out of hibernation). In spring 2024, the turtle's occurrence was estimated on automobile routes 5 times for 10-20 km. On average, the occurrence was 1.1 individuals/km of route. The population density of reptiles of other species was not estimated quantitatively.

5.3 Expected impact and recommendations

In general, the impact of wind farms on amphibians and reptiles has been studied very little. In particular, there are virtually no data on the effects on the species present in the project area. In this regard, one can focus on data on closely related and ecologically similar species in similar arid ecosystems.

With regard to one species of land turtles in desert ecosystems (in the conditions of the Southwestern United States), there is evidence that the survival rate of adult animals in the territory of the wind farm during the entire long-term study period, almost 20 years, remained slightly, but significantly higher than in neighboring areas not affected by the wind farm (Agha et al. 2015). The supposed reasons for this are: there was less traffic on the roads inside the wind farm than on public roads in the vicinity (roadkill is an important factor in the mortality of land turtles in the desert); ruderal plants, preferred by turtles as food, developed in areas disturbed by the construction of wind turbines; The predator pressure in the wind farm area was lower than in the neighboring undeveloped areas. In particular, such an important predator of turtles as the golden eagle was reliably rarely encountered and attacked turtles even more rarely in the wind farm area, which the authors attribute to the increased mortality of the golden eagle at wind turbines and to the golden eagles avoiding this area (Agha et al. 2015). Almost all of these considerations can be applied to the project area.

Recommendations

1. It is recommended to minimize the destruction and disturbance of habitats during the construction of the wind farm.

2. In order to reduce the negative impact on the turtle, as well as a number of other reptiles (steppe agama, lizard and all types of snakes) and the toad, it is necessary to develop measures to prevent these animals from getting onto the roads used during the construction and operation of the wind farm. At the same time, permanent roads should be equipped with crossings for amphibians and reptiles - probably in the form of pipes or wide passages under the roadbed. More specific designs of crossings should be developed later.

6 Invertebrates

6.1 Assessment of the current state

At the foot of the marginal ridges of the Northern Tien Shan, in the zone of foothill semi-deserts, wormwood-turf-grass plant communities prevail on northern (low-carbonate) sierozems. This zone is inhabited by desert and steppe fauna of foothill clay and loess plains. Its upper limit is at an absolute height of about 900 m above sea level. The invertebrate fauna is generally typical for northern-type deserts, quite rich and diverse, weakly affected by anthropogenic factors. According to preliminary estimates, the number of invertebrate species (*Invertebrata*) in the southeast and south of Kazakhstan approaches 100 thousand. And although it is believed that the invertebrate fauna has been poorly studied, and special reports devoted to this territory are absent, the presence of many unique, rare, endemic and relict species has been reliably established here. The extremely uneven state of knowledge does not allow us to give an exhaustive description, as does the great diversity of forms; we will focus only on some representatives of large detachments, using available indicative information on more or less studied groups.

Worms (Vermes)

Of this huge group, consisting of 4 types (annelids - more than 100 species, nemerteans - several species, primary cavity worms - several hundred species, flatworms - more than 100 species). In the territory, only helminths parasitizing vertebrates have been more or less studied. Of the nematodes, second only to insects in the number of species, several dozen species are also known - agricultural pests.

Mollusks (*Mollusca*)

This group of invertebrates inhabiting terrestrial biotopes is numerous in terms of species and population density. In the southern half of Kazakhstan, there are about 300 species from 69 genera of 36 families (Увалиева, 1990). The heavily peneplained Shu-Ilei Mountains are inhabited by representatives of 27 species from 17 genera and 14 families. Of these, 9 species are widespread with a palearctic range and species from the families *Buliminidae* (4), *Dradybatnidae* (3), *Hygrominidae* (3 species). Representatives of two ecological groups of mollusks are found here: species living on rocks, rubble screes, among stone blocks overgrown with xerophilic shrubs, and species living in intrazonal biotopes with psychrophilic vegetation. The malacofauna of the semi-desert zone is similar in species composition to that of the steppe zone, but in a slightly different ratio and consists of 17 xerophytic species adapted to an extremely dry climate. There is not a single endemic genus here, and endemics of the species rank belong to the genera *Carychium, Lindholmomneme, Xerosecta*, while a characteristic feature of the shell of mollusks of arid landscapes is the presence of a mouth fittings in the species. Background species should be considered the most widespread species of mollusks, usually having a palearctic range and occurring in large quantities, such as *Bradybaena lantzi, Ponsadenia semenovi, Angiomphalia regeliana, Pseudonapaeus seculinus, Oxyloma sarsi, Zonitoides nitidus, Pupilla muscorum* (Увалиева, 1990: 38-39). Their distribution is very uneven and is determined by the conditions of specific habitats, so completely waterless and devoid of vegetation areas are not populated by mollusks. In dry habitats, they gravitate towards depressions in the relief and water sources, where they can form dense populations. For many species of both invertebrates and vertebrates, mollusks are food objects, play a role in soil formation. They are also known as carriers and transmitters of various parasites, where they are included in extremely diverse epizootological chains, serve as the most important transit link in the transmission of parasitic diseases, game animals and humans.

Arachnida

Arachnida, the most famous representatives of this class, represented in arid areas are ticks, scorpions, solpugas and spiders. Not being photoxenous, many large active forms (solpugas) gather under artificial light sources, which is associated with food attraction.

Ticks (*Acari)*, only a relatively small number of species are parasites or carriers of human diseases, feeding on decomposing organic matter, they play an important role in the formation of soil humus, some representatives feed on the juice of cultivated plants and are considered agricultural pests.

Scorpions (*Scorpiones*), within the deserts and semi-deserts, only the *Buthidae* family is represented, consisting of 5 genera and 8 species. They are active at night and during the day they hide under stones, in cracks in the ground, destroyed buildings and other shelters. The food is most often insects, as well as arachnids, woodlice and other arthropods (*Arthropoda*).

Solpugas (*Solifugae*), are distributed mainly in desert, dry biotopes, the Asian fauna of which is characterized by the presence of 5 endemic genera (*Gylippus, Karschia, Gluviopsis, Triditarsus, Dinotrax*). Of the characteristic representatives, the genus *Galeodes* is especially

numerous. They feed on insects and other invertebrates, and partly also small vertebrates, such as lizards.

Spiders (*Araneae*), the most numerous groups in the class, are able to react sensitively to the deterioration of the environmental situation due to pollution by industrial waste and can be successfully used as bioindicators. About 367 species of spiders, 127 genera and 32 families are classified as inhabitants of the desert and semi-desert zone (Виноградов, 1948). The largest number of species are cosmopolitan, or widely distributed forms. Notable are species of the *Lucosidae* families, smaller forms of *Gnaphosidae, Salticidae, Eresidae, Thomisidae*. As for the distribution of individual groups that make up the spider fauna of the desert zone, a significant enrichment of the species composition of spiders that constantly live in human dwellings is characteristic. In addition to the common genus *Tegenaria*, spiders of the *Lephthyphantes, Pholcidae, Uroctenidae, Agelinidae* and other families (Виноградов, 1948: 299).

Insecta

The most numerous groups of animals, and one of the most important for the circulation of substances in nature, and also playing a significant role in human life. The fauna of the group in Kazakhstan has not been studied enough, it consists of representatives of 28 orders, which is more than 550 families (Митяев, Казенас, Кащеев, 2005) and includes quite a lot of endemic, as well as relict species of scientific interest. According to the results of research in 2015, 459 species of insects belonging to 7 orders, 40 families, 253 genera were identified in the steppe zone (Кадырбеков, 2016). A striking example of ecological plasticity - the fauna of the southern semi-desert and desert regions is no less diverse, numerous groups are highly differentiated biologically, they are characterized by great morphological diversity, and the characteristic specific indicators are the features of the daily regime, behavior and seasonal cycle. According to preliminary forecast data, the fauna of terrestrial insects of the region includes at least 2000 species, including about 50 species of orthoptera, 150 species of homoptera, 200 species of hemiptera, 500 species of beetles, 400 species of hymenoptera, 350 species of lepidoptera, 300 species of diptera, and 50 species of all other insects (Мелдебеков et al., 2011).

Depending on the type of landscape, 5 main faunistic complexes can be distinguished: stony-desert, sandy-desert, clay-desert, saline and intrazonal meadow-steppe.

These complexes include all the main groups of invertebrates living in the desert zone. However, the species composition of each complex is unique and depends on the ecological preferences of its representatives. Insects, for example, are tied to certain biotopes or groups of biotopes, which is determined by their connection with vegetation and microclimate, as well as the degree of ecological plasticity of the species.

A large group consists of species that live not only in one complex, but also in several, which is due to their more or less broad requirements for living conditions. At the same time, each section of any type of desert has small inclusions of other types, which allows the existence of species adapted to living in the conditions of these "alien deserts".

For example, in mountain rocky deserts there are small sandy, clayey or saline areas with characteristic species of invertebrates. Similar "alien" inclusions are also found in other deserts.

Typical species of invertebrates of the main ecosystem complexes

Stony-desert complex - *Amara aenea De Geer*, *Cleonis pigra* (Scopoli) -, *Mylabris sibirica* F.-W. , *Ocypus cupreus* (Rossi), *Prosodes rugulosa* Gebl , *Cicadatra querula* Pall., *Bembix bicolor* Rad. , *Cerceris flavicornis* Br., *Tachysphex incertus* Rad., *Cataglyphis aenescens* Nyl., *Formica pratensis* Retz., *Sphex funerarius* Guss., *Eumenes sareptanus* Andre, *Pontia daplidicae* (L.),

Euchloe pulverata (Christoph), *Chazara enervata* (Alpheraky), *Melanargia russia* (Esper), *Oedipoda coerulescens* (L.), *Sphingonothus nebulosus* (Fischer-Waldh.), *Asiotmethis muricatus* (Pallas), *Decticus verrucivorus* (L.), *Mesobuthus eupaeus* Koch..

Sand-desert complex - *Julodis variolaris* Pall., *Scarites bucida* Pallas, *Lasiostola pubescens* (Pall.), *Opatrum sabulosum* L, *Carpocoris fuscipennis* Boheman, *Cicadatra querula* Pall., *Bembecinus tridens* (F.), *Bembix oculata* Panzer, *Bembix gracilis* Handl., *Oxybelus spp.*, *Sphecius lutescens* (Rad.), Tachysphex desertorum F.Mor., *Cataglyphis pallidus* (Mayr), *Podalonia tydei* (Guillou), *Prionyx niveatus* (Dufour), *Prionyx viduatus* Christ., *Katamenes dimidiatus dimidiatus* (Brullé), *Pontia* daplidicae (L.), *Myrmeleon formicarius* L, *Dericorys tibialis* (Pallas), *Ochrilidia hebetata* (Uvarov, 1926).

Clay-desert complex - *Harpalus distinguendus* (Duftschmied, *Chrysolina graminis* (L.), *Theone silphoides* Dalm, *Chrysochares asiatica orientalis* Lopatin, Cerocoma schreberi (F.), *Adesmia gebleri* Gebler, *Pimelia cephalotes* Pall., *Graphosoma lineatum* L., *Cicadatra querula* Pall., *Aphis craccivora* Koch, *Cerceris bupresticida* Duf., *Lindenius albilabris* (F.), *Bembix bicolor* Rad., *Cerceris flavicornis* Br., *Liris nigra* (Lind.), *Oxybelus mucronatus* (F.), *Tachysphex mediterraneus* Kohl, *Cataglyphis aenescens* Nyl., *Messor aralocaspius* Ruzsky, *Scolia (Scolioides) schrenckii* Eversmann, *Ammophila heydeni* Dahlbom, Prionyx kirbii (Lind.), *Prionyx subfuscatus* (Dahlb.), *Sphex flavipennis* Fabricius, *Polistes (s. str.) nimpha* (Christ), *Orgyja dubia* Tausch., *Tyta luctuosa* (Denis & Schiffermuller), Colias erate Esper., *Gonepteryx rhamni* (L.), *Pontia daplidicae* (L.), *Chazara enarvata* (Alpheraky), *Mantis religiosa* L., *Ascalaphus macaronius* Schneider, *Arcyptera microptera* (Fischer-Waldh.), *Calliptamus italicus* (L.) , Celes variabilis (Pallas), *Dociostaurus kraussi* (Ingen.), *Oedaleus decorus* (Germar), *Ramulus bituberculatus* Redt., *Latrodectus tredecimguttatus* (Rossi).

Salty-desert complex - *Chrysochares asiatica orientalis* Lopatin, *Cicindela littoralis conjunctaepustulata* Dokht., *Bulaea lichatshovi* Hum., *Chromosomus verrucosus* (Gebler), *Anechura asiatica* Semenov, *Cerceris rubida* Jur., *Vespula* (*Paravespula*) *germanica* (F.), *Eremochares dives* (Brulle), *Epacromius tergestinus* (Charpentier), *Sphingonothus halophilus* Bey-Bienko, *Gryllotalpa unispina* Saussure, *Chrotogonus turanicus* Kuthy, *Pyrgomorpha bispinosa* Walker; *Lycosa singoriensis*; *Hemilepistus sp.*.

Intrazonal meadow-steppe complex – *Calosoma sycophanta* L., *Plagionotus floralis* Pall., *Cetonia aurata* (L.), *Lipara lucens* Meigen, *Adelphocoris lineolatus* Goeze, *Lygus pratensis* L., *Dolycoris baccarum* L., *Aphis craccivora* Koch, *Bombus terrestris* L., Glyptomorpha discolor (Thunb.), *Cerceris tuberculata* Vill., *Trypoxylon scutatum* Chevrier, *Polistes dominula* Christ, *Vespula* (*Paravespula*) *germanica* (F.), *Lythria purpurata* (L.), *Carcharodus alceae* (Esper), *Thymelicus lineola* L., *Aricia agestis* (Denn. et Schiff.), *Eumedonia eumedon* Esper, *Lycaena phlaeas* (L.), *Polyommatus icarus* (Rott.), *Thersamonia thersamon* Esper, *Argynnis pandora* (Den. et Schiff.), *Issoria lathonia* (L.), *Nymphalis urticae* (L.), *Vanessa cardui* L., *Papilio machaon* L., *Anthocharis cardamines* (L.), *Aporia crataegi* L., *Colias erate* Esper, *Chorthippus biguttulus* (L.), *Melanogryllus desertus* (Pallas), *Gryllotalpa unispina* Saussure, *Platycleis intermedia* (Audinet-Serville), *Tettigonia caudata* (Charp.); *Thomisus onustus* Walckenaer.

In addition to the listed ecological complexes, the region also has a complex of invertebrates associated with aquatic biotopes. Dragonflies (*Odonata*), mayflies (E*phemeroptera*), stoneflies (*Plecoptera*), caddisflies (*Trichoptera*), some *Heteroptera*, beetles (*Coleoptera*), butterflies (*Lepidoptera*) and diptera live in aquatic biocenoses. Insect larvae sometimes make up a significant part of the population of water bodies, with diptera larvae and pupae forming a particularly large biomass. The composition of the inhabitants of water bodies depends on many factors, but primarily on the degree of water salinity.

A preliminary list of key indicator insect species of the region under consideration is presented in Annex.

It is important to note that many insect species are eurybionts, i.e. they can live in different conditions. They are usually polyphages, which can be part of several ecological complexes, and most species are background desert ones.

Rare and endangered species

According to the available preliminary data, there are 12 species listed in the Red Book from 7 orders (Red Data Book of RK, 2006):

a. Dragonflies (*Odonata*): *Calopteryx virgo* and *Anax imperator*;

b. Praying mantises (*Mantoptera*): *Bolivaria brachyptera*;

c. *Orthoptera*: *Saga pedo, Ceraeocercus fuscipennis*;

d. *Homoptera*: *Porphyrophora sophorae* and *Porphyrophora victoriae*;

e. *Coleoptera*: *Dorcadion balchashense, Chilocorus bipustulatus, Stethorus punctillum*;

f. *Hymenoptera: Sphex flavipennis*;

g. *Lepidoptera: Coenonympha mongolica*.

The lack of accurate data in this regard indicates the need for effective measures for the general conservation of all biodiversity.

6.2 Expected impact and recommendations

Potential negative local impact on invertebrates (*Invertebrata*) during construction and further operation of the facility may be associated with: removal of the fertile soil layer, cutting of topsoil, soil compaction and removal of flora that serve as a food source for the phytophagous group, attraction of some groups by artificial light sources.

The main impact factors include physical impact during collisions with turbines, blades and towers; disturbance of the habitat: disruption of the migration route; attraction of photoxenic insects (organisms that have the ability to be attracted by a light source).

The species diversity of the animal world at the planned site of the facility is limited in species richness and insignificant in numbers. The mortality of invertebrates *(Lepidoptera*, etc.) as a result of collisions with the designed wind farm installation is insignificant, due to the low longitudinal-axial speeds of the blades.

These above impacts are classified as insignificant or of medium significance.

Recommendations for reducing the impact on rare and endangered species of biodiversity

The following are recommended measures to reduce the impact during the construction phase:

a. before the start of construction, in order to preserve and rationally use the fertile soil layer under the planned development, the fertile soil layer is cut off;

b. after the completion of construction, the fertile soil layer from the piles is moved back, the excess can be used for landscaping the adjacent territories;

c. use light sources with minimal glow in the UV region to illuminate work areas, during periods of mass emergence of some species, limit the duration of the glow (turn off for a period of about 2-3 hours, in the evening after sunset).

According to the results of the study of the zone of the planned activity, it was revealed that:

a. significant accumulations of invertebrates were not identified in the vicinity of this facility based on the studied materials;

b. the territory where the wind turbine is planned to be built is located outside the main migration routes of mass species of invertebrates.

Taking into account the above, the placement of wind turbines in the territory under consideration will not have a significant impact on the populations of protected animal species and the functioning of migration corridors of invertebrates (*Invertebrata*).

7 Plant survey

7.1 Literature review

7.1.1 Geographic zoning

According to the map of soil-geographical zoning, the project sites are located in the Semi-desert and desert soil bioclimatic region on gray-brown soils of the subboreal desert on warm freezing soils in the Aral-Balkhash soil province of flat territories (Fig. 59).

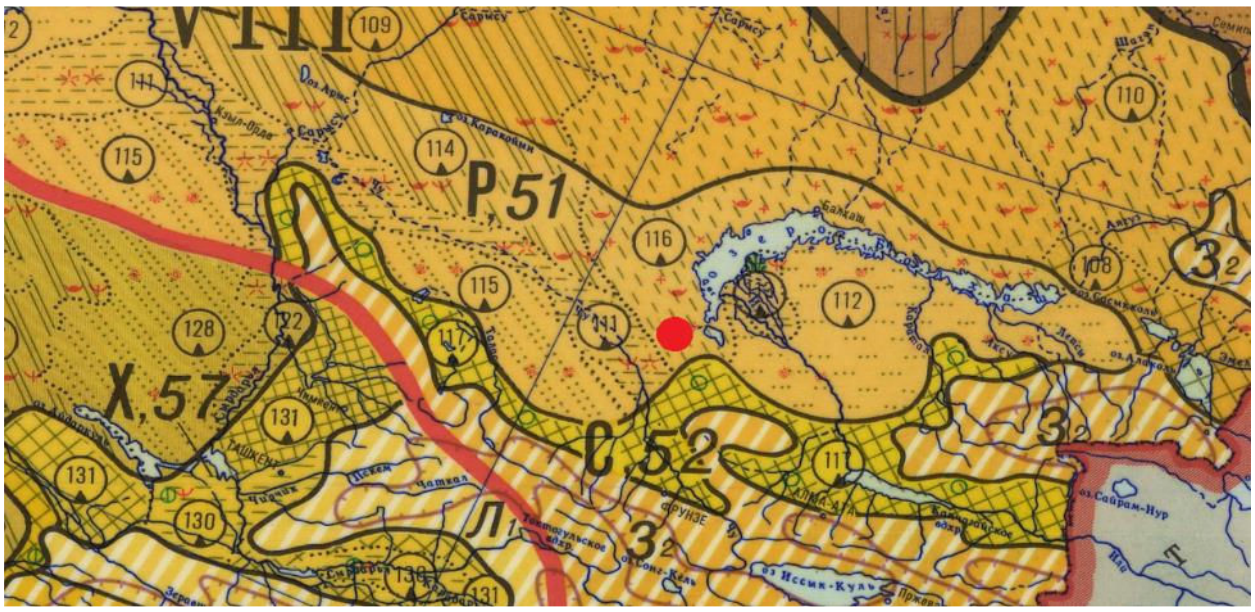


Fig. 59. Map of soil-geographical zoning with the work site

According to the map of geobotanical zoning, the site under consideration is located in the Desert Region, in the zone of Northern wormwood-saltwort deserts on brown soils and gray soils and represents complex sagebrush-saltwort deserts (Fig. 60).

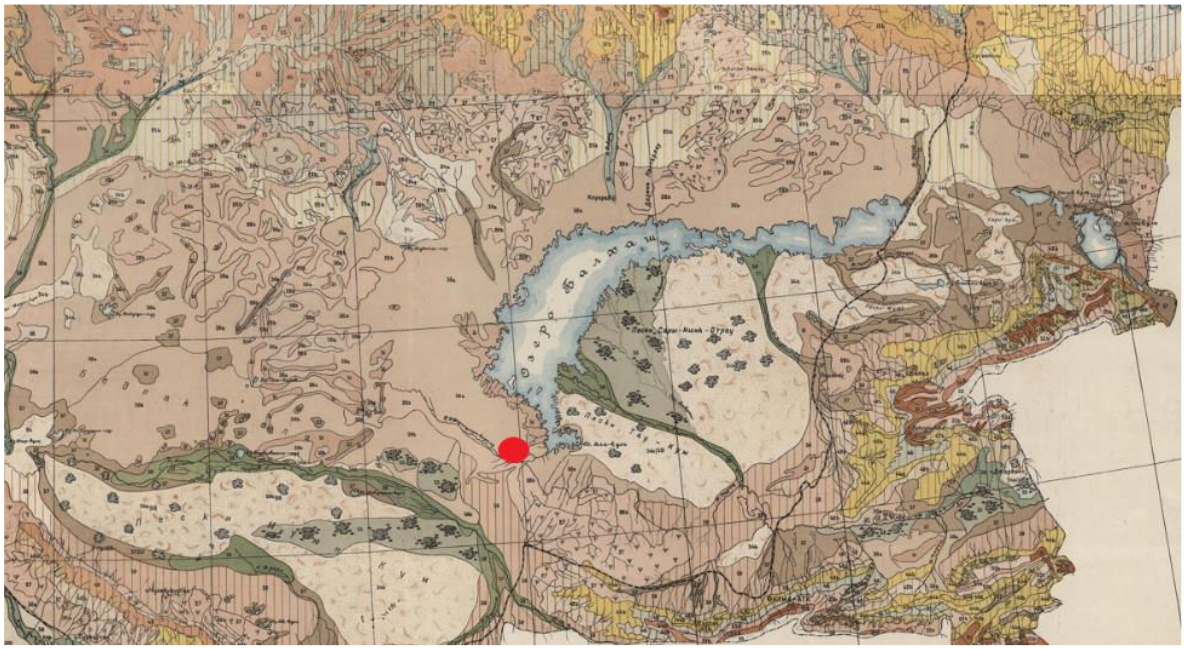
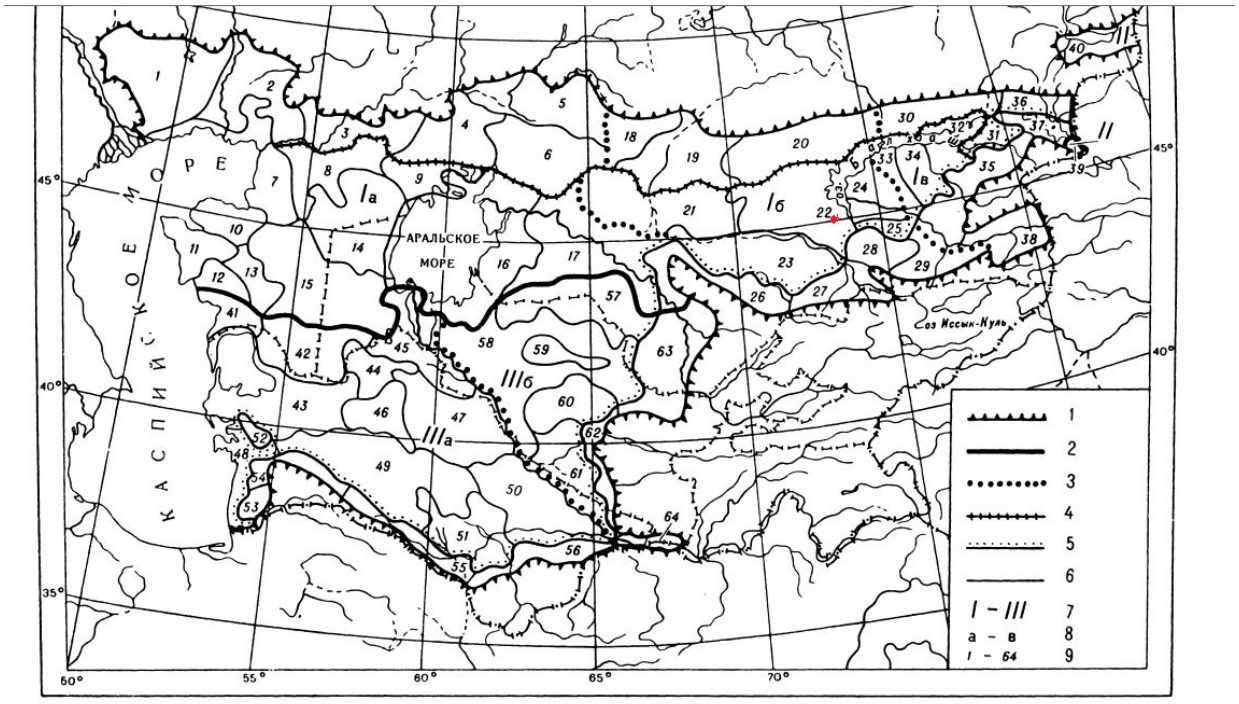


Fig. 60. Map of geobotanical zoning with the work site

According to the "New map of the botanical and geographical zoning of Kazakhstan and Central Asia within the desert region" (Rachkovskaya E.I., Safronova I.N.) (Fig. 61), the territory is located in the Central North Turan subprovince, which occupies the western and southern outskirts of the Central -Kazakhstan small hills (Karsakpay plateau, Betpak-Dala, western part of the Balkhash region) and adjacent areas of the Tertiary plateau (western Sarysu and western Betpak-Dala). The central section is represented by northern, middle and foothill ephemeroid-grass-semi-shrub deserts. The petrophil *Salsola arbusculiformis* is among the most active cenose-formers for the entire sub-province.



Ботанико-географическое районирование Казахстана и Средней Азии в пределах пустынной области.

Границы: *1* – исследованной территории, *2* – провинций, *3* – подпровинций, *4* – полос (подзон), *5* – предгорных и межгорно-котловинных пустынь, *6* – округов. *I–III* – провинции, *а–в* – подпровинции, *1–64* – округа.

Figure 61. Map of botanical and geographical zoning (Rachkovskaya E.I.)

7.1.2 Rare species

According to the literature data, a number of rare and endangered, as well as specially protected or endemic plant species can potentially grow in the survey area (Table 17).

Table 17. Rare, endangered and endemic species

 *(photo – V.Epiktetov)*	**Albert's Tulip (*Tulipa alberti*) –** perennial, 12-20 cm tall. The bulb is ovoid, up to 3-4 cm in diameter, with leathery dark brown continued scales. The stem is strong, squat. The leaves are gray (3-4), wavy along the edge. The flower is goblet, up to 7 cm tall. It is distinguished by a large polymorphism of color - from pure yellow, orange and variegated to scarlet and raspberry red. The bottom of the flower is often black on the inside. Blossoms from early April to the end of the first decade of May, bears fruit - May-June. **Red Data Book of the Republic of Kazakhstan. Endemic**
 *(photo – M.Zhukova)*	**Bem's tulip (*Tulipa behmiana)* -** The bulb is ovoid, 2 - 3 cm thick, with very hard, almost shell-like, black-brown, extended to the surface of the earth, abundantly woolly scales from the inside. The stem is glabrous, strong, 15-40 cm tall, with 4 strongly spaced, gradually decreasing upwards, glaucous, very wavy ("curly") leaves along the edge. The flower is elegant, elongated, usually yellow, rarely dark red. It droops in the bud. Perianth segments up to 6 - 7 cm long, broadly oblong, pointed to a fluffy tip, evenly colored, without spots. Filaments yellow, anthers yellow, often dark purple. Fruits up to 5 cm long, 2.5 cm wide, the number of normally developed seeds up to 264. Seed reproduction, often vegetative. **Endemic**
	Borschov's Tulip (Tulipa borszczowii) - Similar to the previous species (*T. behmiana*) in the structure of the bulb and general habitus. It differs not by a drooping, but by a peduncle sticking out in the

 *(photo – V.Kolbintsev)*	bud, leaves exceeding or reaching the flower, as well as a shorter above-ground part, one and a half to two times shorter than the underground. Flower up to 6 cm tall, with a wide bottom, yellow, orange or orange-red, with a purple or lilac-brown spot in the center, which is very translucent from the inside of the petals and clearly visible on both sides. Filaments almost black, sometimes with a red top, anthers purple or yellow. The fruit is a stupidly rounded capsule up to 4.5 cm long and 2 cm wide, the number of normally developed seeds is up to 227. Reproduction is seed, rarely vegetative. Blossoms in late April-May, bears fruit in late May-June. **Red Data Book of the Republic of Kazakhstan** **Endemic**
 *(photo – V.Epiktetov)*	**Greig's Tulip (*Tulipa greigii*)** – 20-30 cm tall, bulb oblong-ovate, 2-4 cm in diameter with reddish-brown leathery scales. Leaves with dark purple streaks, including 4, less often 3 or 5. The flower is goblet or cup-shaped, often red, sometimes orange, bright yellow, light cream. It blooms from early April to early June, bears fruit in June-July. **Red Data Book of the Republic of Kazakhstan**
	Regel's Tulip (*Tulipa regelii*) – bulb up to 2.5 cm in diameter, with dark brown, leathery scales. The stem is very short, strong, not drooping. The leaf is usually one, oblong, rarely oval, gray-gray, often with a brown tint. Its outer surface has many parallel comb-like outgrowths. The flower is usually solitary, small, up to 3 cm tall. Blossoms from late March to mid-April, bears fruit in late May-

 *(photo – V.Epiktetov)*	June. **Red Data Book of the Republic of Kazakhstan** **Endemic**
 *(photo – L.Valdshmidt)*	**Юнона Кушакевича *(Juno kuschakewiczii)* –** perennial, 5-10 cm tall with densely spaced crescent-shaped dark green leaves. Flowers solitary or 2-3, quite large. Coloration from lilac and light purple to dark purple. Blooms from late March to late April. Fruits in late May-early June. The fruit is an elongated tricuspid capsule up to 3.7 cm long and 0.6-1.5 cm wide. **Red Data Book of the Republic of Kazakhstan**
 *(photo – I.Yevdokimov)*	**Курчавка вальковатолистная (*Atraphaxis teretifolia)* -** Low-growing xerophilous shrub or semi-shrub, rising 20-50 cm above the surface of the substrate. Shortened winding branches are covered with brownish-gray bark. The leaves are small, grayish-green, fleshy. A characteristic feature of the leaves - rolled from the edges wrapped inside - determined the species name of the plant. Flowers with long pedicels are located on annual branches. The pink perianth consists of 5 lobes. The fruit is a trihedral ovoid-lanceolate nutlet of dark brown color. It blooms in May and brings seeds in June. **Red Data Book of the Republic of Kazakhstan** **Relic of Tertiary deserts**

 *(photo – P.Gorbunov)*	**Саксаул черный *(Haloxylon aphyllum)* –** tree up to 8 meters tall. Leaves without spinous pointed, not developed at all or represented only by a tubercle. Flowers inconspicuous, small, yellow. Blooms in April. **Since 2004, there has been a moratorium on cutting down saxaul (extended until December 31, 2023 by Order of the Chairman of the Committee for Forestry and Wildlife of the Ministry of Agriculture of the Republic of Kazakhstan dated August 13, 2015 No. 211.)**
No picture	**Смолевка бетпакдалинская (*Silene betpakdalensis*) -** perennial, herbaceous, short-rough-pubescent plant. Stems numerous, 15-35 cm tall, woody at base. Leaves ovate-lanceolate, 3-8 mm long. Inflorescences racemose. Flower petals are white or pink. Box 6-8 mm long. Propagated by seeds. Blossoms in VI-VII, bears fruit in VII-VIII. It lives on gravelly slopes of low mountains and piedmont plains. Occurs in Betpak-Dala, Chu-Ili mountains. **Red Data Book of the Republic of Kazakhstan** **Endemic**
 *(photo – I.Smelyansky)*	**Строгановия Траутфеттера (*Stroganovia trautvettari*) -** perennial, 15-30 cm. height. Basal leaves are almost sessile, flat, 2.5-6 cm long, 0.7-2.0 cm wide, oblong-obovate. Stem leaves almost spatulate, sessile. Inflorescence spreading; petals are small 4-7.5 mm long with a column at the top. Inhabits clay-solonetz soils, along rubble-sand drains. It is found only in the eastern part of Betpa-Dala. **Red Data Book of the Republic of Kazakhstan** **The species is very rare, highly endemic**

7.2 Terms and methods of research

The main field studies were carried out on June 12-18, 2023 by botanist E.N. Senyak, who worked together with the ornithological group.

According to generally accepted geobotanical methods (V.V. Alekhin and D.P. Syreyshchikov (1926), B.M. Mirkin et al. (2001)) to compile floristic lists of the study area, sites of 10x10 meters in size are laid in the work area (as for desert region). Within the site, the species composition of vegetation, the name of the community, the height of dominant species, the nature of the relief, the nature of the soil surface, the total projective cover, and the abundance of species are described.

Abundance is a visually determined number of individuals, related to the area under study and expressed in points.

The abundance of plant species is taken into account according to the Drude scale:

№	Symbol according to O. Drude	Abundance characteristic	Symbol in Russian
1.	Socials (Soc.)	Plants that interlock with their above-ground parts, forming a common background	Фон (Ф)
2.	Copiosae (Cop.)	Plants found in large numbers, but their aerial parts do not close	Обильно (Об.)
	Cop.3	Very plentiful, but does not give a background	Об.-3
	Cop.2	Abundant, there are many individuals of this species	Об.-2
	Cop.1	Abundantly	Об.-1
3.	Sparsae (Sp.)	Plants are found occasionally, scattered, in small numbers.	Изредка (Изр.)
4.	Solitariae (Sol.)	Plants are rare	Редко (Р)
5.	Unicum (Un.)	The species is represented by a single specimen on the test site	Единично (Ед.)

For the convenience of describing the sites, standard forms were used (in Russian):

Дата			
Номер трансекта		Номер описания на трансекте	
Номер GPS-прибора		Номер точки	
Координаты	с.ш.	в.д.	
Высота над уровнем моря			
Рельеф			

Экспозиция склона		Уклон (град.)	
Характер поверхности почвы (% покрытия)	Песок %	Дресва %	Щебень %
Механический состав почвы	Песок ☐		Супесь ☐
	Суглино ☐		Глина ☐
	Песок %	Пыль %	Глина %
Покрытие почвы кизяком	Овечий %	Коровий %	Конский %
Напочвенный покров в %	Лишайники -	Мхи-	Водоросли
Название сообщества			
Общее проективное покрытие в %			

Список видов	Проективное покрытие в %	Высота доминирующих видов

Plants were identified by:

- Иллюстрированный определитель растений Казахстана (1969)
- Иллюстрированный определитель семейств и родов. Флора Казахстана. Том 1 (1999)
- Определитель растений Средней Азии (1968-1993)
- Online identification with www.plantarium.ru.

To identify rare and endemic plant species, the route method was used (Mirkin B.M. et al., 2001) with a detailed visual inspection of the territory.

Route methods - a class of methods that are implemented by single counts along the route. Both walking and vehicular routes were taken to gain a more general understanding of the distribution of communities.

Prior to the start of field work, satellite images were prepared with the main contours of plant communities drawn in the Landsat program (Fig. 62).

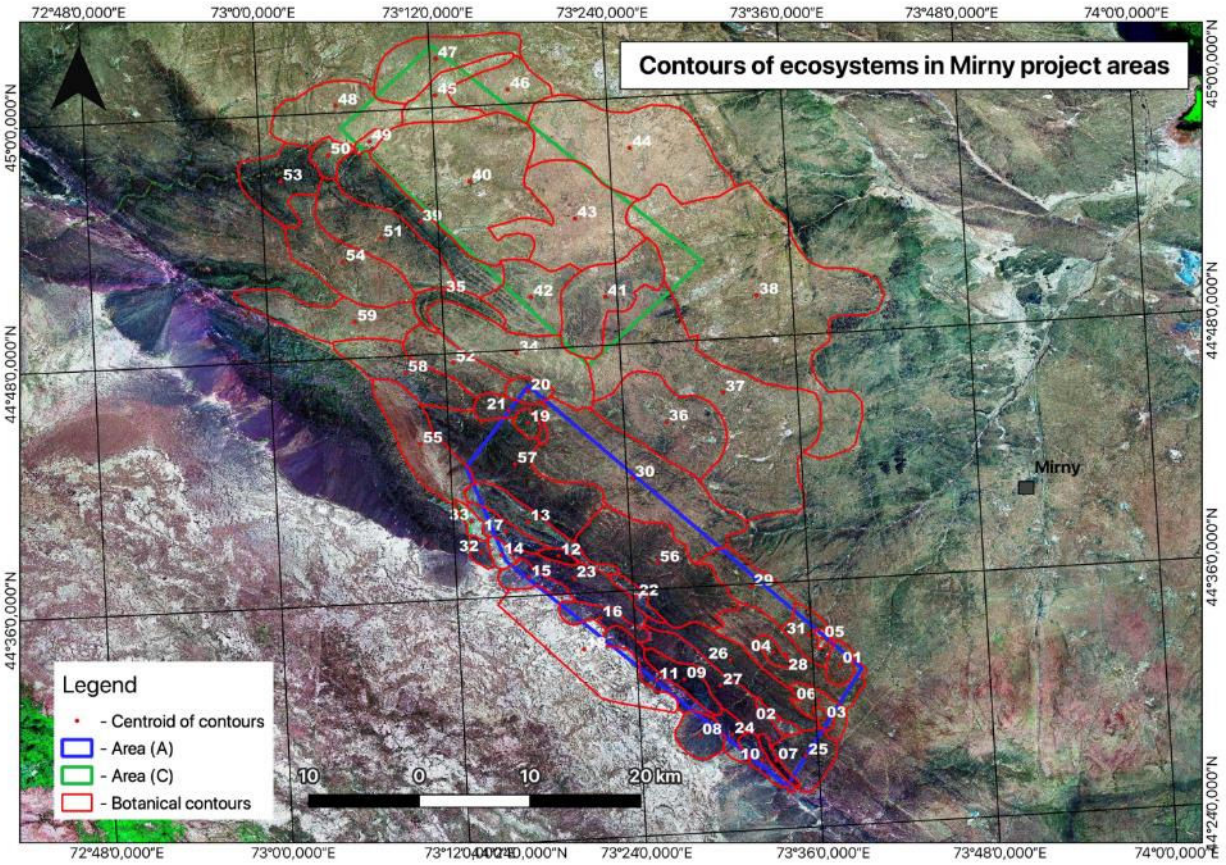
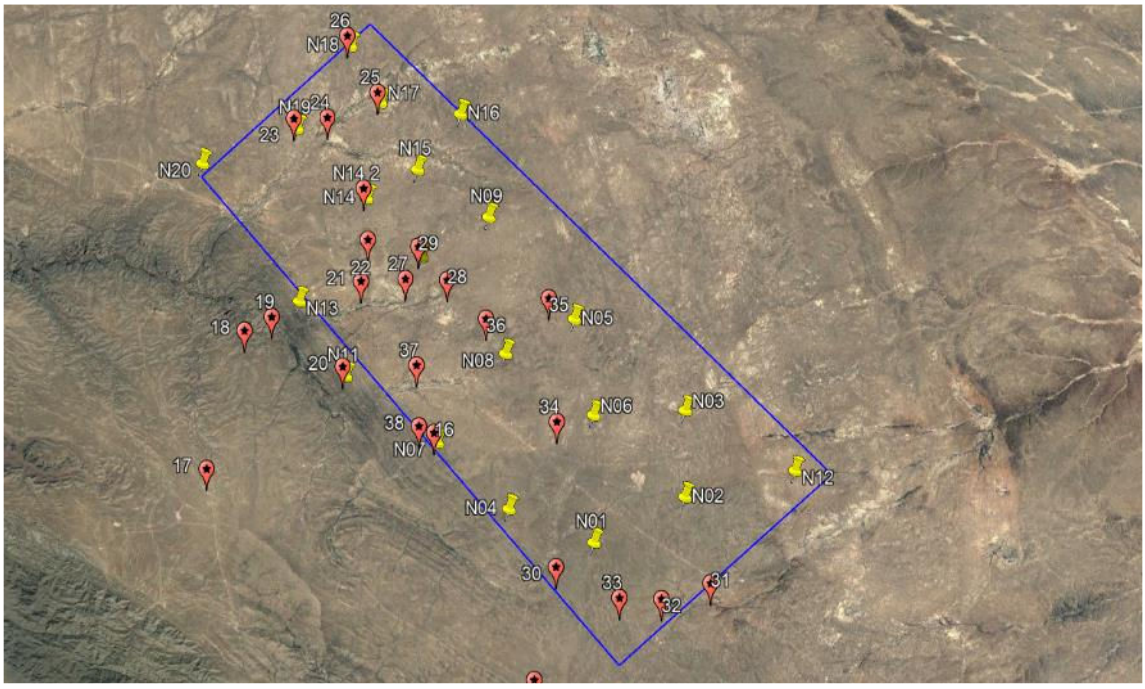


Fig. 62. Satellite image of the site with highlighted community contours.

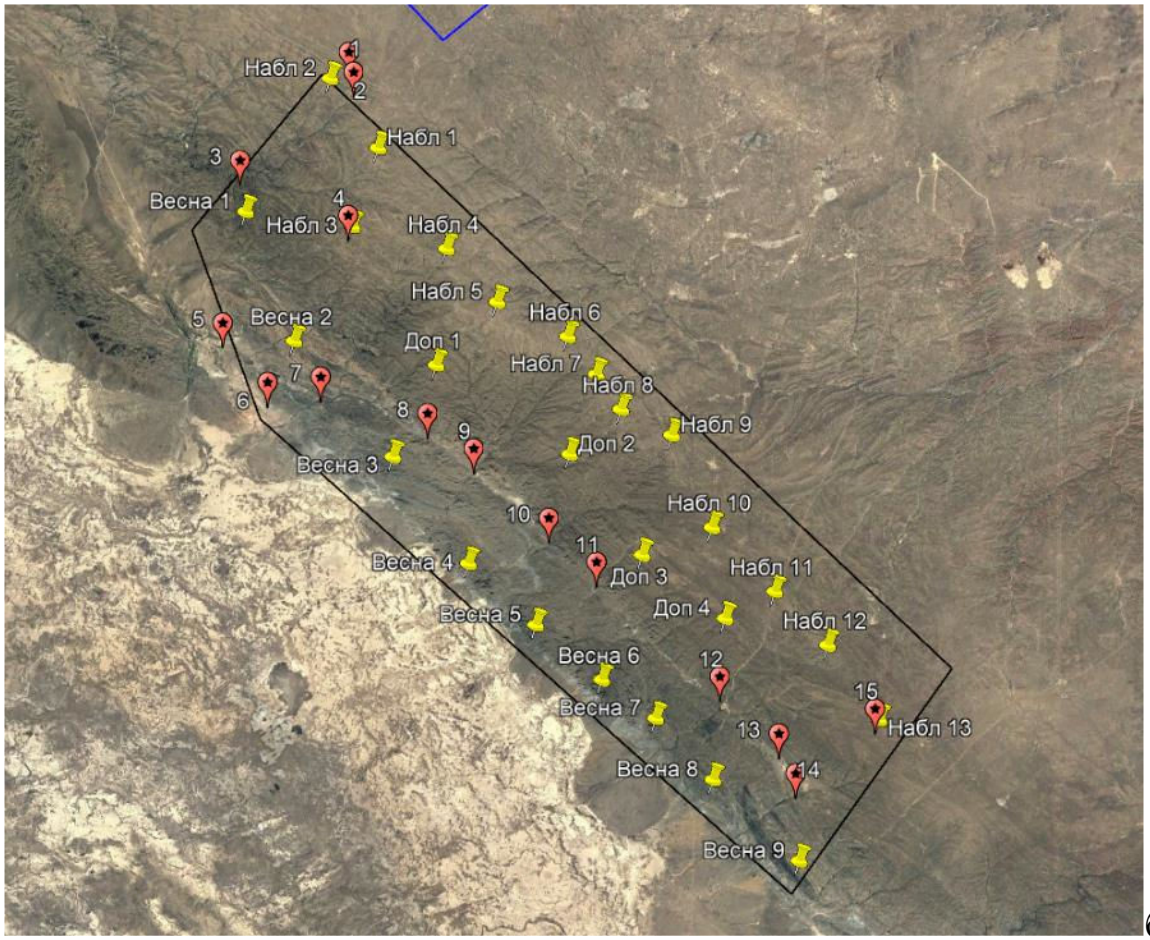
Further on the ground, in the course of describing plant communities and comparing them with the image, decoding and mapping of the main ecosystems of the territory were carried out.

7.3 Survey results

During the field survey of two work sites, descriptive, herbarium, cartographic material was collected by road and foot routes. The location of the main (yellow) and additional (red) points of descriptions of plant communities are presented below (Fig. 63, 64)



а)



б)

Fig. 63, 64. The layout of the main and additional points of the description (a, b)

7.3.1 General characteristics of the territory

In general, the entire territory within which the project sites are located can be characterized as the predominance of the wormwood-boylych complex (*Salsola arbusculiformis, Artemisia terrae-albae, Artemisia semiarida, Artemisia turanica*) with ephemera and ephemeroids along the petrophytic slopes and tops of the hills. Saxaul formations (*Haloxylon aphyllum*) are frequent in depressions of the relief, along the river beds, sometimes in combination with comb (*Tamarix ramosissima*), chingil (*Halimodendron halodendron*). Also, in the lowlands and depressions, there are frequent needlegras (*Neotrinia splendens*) and reeds (*Phragmites australis*) (especially in the southern section of the work).

Sagebrush-boyalych associations Saxaul shrubs

Fig. 65. The main typical associations of the territory (photo Senyak E.

A map of plant communities is presented in the Annex.

7.3.2 Main life forms of plants

According to the main life forms, the plants of the region are divided into 5 types, of which annuals (40%) and herbaceous perennials (35%) predominate. The proportions of semishrubs (10%), shrubs (5%) and semishrubs (5%) are less significant.

The confinement of plants to soil conditions - the distribution of flora by edaphotypes. Three edaphotypes were noted in the plots:

- petrophiles - confined to stony and gravelly soils *(Salsola arbusculiformis, Anabasis salsa*)

- gallophiles - growing on saline and alkaline soils (*Atriplex cana, Suaeda physophora*)

- eurytopic species - widespread, without any special attachment to the mechanical composition and degree of soil scaling (species of the genus *Artemisia, Poa bulbosa*).

Quantitatively, petrophiles and gallophiles predominate in the flora of the study area.

7.3.3 Assessment of the current state of vegetation cover

The assessment of the current state of vegetation in the considered areas and the territory adjacent to them was carried out depending on the main factors of vegetation transformation associated with human economic activity. To assess the degree of anthropogenic disturbance of vegetation, the following criteria are adopted, which are based on changes in: a) species composition; b) phytocenotic role of species (projective cover, abundance and productivity); c) vitality of species (generativity, phenological state, habitus, degree of damage to shoots, disturbance of turfs, presence and abundance of species-indicators of transformation). (Anthropogenic transformation of vegetation in Kazakhstan, 1996). To assess the state of vegetation, the following degrees (gradations) of disturbance were adopted:

1. Background, unchanged vegetation and low degree of disturbance. The latter is manifested in a change in the habitus of individual species, the disappearance of rare and especially sensitive species.

2. Average degree of disturbance: the composition of dominant species is preserved, but individual structural and physiognomic characteristics of communities change; the viability of the species deteriorates.

3. A strong degree of disturbance: there are changes in the species composition of dominants, the species composition of communities is greatly changed and depleted - the number of annuals, ruderal species increases.

In addition to the above gradations, to assess the state of vegetation (according to the "Instructions for conducting large-scale geobotanical surveys of natural forage lands of the Republic of Kazakhstan"), the following criteria have been introduced:

1. *Clean*. The vegetation is in good condition - no tussocks, weeds, failures, etc.

2. *Clogged*. Differ in clogging, inedible, harmful, poisonous plants. Most often, weediness is associated with improperly organized grazing.

3. *Downed.* The emergence of overgrazed pastures is associated with improper economic use (overgrazing), which ultimately leads to a change in the species composition of vegetation and a decrease in productivity.

4. *Eroded*. With a broken surface due to natural causes or as a result of a failure. There is road erosion. Road erosion is shown with a large number of roads.

To assess the impact on the vegetation cover of the study area, the following anthropogenic factors were considered:

1. *Chemical* (pollution by industrial emissions and waste), often an irreversible type of impact; characterized by dusting, deterioration of the vital state of plants and loss of biodiversity at different levels of structural organization. Not observed during site survey in June 2023.

2. *Residential* - industrial (urban, rural, mines, industrial facilities) - local-area irreversible type of impact with various radii from 100 m to 2 km, characterized by the complete destruction of natural vegetation around the objects. Accompanied by littering the territory with household and industrial waste. At several sites (the northern section - near the N14 point) quarry mining was noted, which contributes to the almost complete local destruction of the natural vegetation cover.

Shepherds' sheds are also occasionally found throughout the territory, which can contribute to the contamination of solid waste sites.

3. *Transport* (road network) - a linear-local type of impact, characterized by the complete destruction of vegetation along the road routes, dust and pollution of plants along the routes. It is most pronounced near industrial facilities and in settlements. The road network in the areas under consideration is rather poorly developed. The flow of vehicles is quite low, due to the remoteness of the territory. The only major road leads to the Akbakai field, and in some places, it has an asphalt surface. The traffic load on the sites is weak.

Assessing in general the degree of anthropogenic transformation of vegetation in the study area, it should be noted:

- the natural vegetation cover is mainly in the background state in most of the territory; - the territory is also used for grazing livestock (horses, sheep, cows), which is why certain parts of the territory, as well as around the folds, have downed communities (mainly the southern tip of the southern section);

- in some places there is a high abundance of ebelek (Ceratocarpus arenarius), harmala (Peganum harmala) – indicators of overgrazing;

- the territory is used for watering places (both natural - rivers and channels, and artificial drinking bowls);

- insignificant areas of inter-hill plains and depressions are in the middle degree of anthropogenic transformation (in some places strong - quarry mining); - the presence of a weak network of field roads.

7.3.4 Rare and protected plants

In the course of field work, the presence of several plant species that have the status of rare and endangered, that is, included in the Red Book of the Republic of Kazakhstan, was revealed:

- Albert’s tulip (Tulipa alberti Regel);

- Greig's tulip (Tulipa greigii Regel);

- *Tulipa biflora Pall. (= Tulipa buhseana Boiss.)*

- Borshchov’s tulip (Tulipa borszczowii Regel);

- Regel's tulip (Tulipa regelii Krasn.) - noted in May 2023 within the boundaries of the southern section.

- *Juno kuschakewiczii*

Black saxaul (*Haloxylon aphyllum (Minkw.) Iljin.)* is not included in the Red Book, but is under additional protection (a moratorium on logging).

A brief description and photos of the species are given above in Section 5.1.2.

Tulips were observed sporadically throughout almost the entire territory of the plots, mainly along the rocky slopes and tops of the hills, with the exception of waterlogged relief depressions. At the time of the survey, the tulips were at the stage of fruiting - dry boxes gradually cracked, the seeds were carried by the wind.

In addition to the species included in the Red Book of the Republic of Kazakhstan, endemic species with a limited habitat and confined to the region under consideration were noted at the work site in the period 2023-24:

- Лук шероховатый *(Allium trachyscordum Vved.)*

- Строгановия Траутфеттера *(Stroganowia trautvetteri Botsch.)*

- Астрагал щетинозубый (*Astragalus chaetodon Bunge*)

- Астрагал новый Попова (*Astragalus neo-popovii Golosk.*)

- Зопник северный (*Phlomoides septentrionalis (Popov) Adylov, Kamelin & Makhm.*)

- Шлемник Титова (*Scutellaria titovii Juz.*)

- Кермек узколистный (*Limonium leptophyllum (Schrenk) Kuntze*)

- Саксаульчик шилолистный (*Arthrophytum subulifolium Schrenk*)

- Курчавка прутьевидная (*Atraphaxis virgata (Regel) Kras*n.)

A detailed map of the distribution of Regel's tulip (Tulipa regelii Krasn.) based on the results of the 2023-24 trips is given in Annex.

Black saxaul forms formations on depressions, along riverbeds, and small depressions. The viability of the formations is normal. Massively dry and affected trees were not found.

7.4 Evaluation of the expected impact on the components of the flora. Possible damage during construction

The calculation is carried out in accordance with the “Methodological aspects of the impact assessment on the natural and socio-economic environment” (Kazakh Agency of Applied Ecology “Mariposa”). The significance of anthropogenic disturbances of the natural environment at all levels is assessed according to the following parameters:

– spatial scale (S);

– time scale (T);

– intensity (I).

Comparison of the values of the degree of impact for each parameter is evaluated by a point system according to the developed criteria. Each criterion is based on the practical experience of specialists obtained during the implementation of similar projects. A 4-point system of criteria was adopted. Zero impact will only be in the absence of technical activities or impacts associated with natural natural variability. For a comprehensive methodology for assessing the impact on the natural environment, a multiplicative (multiplication) calculation methodology is used.

7.4.1 Withdrawal of natural habitats and their further degradation

The risk associated with any construction and other human activities. Natural habitats suitable for flora components are removed for the construction of ground facilities (in this case, windmills), roads (access roads to them), etc. This area is already subject to anthropogenic impact - part of it is used for pastures and mining operations (quarries), where the vegetation has already been cleared or there are downed communities. On the other hand, the presence of rare species of flora in the project area increases the risks associated with irreparable loss of habitats for these species.

Habitat removal risks are high (T-4, S-4, I-3) – 11 points.

7.4.2 Habitats fragmentation

Habitat fragmentation is the artificial delineation of natural natural habitats through the construction of roads, pipelines, and other structures. Fragmentation leads not only to a reduction in the number of habitats (and therefore to a reduction in biological diversity), but also to the isolation of the remaining fragments, which increases the risk of species extinction. Habitat fragmentation leads to the emergence and dispersal of simpler species that easily adapt to different ecological niches.

This risk can be assessed as medium (more accurately it will be clear with the scale of construction of access roads): T-4, S-2, I-1 = 7.

7.4.3 Direct influence on flora components during construction

Vegetation will experience excessively high loads, up to complete destruction in the areas of laying the roadbed and the construction of wind farms. However, on the territory, significant impacts should be expected only in local areas allocated directly for infrastructure construction.

Damage can be caused to the Red Book species of tulips - Albert, Greig, Borshchov, Regel - growing everywhere in the plots, as well as black saxaul formations - along relief depressions, as a result of the work of construction equipment (clearing, removing the fertile soil layer, leveling the territory for construction). Works require special attention and should be limited to local location only!

In accordance with the legislation of the Republic of Kazakhstan, for the damage caused to the Red Book and rare species, the user of natural resources is obliged to compensate for the damage in the amount of the approved payment rates for the current moment for each individual or specimen. When deciding on the withdrawal of rare and endangered plant species from the natural environment, their parts or derivatives, the volume of such withdrawals, the amount of the fee and the deadline for payment are established in each individual case by the Government of the Republic of Kazakhstan (Tax Code of the Republic of Kazakhstan).

It should be noted that the issue of the withdrawal of rare plant species for construction purposes, etc. is not regulated by the legislation of the Republic of Kazakhstan.

At the moment, the Ministry of Ecology and Natural Resources is considering a new Order on the prohibition of any logging in saxaul thickets in the territories of the state forest fund of the Republic of Kazakhstan. Logging will be allowed only in cases where it is necessary to lay pipeline routes or develop uranium deposits, and these conditions will be valid until December 31, 2028. At the moment, the Order is under consideration.

Among the disturbed and seized communities is the predominance of the sagebrush-boylych complex (Salsola arbusculiformis, Artemisia terrae-albae) with ephemera and ephemeroids along the petrophytic slopes and tops of the hills. To prevent collision and damage to plants, as well as fragmentation of habitats of flora representatives, it is necessary to exclude unauthorized passage of construction machinery through virgin lands, to ensure travel on specially designated field roads with strict observance of the work schedule.

This risk is assessed as high (T-4, S-3, I-4) = 11.

7.4.4 Influence on the components of flora during the operation of wind turbines

The question of the impact of wind farms on biodiversity components is still open. There are no reliable data on the effect on vegetation. However, in 2012, a group of American researchers obtained data on the impact of wind farms on farm crops (in particular, corn). A positive result of the plant's operation is air mixing, due to which agricultural crops receive more carbon dioxide.

Other positive consequences of the neighborhood of farms with turbines are not so obvious. For example, by making air move, wind turbines can reduce the amount of dew on plant leaves, which would help reduce crop diseases such as those caused by fungi.

Another potentially beneficial result: Because the turbines mix the air masses and slow down the wind, they can also affect the temperature of the air above the crops, making the nights warmer and the days cooler. This could make night frosts and hot days rarer, which will positively affect yields.

Turbulence from turbines is also being investigated, but there is no exact data yet. On the other hand, the influence of turbines on air temperature can also have a downside. An increase in temperature at night can lead to an increase in plant respiration during the night, during which plants return some of the carbon dioxide they have taken in from the air during the day. This can become a negative phenomenon because plants take up less carbon as a result.

The possibility of different exposure options highlights the importance of such studies for agriculture and vegetation in general.

This risk is assessed as medium (B-4, P-3, I-2) = 9.

The assessment of the above risks for the components of the flora is given in Table 18.

Table 18. Ranking of risks for the flora from construction work on the construction of wind farms

Risks for plants	Risk category
Withdrawal of natural habitats and their further degradation	11
Habitat fragmentation	7
Direct influence on flora components during construction	11
Influence on the components of the flora during the operation of windmills	9

7.5 Recommendations for reducing the pressure on vegetation in general and on rare species

- To prevent collision and damage to plants, as well as fragmentation of habitats of flora representatives, it is necessary to exclude unauthorized passage of cars and construction machinery through virgin lands, to ensure travel on specially designated field roads with strict observance of the work schedule.
- The use of specialized containers for solid waste, equipped with tight-fitting lids.
- The use of specialized closed containers for the collection and storage of industrial waste, incl. oiled rag.

- Waste should be removed by specialized enterprises and placed only in specialized landfills.

It is recommended to develop **Internal Rules** to regulate the activities of personnel to reduce the impact on the flora. The rules should include:

- Information about breeding and habitats of rare species of flora and fauna
- Measures to limit disturbance factors during the breeding and growing seasons of rare species
- Restriction on visits by employees to habitats of rare species of flora during the seasons of their greatest environmental sensitivity
- It is recommended, on the basis of the Internal Rules, to develop brief information booklets, with the application of cartographic materials and information on the species composition of rare species of flora in the project area. Information booklets are intended for replication among the staff. You can also place basic information about the regulations in public places on the territory of the enterprise. Timely training of personnel will allow coordinating their actions during the seasons of ecological sensitivity of rare species of flora.

With the implementation of the above recommendations to reduce impact and damage, the risks to biodiversity in general appear to be low and acceptable.

It is also worth taking into account the fact that the work site affects the territory of a protected area - the Zhusandala State Reserved Zone. Within the boundaries of the southern section, in May 2023, the presence of a rare endemic species, the Regel's Tulip, was confirmed. The species grows only in this region – in Chu-Ile mountains. In view of this, it is recommended to change or move the boundaries of the plot in order to preserve the range of this species.

Conclusion and general recommendations

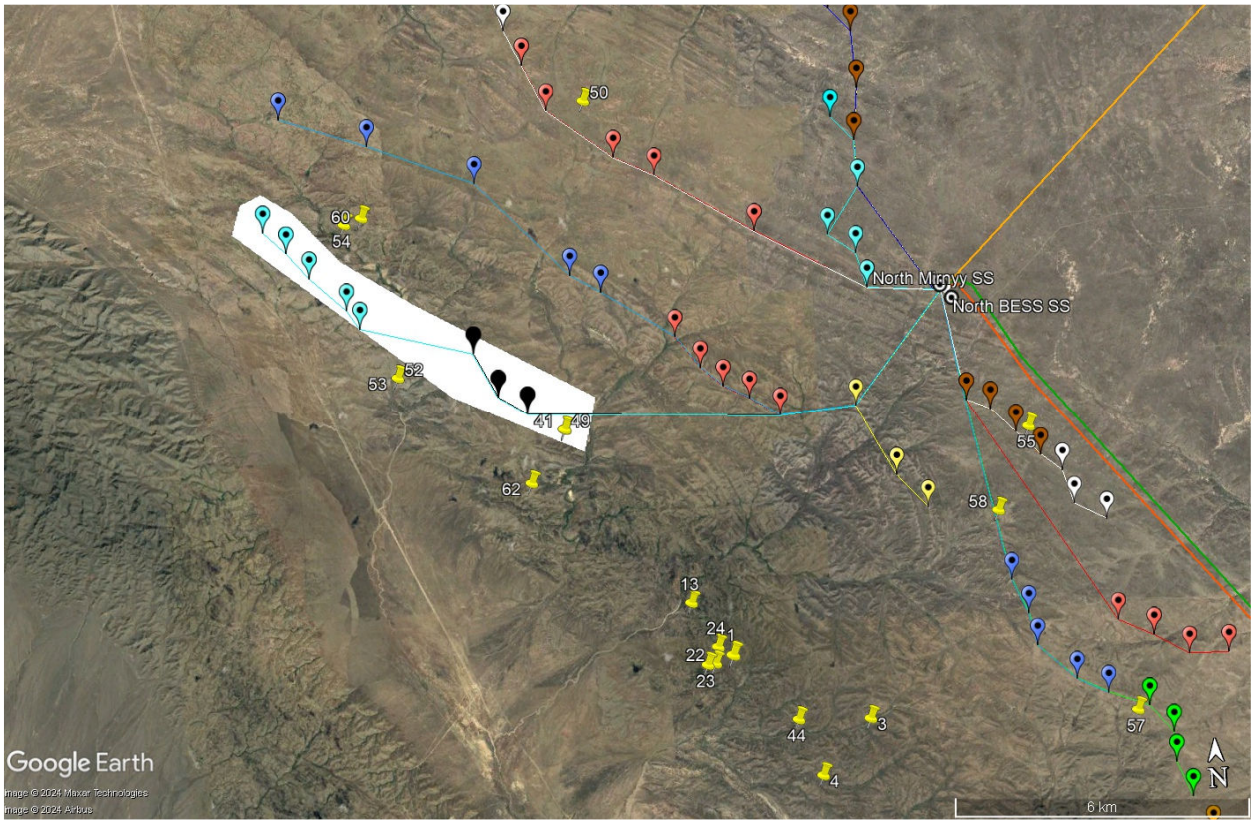
The tasks set by the agreement have been completed. Observation cycles have been conducted and materials have been collected in all areas of work. Materials not presented in the report and used in the calculations of the collision risk for birds are given in Excel tables separately.

During the work, based on the data of spring and summer 2023, the placement of wind turbines has already been adjusted, removed from a significant part of the southern site, where there is a high density of argali and nesting of rare species of birds of prey - the golden eagle and saker falcon. Further measures to reduce harm should be taken on the basis of supplemented observations, taking into account the final project for the placement of wind turbines and based on the calculation of the risk of collisions for migratory and local birds.

Recommendations for reducing the negative impact and preliminary measures to compensate for the harm are given in the sections on individual groups of animals and on plants.

For argali, the following measures are additionally recommended as a priority:

1. Move 8 turbines (GW) from the extreme southwestern branch to more northern sections (to the level of other existing lines or further north), i.e. eliminate this branch (Fig. 66, 67)



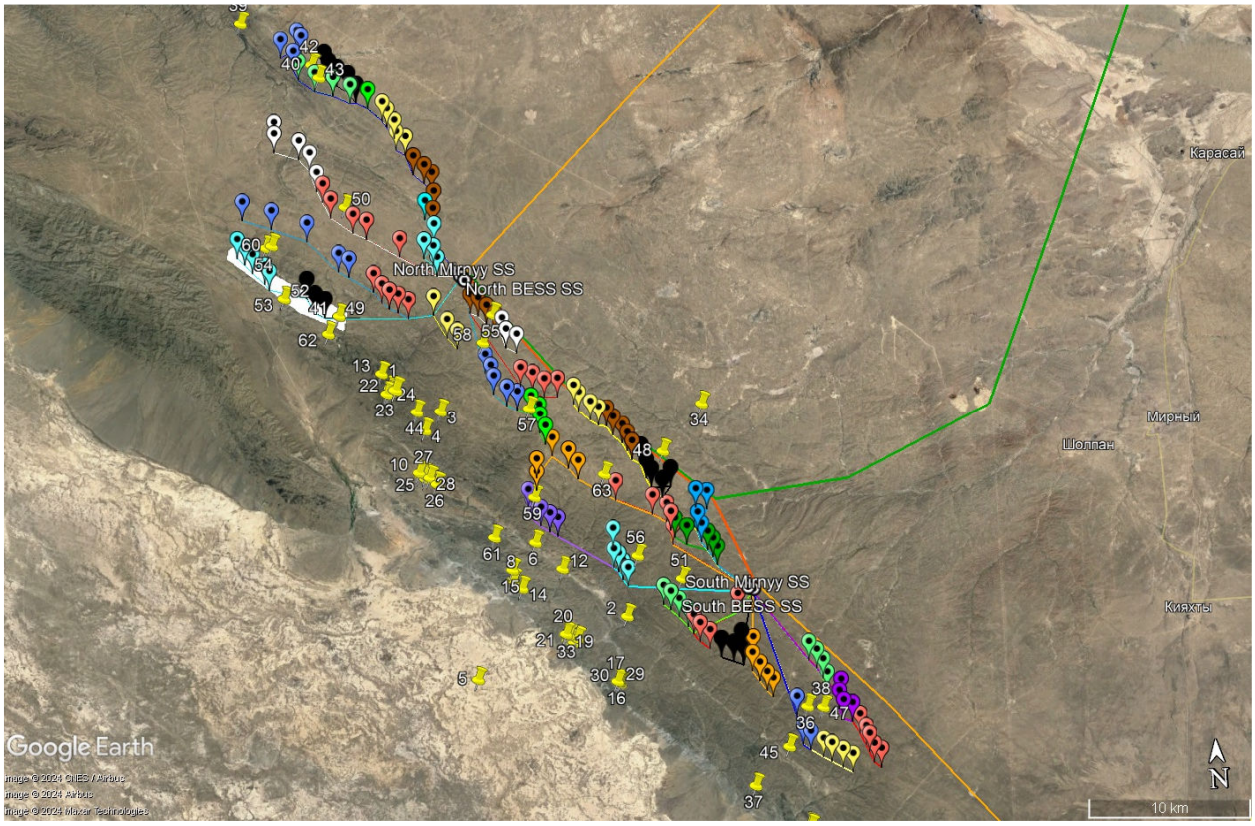


Fig. 66, 67. Turbine layout project (fall 2023) and turbines proposed for relocation (in white fill).

This will facilitate the animals' passage through the valley connecting different parts of the lowlands and reduce potential harm.

2. Minimize the number of technological roads used for construction and then for servicing the installations.

3. Plan (if possible) staged construction in different areas so as not to cause significant disturbance throughout the entire area at once. If local blasting operations are necessary, carry them out in a short time.

4. Use a standard set of measures to reduce disturbance and habitat damage - inadmissibility of transport and other equipment movement off-road, oil spills, waste storage outside special places, informing and instructing personnel, etc.

5. Conduct an inventory of water sources (watering places for argali) in the project area and within a radius of up to 10 km from it, analyze their location and adequacy. If necessary, clear and equip watering places.

6. Discuss with PO Okhotzooprom the possibilities of strengthening the protection of argali in the Chu-Ili Mountains as a whole, develop and agree on a plan to support the conservation of argali and other rare species (as part of the Action Plan for the Conservation of Biodiversity).

Summary recommendations for biodiversity conservation are provided below.

Recommendations for reducing negative impacts and measures to mitigate impacts on argali and other components of biodiversity

1. The construction and operation of the wind farm must be carried out using the best available technologies and design solutions that minimize habitat disturbance. Use a standard set of measures to reduce disturbance and destruction of the habitat - the inadmissibility of moving

vehicles and other equipment outside designated roads, oil spills, storing waste outside special places, etc.

On sensitive species areas, there will not be allowed installation of temporary storage facilities (like storage of diesel / oil, hazardous waste, repair machinery, no workshops, no compound, etc.).

2. Minimize the number of technological roads used for construction and then for servicing the wind farm complex. To reduce the impact, it will establish access control to the road within the wind farm sensitive areas, allowing their use only for limited staff. A specific Traffic Management Plant on sensitive areas, will be implemented and followed to minimize the potential traffic related incidences. Main access roads, temporary and permanent Compound, wind farm substations and battery system will be always located outside the project sensitive areas.

3. Prior the start of construction works within the working areas, conduct short biodiversity checks for the presence of protected flora and fauna species and make sure that relocation of the species is properly and continuously done.

4. Provide for cutting off the top (fertile) layer of soil during excavation work and returning it to its place for reclamation and minimizing changes in the landscape. A Restoration Action Plan will be prepared to guide post-construction restoration of sensitive areas to suitable habitat conditions via seeding with seeds collected prior to the construction phase, re-planting, and landscaping with sensitive flora species will further serve to reduce the impact of habitat loss.

5. In general, no long term fences will be erected on the sensitive species areas. If it is necessary to fence individual areas for health & safety reasons, those fences will be stablished for very reduced and specific periods of time; it is recommended to use metal deer fence (game fence) with different opening sizes for fencing: 400×300 mm two bottom and two upper rows + 50×300 mm all the middle rows, 19 horizontal wires in total, fixed knots, 2000 mm height. Such a fence allows the non-traumatic entry of medium-sized mammals, up to the size of a goitered gazelle, but is an effective barrier for larger animals and humans. This will reduce the negative effect of the fence as an obstacle to the movement of animals.

6. One of the consequences of the construction of a wind farm may be an increase in the density of great gerbil settlements on its territory, which will entail an increased risk of collisions with wind generator blades and the death of large birds of prey. Upon completion of construction, it is recommended to minimize the number and area of objects that are attractive for the construction of burrows for the great gerbil - heaps of soil, uncompacted slopes, etc. In particular, it is recommended to fill the slopes with a layer of crushed stone at least 10 cm deep - this will significantly reduce their attractiveness for the great gerbil.

7. Plan (if possible) phased construction in different areas, so as not to cause powerful disturbances throughout the entire territory at once. If local blasting operations are necessary, carry them out as quickly as possible. It is advisable to minimize work in the valley saxaul forests from April to the end of July, in the small hills - from April to mid-July and in September (periods of breeding and increased activity of animals).

8. Clarify the placement of individual wind turbines to avoid corridors with the highest migrating bird density.

9. Equip wind turbines in particularly sensitive parts of the territory with devices for automatically stopping the turbines when large birds or flocks approach.

10. To prevent the attraction and death of insects, use light sources at the site with minimal glow in the ultraviolet part of spectrum, and during periods of mass of some species, limit the duration of the glow (turn off for a certain period of about 2-3 hours, in the evening after sunset).

11. To reduce the negative impact on the turtle, as well as a number of other reptiles (steppe agama, small lizards and all species of snakes) and toad, it is necessary to develop measures to prevent these animals from getting on the roads used during the construction and operation of the wind farm. Permanent roads should be provided with passages for amphibians and reptiles, probably in the form of pipes or wide passages under the road surface.

12. Conduct an inventory of water sources (argali watering places) in the project area and within a radius of up to 20 km from it, analyze their location and sufficiency. If a need is identified, clean and arrange places for watering.

13. Develop internal rules for personnel regulating behavior at the facility, taking into account the conservation of biodiversity. Conduct mandatory informing and instructing personnel using information booklets/posters about the presence of rare species of plants and animals, sensitive seasons, etc.

14. Conduct long-term biodiversity monitoring to assess possible impacts of flora and fauna species. And if negative impacts are confirmed implement compensation and offset measures. It is recommended to ensure the conservation of similar habitats and species outside the area disturbed by the wind farm (biodiversity offset). It seems most appropriate to provide for constant (during the operation of the wind farm) support of either the Zhusandala reserved zone or the Andasay nature sanctuary closest to it, for the effective conservation of habitats and populations of argali and goitered gazelle in an area no less than will be lost (or degraded) for these species due to the creation wind farm.

15. For the practical implementation of compensatory measures, develop, in coordination with PA Okhotzooprom, a plan to support the conservation of argali and other rare species (within the framework of the Action Plan for Biodiversity Conservation), with appropriate funding from wind farm operators and the signing of relevant agreements.

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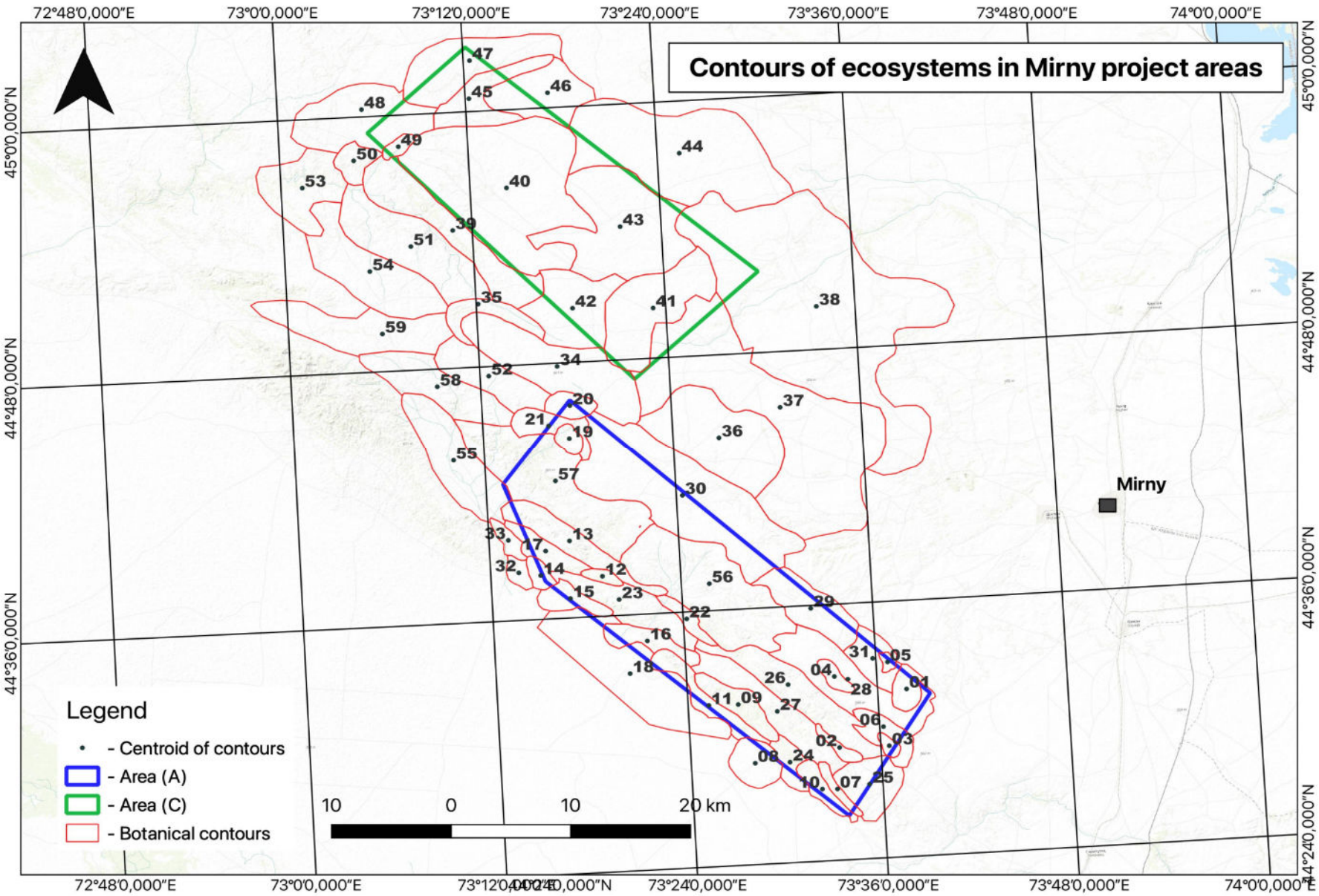
Annexes

Annex 1. Main ecosystems of the project area

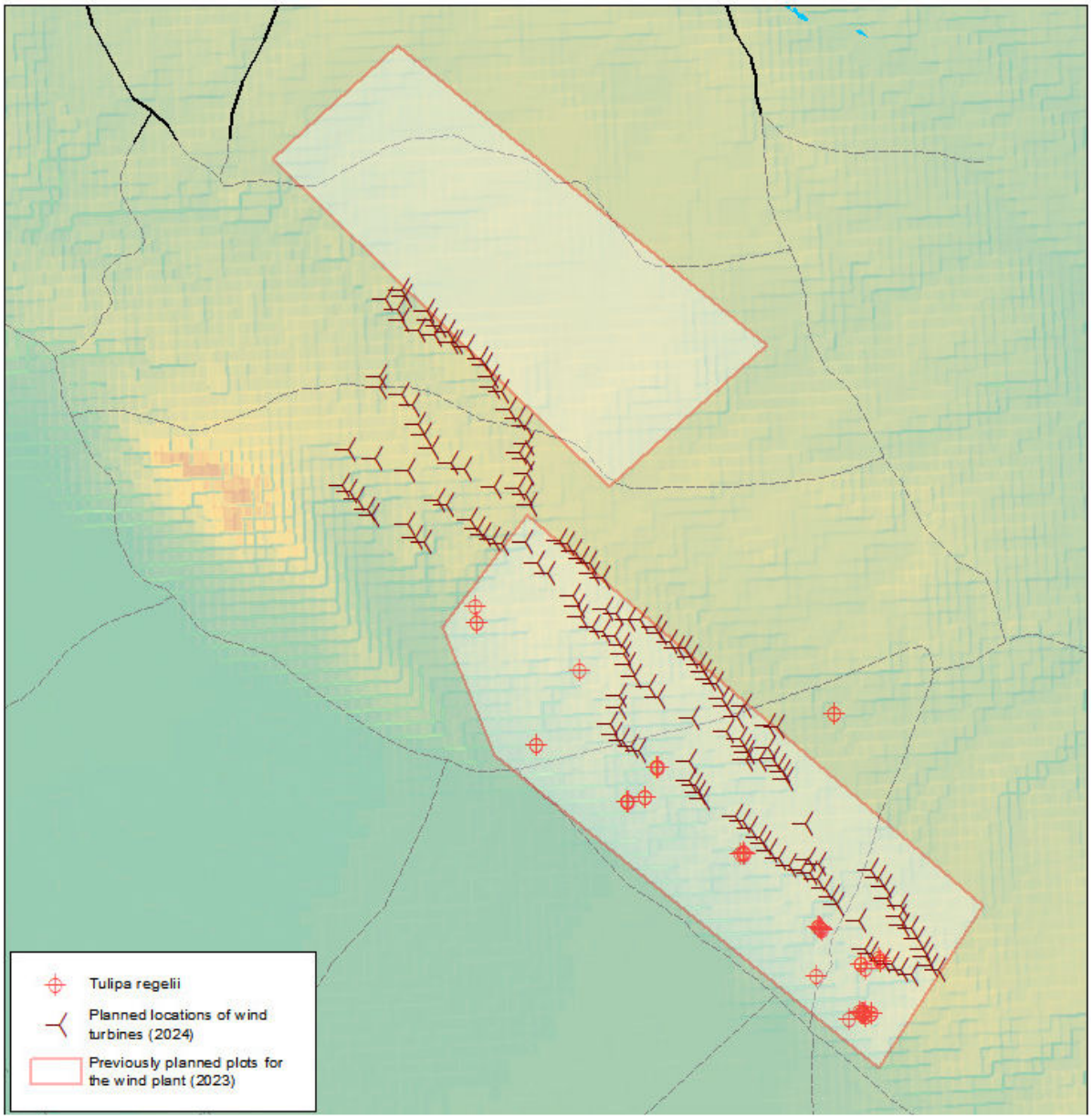


Legend for the ecosystems map

Contour number	Ecosystem (plant association)
Southern area	
01, 28, 04, 05, 06, 31, 29	Wormwood-wire with bluegrass and ebelek (*Ceratocarpus arenarius + Poa bulbosa, Kochia prostrata+ Artemisia semiarida, Artemisia turanica)*
02	Kokpek-sagebrush on the plains (*Artemisia semiarida + Atriplex cana*) and boyalych with bluegrass on the slopes of the hills (*Poa bulbosa, Salsola arbusculiformis*). Sporadically scattered on the slopes **tulips**. **Regel's Tulip (***Tulipa regelii***)** noted.
03	Wormwood with bluegrass
25	Wormwood-boyalych associations along the slopes. **Regel's tulip** (*Tulipa regelii*) was noted.
26, 27	On the plains - Wormwood associations with teresken (*Eurotia ceratoides + Artemisia semiarida + Artemisia tarrae-albae*) in combination with boyalych's (*Salsola arbusculiformis*) associations on the slopes. **Tulips** sporadically on the slopes.
30, 20	A complex of boyalych associations with ephemera and ephemeroids along the slopes of the hills (*Rheum tataricum + Ferula songarica + Tulipa spp. Salsola arbusculiformis*) with sagebrush associations along the valleys between the hills (*Artemisia semiarida, Artemisia tarrae-albae*). On moist lowlands - reeds and mesophytic herbs.
57	On the plains - Wormwood associations with teresken (*Eurotia ceratoides + Artemisia semiarida + Artemisia tarrae-albae*) in combination with boyalych (*Salsola arbusculiformis*) on the slopes. **Tulips** scattered along the slopes. Also, floodplain saxaul formations in combination with chingil, comb (*Tamarix ramosissima, Halimodendron halodendron, Haloxylon aphyllum*). **Regel's tulip (*Tulipa regelii*)** found within the contour
56	On the plains - Wormwood associations with teresken (*Eurotia ceratoides + Artemisia semiarida + Artemisia tarrae-albae*) in combination with boyalych (*Salsola arbusculiformis*) on the slopes. On the slopes, **tulips** are absently scattered. In swampy lowlands – needlegrass (*Neotrinia splendens*) and reed (*Phragmites australis*) formations
Northern area	
40	Complex of sagebrush-boyalych with bluegrass and ephemera *(Rheum tataricum + Ferula songarica + Tulipa spp. + Poa bulbosa + Salsola arbusculiformis + Artemisia semiarida*) with saltwort (*Climacoptera brachiata + Anabasis truncata*), also with nanophyton (*Nanophyton erinaceum*). Saxaul (*Haloxylon aphyllum*) formations along relief depressions and along river beds
43, 44	Complex of Turan-wormwood-boyalych (*Salsola arbusculiformis + Artemisia turanica*) and bluegrass (*Poa bulbosa*) associations
37, 38, 41, 42	Sagebrush on the plains (*Artemisia semiarida*) in combination with boyalych (*Salsola arbusculiformis)* on the slopes. On petrophytic slopes sporadically **tulips**.
45, 46, 47	Wormwood-boyalych (*Salsola arbusculiformis + Artemisia semiarida*). Sporadically sparsely **tulips.**

48, 49	Wormwood with ephemera and ephemeroids (*Rheum tataricum* + *Ferula songarica* + *Artemisia semiarida* + *Artemisia tarrae-albae*) in combination with boyalych associations (Salsola arbusculiformis). Sporadically all over the contour **tulips.**

Annex 2 Map of the distribution of Regel's tulip in the study area



Annex 3. List of plant species recorded during the field survey within the boundaries of the work sites

№	Genus	Russian name	Latin name
Family Хвойниковые - Ephedraceae			
1	**Эфедра (Хвойник) (Ephedra)**	Хвойник хвощевидный	Ephedra equisetina Bunge
Family Луковые - Alliaceae			
2	**Лук (Allium)**	Лук илийский	Allium iliense Regel
3		Лук голубовато-серый	Allium caesium Schrenk
4		Лук обманчивый	Allium decipiens Fisch. ex Schult. & Schult. F.
5		Лук шероховатый	Allium trachyscordum Vved.
6		Лук длинноостроконечный	Allium longicuspis Regel
7		Лук sp.sp.	Allium sp.sp.
Family Асфоделиевые - Asphodelaceae			
8	**Эремурус (Eremurus)**	Эремурус гребенчатый	Eremurus cf. cristatus Vved.
Family Касатиковые (Ирисовые) - Iridaceae			
9	**Ирис (Iris)**	Ирис Кушакевича	Iris kuschakewiczii B.Fedtsch. (= Juno kuschakewiczii (B.Fedtsch.) Poljakov)
10		Ирис тонколистный	Iris tenuifolia Pall.
11		Ирис двучешуйчатый	Iris lactea f. biglumis (Vahl) Kitag. (= Iris pallasii Fisch. ex Trevir. = Iris haematophylla Fisch. ex Link)
Family Амариллисовые - Amaryllidaceae			
12	**Иксиолирион (Ixiolirion)**	Иксиолирион татарский	Ixiolirion tataricum (Pall.) Schult. & Schult. fil.
Family Лилейные - Liliaceae			
13	**Ринопеталюм (Rhinopetalum)**	Ринопеталюм Карелина	Fritillaria karelinii (Fisch. ex D.Don) Baker (= Rhinopetalum karelinii Fisch. ex D.Don)
14	**Тюльпан (Tulipa)**	Тюльпан Альберта	Tulipa alberti Regel
15		Тюльпан Борщова	Tulipa borszczowii Regel
16		Тюльпан Грейга	Tulipa greigii Regel
17		Тюльпан двуцветковый (=Т.бузе)	Tulipa biflora Pall. (= Tulipa buhseana Boiss.)
18		Тюльпан Колпаковского	Tulipa kolpakowskiana Regel
19		Тюльпан Регеля	Tulipa regelii Krasn.

Family Мятликовые - Poaceae			
20	**Костер (Bromus)**	Костер кровельный	Bromus tectorum L.
21	**Мортук (Eremopyrum)**	Мортук восточный	Eremopyrum orientale (L.) Jaub. & Spach
22		Мортук пшеничный	Eremopyrum triticeum (Gaertn.) Nevski
23	**Чий (Neotrinia)**	Чий блестящий	Neotrinia splendens (Trin.) M.Nobis, P.D.Gudkova & A.Nowak
24		Чий раскидистый	Timouria conferta (Poir.) Sennikov (= Achnatherum caragana (Trin.) Nevski)
25	**Мятлик (Poa)**	Мятлик луковичный	Poa bulbosa L.
26	**Ломкоколосник (Psathyrostachys)**	Ломкоколосник ситниковый	Psathyrostachys juncea (Fisch.) Nevski
27	**Ковыль (Stipa)**	Ковыль кавказский	Stipa caucasica Schmalh.
28		Ковыль Дробова	Stipa drobovii (Tzvelev) Czerep.
29		Ковыль Гогенаккера	Stipa hohenackeriana Trin. & Rupr.
30		Ковыль Рихтера	Stipa richteriana Kar. & Kir.
31		Ковыль сарептский	Stipa sareptana A.K.Becker
32		Ковыль подвид Дробова	Stipa cf. subdrobovii M. Nobis & A. Nowak
33	**Тростник (Phragmites)**	Тростник обыкновенный	Phragmites australis (Cav.) Trin. ex Steud. (= Phragmites communis Trin.)
34	**Щетинник (Setaria)**	Щетинник зеленый	Setaria viridis (L.) P. Beauv.
35	**Скрытница (Crypsis)**	Скрытница лисохвостовидная	Sporobolus alopecuroides (Piller & Mitterp.) P.M.Peterson (= Crypsis alopecuroides (Piller & Mitterp.) Schrad.)
Family Осоковые - Cyperaceae			
36	**Осока (Carex)**	Осока толстостолбиковая	Carex pachystylis J. Gay
37		Осока вздутая	Carex physodes M. Bieb.
Family Лютиковые - Ranunculaceae			
38	**Живокость (Delphinium)**	Живокость мелкоморщинистая	Delphinium rugulosum Boiss.
39	**Ломонос (Клематис) (Clematis)**	Ломонос восточный	Clematis orientalis L.
40	**Лютик (Ranunculus)**	Лютик плоскоплодный	Ranunculus platyspermus Fisch. ex DC.
41	**Рогоглавник (Ceratocephala)**	Рогоглавник пряморогий	Ceratocephala orthoceras DC.
42	**Василистник (Thalictrum)**	Василистник равноплодниковый	Thalictrum isopyroides C.A. Mey.
Family Зонтичные - Apiaceae			

43	**Ферула (Ferula)**	Ферула овечья	Ferula ovina (Boiss.) Boiss.
44		Ферула сырейщикова	Ferula syreitschikowii Koso-Pol.
45		Ферула изменчивая	Ferula varia (Schrenk ex Fisch., C.A.Mey. & Avé-Lall.) Trautv.
46	**Ойдибазис (Oedibasis)**	Ойдибазис остроконечный	Oedibasis apiculata (Kar. & Kir.) Koso-Pol.
47		Ойдибазис бутеневый	Oedibasis chaerophylloides (Regel & Schmalh.) Korovin
48	**Шренкия (Schrenkia)**	Шренкия обертковая	Schrenkia involucrata Regel & Schmalh.
Family Крестоцветные - Brassicaceae			
49	**Бурачок (Alyssum)**	Бурачок туркестанский	Alyssum turkestanicum Regel & Schmalh.
50	**Катран (Crambe)**	Катран восточный	Crambe orientalis L.
51	**Дейскурайния (Descurainia)**	Дескурайния Софии	Descurainia sophia (L.) Webb ex Prantl
52	**Веснянка (Erophila)**	Веснянка весенняя	Erophila verna (L.) Bess.
53	**Желтушник (Erysimum)**	Желтушник белоцветный	Erysimum leucanthemum (Stephan ex Willd.) B.Fedtsch.
54	**Ильинския (Iljinskaea)**	Ильинския плоскостручковая	Iljinskaea planisiliqua (Fisch. & C.A. Mey.) Al-Shehbaz, Özüdoğru & D.A. German (= Conringia planisiliqua Fisch. & C.A.Mey.)
55	**Таушерия (Tauscheria)**	Таушерия опушеннoплодная	Isatis gymnocarpa (Fisch. ex DC.) Al-Shehbaz, Moazzeni & Mumm. (= Tauscheria lasiocarpa Fisch. ex DC.)
56	**Клоповник (Lepidium)**	Клоповник пронзенный	Lepidium perfoliatum L.
57	**Строгановия (Stroganowia)**	Строгановия Траутфеттера	Lepidium trautvetteri (Botsch.) Al-Shehbaz (= Stroganowia trautvetteri Botsch.)
58	**Левкой (Matthiola)**	Левкой татарский	Matthiola tatarica (Pall.) DC.
59	**Крупноплодник (Megacarpaea)**	Крупноплодник большеплодый	Megacarpaea megalocarpa (Fisch. ex DC.) B. Fedtsch.
60	**Гулявник (Sisymbrium)**	Гулявник капустовидный	Sisymbrium brassiciforme C.A. Mey.
61		Гулявник изменчивый	Sisymbrium polymorphum (Murray) Roth
62	**Стригозелла (Strigosella)**	Стригозелла африканская	Strigosella africana (L.) Botsch.
Family Барбарисовые - Berberidaceae			
63	**Леонтица (Leontice)**	Леонтица сомнительная	Leontice incerta Pall.
Family Дымянковые - Fumariaceae			
64	**Хохлатка (Corydalis)**	Хохлатка Шангина	Corydalis schanginii (Pall.) B.Fedtsch.
Family Маковые - Papaveraceae			

65	**Мак (Papaver)**	Мак павлиний	Roemeria pavonina (Schrenk) Banfi, Bartolucci, J.-M.Tison & Galasso (= Papaver pavoninum Schrenk)
66		Мак песчаный	Papaver arenarium M. Bieb.
Family Тыквенные - Cucurbitaceae			
67	**Переступень (Bryonia)**	Переступень белый	Bryonia alba L.
Family Пасленовые - Solanaceae			
68	**Дереза (Lycium)**	Дереза волосистотычинковая	Lycium dasystemum Pojark.
Family Бобовые - Fabaceae			
69	**Верблюжья колючка (Alhagi)**	Верблюжья колючка обыкновенная	Alhagi pseudalhagi (M.Bieb.) Desv. ex Wangerin
70	**Астрагал (Astragalus)**	Астрагал щетинозубый	Astragalus chaetodon Bunge
71		Астрагал длиннолистный	Astragalus dolichophyllus Pall.
72		Астрагал шерстистый	Astragalus lanuginosus Kar. & Kir.
73		Астрагал длинноножковый	Astragalus macropus Bunge
74		Астрагал длиннолодочный	Astragalus macrotropis Bunge
75		Астрагал новый Попова	Astragalus neo-popovii Golosk.
76		Астрагал остроплодный	Astragalus oxyglottis Steven ex M. Bieb.
77		Астрагал Палласа	Astragalus pallasii Biehler (= Astragalus lasiophyllus Ledeb.)
78		Астрагал Турчанинова	Astragalus turczaninowii Kar. et Kir.
79		Астрагал sp.sp.	Astragalus sp. (sect. Chaetodon)
80	**Карагана (Caragana)**	Карагана балхашская	Caragana balchaschensis (Kom.) Pojark.
81	**Чингиль (Halimodendron)**	Чингиль серебристый	Caragana halodendron (Pall.) Dum.Cours. (= Halimodendron halodendron (Pall.) Voss)
82	**Ложнософора (Sophora)**	Ложнософора лисохвостная	Sophora alopecuroides L. (= Pseudosophora alopecuroides (L.) Sweet)
83	**Сферофиза (Sphaerophysa)**	Сферофиза солонцовая	Sphaerophysa salsula (Pall.) DC.
84	**Пажитник (Trigonella)**	Пажитник дугообразный	Trigonella arcuata C.A. Mey.
85		Пажитник парноцветковый	Trigonella geminiflora Bunge
86	**Горошек (Vicia)**	Горошек маловолосистый	Vicia subvillosa (Ledeb.) Boiss.
Family Гвоздичные - Caryophyllaceae			
87	**Смолевка (Silene)**	Смолевка кустарничковая	Silene fruticulosa M. Bieb.
88		Смолевка sp.sp.1	Silene sp 1
89		Смолевка sp.sp.2	Silene sp 2

90	**Колючелистник (Acanthophyllum)**	Колючелистник колючий	Acanthophyllum pungens (Bunge) Boiss.
Family Розоцветные - Rosaceae			
91	**Лапчатка (Potentilla)**	Лапчатка джунгарская	Potentilla soongorica Bunge
92		Лапчатка восточная	Sibbaldianthe orientalis (Juz. ex Soják) Mosyakin & Shiyan (= Potentilla orientalis Juz.)
93	**Роза (Rosa)**	Роза персидская	Rosa persica Michaut ex Juss.
94	**Спирея (Spiraea)**	Спирея зверобоелистная	Spiraea hypericifolia L.
Family Гераниевые - Geraniaceae			
95	**Герань (Geranium)**	Герань поперечная	Geranium transversale (Kar. & Kir.) Vved.
96	**Аистник (Erodium)**	Аистник цикутовый	Erodium cicutarium (L.) L'Her.
Family Норичниковые - Scrophpulariaceae			
97	**Додарция (Dodartia)**	Додарция восточная	Dodartia orientalis L.
98	**Цистанхе (Cistanche)**	Цистанхе солончаковая	Cistanche salsa (C.A.Mey.) Beck
99	**Льнянка (Linaria)**	Льнянка заилийская	Linaria transiliensis Kuprian.
100	**Заразиха (Orobanche)**	Заразиха прелестная	Orobanche cf. amoena C.A. Mey.
Family Губоцветные - Lamiaceae			
101	**Зопник (Phlomoides)**	Зопник северный	Phlomoides septentrionalis (Popov) Adylov, Kamelin & Makhm.
102	**Шлемник (Scutellaria)**	Шлемник Титова	Scutellaria titovii Juz.
103	Зизифора (Ziziphora)	Зизифора тонкая	Ziziphora tenuior L.
Family Бурачниковые - Boraginaceae			
104	**Арнебия (Arnebia)**	Арнебия пятнистая	Arnebia guttata Bunge
105	**Нонея (Nonea)**	Нонея каспийская	Nonea caspica (Willd.) G.Donfil.
106	**Гелиотроп (Heliotropium)**	Гелиотроп остроцветковый	Heliotropium acutiflorum Kar. & Kir.
107	**Риндера (Rindera)**	Риндера четырехщитковая	Rindera tetraspis Pall.
Family Свинчатковые - Plumbaginaceae			
108	**Кермек (Limonium)**	Кермек узколистный	Limonium leptophyllum (Schrenk) Kuntze
109		Кермек полукустарниковый	Limonium suffruticosum (L.) Kuntze
110		Кермек ушколистный	Limonium otolepis (Schrenk) Kuntze
111	**Углостебельник (Goniolimon)**	Углостебельник остроконечный	Goniolimon cuspidatum Gamajun.
Family Молочайные - Euphorbiaceae			
112	**Молочай (Euphorbia)**	Молочай репка	Euphorbia rapulum Kar. & Kir.

Family Толстянковые - Crassulaceae			
113	**Ложноочиток (Pseudosedum)**	Ложноочиток Ливена	Pseudosedum lievenii (Ledeb.) A. Berger
Family Маревые - Chenopodiaceae			
114	**Анабазис (Anabasis)**	Анабазис (ежовник) меловой	Anabasis cretacea Pall.
115		Ежовник (анабазис) шерстистоногий	Anabasis eriopoda (Schrenk) Paulsen
116		Анабазис (ежовник) солончаковый	Anabasis salsa (Ledeb.) Benth. ex Volkens
117		Анабазис усеченный	Anabasis truncata (Schrenk) Bunge
118	**Саксаульчик (Arthrophytum)**	Саксаульчик шилолистный	Arthrophytum subulifolium Schrenk
119	**Лебеда (Atriplex)**	Лебеда седая (кокпек)	Atriplex cana Ledeb.
120	**Бассия (Bassia)**	Бассия простертая	Bassia prostrata (L.) Beck (= Kochia prostrata (L.) Schrad.)
121	**Камфоросма (Camphorosma)**	Камфоросма монпелийская	Camphorosma monspeliaca L.
122	**Солянка (Salsola)**	Солянка восточная	Caroxylon orientale (S.G.Gmel.) Tzvelev (= Salsola orientalis S.G. Gmel. = Salsola rigida Pall.)
123		Солянка боялычевидная (Боялыч черный)	Oreosalsola arbusculiformis (Drobow) Sennikov (= Salsola arbusculiformis Drobow)
124		Солянка деревцевидная (Боялыч белый)	Xylosalsola arbuscula (Pall.) Tzvelev
125		Солянка почечконосная	Salsola gemmascens Pall.
126	**Рогач (Ceratocarpus)**	Рогач сумчатый	Ceratocarpus arenarius L. (incl. Ceratocarpus utriculosus Bluket ex Krylov)
127	**Сарсазан (Halocnemum)**	Сарсазан шишковатый	Halocnemum strobilaceum (Pall.) M.Bieb.
128	**Саксаул (Haloxylon)**	Саксаул зайсанский	Haloxylon ammodendron (C.A.Mey.) Bunge ex Fenzl
129		Саксаул черный (безлистный)	Haloxylon aphyllum (Minkw.) Iljin)
130	**Крашенинниковия (Krascheninnikovia)**	Крашенинниковия терескеновая	Krascheninnikovia ceratoides (L.) Gueldenst.
131	**Нанофитон (Nanophyton)**	Нанофитон ежовый	Nanophyton erinaceum (Pall.) Bunge
132	**Сведа (Suaeda)**	Сведа вздутоплодная	Suaeda physophora Pall.
Family Ивовые - Salicaceae			
133	**Тополь (Populus)**	Тополь разнолистный (Туранга)	Populus euphratica Olivier (= Populus diversifolia Schrenk)
134	**Ива (Salix)**	Ива sp.sp.	Salix sp.sp.
Family Гречишные - Polygonaceae			
135	**Курчавка (Atraphaxis)**	Курчавка кустарниковая	Atraphaxis frutescens (L.) K. Koch
136		Курчавка отогнутая	Atraphaxis replicata Lam.
137		Курчавка колючая	Atraphaxis spinosa L.

138		Курчавка прутьевидная	Atraphaxis virgata (Regel) Krasn.
139	**Спорыш (Polygonum)**	Спорыш (Горец) приноготовниковидный	Polygonum paronychioides C.A. Mey.
140	**Щавель (Rumex)**	Щавель sp.sp.	Rumex sp.sp.
141	**Ревень (Rheum)**	Ревень татарский	Rheum tataricum L. f.
Family Гребенщиковые - Tamaricaceae			
142	**Гребенщик (Tamarix)**	Гребенщик рыхлый	Tamarix laxa Willd.
143		Гребенщик ветвистый	Tamarix ramosissima Ledeb.
144			Tamarix sp.
Family Лоховые - Elaeagnaceae			
145	**Лох (Elaeagnus)**	Лох узколистный	Elaeagnus angustifolia L.
Family Ластовневые - Asclepiadaceae			
146	**Ластовень (Cynanchum)**	Ластовень острый	Cynanchum acutum L.
Family Рутовые - Rutaceae			
147	**Цельнолистник (Haplophyllum)**	Цельнолистник исколотый	Haplophyllum acutifolium (DC.) G. Don (= Haplophyllum perforatum (M. Bieb.) Kar. & Kir.)
148		Цельнолистник Бунге	Haplophyllum bungei Trautv.
Family Парнолистниковые - Zygophyllaceae			
149	**Парнолистник (Zygophyllum)**	Парнолистник обыкновенный	Zygophyllum fabago L.
150		Парнолистник бетпакдалинский	Zygophyllum betpakdalense Golosk. & Semiotr. ИЛИ Zygophyllum iliense Popov
Family Селитрянковые - Nitrariaceae			
151	**Селитрянка (Nitraria)**	Селитрянка сибирская	Nitraria sibirica Pall.
Family Гармаловые - Peganaceae			
152	**Гармала (Peganum)**	Гармала обыкновенная	Peganum harmala L.
Family Сложноцветные - Asteraceae			
153	**Амбербоа (Amberboa)**	Амбербоа туранская	Amberboa turanica Iljin
154	**Полынь (Artemisia)**	Полынь ситниковая	Artemisia juncea Kar. & Kir.
155		Полынь лессинговидная	Artemisia sublessingiana Krasch. ex Poljakov
156		Полынь бело-земельная	Artemisia terrae-albae Krasch.
157		Полынь туранская	Artemisia turanica Krasch.
158	**Канкриния (Cancrinia)**	Канкриния безъязычковая	Cancrinia discoidea (Ledeb.) Poljakov ex Tzvelev

159	**Гиалея (Hyalea)**	Гиалея красивая	Centaurea pulchella Ledeb. (= Hyalea pulchella (Ledeb.) K.Koch)
160	**Степторамфус (Steptorhamphus)**	Степторамфус толстостебельный	Cicerbita crassicaulis (Trautv.) Beauverd (= Steptorhamphus crassicaulis (Trautv.) Kirp.)
161	**Кузиния (Cousinia)**	Кузиния родственная	Cousinia affinis Schrenk
162		Кузиния крылатая	Cousinia cf. alata Schrenk
163	**Юнгия (Youngia)**	Юнгия тонколистная	Crepidiastrum tenuifolium (Willd.) Sennikov (= Youngia tenuifolia (Willd.) Babc. & Stebbins)
164	**Наголоватка (Jurinea)**	Наголоватка многолопастная	Jurinea multiloba Iljin
165	**Кёльпиния (Koelpinia)**	Кёльпиния линейная	Koelpinia linearis Pall.
166	**Мелкоголовка (Microcephala)**	Мелкоголовка пластинчатая	Microcephala lamellata (Bunge) Pobed.
167	**Горчак (Acroptilon)**	Горчак ползучий	Rhaponticum repens (L.) Hidalgo (= Acroptilon repens (L.) DC.)
168	**Крестовник (Senecio)**	Крестовник коронопусолистный	Senecio glaucus subsp. coronopifolius (Maire) C.Alexander
169	**Козлобородник (Tragopogon)**	Козлобородник окаймленнолистный	Tragopogon marginifolius Pavl.
170	**Тахтаджяниантa (Takhtajaniantha)**	Тахтаджяниантa крошечная	Takhtajaniantha pusilla (Pall.) Nazarova (= Scorzonera pusilla Pall.)
171	**Одуванчик (Taraxacum)**	Одуванчик sp.sp.	Taraxacum sp.sp.
Family Кутровые - Apocynoceae			
172	**Кендырь (Apocynum)**	Кендырь ланцетолистный	Apocynum lancifolium Russan.

*The species included in the Red Data Book of Kazakhstan are red-marked

Endemic and narrow-area species are orange-marked

Annex 4. Species of birds recorded in April-May 2023 in the project area (Mg - migratory, Br - nesting; * - species recorded outside the boundaries of sites 1 and 2. The species included in Red Data Book of Kazakhstan are highlighted in bold; various threat in IUCN Red List is indicated in brackets in "status" column).

№	Russian name	Scientific name	English Name	Area 1 (north)	Area 2 (south)	Status
	Отряд Пеликанообразные - Pelecaniformes					
1	**Розовый пеликан**	***Pelecanus onocrotalus***	**Great White Pelican**	X	X	Mg
2	Большой баклан	*Phalacrocorax carbo*	Great Cormorant	X		Mg
	Отряд Аистообразные - Ciconiiformes					
3	**Чёрный аист**	***Ciconia nigra***	**Black Stork**	X		Mg
4	Серая цапля	*Ardea cinerea*	Grey Heron		X	Mg
	Отряд Гусеобразные - Anseriformes					
5	Огарь	*Tadorna ferruginea*	Ruddy Shelduck	X		Br?
6	Кряква	*Anas platyrhynchos*	Mallard		X	Mg?
7	Чирок-трескунок	*Anas querquedula*	Garganey		X	Mg, Br?
	Отряд Курообразные - Galliformes					
8	Кеклик	*Alectoris chukar (=kakelik)*	Chukar		X	Br
9	Перепел	*Coturnix coturnix*	Common Quail	X		Mg, Br?
10	Фазан	*Phasianus colchicus*	Common Pheasant (ssp. mongolian)		X	Br
	Отряд Соколообразные – Falconiformes					
11	Пустельга	*Falco tinnunculus*	Kestrel	X	X	Br, Mg
12	Чеглок	*Falco subbuteo*	Eurasian Hobby	X	X	Mg, Br?
13	**Балобан**	***Falco cherrug***	**Saker Falcon**		X	Br, Mg **(EN)**
14	**Шахин**	***Falco pelegrinoides [peregrinus]***	**Barbary Falcon**		X	Br?
15	Хохлатый осоед	*Pernis ptilorhynchus*	Oriental Honey-buzzard		X	Mg
16	Чёрный коршун	*Milvus migrans (*вкл. *lineatus)*	Black Kite	X	X	Mg?
17	**Орлан-белохвост**	***Haliaeetus albicilla***	**White-tailed Sea-eagle**		X	Mg
18	**Змееяд**	***Circaetus gallicus (=ferox)***	**Short-toed Eagle**	X		Br, Mg
19	Болотный лунь	*Circus aeruginosus*	Western Marsh Harrier	X		Mg
20	Степной лунь	*Circus macrourus*	Pallid Harrier	X		Mg, Br? **(NT)**

21	Луговой лунь	*Circus pygargus*	Montagu's Harrier		X	Mg, Br?
22	Тювик	*Accipiter badius*	Shikra		X	Mg, Br?
23	Перепелятник	*Accipiter nisus*	Eurasian Sparrowhawk	X	X	Mg, Br?
24	Тетеревятник	*Accipiter gentilis*	Northern Goshawk	X		Mg
25	Сарыч	*Buteo buteo (*вкл. *vulpinus, menetriesi, japonicus)*	Common Buzzard	X	X	Mg
26	Курганник	*Buteo rufinus*	Long-legged Buzzard	X	X	Br, Mg
27	**Степной орёл**	***Aquila nipalensis***	**Steppe Eagle**	X	X	Br, Mg **(EN)**
28	**Могильник**	***Aquila heliaca***	**Eastern Imperial Eagle**		X	Br, Mg **(VU)**
29	**Беркут**	***Aquila chrysaetos***	**Golden Eagle**	X	X	Br
30	**Орёл-карлик**	***Hieraaetus pennatus***	**Booted Eagle**	X		Mg
	Отряд Журавлеобразные – Gruiformes					
31	**Джек**	***Chlamydotis macqueenii***	**Macqueen's Bustard / Houbara**	X	X	Br, Mg **(VU)**
32	**Стрепет**	***Tetrax tetrax***	**Little Bustard**	X	X	Mg, Br? **(NT)**
33	**Журавль не опред.**		**Crane sp.**	X		Mg
	Отряд Ржанкообразные - Charadriiformes					
34	Авдотка	*Burhinus oedicnemus*	Eurasian Stone-curlew *			Br, Mg
35	Ходулочник	*Himantopus himantopus*	Black-winged Stilt*			Mg, Br?
36	Чибис	*Vanellus vanellus*	Northern Lapwing		X	Mg
37	Малый зуёк	*Charadrius dubius*	Little Ringed Plover	X		Br, Mg
38	Толстоклювый зуёк	*Charadrius leschenaultii*	Greater Sand Plover	X	X	Br, Mg
39	Большой кроншнеп	*Numenius arquata*	Eurasian Curlew*			Mg **(NT)**
40	Травник	*Tringa totanus*	Common Redshank		X	Mg?
41	Черныш	*Tringa ochropus*	Green Sandpiper	X		Mg
42	Перевозчик	*Actitis hypoleucos*	Common Sandpiper	X		Mg
43	Хохотунья	*Larus cachinnans*	Caspian Gull		X	Mg
44	Чеграва	*Hydroprogne caspia (=tschegrava)*	Caspian Tern	X		Mg
	Отряд Рябкообразные – Pterocliformes					
45	**Чернобрюхий рябок**	***Pterocles orientalis***	**Black-bellied Sandgrouse**	X	X	Br, Mg
46	**Саджа**	***Syrrhaptes paradoxus***	**Pallas's Sandgrouse**		X	Br, Mg
	Отряд Голубеобразные – Columbiformes					

47	Сизый голубь	*Columba livia*	Feral Pigeon		X	Br
48	Большая горлица	*Streptopelia orientalis (*вкл. *meena)*	Oriental Turtle-dove		X	Br
49	Кольчатая горлица	*Streptopelia decaocto*	Eurasian Collared-dove*			Br?
	Отряд Кукушкообразные - Cuculiformes					
50	Кукушка	*Cuculus canorus*	Eurasian Cuckoo		X	Br, Mg
	Отряд Козодоеобразные - Caprimulgiformes					
51	Козодой	*Caprimulgus europaeus*	European Nightjar		X	Br, Mg
	Отряд Ракшеобразные – Coraciiformes					
52	Сизоворонка	*Coracias garrulus*	European Roller		X	Br, Mg
53	Зимородок	*Alcedo atthis*	Common Kingfisher		X	Mg, Br?
54	Золотистая щурка	*Merops apiaster*	European Bee-eater		X	Mg, Br?
	Отряд Удодообразные – Upupiformes					
55	Удод	*Upupa epops*	Common Hoopoe		X	Br, Mg
	Отряд Воробьинообразные – Passeriformes					
56	Степной жаворонок	*Melanocorypha calandra*	Calandra Lark	X		Br, Mg
57	Двупятнистый жаворонок	*Melanocorypha bimaculata*	Bimaculated Lark	X	X	Br, Mg
58	Малый жаворонок	*Calandrella brachydactyla*	Greater Short-toed Lark	X		Br, Mg
59	Серый жаворонок	*Calandrella rufescens*	Lesser Short-toed Lark	X	X	Br, Mg
60	Береговушка	*Riparia riparia*	Sand Martin	X		Br, Mg
61	Деревенская ласточка	*Hirundo rustica*	Barn Swallow	X		Mg, Br?
62	Полевой конёк	*Anthus campestris*	Tawny Pipit	X	X	Br, Mg
63	Лесной конёк	*Anthus trivialis*	Tree Pipit	X		Mg
64	Жёлтая трясогузка	*Motacilla flava*	Yellow Wagtail	X		Mg
65	Черноголовая трясогузка	*Motacilla feldegg [flava]*	Black-headed Wagtail		X	Mg
66	Желтоголовая трясогузка	*Motacilla citreola*	Citrine Wagtail	X		Mg
67	Горная трясогузка	*Motacilla cinerea*	Grey Wagtail	X	X	Mg, Br?
68	Белая трясогузка	*Motacilla alba*	White Wagtail	X	X	Mg
69	Маскированная трясогузка	*Motacilla personata*	Masked Wagtail		X	Mg, Br?
70	Горихвостка-лысушка	*Phoenicurus phoenicurus*	Common Redstart	X		Mg
71	Тугайный соловей	*Erythropygia galactotes*	Rufous-tailed Scrub-robin		X	Br, Mg

72	Азиатский черноголовый чекан	*Saxicola torquatus ssp. maurus*	Siberian Stonechat	X	X	Mg, Br?
73	Каменка	*Oenanthe oenanthe*	Northern Wheatear	X		Mg
74	Каменка-плешанка	*Oenanthe pleschanka*	Pied Wheatear	X	X	Br, Mg
75	Пустынная каменка	*Oenanthe deserti*	Desert Wheatear	X	X	Br, Mg
76	Каменка-плясунья	*Oenanthe isabellina*	Isabelline Wheatear	X	X	Br, Mg
77	Пестрый каменный дрозд	*Monticola saxatilis*	Rock Thrush		X	Br
78	Серая мухоловка	*Muscicapa striata*	Spotted Flycatcher	X		Mg
79	Тонкоклювая камышевка	*Acrocephalus melanopogon*	Moustached Warbler	X		Mg
80	Пеночка-теньковка	*Phylloscopus collybita (incl. tristis)*	Siberian Chiffchaff	X		Mg
81	Серая славка	*Sylvia communis*	Common Whitethroat		X	Mg, Br?
82	Славка-завирушка	*Sylvia curruca (*вкл. *minula)*	Lesser Whitethroat	X	X	Br, Mg
83	Пустынная славка	*Sylvia nana*	Asian Desert Warbler	X	X	Br, Mg
84	Бухарская синица	*Parus bokharensis [major]*	Turkestan Tit	X		Br?
85	Туркестанский жулан	*Lanius phoenicuroides*	Red-tailed Shrike	X		Br, Mg
86	Пустынный сорокопут	*Lanius excubitor*	Steppe Grey Shrike	X	X	Br, Mg
87	Сорока	*Pica pica*	Eurasian Magpie		X	Br
88	Чёрная ворона	*Corvus orientalis [corone]*	Oriental Carrion Crow		X	Br?
89	Пустынный ворон	*Corvus ruficollis*	Brown-necked Raven		X	Br
90	Ворон	*Corvus corax*	Common Raven		X	?
91	Майна	*Acridotheres tristis*	Common Myna*			Br
92	Розовый скворец	*Pastor roseus*	Rosy Starling		X	Br, Mg
93	Индийский воробей	*Passer indicus [domesticus]*	Indian Sparrow		X	Br, Mg
94	Горная коноплянка	*Acanthis flavirostris*	Twite		X	Br, Mg
95	Буланый вьюрок	*Rhodospiza obsoleta*	Desert Finch		X	Br, Mg
96	Чечевица	*Carpodacus erythrinus*	Common Rosefinch		X	Mg, Br?
97	Просянка	*Miliaria calandra*	Corn Bunting		X	Mg
98	Скальная овсянка	*Emberiza buchanani*	Grey-necked Bunting		X	Br, Mg
99	Желчная овсянка	*Emberiza bruniceps*	Red-headed Bunting	X	X	Br, Mg

Annex 5. Observations with vantage points in April-May 2023 (Point numbering corresponds to that in the text. Field numbering in brackets, it is also used in the kmz field file.)

№ of VP	Picture of landscape	Date	Time	Air temperature	Moisture, %	Wind speed, m/sec	Wind direction (to)	Clouds, %	Species	Latin name	Number of birds	Time of passage	Height of passage, m	Comments
N02 (2)	100-102	23.04.2023	11:55-13:00	16,2	20,4	6-6,6		50	Sparrowhawk	*Accipiter nisus*	1	12:00	30-40	
N02 (2)	100-102	23.04.2023	11:55-13:00					50	lark sp.	*Melanocorypha sp.*	1+1	12:02		
N02 (2)	100-102	23.04.2023	11:55-13:00			4		50	Short-toed Eagle	*Circaetus gallicus (=ferox)*	1	12:05	162	
N02 (2)	100-102	23.04.2023	11:55-13:00					50	Kestrel	*Falco tinnunculus*	1		10-20	
N02 (2)	100-102	23.04.2023	11:55-13:00					50	Kestrel	*Falco tinnunculus*	1 + 1 femal e	12:40	20-30	
N02 (2)	100-102	23.04.2023	11:55-13:00					50	desert warbler	*Sylvia nana*	1			
N03 (3)	109-111	23.04.2023	14:30-15:40		22,5	3,7	SE	70-80	Montagu's harrier	*Circus cyaneus*	1 male	14:40	5 (low)	NE
N03 (3)	109-111	23.04.2023	14:30-15:40					70-80	desert wheatear	*Oenanthe deserti*	1		5-10	
N03 (3)	109-111	23.04.2023	14:30-15:40					70-80	small passerines		1+1			
N03 (3)	109-111	23.04.2023	14:30-15:40					70-80	Short-toed lark	*Calandrella brachydactyla*	1		28	
N03 (3)	109-111	23.04.2023	14:30-15:40					70-80	Short-toed lark	*Calandrella brachydactyla*	5 (3+2)	15:30		

N12 (12)	125	23.04.2023	16:12-17:25	3,3-4	B	40-50, sunny	Long-legged Buzzard	*Buteo rufinus*	2 (male, female	16:30	1000-1500	about 4 km from VP, from SE to NW
N12 (12)	125	23.04.2023	16:12-17:25	2-2,3		40-50, sunny	desert wheatear	*Oenanthe deserti*	2 singing males + 1 female	16:30		
N12 (12)	125	23.04.2023	16:12-17:25			40-50, sunny	Long-legged Buzzard	*Buteo rufinus*				
(st23april)	pictures of Eremias arguta and great gerbil	24.04.2023	10:50-12:00		NW	cloudy	Montagu's harrier	*Circus pygargus*	1	10:50	30	from S to N
(st23april)		24.04.2023	10:50-12:00			cloudy	ruddy shelduck	*Tadorna ferruginea*	2 pair)			to NE
(st23april)		24.04.2023	10:50-12:00			cloudy	Short-toed Eagle	*Circaetus gallicus (=ferox)*	1	11:20	50	above VP
(st23april)		24.04.2023	10:50-12:00			cloudy	Turkestan tit	*Parus bokharensis [major]*	2 (pair)	11:30	6-30	breeding area in radius of 80 m from VP
(st23april)		24.04.2023	10:50-12:00			cloudy	pied wheatear	*Oenanthe pleschanka*	2 (territorial pair)		4-6	
(st23april)		24.04.2023	10:50-12:00			cloudy	black redstart	*Phoenicurus ochruros*	1 (male)			to west from VP
(st23april)		24.04.2023	10:50-12:00			cloudy	chiffchaff	*Phylloscopus collybita*	3 feeding	11:30	1-5	

								(вкл. tristis)				
(st23april)		24.04.2023	10:50-12:00			cloudy	lesser whitethroat	*Sylvia curruca (incl. minula)*	2	11:40	5	77 m to north from VP
(st23april)		24.04.2023	10:50-12:00			cloudy	calandra lark	*Melanocorypha calandra*	1 male	11:50	50	100 m E
(st23april)		24.04.2023	10:50-12:00			cloudy	calandra lark	*Melanocorypha calandra*	1	11:55	50	200 m W
N06 (6)	0232-0234	24.04.2023	14:40-15:40	21, cool	5,1-5,3	NW, 324	calandra lark	calandra lark	*Melanocorypha calandra*	3 singing		in bushes	
N06 (6)	0232-0234	24.04.2023	14:40-15:40	21, cool			90-70	white wagtail	*Motacilla alba(вкл. ocularis, baicalensis, leucopsis)*	2+2	15:05		
N06 (6)	0232-0234	24.04.2023	14:40-15:40	21, cool			90-70	small passerines		6	15:00	50	from W to E
N06 (6)	0232-0234	24.04.2023	14:40-15:40	21, cool			90-70	great grey shrike	*Lanius lahtora (incl. pallidirostris) [excubitor, meridionalis]*	1	15:15	on bush	
N05 (5)	0246-0248	24.04.2023	16:00-17:30	20,3-21, cool	3,2-4,3	NW, 305	60-50	small passerines		1			from W to N
N05 (5)	0246-0248	24.04.2023	16:00-17:30	20,3-21, cool	3,2-4,3	NW, 305	60-50	Sparrowhawk	*Accipiter nisus*	1	16:10	10	above VP
N05 (5)	0246-0248	24.04.2023	16:00-17:30	20,3-21, cool	3,2-4,3	NW, 305	60-50	lark sp.	*Calandrella sp.*	1	16:30	30	from N to S
N05 (5)	0246-0248	24.04.2023	16:00-17:30	20,3-21, cool	3,2-4,3	NW, 305	60-50	small passerines		1		30-40	from N to NW

N05 (5)	0246-0248	24.04.2023	16:00-17:30	20,3-21, cool		3,2-4,3	NW, 305	60-50	Common Buzzard	*Buteo buteo (incl. vulpinus, menetriesi, japonicus)*	1	16:07	30	from NW to SE, 100 m from VP
N08 (8)	0267-0270	24.04.2023	17:55-18:55	22,9		5,5-6,1	WNW, 286	40-50, sunny	small passerines		group			100-200 from VP, flying between bushes
N08 (8)	0267-0270	24.04.2023	17:55-18:55	22,9		5,5-6,1	WNW, 286	40-50, sunny	isabelline wheatear	*Oenanthe isabellina*	1	18:00	1-3	on bushes
N08 (8)	0267-0270	24.04.2023	17:55-18:55	22,9		5,5-6,1	WNW, 286	40-50, sunny	desert wheatear	*Oenanthe deserti*	4	18:10	1-3	on bushes
N08 (8)	0267-0270	24.04.2023	17:55-18:55	22,9		5,5-6,1	WNW, 286	40-50, sunny	desert wheatear	*Oenanthe deserti*	1	18:20	1-2	from SW to E
(st24april)	0284-0287	25.04.2023	9:00-11:00	13		strong wind, 4,8-5,5, sometimes up to 6,8-8.	ENE, 62	0	yellow wagtail	*Motacilla flava*	2	9:10	30	
(st24april)	0284-0287	25.04.2023	9:00-11:00	13		strong wind, 4,8-5,5, sometimes up to 6,8-8.	ENE, 62	0	Long-legged Buzzard	*Buteo rufinus*	1	9:20	10-20	1.5 km from VP
(st24april)	0284-0287	25.04.2023	9:00-11:00	13		strong wind, 4,8-5,5, sometimes up to 6,8-8.	ENE, 62	0	short-toed lark	*Calandrella brachydactyla*	1		1-3	

(st24april)	0284-0287	25.04.2023	9:00-11:00	13		strong wind, 4,8-5,5, sometimes up to 6,8-8.	ENE, 62	0	calandra lark	*Melanocorypha calandra*	1			
(st24april)	0284-0287	25.04.2023	9:00-11:00	13		strong wind, 4,8-5,5, sometimes up to 6,8-8.	ENE, 62	0	lesser short-toed lark	*Calandrella rufescens*	1			
(st24april)	0284-0287	25.04.2023	9:00-11:00	13		strong wind, 4,8-5,5, sometimes up to 6,8-8.	ENE, 62	0	lesser short-toed lark	*Calandrella rufescens*	3	10:28	5-10	100 m from VP, singing
(st24april)	0284-0287	25.04.2023	9:00-11:00	13		strong wind, 4,8-5,5, sometimes up to 6,8-8.	ENE, 62	0	Long-legged Buzzard	*Buteo rufinus*	1		5-10	from NW to E; 250 m from VP to S
(st24april)	0284-0287	25.04.2023	9:00-11:00	13		strong wind, 4,8-5,5, sometimes up to 6,8-8.	ENE, 62	0	yellow wagtail	*Motacilla flava*	1	10:55	1-10	from S to N
N09 (9)	0296-0292	25.04.2023	12:02-13:02	17, cool	38	4,8-5,8	ENE, 48-51	0	lark sp.	*Calandrella*	3	12:20		

										brachydactyla				
N09 (9)	0296-0292	25.04.2023	12:02-13:03	17, cool	38	4,8-5,8	ENE, 48-51	0	small passerines		6	12:40	20-40	
N09 (9)	0296-0292	25.04.2023	12:02-13:04	17, cool	38	4,8-5,8	ENE, 48-51	0	desert wheatear	*Oenanthe deserti*	1	13:00		20 m from VP
N15 (15)	0300-0303	25.04.2023	13:25-14:25	cold, 17,8		6,2-5,6 (up to 8,1)	ENE-NE 48	0	Желтая трясогузка	*Motacilla flava*	1	14:05	2-4	at VP
N15 (15)	0300-0303	25.04.2023	13:25-14:25	cold, 17,8		6,2-5,6 (up to 8,1)	ENE-NE 48	0	Long-legged Buzzard	*Buteo rufinus*	1	14:00	1000-1500	1 km from VP
(st27april)	0320-0318	28.04.2023	8:40-12:10	cool		4		0	Sparrowhawk	*Accipiter nisus*	1	9:42	3-4	from S to N
(st27april)	0320-0318	28.04.2023	8:40-12:10	cool		4		0	white wagtail	*Motacilla alba(вкл. ocularis, baicalensis, leucopsis)*	20	9:50	3	from S to N
(st27april)	0320-0318	28.04.2023	8:40-12:10	cool		4		0	calandra lark	*Melanocorypha calandra*	1			
(st27april)	0320-0318	28.04.2023	8:40-12:10	cool		4		0	desert wheatear	*Oenanthe deserti*	1	11:00		
(st27april)	0320-0318	28.04.2023	8:40-12:10	cool		4		0	booted eagle	*Hieraaetus pennatus*	1			
(st27april)	0320-0318	28.04.2023	8:40-12:10	cool		4		0	sand martin	*Riparia riparia*	1			
(st27april)	0320-0318	28.04.2023	8:40-12:10	cool		4		0	yellow wagtail	*Motacilla flava*	6	10:02	2	from E to W
(st27april)	0320-0318	28.04.2023	8:40-12:10	cool		4		0	Long-legged Buzzard	*Buteo rufinus*	1	10:50	30	above VP
(st27april)	0320-0318	28.04.2023	8:40-12:10	cool		4		0	Sparrowhawk	*Accipiter nisus*	1	11:05	8	
(st27april)	0320-0318	28.04.2023	8:40-12:10	cool		4		0	yellow wagtail	*Motacilla flava*	4	11:37	10-15	

(st27april)	0320-0318	28.04.2023	8:40-12:10	cool	4		0	Sparrowhawk	*Accipiter nisus*	1	11:45	3-4	
N20 (20)	0321-0322	28.04.2023	13:15-14:30	25,8	5,4	347	0	yellow wagtail	*Motacilla flava*	2			
N20 (20)	0321-0322	28.04.2023	13:15-14:30	25,8	5,4	347	0	calandra lark	*Melanocorypha calandra*	1			
N19 (19)	0323-0325	28.04.2023	16:00-17:20	28	2,1-6,1	C	0	lesser short-toed lark	*Calandrella rufescens*	3		10-20	
N19 (19)	0323-0325	28.04.2023	16:00-17:20	28	2,1-6,1	C	0	calandra lark	*Melanocorypha calandra*	2			in bushes
N18 (18)	0327-0329	28.04.2023	17:58-19:00	25	4,6	NNW	0	short-toed lark	*Calandrella brachydactyla*	1	18:00		in bushes
N18 (18)	0327-0329	28.04.2023	17:58-19:00	25	4,6	NNW	0	hoopoe	*Upupa epops*	1	18:29	1-2	from W to E
N18 (18)	0327-0329	28.04.2023	17:58-19:00	25	4,6	NNW	0	lesser short-toed lark	*Calandrella rufescens*	2	18:40	40	above VP
N18 (18)	0327-0329	28.04.2023	17:58-19:00	25	4,6	NNW	0	sand martin	*Riparia riparia*	1		40-50	above VP
N01 (1)	0330-0333	29.04.2023	14:34-15:34	hot, 30	1,6	W, 264	0	lark sp.	*Calandrella sp.*	2	14:45	10-20	
N01 (1)	0330-0333	29.04.2023	14:34-15:34	hot, 30	1,6	W, 264	0	short-toed lark	*Calandrella brachydactyla*	3	14:50	0	in bushes near VP
N01 (1)	0330-0333	29.04.2023	14:34-15:34	hot, 30	1,6	W, 264	0	yellow wagtail	*Motacilla flava*	1	15:05	30-40	to N
N01 (1)	0330-0333	29.04.2023	14:34-15:34	hot, 30	1,6	W, 264	0	yellow wagtail	*Motacilla flava*	2	15:07	5	to S
N01 (1)	0330-0333	29.04.2023	14:34-15:34	hot, 30	1,6	W, 264	0	northern wheatear	*Oenanthe oenanthe*	1		0	in bushes
N01 (1)	0330-0333	29.04.2023	14:34-15:34	hot, 30	1,6	W, 264	0	Sparrowhawk	*Accipiter nisus*	1	15:10	30-200	500 m from VP, to NE from VP

N04 (4)	0334-0337	29.04.2023	15:59-16:59	29		3,2-4,2	WNW 291	0	short-toed lark	*Calandrella brachydactyla*	2	16:00	0	in bushes
N04 (4)	0334-0337	29.04.2023	15:59-16:59	29		3,2-4,2	WNW 291	0	short-toed lark	*Calandrella brachydactyla*	1	16:05	30-40	singing
N04 (4)	0334-0337	29.04.2023	15:59-16:59	29		3,2-4,2	WNW 291	0	raptor sp.		1	16:30	0-500	to W; 700 m from VP to S
N07 (7)	0345-0348	29.04.2023	17:33-18:53	28-25		2,6	WNW 295	0	short-toed lark	*Calandrella brachydactyla*	1	17:40	0	in bushes
N07 (7)	0345-0348	29.04.2023	17:33-18:53	28-25		2,6	WNW 295	0	lesser short-toed lark	*Calandrella rufescens*	1	17:54	4	100 m E from VP
N07 (7)	0345-0348	29.04.2023	17:33-18:53	28-25		2,6	WNW 295	0	short-toed lark	*Calandrella brachydactyla*	1	18:20	0	in bushes
N07 (7)	0345-0348	29.04.2023	17:33-18:53	28-25		2,6	WNW 295	0	Short-toed Eagle	*Circaetus gallicus (=ferox)*	2	17:50	300-500	from SW to NE
N11 (11)		30.04.2023	08:30-11:07	warm, but the wind is cool			N	0	tawny pipit	*Anthus campestris*	1	8:30		in bushes
N11 (11)		30.04.2023	08:30-11:07	warm, but the wind is cool			N	0	grey wagtail	*Motacilla cinerea*	1	8:40-9:00	0-10	between bushes
N11 (11)		30.04.2023	08:30-11:07	warm, but the wind is cool			N	0	desert wheatear	*Oenanthe deserti*	2 males			
N11 (11)		30.04.2023	08:30-11:07	warm, but the wind is cool			N	0	lesser short-toed lark	*Calandrella rufescens*	2			
N11 (11)		30.04.2023	08:30-11:07	warm, but the wind is cool			N	0	wagtail sp.	*Motacilla sp.*	3	10:15	2-3	
N11 (11)		30.04.2023	08:30-11:07	warm, but the wind is cool			N	0	barn swallow	*Hirundo rustica*	1	10:40	5-7	above VP

N13 (13)	0358-0361	30.04.2023	13:45-15:15	27,5		6,8	N	40	Golden Eagle	*Aquila chrysaetos*	feathers found here; roost			
N13 (13)	0358-0361	30.04.2023	13:45-15:15	27,5		6,8	N	40	stonechat	*Saxicola maurus (incl. variegatus, armenicus) [torquatus]*	1		0	180 m S from VP.
N13 (13)	0358-0361	30.04.2023	13:45-15:15	27,5		6,8	N	40	Long-legged Buzzard	*Buteo rufinus*	3	15:10	250	above VP
N13 (13)	0358-0361	30.04.2023	13:45-15:15	27,5		6,8	N	40	Hobby	*Falco subbuteo*	1	14:50	50	
N13 (13)	0358-0361	30.04.2023	13:45-15:15	27,5		6,8	N	40	sand martin	*Riparia riparia*	9	15:13	5-7	
N13 (13)	0358-0361	30.04.2023	13:45-15:15	27,5		6,8	N	40	kestrel	*Falco tinnunculus*	1	14:50	50	
N16 (16)	0362-0364	30.04.2023	17:18-18:19	24		4-6,5	NNW, 334	0	stonechat	*Saxicola maurus (incl. variegatus, armenicus) [torquatus]*	1	17:20		on bushaway,
N16 (16)	0362-0364	30.04.2023	17:18-18:19	24		4-6,5	NNW, 334	0	Long-legged Buzzard	*Buteo rufinus*	1	17:30		flew up and away, 90 m from VP
N16 (16)	0362-0364	30.04.2023	17:18-18:19	24		4-6,5	NNW, 334	0	short-toed lark	*Calandrella brachydactyla*	1	17:50		in bushes
N16 (16)	0362-0364	30.04.2023	17:18-18:19	24		4-6,5	NNW, 334	0	desert wheatear	*Oenanthe deserti*	1 male			150 m to W from VP
N16 (16)	0362-0364	30.04.2023	17:18-18:19	24		4-6,5	NNW, 334	0	desert wheatear	*Oenanthe deserti*	2 male			at SW from VP

N16 (16)	0362-0364	30.04.2023	17:18-18:19	24		4-6,5	NNW, 334	0	lesser short-toed lark	*Calandrella rufescens*	1	17:30		in bushes
N17 (17)	0387-0390	30.04.2023	18:52-19:52	22-20		4,7	NNW, 342	20	lesser short-toed lark	*Calandrella rufescens*	1	19:00	30-40	flying above VP and singing
N17 (17)	0387-0390	30.04.2023	18:52-19:52	22-20		4,7	NNW, 342	20	calandra lark	*Melanocorypha calandra*	1	19:00	30-40	flying above VP and singing
N17 (17)	0387-0390	30.04.2023	18:52-19:52	22-20		4,7	NNW, 342	20	Long-legged Buzzard	*Buteo rufinus*	1	19:12	100-150	flew up and away
N17 (17)	0387-0390	30.04.2023	18:52-19:52	22-20		4,7	NNW, 342	20	desert wheatear	*Oenanthe deserti*	1	19:20	2	flying between bushes and singing
N17 (17)	0387-0390	30.04.2023	18:52-19:52	22-20		4,7	NNW, 342	20	lesser short-toed lark	*Calandrella rufescens*	1	19:40	60	singing
N10 (10)	0391-0394	01.05.2023	08:00-11:28	13		8		10	yellow wagtail	*Motacilla flava*	1	8:05		
N10 (10)	0391-0394	01.05.2023	08:00-11:28	13		8		10	turkestan shrike	*Lanius phoenicuroides (incl. karelini) [isabellinus]*	1			singing on bush
N10 (10)	0391-0394	01.05.2023	08:00-11:28	13		8		10	lesser short-toed lark	*Calandrella rufescens*	1			singing on bush
N10 (10)	0391-0394	01.05.2023	08:00-11:28	13		8		10	desert wheatear	*Oenanthe deserti*	1			
N10 (10)	0391-0394	01.05.2023	08:00-11:28	13		8		10	lesser short-toed lark	*Calandrella rufescens*	1	10:15	20	above VP
N10 (10)	0391-0394	01.05.2023	08:00-11:28	13		8		10	black-bellied sandgrouse	*Pterocles orientalis*	6	10:17	100	from E to W
N14 (14)	0395-0398	02.05.2023	12:24-13:26	18, cold; cold wind		8-10	NNE	10	short-toed lark	*Calandrella*	1	12:30	2	above VP

									brachydactyla				
N14 (14)	0395-0398	02.05.2023	12:24-13:26	18, cold; cold wind	8-10	NNE	10	short-toed lark	*Calandrella brachydactyla*	1 самец		0	singing in bushes
N14 (14)	0395-0398	02.05.2023	12:24-13:26	18, cold; cold wind	8-10	NNE	10	lesser short-toed lark	*Calandrella rufescens*	2			140 m NE from VP
N14 (14)	0395-0398	02.05.2023	12:24-13:26	18, cold; cold wind	8-10	NNE	10	desert warbler	*Sylvia nana*	1	13:02	0	singing in bushes

Annex 6. Coordinates of stationary bat counting points

№ of point	Coordinates		№ of point	Coordinates	
	° North	° East		° North	° East
Camp 2023-06-18	44,85023	73,39798	A02 2023-06-26	44,88626	73,39958
A01 2023-06-20 12:30	44,92471	73,33214	A02 2023-06-27	44,95707	73,14705
A01 2023-06-20 20:32	45,01121	73,26409	A02 2023-06-28	44,52045	73,52918
A01 2023-06-21	44,86067	73,47192	A02 2023-06-30	44,70284	73,28700
A01 2023-06-22	44,71018	73,24838	A03 2023-06-19	44,87958	73,45465
A01 2023-06-23	44,57227	73,47664	A03 2023-06-22	44,70750	73,25072
A01 2023-06-24	44,56489	73,37744	A03 2023-06-23	44,52043	73,51179
A01 2023-06-25	44,47567	73,51141	A03 2023-06-26	44,88833	73,40233
A01 2023-06-26	44,88568	73,40274	A03 2023-06-27	44,93514	73,19874
A01 2023-06-27	44,90915	73,28879	A03 2023-06-28	44,51321	73,54851
A01 2023-06-28	44,55352	73,55370	A03 2023-06-30	44,70332	73,28279
A01 2023-06-29	44,61110	73,43246	A04 2023-06-19	44,86522	73,48304
A01 2023-06-30	44,70170	73,29027	A04 2023-06-22	44,70588	73,25252
A01 2023-07-01	44,65687	73,27481	A04 2023-06-23	44,54771	73,47439
A01 2023-07-02	44,96447	73,20342	A04 2023-06-26	44,90051	73,25975
A01 2023-07-03	44,85252	73,39985	A04 2023-06-28	44,48172	73,58412
A02 2023-06-19	44,81140	73,42204	Meteomast C11	44,83573	73,30304
A02 2023-06-22	44,69608	73,24238	Meteomast A11	44,67373	73,37026
A02 2023-06-23	44,50938	73,51986	Meteomast "Southern"	44,55387	73,56215

Annex 7. Preliminary list of key insect species of the project area

Species		Family
Latine name	**Russian name**	
Odonata		
Enallagma cyathigerum risi Schmidt	стрелка голубая	Coenagrionidae
Ischnura elegans (VdL.)	тонкохвост изящный	Coenagrionidae
Lestes barbarus (Fabricius)	лютка дикая	Lestidae
S. sanguineum Mull.	стрекоза кроваво-красная	Libellulidae
Orthoptera		
Acrotylus insubricus (Scopoli)	зиняя кобылка	Acrididae
Arcyptera microptera (Fischer-Waldh.)	крестовая кобылка	Acrididae
Asiotmethis muricatus (Pallas)	степная кобылка	Pamphagidae
Calliptamus italicus (L.)	итальянский (оазисный) прус	Acrididae
Celes variabilis (Pallas)	изменчивая кобылка	Acrididae
Ceraeocercus fuscipennis Uvarov	кузнечик темнокрылый	Tettigoniidae
Chorthippus albomarginatus (De Geer)	белополосая кобылка	Acrididae
Chorthippus biguttulus (L.)	изменчивый конек	Acrididae
Chrotogonus turanicus Kuthy	туранский хротогон	Pyrgomorphidae
Decticus verrucivorus (L.)	кузнечик серый	Tettigoniidae
Dericorys tibialis (Pallas)	пятнистая горбатка	Acrididae
Dociostaurus kraussi (Ingen.)	атбасарка (атбасарская крестовичка)	Acrididae
Epacromius tergestinus (Charpentier)	солончаковая летунья	Acrididae
Gampsocleis glabra (Herbst)	кузнечик гладкий	Tettigoniidae
Gryllotalpa unispina Saussure	медведка одношипная	Gryllotalpidae
Melanogryllus desertus (Pallas)	сверчок степной	Gryllidae
Ochrilidia hebetata (Uvarov, 1926)	песчаная остроголовка	Acrididae
Oedaleus decorus (Germar)	чернополосая кобылка	Acrididae
Oedipoda coerulescens (L.)	голубокрылая кобылка	Acrididae
Phaneroptera falcata (Poda)	пластинокрыл обыкновенный	Tettigoniidae
Platycleis intermedia (Audinet-Serville)	скачок пятнистый	Tettigoniidae
Pyrgodera armata Fischer-Waldh.	гребневка	Acrididae
Pyrgomorpha bispinosa Walker	пустынная остроголовка	Pyrgomorphidae
Pyrgomorpha bispinosa deserti B.-Bienko.	пиргоморфа пустынная	Pyrgomorphidae
Sphingonothus halophilus Bey-Bienko	светлокрылая солончаковая пустынница	Acrididae
Sphingonothus maculatus Uvarov	пятнистая пустынница	Acrididae
Sphingonothus nebulosus (Fischer-Waldh.)	скальная пучтынница	Acrididae
Tettigonia caudata (Charp.)	кузнечик хвостатый	Tettigoniidae

Species		Family
Latine name	**Russian name**	
	(длиннохвостый)	
Mantoptera		
Mantis religiosa L.	богомол обыкновенный	Manteidae
Empusa pennicornis (Pallas)	эмпуза перистоусая	Empusidae
Heteroptera		
Adelphocoris lineolatus Goeze	клоп люцерновый	Miridae
Aelia acuminata L.	элия остроголовая	Pentatomidae
Camptopus lateralis Germar	камптопус окаймленный	Alydidae
Carpocoris fuscipennis Boheman	щитник остроплечий	Pentatomidae
Carpocoris purpureipennis De Geer	щитник черноусый	Pentatomidae
Codophila varia (F.)	кодофила	Pentatomidae
Coreus marginatus L.	краевик щавелевый	Coreidae
Corizus hyoscyami (L.)	булавник беленной	Rhopalidae
Dolycoris baccarum L.	щитник (клоп) ягодный	Pentatomidae
Eurydema oleracea L.	клоп рапсовый	Pentatomidae
Eurydema ornata (L.)	клоп горчичный (разукрашенный)	Pentatomidae
Eurygaster integriceps Putnam	черепашка вредная	Scutelleridae
Graphosoma lineatum L.	графозома полосатая	Pentatomidae
Lygaeus equestris L.	лигей пятнистый	Lygaeidae
Lygus pratensis L.	клопик полевой	Miridae
Nabis ferus (L.)	редувиол дикий	Nabidae
Odontotarsus purpureolineatus Rossi	черепашка-краснополосая	Scutelleridae
Pyrrhocoris apterus L.	красноклоп обыкновенный	Pyrrhocoridae
Rhinocoris iracundus (Poda)	хищнец	Reduviidae
Rhopalus maculatus (Fieber)	ропалус пятнистый	Rhopalidae
Homoptera		
Aphis craccivora Koch	тля люцерновая	Aphididae
Aphis fabae Scopoli	тля свекловичная	Aphididae
Brachycaudus cardui L.	тля чертополоховая	Aphididae
Cicadatra querula Pall.	цикада жалобная	Cicadidae
Cicadella viridis (L.)	цикадка зеленая	Cicadellidae
Cicadetta prasina Pall.	цикада зеленая	Cicadidae
Philaenus spumarius (L.)	пенница слюнявая	Aphrophoridae
Coleoptera		
Adesmia gebleri Gebler	чернотелка	Tenebrionidae
Adonia variegata Goeze.	коровка изменчивая	Coccinellidae
Amara aenea De Geer	тускляк бронзовый	Carabidae
Amphimallon sp.	нехрущ	Scarabaeidae
Anisoplia agricola (Poda)	кузька-крестоносец	Scarabaeidae
Anisoplia segetum (Herbst.)	хрущ полевой	Scarabaeidae
Aphodius fimetarius (L.)	навозничек обыкновенный	Scarabaeidae
Blaps lethifera Marsh.	медляк широкогрудый	Tenebrionidae
Bulaea lichatshovi Hum.	коровка Лихачева	Coccinellidae
Calosoma sycophanta L.	красотел пахучий	Carabidae

Species		Family
Latine name	**Russian name**	
Cassida nebulosa L.	щитоноска свекловичная	Chrysomelidae
Cerocoma schreberi (F.)	нарывник Шребера	Meloidae
Cetonia aurata (L.)	бронзовка золотистая	Scarabaeidae
Chironitis moeris (Pallas).	навозник	Scarabaeidae
Chromosomus verrucosus (Gebler)	долгоносик	Curculionidae
Chrysochares asiatica orientalis Lopatin	листоед азиатский	Chrysomelidae
Chrysolina graminis (L.)	листоед травяной	Chrysomelidae
Cleonis pigra (Scopoli)	двухкилевой чертополоховый долгоносик	Chromosomus
Coccinella septempunctata L.	коровка семиточечная	Coccinellidae
Cryptocephalus sericeus L.	скрытоглав шелковистый	Chrysomelidae
Dorcadion crassipes Ballion	корнеед	Cerambycidae
Enthomoscelis adonidis Pall.	листоед рапсовый	Chrysomelidae
Epicauta erythrocephala (Pallas)	шпанка красноголовая	Meloidae
Euspermophagus sericeus Geoffr.	зерновка вьюнковая	Bruchidae
Gonocephalum rusticum Ol.	чернотелка	Tenebrionidae
Gymnopleurus aciculatus Gebl.	навозник	Scarabaeidae
Harpalus distinguendus (Duftschmied)	бегун обыкновенный	Carabidae
Harpalus anxius (Duft.)	жужелица зерноядная (бегун)	Carabidae
Hycleus quatuordecimpunctatus Pall.	нарывник 14-точечный	Meloidae
Cicindela littoralis conjunctaepustulata Dokht.	скакун прибрежный	Carabidae
Julodis variolaris Pall.	златка изменчивая (пустынная почвенная)	Buprestidae
Lasiostola pubescens (Pall.).	чернотелка лазиостоля	Tenebrionidae
Lixus iridis Olivier	фрачник (стеблеед) обыкновенный	Curculionidae
Malachius aeneus L.	малашка медная	Malachiidae
Meloe proscarabeus L.	майка черная (обыкновенная)	Meloidae
Mylabris calida Pall.	нарывник пятнистый	Meloidae
Mylabris crocata Pall.	нарывник шафранный	Meloidae
Mylabris frolovi iliensis Kuzin	нарывник Фролова илийский	Meloidae
Mylabris intermedia F.-W.	нарывник промежуточный	Meloidae
Mylabris quadripunctata L.	нарывник четырехточечный	Meloidae
Mylabris sibirica F.-W.	нарывник сибирский	Meloidae
Ocypus cupreus (Rossi)	стафилин	Staphylinidae
Opatrum sabulosum L.	медляк песчаный	Tenebrionidae
Oryctes nasicornis (L.)	жук-носорог обыкновенный	Scarabaeidae
Oxythyrea cinctella Schm.	оленка окаймленная	Scarabaeidae
Pallasiola absinthii (Pall.)	листоед подсолнечниковый	Chrysomelidae
Pimelia cephalotes Pall.	толстяк	Tenebrionidae
Plagionotus floralis Pall.	усач люцерновый	(Cerambycidae)
Prosodes rugulosa Gebl	медляк	Scarabaeidae
Protaecia marginicollis Ballion	бронзовка зеленая туркестанская	Scarabaeidae

Species		Family
Latine name	**Russian name**	
Scarabaeus typhon Fischer	скарабей	Scarabaeidae
Scarites bucida Pallas	скарит песчаный	Carabidae
Scarites terricola Bouwer	скарит земляной	Carabidae
Silpha obscura L.	мертвоед черный (темный)	Silphidae
Tanymecus palliatus Fabricius	долгоносик серый многоядный	Curculionidae
Tentyria nomas Pall.	тентирия	Tenebrionidae
Theone silphoides Dalm.	полынный листоед	Chrysomelidae
Trichodes axillaris F.-W.	пчеложук	Cleridae
Trichodes spectabilis Kr.	пчеложук	Cleridae
Zabrus tenebrioides Goeze	жужелица хлебная	Carabidae
Hymenoptera		
Ammophila heydeni Dahlbom	аммофила Гейдена	Sphecidae
Anoplius viaticus (L.)	аноплий бурый	Pompilidae
Anthidium sp.	пчела-шерстобит	Megachilidae
Apis mellifera L.	пчела медоносная домашняя	Apidae
Astata boops Schr.	песчаная оса Астата	Crabronidae
Athalia (s.str.) rosae (L.)	пилильщик рапсовый	Tenthredinidae
Bembecinus tridens (F.)	песчаная оса Бембецинус	Crabronidae
Bembix bicolor Rad.	бембикс двухцветный	Crabronidae
Bembix gracilis Handl.	бембикс изящный	Crabronidae
Bembix oculata Panzer	бембикс глазчатый	Crabronidae
Bembix rostrata L.	бембикс носатый	Crabronidae
Bombus terrestris L.	шмель земляной	Apidae
Brachymeria femorata (Panz)	брахимерия	Chalcididae
Cataglyphis aenescens Nyl.	бегунок черный	Formicidae
Cataglyphis pallidus (Mayr)	бегунок бледный	Formicidae
Cerceris bupresticida Duf.	церцерис-златкоубийца	Crabronidae
Cerceris flavicornis Br.	церцерис желтоусая	Crabronidae
Cerceris flavilabris (F.)	церцерис желтогубая	Crabronidae
Cerceris rubida Jur.	церцерис рубида	Crabronidae
Cerceris tuberculata Vill.	церцерис бугорчатая	Crabronidae
Chrysis ignita L.	блестянка пламенно-красная	Chrysididae
Colletes sp.	пчела-коллет	Colletidae
Dasypoda plumipes Panzer	дазипода (мохноногая пчела)	Melittidae
Diodontus minutus (F.)		Crabronidae
Eremochares dives (Brulle)		Sphecidae
Euchroeus purpuratus Fabricius	оса-блестянка	Chrysididae
Eumenes mediterraneus Kriechbaumer	оса средиземноморская	Vespidae
Eumenes sareptanus Andre	пилюльная оса сарептская	Vespidae
Formica litoralis (K.-Ug.)	прибрежный муравей	Formicidae
Messor denticulatus Sants.	красногрудый муравей-жнец	Formicidae
Messor aralocaspius Ruzsky	муравей-жнец арало-каспийский	Formicidae
Glyptomorpha discolor (Thunb.)	глиптоморфа	Braconidae
Gorytes sulcifrons (A.Costa)	песочная оса	Crabronidae
Halictus quadricinctus F.	галикт четырехполосый	Halictidae

Species		Family
Latine name	**Russian name**	
Hedychrum virens Dahlbom	оса-блестянка	Chrysididae
Katamenes dimidiatus dimidiatus (Brule)	оса катаменсис	Vespidae
Lindenius albilabris (F.)		Crabronidae
Liris nigra (Lind.)	тахит черный	Crabronidae
Megachile sp.	пчела-листорез	Megachilidae
Netelia sp.	нетелия	Ichneumonidae
Oxybelus latidens Gerst.		Crabronidae
Oxybelus latro Ol.		Crabronidae
Oxybelus mucronatus (F.)		Crabronidae
Palarus variegatus (F.)	паларус изменчивый	Crabronidae
Parabatozonus lacerticida Pall.		Pompilidae
Pemphredon lethifer (Shuck.).		Crabronidae
Philanthus coronatus F.	филант корончатый	Crabronidae
Podalonia affinis K.		Sphecidae
Podalonia hirsuta Scop.		Sphecidae
Podalonia luffi (Saund.)		Sphecidae
Podalonia tydei (Guillou)	аммофила серебристая	Sphecidae
Polistes dominula Christ		Vespidae
Polistes nimpha (Christ)	полист-нимфа	Vespidae
Prionyx kirbii (Lind.)	сфекс белокаемчатый	Sphecidae
Prionyx niveatus (Dufour)		Sphecidae
Prionyx nudatus (Kohl)		Sphecidae
Prionyx subfuscatus (Dahlb.)		Sphecidae
Prionyx viduatus Christ.		Sphecidae
Scolia (*Scolioides*) *schrenckii* Eversmann	сколия Шренка	Scoliidae
Sphecius lutescens (Rad.)	сфециус	Crabronidae
Sphex flavipennis Fabr.		Sphecidae
Sphex funerarius Guss.	сфекс зубастый	Sphecidae
Stizoides tridentatus F.	стизоидес трехзубцовый	Crabronidae
Stizus ruficornis (J. Forster).		Crabronidae
Tachysphex desertorum F.Mor.		Crabronidae
Tachysphex incertus Rad.		Crabronidae
Tachysphex mediterraneus Kohl		Crabronidae
Tachytes obsoletus Rossi	тахит	Crabronidae
Tetramorium caespitum (L.)	муравей дерновой	Formicidae
Tiphia femorata Fabricius	тифия толстоногая	Tiphiidae
Trichrysis cyanea (L.)	оса-блестянка	Chrysididae
Trypoxylon scutatum Chevrier	трипоксил	Crabronidae
Vespula (Paravespula) germanica (F.)	оса германская	Vespidae
Xylocopa valga Gerst.	пчела-плотник	Apidae
Lepidoptera		
Agrotis segetum (Denis & Schiffermüller)	совка озимая	Noctuidae

Species		Family
Latine name	**Russian name**	
Anthocharis cardamines (L.)	зорька	Pieridae
Aplocera plagiata (L.)	пяденица зверобойная	Geometridae
Aporia crataegi L.	боярышница	Pieridae
Argynnis pandora (Den. et Schiff.)	перламутровка Пандора	Nymphalidae
Aricia agestis (Denn. et Schiff.)	голубянка темно-бурая	Lycaenidae
Autographa gamma L.	совка-гамма	Noctuidae
Carcharodus alceae (Esper)	толстоголовка мальвовая	Hesperiidae
Chazara enarvata (Alpheraky)	бархатница энервата	Satyridae
Cigaritis epargyros (Ev.)	голубянка эпаргурус	Lycaenidae
Coenonympha pamphilus (L.)	сенница памфил	Satyridae
Colias erate Esper.	желтушка	Pieridae
Emmelia trabealis Scop.	Совка вьюнковая	Noctuidae
Euchloe pulverata (Christoph)	Зорька белая	Pieridae
Euclidia glyphica (L.)	Совка клеверная бурая	Noctuidae
Eumedonia eumedon Esper	голубянка эвмедон	Lycaenidae
Gonepteryx rhamni (L.)	лимонница обыкновенная (крушинница)	Pieridae
Idaea ochrata (Scopoli)	пяденица охряная	Geometridae
Issoria lathonia (L.)	перламутровка блестящая (полевая)	Nymphalidae
Lycaena phlaeas (L.)	червонец пятнистый	Lycaenidae
Lythria purpurata (L.)	пяденица	Geometridae
Macroglossum stellatarum L.	языкан обыкновенный	Sphingidae
Margaritia sticticalis (L.)	мотылек луговой	Pyraustidae
Megaspilates mundataria (Stoll)	пяденица	Geometridae
Melanargia russia (Esper)	пестроглазка	Nymphalidae
Melitaea didyma (Esper.)	шашечница красная	Nymphalidae
Melitaea phoebe (Den. et Schiff.)	шашечница	Nymphalidae
Nymphalis urticae (L.)	крапивница	Nymphalidae
Orgyja dubia Tausch.	кистехвостка	Lymantriidae
Papilio machaon L.	махаон	Papilionidae
Pieris brassicae (L.)	капустница, или белянка капустная	Pieridae
Pieris rapae (L.)	репница (белянка репная)	Pieridae
Polyommatus icarus (Rott.)	голубянка Икар	Lycaenidae
Pontia daplidicae (L.)	белянка резедовая	Pieridae
Scopula ornata Scop.	пяденица украшенная	Geometridae
Thersamonia thersamon Esper	червонец терсамон	Lycaenidae
Thymelicus lineola L.	толстоголовка штриховая	Hesperiidae
Tyta luctuosa (Denis & Schiffermuller)	совка пятнистая темная	Noctuidae
Vanessa cardui L.	репейница (чертополоховка)	Nymphalidae
Neuroptera		
Ascalaphus libelluloides Schiff.	аскалаф	Ascalaphidae
Ascalaphus macaronius Schneider	аскалаф южный	Ascalaphidae

Species		Family
Latine name	**Russian name**	
Myrmeleon formicarius L.	муравьиный лев обыкновенный	Myrmeleontidae
Diptera		
Aedes sp.	комар-кусака	Culicidae
Bombylius major L.	жужжало большой	Bombyliidae
Chrysops relictus Mg.	златоглазик (пестряк) обыкновенный	Tabanidae
Chrysotoxum festivum Meigen	журчалка красивая	Syrphidae
Ephydra macellaria Egger	береговушка	Ephydridae
Episyrphus balteatus (De Geer)	мармеладная муха	Syrphidae
Eristalis arbustorum L.	пчеловидка лесная	Syrphidae
Eristalis tenax L.	ильница цепкая (обыкновенная)	Syrphidae
Hybomitra acuminata (Lw.)	слепень остробрюхий	Tabanidae
Lipara lucens Meigen	муха тростниковая	Chloropidae
Lucilia caesar L.	зеленая падальница обыкновенная	Calliphoridae
Musca domestica L.	муха комнатная	Muscidae
Oplodontha viridula (F.)	муха-львинка	Stratiomyidae
Satanas gigas Ev.	ктырь гигантский	Asilidae
Scaeva pyrastri (L.)	муха-журчалка	Syrphidae
Scatophaga stercoraria L.	муха навозная рыжая	Scatophagidae
Spherophoria sp.	серфиды	Syrphidae
Syrphus ribesii L.	журчалка обыкновенная	Syrphidae
Tabanus sabuletorum Lw.	слепень песчаный	Tabanidae
Tachina fera L.	ежемуха рыжая	Tachinidae
Wohlfahrtia magnifica Schin.	муха вольфартова	Sarcophagidae
Phasmatodea		
Ramulus bituberculatus Redtenbacher	палочник двухбугорчатый	Lonchodidae
Dermaptera		
Anechura asiatica Semenov	уховертка азиатская	Forficulidae