Gobi Green Energy

MANLAI WIND AND SOLAR PARKS, MONGOLIA

ORNITHOLOGICAL REPORT FOR 220 KV OVERHEAD TRANSMISSION LINES

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Gobi Green Energy

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ORNITHOLOGICAL REPORT FOR 220 KV OVERHEAD TRANSMISSION LINES

FROM SPRING TO WINTER SURVEY

(Approximately 90 km long 220 kV OHL between Oyu Tolgoi and Manlai wind and solar parks)

Duration:

From April 2020 to February 2021

Prepared for:

Gobi Green Energy LLC

Implemented by:

Mongolica Consulting

In collaboration with:

National University of Mongolia (NUM)

Reviewed by:

S. Gombobaatar (PhD.)

CONTENT

INTRODUCTION

In the first half of the last century, Mongolia has started to use electric power, which now is intensively used for household, construction, industry, and mining. Today, it has become a crucial part of our life. The electric power has been distributed by overhead transmission lines (OHL) to consumers from power plants in Mongolia. Depending on the type of the power voltages, mostly being 110 kilovolts (hereinafter referred to kV), 220 kV, 35 kV, 15 kV, 10 kV, and 6 kV, the structure of transmission poles and pylons varies (Bird Life International, 2003). However, it is known that globally and regionally threatened birds, especially with the body size of more than 16 cm have been a victim of the old structured high-voltage transmission lines, and now the number of bird collision tend to increase (35 kV, 15 kV, 10 kV, and 6 kV).

The transmission poles and pylons in Mongolia are suitable nesting substrates for steppe raptors (Harness et al., 1999, 2000, 2008, 2009; Potapov et al., 1999, 2001, 2002; Kruger & Rooyen, 2000; Rooyen, 2000; Bold et al., 2003; Gombobaatar et al, 2005, 2006, 2006a, 2008a; Rubolini et al., 2005; Gombobaatar et al., 2007, 2008, 2008a; Karyakin et al., 2008, 2009). In addition, those poles and pylons play significant roles for suitable nesting, roosting, and resting substrates of raptors during migrations, and also observing preys and hunting from a certain height etc (Gombobaatar, 2006, 2006a; Kruger & Rooyen, 2000; Rooyen, 2000).

Recent years, a few companies have been taken conservation measures in order to prevent from birds' collisions and electrocutions along transmission lines and wind farms.

Mongolia needs to learn best practices from the countries where they have already found a solution to bird conservation, and must put them into actions. Based on our field studies, mitigation and conservation action plans for birds at the site will be developed by Mongolica team and taken necessary actions to reduce the impact on birds from the lines for the future.

The MWSF is located more than 500 km south of Ulaanbaatar city, the capital of Mongolia and 60 km south-east of Manlai soum of Umnugobi province. The Manlai Wind and Solar Park's total power is 501 MW, consisting of 275MW of Wind Turbine Parks and 226 MW of Solar Park, and additionally 90 km long 220кV transmission line to the Oyu Tolgoi mining site.

This report presents the results of the ornithological surveys carried out for 220кV transmission line, 90 km long, between Oyu Tolgoi and Manlai Wind and Solar Parks from April 2020 to February 2021.

INTRODUCTION

Numerous conservation actions have been taken in other countries after long-term monitoring on birds' activity, behaviour, home range, and habitat use at transmission lines. National and international experts in Mongolia carried out numbers of field studies, and estimated impacts on birds from overhead lines (OHLs), but until now there were only very few actions on the mitigation of these threats. A study revealed that the low-cost protection actions (e.g. spike, mini-windmill with mirror) taken from energy-producing organizations has not changed the number of bird-kills along transmission lines (Gombobaatar, 2012).

Joint ornithological surveys on mortalities and impact assessments of birds in Mongolia by Mongolian Ornithological Society (MOS), National University of Mongolia (NUM), and Ministry of Environment and Tourism (MET) conducted along OHLs in many provinces including Tuv, Dundgobi, Gobisumber, Dornogobi, Umnugobi, Sukhbaatar, Khentii, Dornod, Uvurkhangai, Arkhangai, Bayankhongor, Uvs, and Khovd in 2007-2009 and 2012. Unfortunately, many species of birds with nationally and globally threatened such as Saker Falcon (*Falco cherrug*), Lesser Kestrel (*Falco naumanni*), Common Kestrel (*Falco tinnuculus*), Upland Buzzard (*Buteo hemilasius*), Steppe Eagle (*Aquila nipalensis*), and Golden Eagle (*Aquila chrysaetos*) were collided or electrocuted in transmission lines.

In 2012, a total of 945 individuals belonging to 41 species were found dead along with the overhead electric power distribution and transmission lines with the voltages of 110 KV (245 km long and average height is 18-23 m), 220 KV (180 km long and average height is 30-35 m), 6 KV (150 km long and average height is 6-8 m), 10 KV (525 km long and average height is 7-10 m), 15 (2502 km long and average height is 7-11 m) KV and 35 KV (750 km long and average height is 9-13 m) in above-mentioned areas, out of which 90.6% was electrocuted (Harness and Gombobaatar, 2008 and Gombobaatar and Amartuvshin, 2012).

The 10 and 15 KV transmission line were the main bird-killing structure as 94.1% of all dead birds (n=856) was found along with the type of transmission lines because of the old design of the poles/pylons. Out of 89 bird collisions recorded during the same survey, only 2 bird collisions (2.24%) in 35 KV conductors and 20 collisions (22.4%) in 220 KV were documented. The most collision incidents were recorded away from the poles/pylons, showing us that the diverters should be securely fastened at about 100 m intervals (Harness and Gombobaatar, 2008 and Gombobaatar and Amartuvshin, 2012).

According to various assessment surveys of transmission lines with different voltage in Mongolia, the collision risk was higher than electrocution rate in 35, 110, and 220 KV transmission lines in previous years (Gombobaatar and Amartuvshin, 2012). According to the surveys of Kruger and Rooyen, (2000), Gombobaatar, (2006), Harness and Gombobaatar, (2008), and Gombobaatar and Amartuvshin (2012), 220Kv power lines have not been seriously impacted on birds due to its structural advantage. Therefore, we decided to conduct the field survey on the assessment of collision risks rather than electrocution for this transmission line. A conservation management plan should be carefully completed based on some outcomes from this survey.

GOAL AND OBJECTIVES

The main goal of the ornithological surveys of the powerline during the pre-construction period is to:

a) collect scientific data on birds' distribution, population, migration, young bird dispersal, and flight activities,

b) assess the potential impacts on birds, and

c) develop a Mitigation Action Plan.

Our objectives are to:

1. define target species based on the outputs from previous studies in the region,
2. prepare all necessary tools for field studies (4WD vehicles for the field study, and make a renting agreement, and appoint team members),
3. conduct a field study using widely accepted research methods according to the plan,
4. Revealed species composition in the study area, migration intensity and path, distribution, population size, flight height, and activities,
5. Carry out breeding birds' survey (define breeding locations and success),
6. Write reports and develop a Mitigation Action Plan for Birds.

STUDY AREA, DURATION, AND SITE VISIT

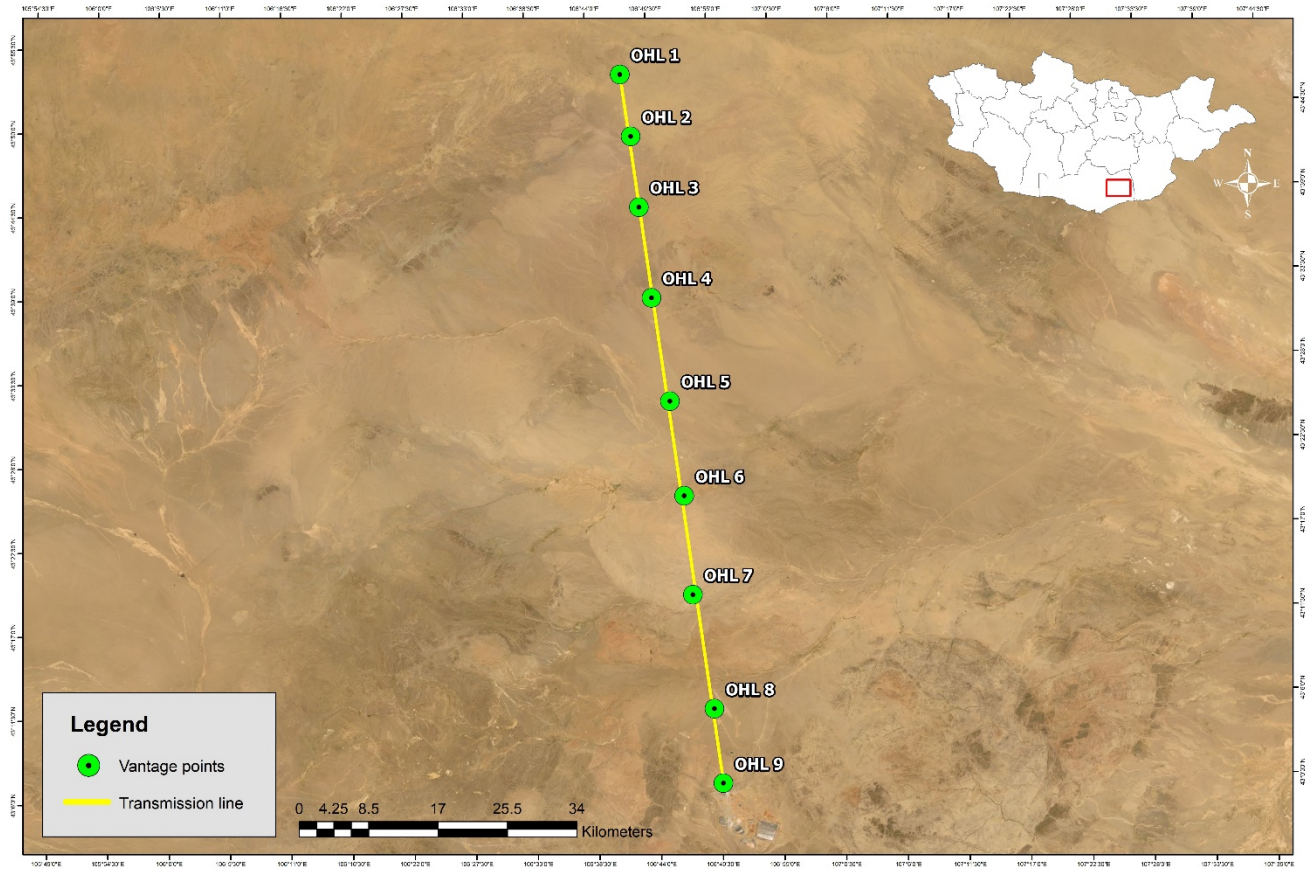
The current field study was conducted in the territoriy of Manlai and Khanbogd sums of Umnugobi province. The study site is situated in open desert steppe that consists of sparse vegetation and sandy soil. We carefully selected 9 observation (vantage) points in 8-12 km apart from each others. All locations of the vantage points (VP) showed in table 1 and map 1.

Table 1. Location and coordinates of vantage points

Location/VP's	Coordinates	
OHL1	43.84095°	106.77921°
OHL2	43.77225°	106.78698°
OHL3	43.70115°	106.79614°
OHL4	43.59417°	106.79532°
OHL5	43.47965°	106.80840°
OHL6	43.37497°	106.81647°
OHL7	43.26638°	106.81570°
OHL8	43.13968°	106.83175°
OHL9	43.05762°	106.83469°

The observation points, titled OHL 1, 2, 4, 5, and 7, are located in the open steppe, and points OHL6 and 9 in rocky and low hills (map 1 and photograph 1).

Map 1. Location of the study area



Photograph 1. View of the study areas

Sixteen members and experts of four field teams worked on this project. This needs to align with the table 2 provided. Research team members are professional experts on bird research and conservation in the country, including biology and ecology as well as impacts on birds and bats from electric lines, wind farms, and aircraft in Mongolia.

Table 2. Field survey team from April 2020 to February 2021

No	Name of experts	Expertise field	Year of the expertise	Institutions
1	S. Gombobaatar, PhD.	Expert and consultant, ornithologist	24	Prof. of NUM
2	J. Munkh-Erdene, MSc.	Field survey leader, ornithologist	9	Executive director of Mongolica Consulting
3	P. Davaasuren, MSc.	Field survey leader, ornithologist	5	Mongolica Consulting
4	S. Lkham, MSc.	Researcher, ornithologist	5	Mongolica Consulting
5	M. Bayasgalantselmeg, MSc.	Researcher, ornithologist	7	Mongolica Consulting
6	B. Odkhuu, MSc.	Researcher, ornithologist	14	MOS
7	D. Bat-Erdene	Researcher, ornithologist	6	MOS
8	B. Tseveenpurev	Researcher, ornithologist	7	MOS
9	U. Tuvshin	Researcher, ornithologist	10	MOS
10	G. Sundui	Field assistant	1	Student, National University of Mongolia
11	Ts. Tserenkhand	Field assistant	2	Student, National University of Mongolia
12	A. Bujinlkham	Field assistant	1	Student, National University of Mongolia
13	B. Odkhuu	Driver	15	Mongolica Consulting
14	N. Batnyamsuren	Driver	50	Mongolica Consulting
15	N. Uuganbat	Driver	18	Mongolica Consulting
16	D. Erdenebold	Driver	35	Mongolica Consulting

Duration of the survey:

We used various references (Gombobaatar et al., 2011; Gombobaatar and Bayanmunkh, 2016; Munkh-Erdene, 2017) for monitoring survey period. The references mentioned that spring migration period is from March to early May, breeding period from mid-May to July, autumn migration period from early August to early October, and winter period from late October to late February.

We conducted field surveys within these time periods in general.

Spring migration surveys: 03-29 April and 02-27 May of 2020.

Breeding bird surveys: 19-30 June and 01-10, 15-31 July, 2020.

Autumn migration surveys: 04-26 August; 06-24 September; and 22 September - 07 October, 2020.

Winter bird surveys: 14 October - 12 November, 2020 and 25 January - 10 February, 2021.

The date and duration of the field surveys showed below:

- Vantage point observation: 07-27 April; 04-25 May; 21-29 June; 02-08, 16-30 July; 06-24 August; 06-28, 30 September; 01-05 October; 16 October-11 November 2020 and 26 January-9 February 2021.
- Vantage points and duration of observation: 144 hours for VPM1- VPM16. We have covered all activities of birds from dawn to dusk.
- Line transect: 07-27 April; 04-25 May; 21-29 June; 02-08, 16-30 July; 06-24 August; 06-28, 30 September; 01-05 October; 16 October-11 November 2020 and 26 January - 9 February 2021.

METHODOLOGY

Vantage Point: A widely accepted vantage point survey (VPS) was used at the previously designated points, which covered 180° arc view and located on the highest area of the site (Scottish Natural Heritage, 2014). A total of 9 Vantage Points were selected at the area between Oyu Tolgoi and Manlai Wind and Solar Parks. Every single individual (ind.) of birds was recorded and photographed in the field. In case of identification difficulties in the field, a record shot of every single bird has taken and compared with field guidebooks and bird collections at the NUM (Brazil, 2009; Svensson et al., 2010; Gombobaatar and Leahy, 2019).

Our observations continued from sunrise until sunset with an interval of 3 hours at one vantage point with 10-30 minutes breaks in order to keep the observers' ability of observation quality. We used a range finder to measure the distance between birds and observers and flight height of an individual, and used a compass to record the bearings of a bird.

In order to gather detailed data on flight height, an observer recorded the device when a bird changed their flying heights. Furthermore, we noted weather data and birds' behaviour and activity as shown in Annex 1.

Line transect: To estimate the abundance, density, and composition of birds, we will carefully conduct field surveys. We drive very slowly with the speed of <10 km/hour from selected OHL point to next OHL point and count every single individual of birds using the standard method in order to estimate population density in the area (Krebs, 2013).

Internationally recognized and proven ornithological field equipment such as Leica Televid spotting scope, Swarovski 8 x 42, Nikon 8 x 42, Pentax 12 x 50 and Eagle optics 10 x 42 binoculars, Garmin GPS, Kestrel wind speed-meter, compass, UNI-T range finder, Sony camera, Canon 7D with 400 mm lens, and Nikon 7100 with 150-600 mm lens used for field observation and documentation.

We have used the following terms when processing our data:

Average number: An average number of bird individuals observed in a certain time period. It is calculated that all observed bird numbers divided by the number of observations (or frequency) in a certain time period.

Total number: The total number (or sum) of bird individuals observed in a certain time period.

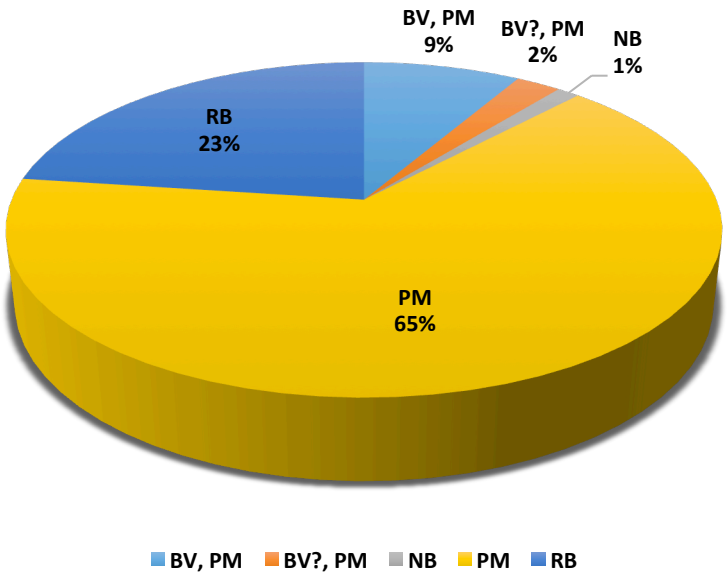
Frequency (n): The total number of each observed bird(s)/flock(s) belonging to the same species. It shows how many times a particular bird species has been recorded. For example, Horned Lark has been recorded three times in separate groups of 3, 5, and 9 individuals in May so the frequency should be 3 and average number should be 5.67 individuals, and the total number is 17 individuals.

BASELINE ORNITHOLOGICAL CONDITIONS

We documented 85 species of birds in the study site and surrounding areas from April 2020 to February 2021 of which 56 species are passage migrants (graph 1 and table 3). The number and frequency of migratory species is lower than residents. Therefore we have been focused on resident species. The status of all observed birds was summarized in table 3 and photograph 2.

Graph 1. Ecological status of all recorded species.

Abbreviations: BV - Breeding Visitor; PM - Passage Migrant; RB – Resident; ? - Possible or uncertain.



Globally and nationally threatened species such as Saker Falcon (*Falco cherrug*), Cinereous Vulture (*Aegypius monachus*), Lammergeier (*Gypaetus barbatus*), Steppe Eagle (*Aquila nipalensis*), Mongolian Ground Jay (*Podoces hendersoni*), and Short-toed Snake Eagle (*Circaetus gallicus*) were recorded in small numbers in the study area. The occurrence of these species varies depending on habitat types. Horned Lark, Pallas's Sandgrouse, Northern Raven, and Asian Short-toed Lark are dominating species in all habitats in the site (graph 2 and table 3). We could not observe any large flocks of migratory and resident species.

Graph 2. Frequency, and total and average number of recorded species in the study area (April 2020-February 2021)

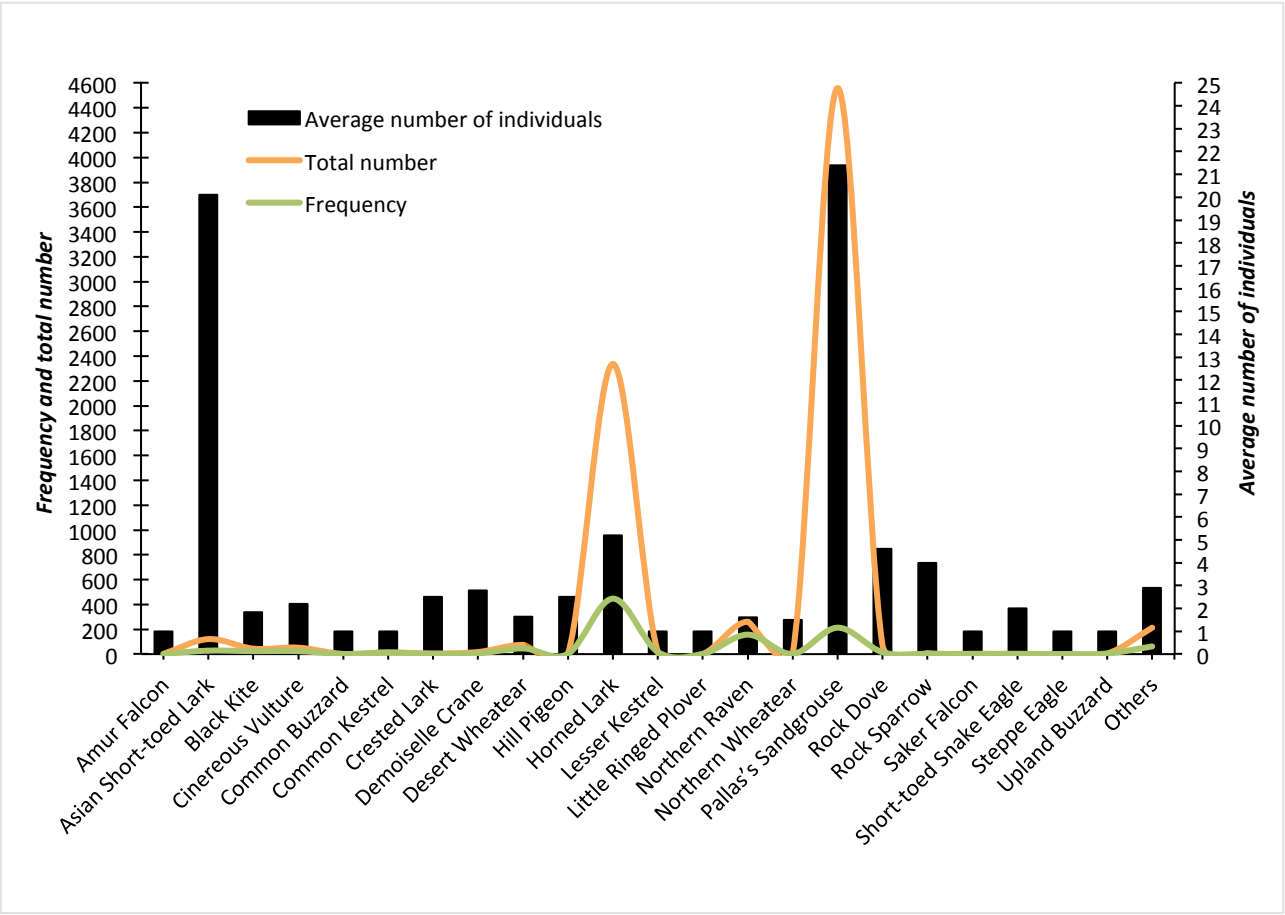


Table 3. All observed bird species at the field study site from April 2020 to February 2021

№	Species name	Common name	Status in the study area	Conservation Status					Occurrence																														Sensitivity
									2020																						2021										
									April			May			June			July			August			September			October			November			January			February			
				Global Assessment (IUCN)	National Assessment (IUCN)	Mongolian Red Book (2016)	CITES Appendix I, II	CMS Appendix I, II	Average number	Total number	Frequency (n)	Average number	Total number	Frequency (n)	Average number	Total number	Frequency (n)	Average number	Total number	Frequency (n)	Average number	Total number	Frequency (n)	Average number	Total number	Frequency (n)	Average number	Total number	Frequency (n)	Average number	Total number	Frequency (n)	Average number	Total number	Frequency (n)	Average number	Total number	Frequency (n)	
1	*Accipiter nisus*	Eurasian Sparrowhawk	PM	LC	LC		II	II	1	1	1																												Not significant
2	*Actitis hypoleucos*	Common Sandpiper	PM	LC	LC																2	2	1																Not significant
3	*Aegypius monachus*	Cinereous Vulture	RB	NT	LC		II	II	2	2	1	3	9	3	1.5	3	2				3.3	10	3	1	2	2	2.2	11	5	2.6	8	3	2	6	3	1	1	1	Low/Moderate
4	*Anthus godlewskii*	Blyth's Pipit	PM	LC	LC		II	II				2	2	1																								Not significant
5	*Anthus hodgsoni*	Olive-backed Pipit	PM	LC	LC		II	II				1	1	1										1	1	1													Not significant
6	*Anthus richardi*	Richard's Pipit	PM	LC	LC		II	II	5	5	1																												Not significant
7	*Apus apus*	Common Swift	PM	LC	LC							2	6	3	2	2	1	3.3	16	4																			Not significant
8	*Apus pacificus*	Pacific Swift	PM	LC	LC							8	8	1										5	5	1													Not significant
9	*Aquila chrysaetos*	Golden Eagle	RB	LC	LC		II	II																			2	2	1											Low
10	*Aquila nipalensis*	Steppe Eagle	BV?, PM	EN	LC		II	I,II	1	1	1													1	1	1	1	1	1										Moderate
11	*Athene noctua*	Little Owl	RB	LC	LC							1	1	1				1	1	1	1	1	1	1	2	2													Not significant
12	*Aythya fuligula*	Tufted Duck	PM	LC	LC			II																1	1	1													Not significant
13	*Buteo buteo*	Eastern Buzzard	PM	LC	LC		II	II	1	1	1													1	1	1													Low
14	*Buteo hemilasius*	Upland Buzzard	RB	LC	LC		II	II	1	1	1	1	1	1				1	2	2				1	2	2	1	1	1	1	2	2							Low
15	*Buteo rufinus*	Long-legged Buzzard	PM	LC	LC		II	II				1	1	1							1	3	3	1	4	4													Low
16	*Bucanetes mongolicus*	Mongolian Finch	RB	LC	LC				1	1	1	3	3	1	8	8	1	2	2	1																59.3	178	3	Not significant
17	*Calandrella cheleensis*	Asian Short-toed Lark	BV, PM	LC	LC				2.3	33	14	2.2	11	5				2	2	1				6	12	2							80	80	1	11.4	137	12	Not significant
18	*Calliope calliope*	Siberian Rubythroat	PM	LC	LC			II				1	1	1										1	2	2													Not significant
19	*Charadrius alexandrinus*	Kentish Plover	PM	LC	LC			II													16	16	1																Not significant
20	*Charadrius dubius*	Little Ringed Plover	PM	LC	LC			II				1	2	2				3.5	7	2																			Not significant
21	*Charadrius leschenaultii*	Greater Sandplover	BV, PM	LC	LC			II				1	1	1				2	2	1																			Not significant
22	*Circus cyaneus*	Hen Harrier	PM	LC	LC		II	II				1	1	1										1	1	1													Not significant
23	*Circaetus gallicus*	Short-toed Snake Eagle	BV, PM	LC	EN		II	II							1	1	1	2	2	1																			Moderate

№	Species name	Common name	Status in the study area	Conservation Status					Occurrence																												Sensitivity
									2020																						2021							
									April			May			June			July			August			September			October			November			January			February			
				Global Assessment (IUCN)	National Assessment (IUCN)	Mongolian Red Book (2016)	CITES Appendix I, II	CMS Appendix I, II	Average number	Total number	Frequency (n)	Average number	Total number	Frequency (n)	Average number	Total number	Frequency (n)	Average number	Total number	Frequency (n)	Average number	Total number	Frequency (n)	Average number	Total number	Frequency (n)	Average number	Total number	Frequency (n)	Average number	Total number	Frequency (n)	Average number	Total number	Frequency (n)	Average number	Total number	Frequency (n)	
24	*Columba livia*	Rock Dove	RB	LC	LC				1	1	1	4	4	1	8	8	1	3	12	4				5.5	44	8				2	2	1							Not significant
25	*Columba rupestris*	Hill Pigeon	RB	LC	LC							2.5	5	2																								Not significant
26	*Corvus corax*	Northern Raven	RB	LC	LC				4.5	73	16	1	17	17	1.1	10	9	1.6	85	54	1.4	35	26	1.6	56	35	1.1	16	14	2.5	28	11	1.1	8	7	1.8	25	14	Low
27	*Emberiza pallasi*	Pallas's Bunting	PM	LC	LC																			2	2	1												Not significant
28	*Emberiza pusilla*	Little Bunting	PM	LC	LC							3	3	1																								Not significant
29	*Emberiza schoeniclus*	Reed Bunting	PM	LC	LC																			1	1	1												Not significant
30	*Eremophila alpestris*	Horned Lark	RB	LC	LC				2.2	128	56	2.3	174	75	1.8	214	120	3.9	499	126	4.7	210	44	6.5	831	128	8.1	664	82	19.3	965	50	19	567	30	19	1358	71	Low
31	*Falco amurensis*	Amur Falcon	PM	LC	LC		II	II	1	1	1	1	1	1																								Not significant
32	*Falco cherrug*	Saker Falcon	RB	EN	VU		II	I,II	1	1	1				1	1	1																	1	1	1	1	1	1	High
33	*Falco naumanni*	Lesser Kestrel	BV, PM	LC	LC		II	I,II	1	2	2	1.2	6	5	1	3	3	1	8	8	1	8	8	1	3	3												Low
34	*Falco subbuteo*	Eurasian Hobby	PM	LC	LC			II													1	2	2	1	1	1												Not significant
35	*Falco tinnunculus*	Common Kestrel	RB	LC	LC		II	II	1	1	1							1	10	10				1	1	1	1	2	2	1	2	1				1	1	1	Not significant
36	*Ficedula albicilla*	Taiga Flycatcher	PM	LC	LC			II				1	1	1																								Not significant
37	*Galerida cristata*	Crested Lark	RB	LC	LC							2.5	5	2																								Not significant
38	*Gypaetus barbatus*	Lammergeier	RB	NT	VU	+	II	II	1	1	1																											Low/Moderate
39	*Gyps himalayensis*	Himalayan Griffon	NB	NT	LC		II	II										1	1	1																		Not significant
40	*Grus virgo*	Demoiselle Crane	BV?, PM	LC	LC		II	II				2	2	1				1	2	2	4.3	13	3															Low
41	*Hirundo rustica*	Barn Swallow	PM	LC	LC							4	4	1																								Not significant
42	*Hieraaetus pennatus*	Booted Eagle	PM						1	1	1																											Not significant
43	*Lanius cristatus*	Brown Shrike	PM	LC	LC							1	1	1																								Not significant
44	*Lanius isabellinus*	Isabelline Shrike	PM	LC	LC				1	1	1																											Not significant
45	*Lanius pallidirostris*	Steppe Grey Shrike	BV, PM	LC	LC							1	1	1										1	2	2												Not significant
46	*Lanius sphenocercus*	Chinese Grey Shrike	PM	LC	DD																																	Not significant
47	*Helopsaltes certhiola*	Pallas's Grasshopper Warbler	PM	LC	LC			II				1	1	1																								Not significant
48	*Melanocorypha*	Mongolian Lark	PM	LC	LC																														8.5	34	4	Not significant

№	Species name	Common name	Status in the study area	Conservation Status					Occurrence																												Sensitivity
									2020																						2021							
									April			May			June			July			August			September			October			November			January			February			
				Global Assessment (IUCN)	National Assessment (IUCN)	Mongolian Red Book (2016)	CITES Appendix I, II	CMS Appendix I, II	Average number	Total number	Frequency (n)	Average number	Total number	Frequency (n)	Average number	Total number	Frequency (n)	Average number	Total number	Frequency (n)	Average number	Total number	Frequency (n)	Average number	Total number	Frequency (n)	Average number	Total number	Frequency (n)	Average number	Total number	Frequency (n)	Average number	Total number	Frequency (n)	Average number	Total number	Frequency (n)	
	mongolica																																				
49	*Milvus migrans*	Black Kite	PM	LC	LC		II	II	1	4	4										1	1	1	2.1	39	19												Not significant
50	*Motacilla alba*	White Wagtail	PM	LC	LC			II	1	2	2										5	5	1	2.6	8	3												Not significant
51	*Motacilla cinerea*	Grey Wagtail	PM	LC	LC			II				2	2	1							4	4	1	1	1	1												Not significant
52	*Motacilla citreola*	Citrine Wagtail	PM	LC	LC			II				1	1	1																								Not significant
53	*Motacilla flava*	Yellow Wagtail	PM	LC	LC			II				1	1	1																								Not significant
54	*Oenanthe deserti*	Desert Wheatear	BV, PM	LC	LC			II	1	3	3	1	2	2	1.2	5	4	1.4	26	18	1.9	25	13	1.7	25	14												Not significant
55	*Oenanthe isabellina*	Isabelline Wheatear	PM	LC	LC			II	1	1	1													1	1	1												Not significant
56	*Oenanthe oenanthe*	Northern Wheatear	PM	LC	LC			II	2	2	1	1	1	1																								Not significant
57	*Oenanthe pleschanka*	Pied Wheatear	BV, PM	LC	LC			II				2	2	1																								Not significant
58	*Otis tarda*	Great Bustard	PM	VU	VU	+	II	I,II																			2	2	1									Low/Moderate
59	*Passer montanus*	Eurasian Tree Sparrow	RB	LC	LC				2	2	1	2	2	1																								Not significant
60	*Pernis ptilorhynchus*	Crested Honey Buzzard	PM	LC	LC		II	II																1	1	1												Low
61	*Petronia petronia*	Rock Sparrow	RB	LC	LC				1	1	1	7	7	1										5	5	1							14	14	1	10	10	1	Not significant
62	*Phalacrocorax carbo*	Great Cormorant	PM	LC	LC																			1	1	1												Not significant
63	*Phoenicurus auroreus*	Daurian Redstart	PM	LC	LC			II	1	2	2	6	6	1																								Not significant
64	*Phoenicurus phoenicurus*	Common Redstart	PM	LC	LC			II				1	1	1																								Not significant
65	*Phylloscopus fuscatus*	Dusky Warbler	PM	LC	LC			II				2	2	1										2	2	1												Not significant
66	*Phylloscopus proregulus*	Pallas Leaf Warbler	PM	LC	LC																			1	1	1												Not significant
67	*Phylloscopus inornatus*	Yellow-browed Warbler	PM	LC	LC																			1	1	1												Not significant
68	*Podoces hendersoni*	Mongolian Ground Jay	RB	LC	VU	+						1	1	1	1	1	1													1	1	1							Low
69	*Pyrrhocorax pyrrhocorax*	Red-billed Chough	RB	LC	LC							3	3	1																								Not significant
70	*Prunella montanella*	Siberian Accentor	PM	LC	LC							4	4	1																								Not significant
71	*Saxicola maurus*	Siberian Stonechat	PM	LC	LC							1	1	1																								Not significant
72	*Sterna hirundo*	Common Tern	PM	LC	LC			II										1	1	1	3	3	1															Not significant
73	*Sylvia curruca*	Lesser Whitetroat	PM	LC	LC			II				1	1	1																								Not significant

№	Species name	Common name	Status in the study area	Conservation Status					Occurrence																														Sensitivity
									2020																										2021						
									April			May			June			July			August			September			October			November			January			February			
				Global Assessment (IUCN)	National Assessment (IUCN)	Mongolian Red Book (2016)	CITES Appendix I, II	CMS Appendix I, II	Average number	Total number	Frequency (n)	Average number	Total number	Frequency (n)	Average number	Total number	Frequency (n)	Average number	Total number	Frequency (n)	Average number	Total number	Frequency (n)	Average number	Total number	Frequency (n)	Average number	Total number	Frequency (n)	Average number	Total number	Frequency (n)	Average number	Total number	Frequency (n)	Average number	Total number	Frequency (n)	
74	*Syrrhaptes paradoxus*	Pallas's Sandgrouse	RB	LC	LC				2.3	7	3	3.9	63	16	6.5	130	20	5.6	393	70	11.5	46	4	45	765	17	32.5	1301	40	34	982	29	28	649	23	31	750	24	Moderate
75	*Tringa ochropus*	Green Sandpiper	PM	LC	LC			II				1	1	1				2.5	5	2	1	1	1															Not significant
76	*Tringa glareola*	Wood Sandpiper	PM	LC	LC			II													1	1	1															Not significant
77	*Tringa totanus*	Common Redshank	PM	LC	LC			II													1	1	1															Not significant
78	*Turdus obscurus*	Eyebrowed Thrush	PM	LC	LC			II				1	1	1										1	1	1													Not significant
79	*Turdus ruficollis*	Red-throated Thrush	PM	LC	LC							2	4	2										2	2	1													Not significant
80	*Turdus naumanni*	Naumann's Thrush	PM	LC	LC							1	1	1																									Not significant
81	*Turdus eunomus*	Dusky Thrush	PM	LC	LC							1	1	1																									Not significant
82	*Tadorna ferruginea*	Ruddy Shelduck	PM	LC	LC			II	2	2	1							1.5	3	2																			Not significant
83	*Tadorna tadorna*	Common Shelduck	PM	LC	LC			II													5	10	2																Not significant
84	*Upupa epops*	Eurasian Hoopoe	RB	LC	LC																1	2	2																Not significant
85	*Zoothera aurea*	White's Thrush	PM	LC	LC			II				12	12	1										2	2	1													Not significant

Abbr: ?-uncertain; RB-Resident Breeder; SV-Summer Visitor WV- Winter Visitor; PM-Passage migrant; BV-Breeding visitor

IUCN Red List Category: LC-Least Concern; VU-Vulnerable; EN-Endangered; DD-Data Deficient; NT-Near Threatened

Photograph 2. Documented bird species in the study area

Cinereous Vulture

Golden Eagle

Upland Buzzard

Short-toed Snake Eagle

Hen Harrier

Little owl

Common Sandpiper

Kentish Plover

Demoiselle Crane

Great Cormorant

Great Bustard

Dusky Warbler

Raptors:

We recorded the following 19 species of raptors in the study area (table 4):

- Amur Falcon
- Black Kite
- Booted Eagle
- Cinereous Vulture
- Eastern Buzzard
- Common Kestrel
- Crested Honey Buzzard
- Eurasian Hobby
- Golden Eagle
- Hen Harrier
- Himalayan Griffon
- Lammergeier
- Lesser Kestrel
- Long-legged Buzzard
- Little Owl
- Saker Falcon
- Steppe Eagle
- Short-toed Snake Eagle
- Upland Buzzard.

Passage migrating raptors across the study area were Eurasian Sparrowhawk, Hen Harrier, Eastern Buzzard, Long-legged Buzzard, Amur Falcon, Booted Eagle, Black Kite, Steppe Eagle, Eurasian Hobby, and Crested Honey Buzzard in April, May, August, and September. Breeding visitors, such as Lesser Kestrel and Little Owl were documented in April-October.

We observed Cinereous Vulture, Himalayan Griffon, Lammergeier, Saker Falcon, Steppe Eagle, and Upland Buzzard on mountain ridges and slopes as well. We documented nationally threatened Short-toed Snake Eagle and also Himalayan Griffon at the area in June-July (table 4).

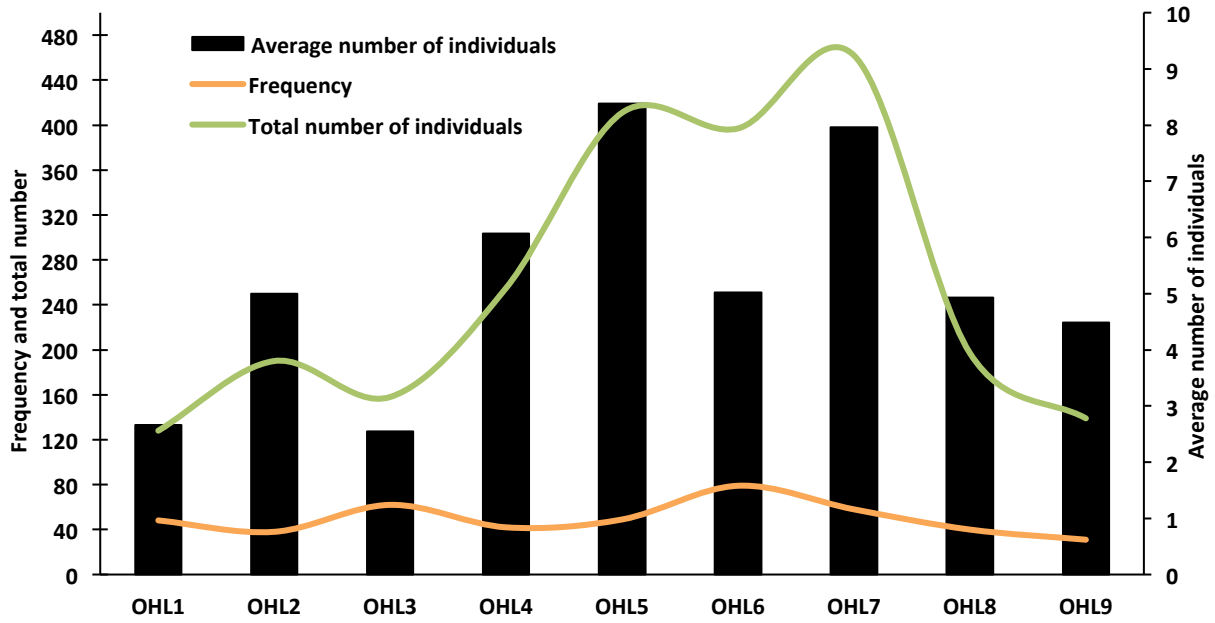
Table 4. The average number of all recorded raptor species in the study area

№	Species name	Common name	Status in the study area	Conservation Status					Occurrence 2020																		Occurrence 2021											
									April			May			June			July			Aug			Sep			Oct			Nov			Jan			Feb		
				Global Assessment (IUCN)	National Assessment (IUCN)	Mongolian Red Book (2016)	CITES Appendix I, II	CMS Appendix I, II	Average number	Total number	Frequency (n)	Average number	Total number	Frequency (n)	Average number	Total number	Frequency (n)	Average number	Total number	Frequency (n)	Average number	Total number	Frequency (n)	Average number	Total number	Frequency (n)	Average number	Total number	Frequency (n)	Average number	Total number	Frequency (n)	Average number	Total number	Frequency (n)	Average number	Total number	Frequency (n)	Average number	Total number	Frequency (n)
1	*Accipiter nisus*	Eurasian Sparrowhawk	PM	LC	LC		II	II	1	1	1																										
2	*Aegypius monachus*	Cinereous Vulture	RB	NT	LC		II	II	2	2	1	3	9	3	1.5	3	2												2.2	11	5	2.6	8	3	2	6	3	1	1	1
3	*Aquila chrysaetos*	Golden Eagle																									1	1	1									
4	*Aquila nipalensis*	Steppe Eagle	BV?, PM	EN	LC		II	I, II	1	1	1																											
5	*Athene noctua*	Little Owl	RB	LC	LC							1	1	1				1	1	1																		
6	*Buteo buteo*	Eastern Buzzard	PM	LC	LC		II	II	1	1	1																											
7	*Buteo hemilasius*	Upland Buzzard	RB	LC	LC		II	II	1	1	1	1	1	1				1	2	2							1	1	1	1	2	2						
8	*Buteo rufinus*	Long-legged Buzzard	PM	LC	LC		II	II				1	1	1																								
9	*Circaetus gallicus*	Short-toed Snake Eagle	BV, PM	LC	EN		II	II							1	1	1	2	2	1																		
10	*Falco amurensis*	Amur Falcon	BV	LC	LC		II	II	1	1	1	1	1	1																								
11	*Falco cherrug*	Saker Falcon	RB	EN	VU		II	I, II	1	1	1				1	1	1																		1	1	1	1	1	1
12	*Falco naumanni*	Lesser Kestrel	BV, PM	LC	LC		II	I, II	1	2	2	1.2	6	5	1	3	3	1	8	8																		
13	*Falco subbuteo*	Eurasian Hobby	PM	LC	LC																1	1	1	1	1	1												
14	*Falco tinnunculus*	Common Kestrel	RB	LC	LC		II	II	1	1	1							1	10	10							1	2	2	1	2	1				1	1	1
15	*Gypaetus barbatus*	Lammergeier	RB	NT	VU	+	II	II																														
16	Gyps himalayensis	Himalayan Griffon	NB	NT	LC		II	II										1	1	1																		
17	*Hieraaetus pennatus*	Booted Eagle	PM	LC	LC				1	1	1																											
18	*Milvus migrans*	Black Kite	PM	LC	LC		II	II	1	4	4																											
19	*Pernis ptilorhynchus*	Crested Honey Buzzard	PM	LC	LC			II																1	1	1												

During the field surveys in observed periods, Horned Lark, Northern Raven, and Pallas's Sandgrouse are considered as a potential high-risk species because of their high number and occurrence.

Horned Lark: This breeding species is widely distributed across the study area. Average number term in this calculation represents the average frequency of birds in the area. The average number of the species in the study area was 2.3 individuals (frequency (n)=5, min. 1, max. 7) in April; 2.32 (n=75, min. 1, max. 7) in May of 2020; 1.8 (n=120, min. 1, max. 11) in June of 2020; 3.9 (n=126, min. 1, max. 65) in July of 2020; 4.7 (n=44, min. 1, max. 24) in August of 2020; 6.4 (n=128, min. 1, max. 135) in September of 2020; 8.1 (n=82, min. 1, max. 38) in October of 2020; 19.3 (n=50, min. 1, max. 150) in November of 2020; 18.9 (n=30, min. 2, max. 54) in January of 2021 and 19.1 (n=71, min. 1, max. 400) in February of 2021. More than 873 individuals were recorded at OHL 5 and OHL 7 (graph 3). Average flight height of these individuals was 4.7 m (±19.9 SD, min. 1, max. 385, n=448) from April 2020 to February 2021. However collision risk with powerline is comparatively low.

Graph 3. Frequency, and total and average number of individuals of Horned Lark at VPs from April 2020-February 2021



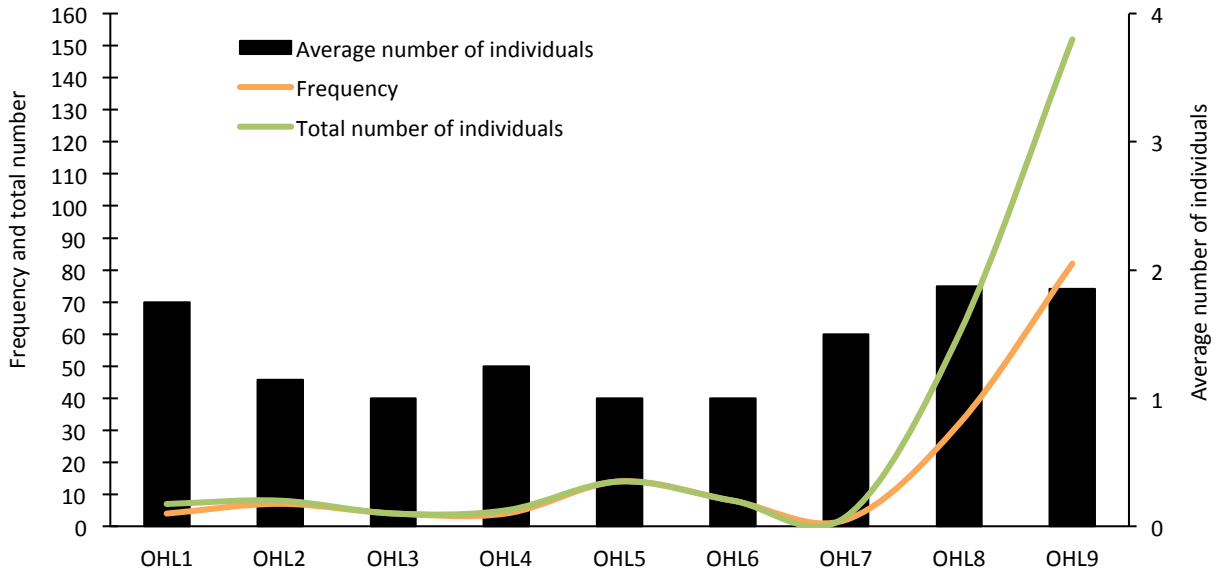
Northern Raven:

It was often observed from the observation points located near human settlements and transmission lines, where they breed. The average number of the species was differed by study areas and months ($F_{1, 147}$=2.8, p > 0.04): 4.56 individuals (n=16, min. 1, max.27) in April; 1 (n=17, min. 1, max. 1) in May; 1 (n=8, min. 1, max. 1) in June; 1.5 (n=38, min. 1, max. 4) in July of 2020; 1.4 (n=26, min. 1, max. 4) in August of 2020; 1.6 (n=35, min. 1, max. 6) in September of 2020; 1.1 (n=14, min. 1, max. 2) in October of 2020; 2.6 (n=11, min. 1, max. 9) in November of 2020; 1.1 (n=7, min. 1, max. 2) in January of 2021; and 1.8 (n=14, min. 1, max. 4) in February of 2021.

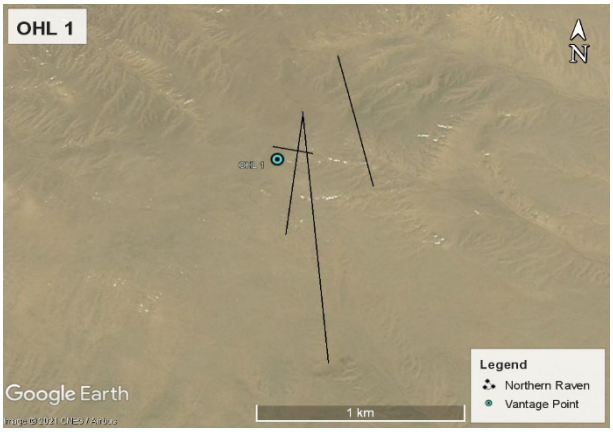
The flight duration of these individuals was 88.3 sec (±74.3 SD, min. 20, max. 330, n=158) and average flight height of all observed ravens was 14.6 m (±10.9 SD, min. 1, max. 75, n=158). High frequency in the area from Khanbumbat to Oyutolgoi near OHL8 and OHL 9 (n=114) was reported (graph 4 and map 2).

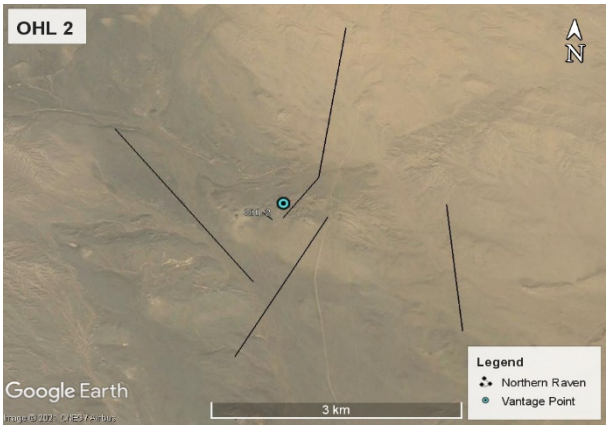
From the result of spring migration, breeding, autumn migration, and winter surveys, we conclude that a comparatively low collision risk for the species occurred in the area comparing with the references such as Harness and Gombobaatar (2008), Harness et al. (2009), and Gombobaatar et al. (2019).

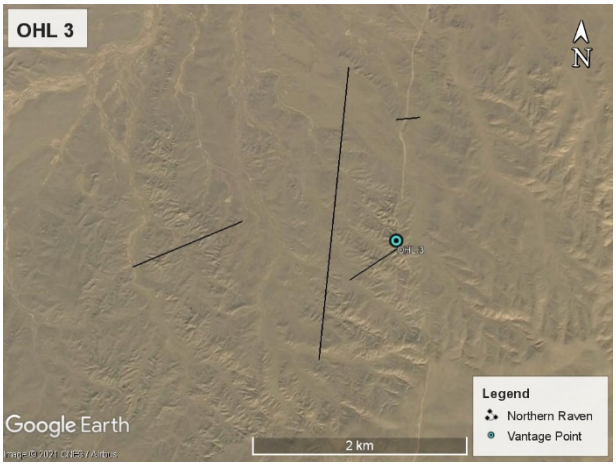
Graph 4. Frequency, and total and average number of individuals of Common Raven at VPs in April 2020-February 2021

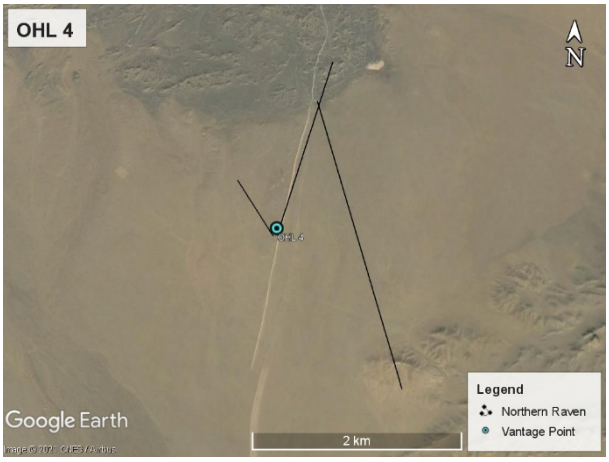


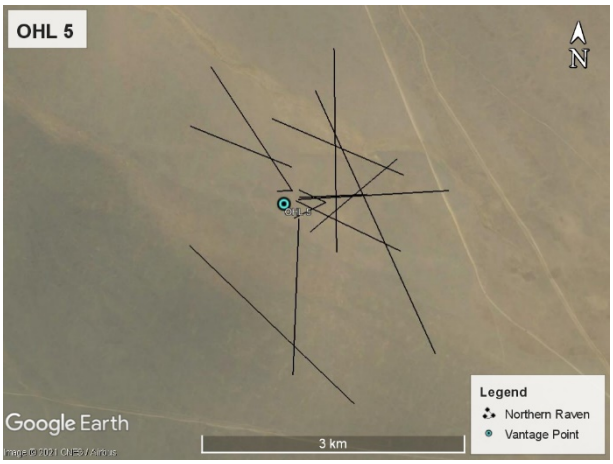
Map 2. The occurrence of Northern Raven in the study areas in April 2020-February 2021

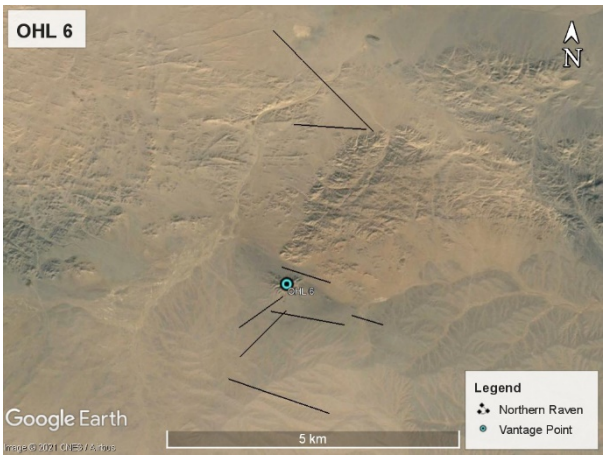


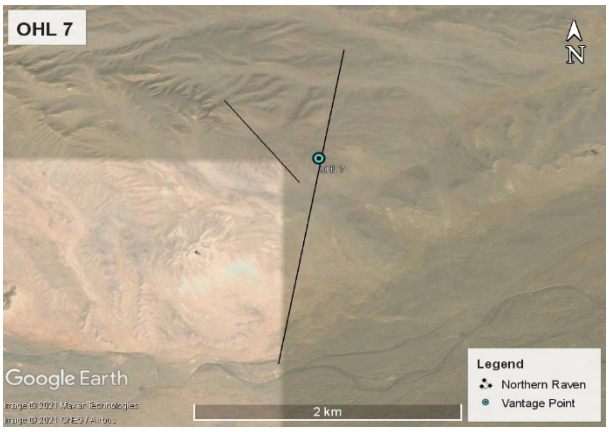


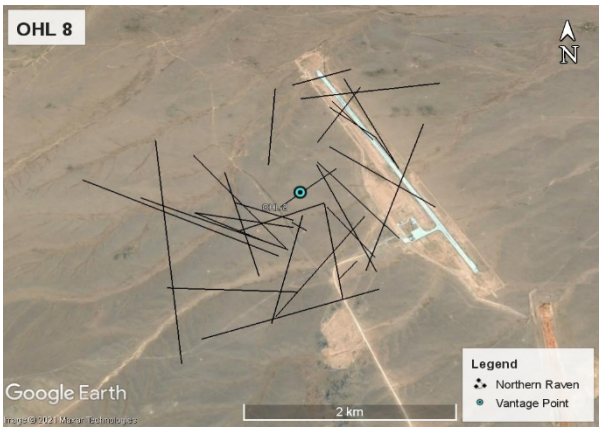


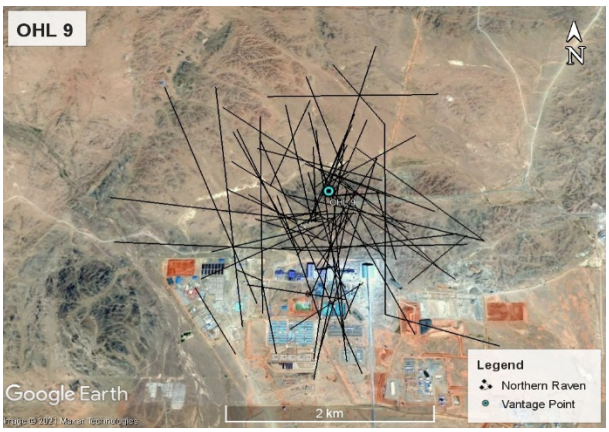










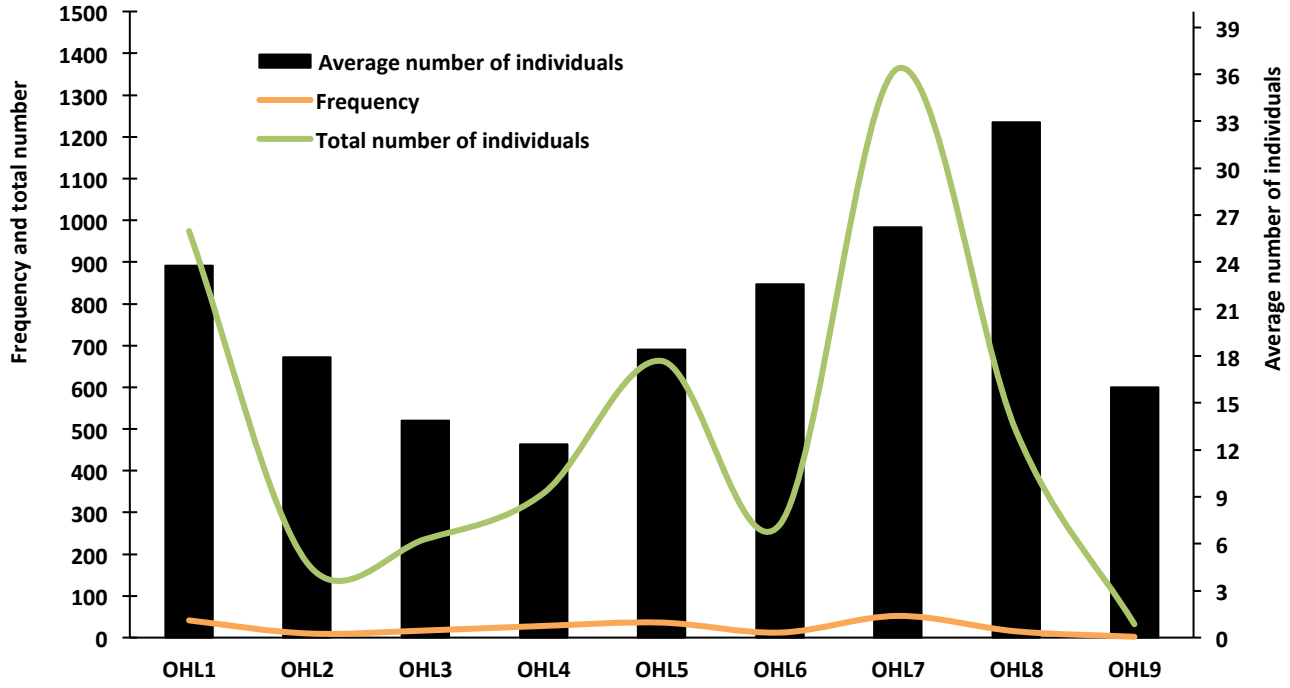


Pallas's Sandgrouse:

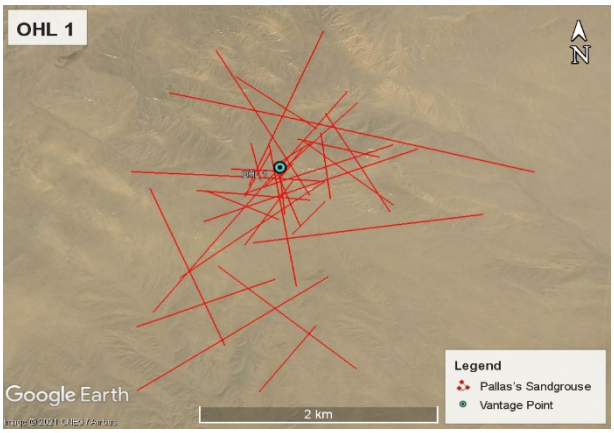
There were 7 individuals of this species in April; 63 inds in May; 127 inds in June; 351 inds in July; 104 inds in August; 725 inds in September; 1,301 inds in October; 982 inds in November 2020; 649 inds in January; and 750 inds in February 2021 at study areas. The flight duration of these individuals was 38.4 sec (±35.6 SD, min. 10, max. 261, n=212) and average flight height of all observed

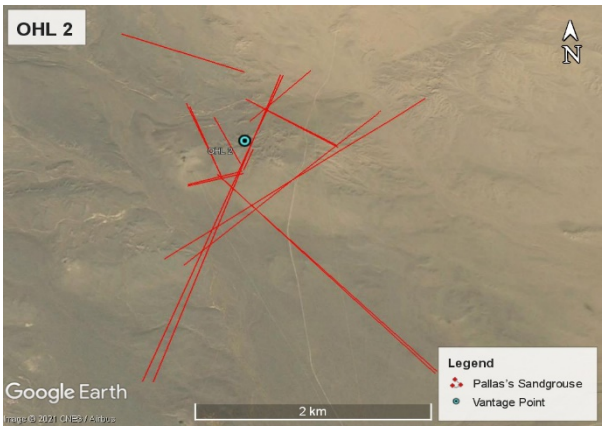
Pallas's Sandgrouse was 14.1 m (±9 SD, min. 1.5, max. 70, n=212). The number of observed individuals in the area was a very low percentage of the global population of the species (Gombobaatar et al., 2011). We recorded most individuals (2,338 individuals, n=93) in a depression of hills near OHL 1 and OHL 7 (Map 3). During the autumn migration and winter, we observed large flocks of this species consisting of 322 individuals in the first flock, 200 individuals in the second flock, and 180 individuals in the third flock.

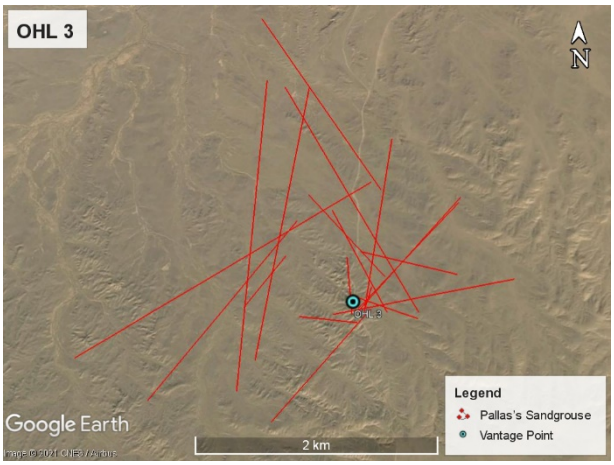
Graph 5. Frequency, and total and average number of individuals of Pallas's Sandgrouse at VPs in April 2020- February 2021

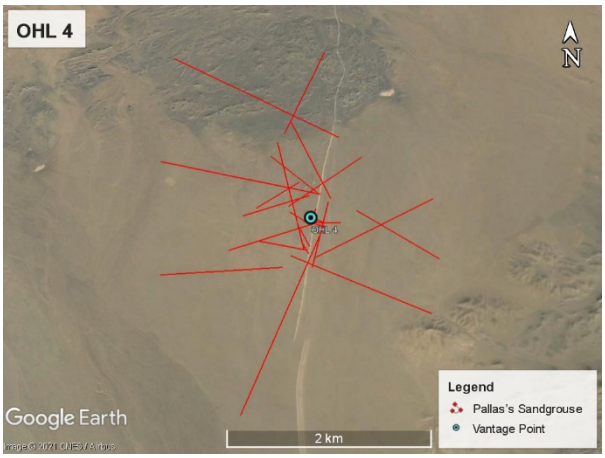


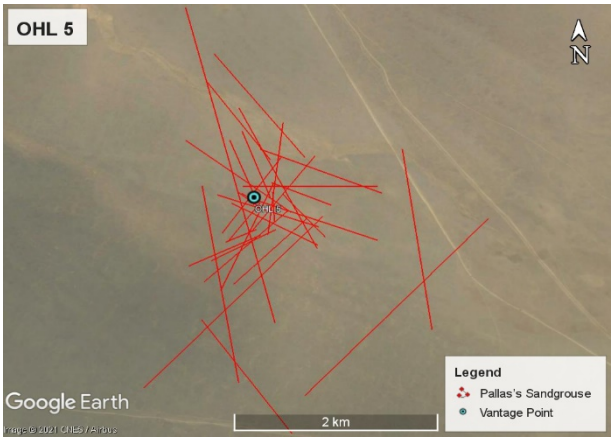
Map 3. Observed Pallas's Sandgrouse in the study area in April 2020- February 2021

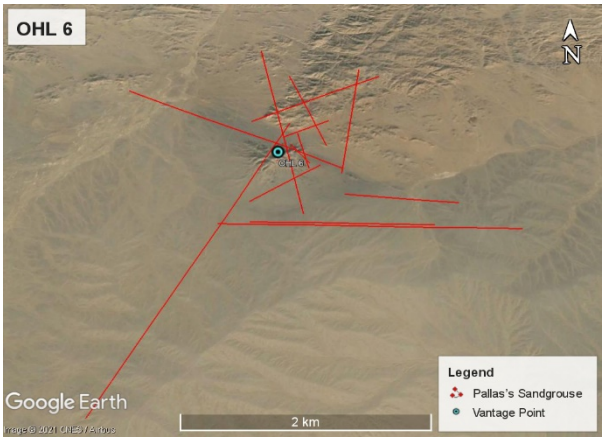

OHL 1
N
Legend
Pallas's Sandgrouse
Vantage Point
Google Earth
2 km

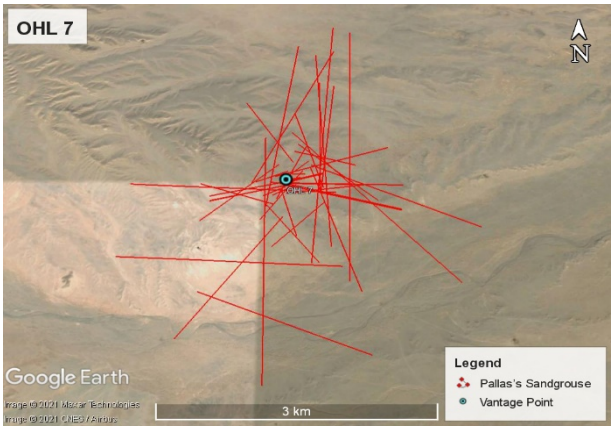

OHL 2
N
Legend
Pallas's Sandgrouse
Vantage Point
Google Earth
2 km

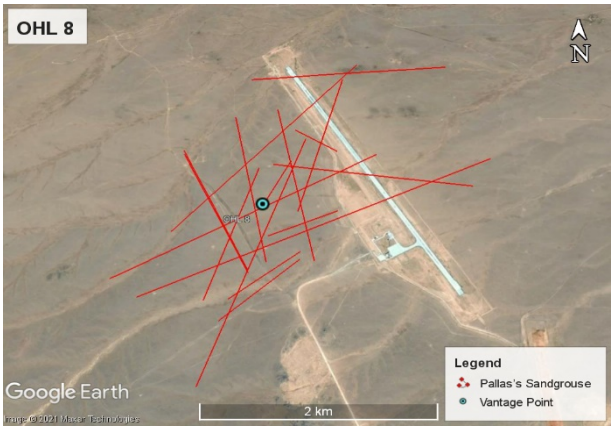

OHL 3
N
Legend
Pallas's Sandgrouse
Vantage Point
Google Earth
2 km

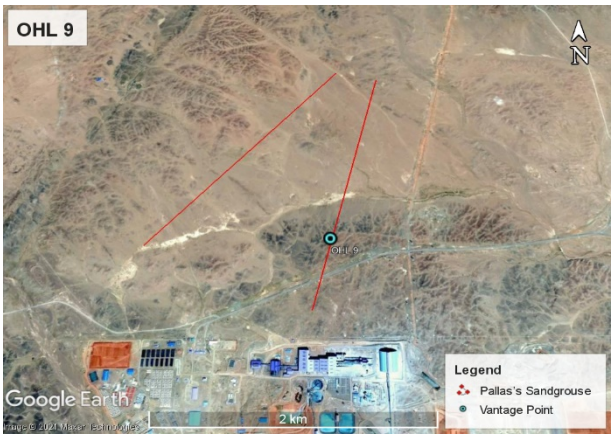

OHL 4
N
Legend
Pallas's Sandgrouse
Vantage Point
Google Earth
2 km


OHL 5
N
Legend
Pallas's Sandgrouse
Vantage Point
Google Earth
2 km


OHL 6
N
Legend
Pallas's Sandgrouse
Vantage Point
Google Earth
2 km


OHL 7
N
Legend
Pallas's Sandgrouse
Vantage Point
Google Earth
3 km


OHL 8
N
Legend
Pallas's Sandgrouse
Vantage Point
Google Earth
2 km



Based on the survey results we can recommend that diverters should be installed on the line of OHL1, 6, 7, and 8.

TARGET SPECIES SURVEY

Our initial plan of the field works was to assess and identify the target species based on different Sensitivity and Impact Significance Matrix (Scottish Natural Heritage, 2014). Based on survey data and criteria, we have identified that none of species is the "**High**" sensitive; Saker Falcon, Steppe Eagle, Short-toed Snake Eagle, and Pallas's Sandgrouse - "**Moderate"** sensitive; Lammergeier, Cinereous Vulture, and Great Bustard - "**Low-Moderate**" sensitive; Upland Buzzard, Eastern Buzzard, Long-legged Buzzard, Northern Raven, Horned Lark, Lesser Kestrel, Demoiselle Crane, and Golden Eagle - "Low" sensitive (table 6-7).

Four individuals of Saker Falcon observed in spring migration (n=2) and winter period (n=2). During the spring migration, one individual of Steppe Eagle was documented at the study site. We saw a large number of individuals of Pallas's Sandgrouse with "Moderate" sensitive status in the study area in breeding and winter periods. From this field survey result, we can conclude that a comparatively low collision risk for Saker Falcon, Steppe Eagle, and Pallas's Sandgrouse will occur.

Table 5. Impact Significance Matrix and Species Sensitivity

		RECEPTOR SENSITIVITY (VULNERABILITY)			
		Negligible	Low	Moderate	High
IMPACT MAGNITUDE (NUMBER AND OCCURRENCE)	Negligible	Blyth's Pipit, Olive-backed Pipit, Richard's Pipit, Common Swift, Pacific Swift, Siberian Rubythroat, Little Ringed Plover, Little Bunting, Taiga Flycatcher, Crested Lark, Barn Swallow, Brown Shrike, Isabelline Shrike, Steppe Grey Shrike, Chinese Grey Shrike, Pallas's Grasshopper Warbler, White Wagtail, Grey Wagtail, Citrine Wagtail, Yellow Wagtail, Isabelline Wheatear, Northern Wheatear, Pied Wheatear, Eurasian Tree Sparrow, Rock Sparrow, Daurian Redstart, Common Redstart, Dusky Warbler, Siberian Accentor, Siberian Stonechat, Lesser Whitetroat, Green Sandpiper, Eyebrowed Thrush, Red-throated Thrush, Naumann's Thrush, Dusky Thrush, Ruddy Shelduck, White's Thrush, Mongolian Lark		Mongolian Ground Jay Himalayan Griffon	
	Low	Little Owl, Mongolian Filch, Asian Short-toed Lark, Greater Sandplover, Desert Wheatear, Red-billed Chough, Common Tern, Common Shelduck, Great Cormorant		Lammergeier	Steppe Eagle Short-toed Snake Eagle
	Moderate	Eurasian Sparrowhawk, Long-legged Buzzard, Hen Harrier, Rock Dove, Hill Pigeon, Amur Falcon, Common Kestrel, Booted Eagle, Black Kite, Eurasian Hobby	Cinereous Vulture	Saker Falcon	
	High	Upland Buzzard, Eastern Buzzard, Long-legged Buzzard, Northern Raven, Horned Lark Lesser Kestrel, Demoiselle Crane, Great Bustard, Golden Eagle	Pallas's Sandgrouse		

Table 6. Sensitivity analyze of all recorded species iat the study

№	Species name	Ecological Status in the study area	Global Assessment (IUCN)	National Assessment (IUCN)	Sensitivity
1	Saker Falcon	Resident breeder	**Endangered**	**Vulnerable**	Moderate
2	Steppe Eagle	Breeding visitor?, passage migrant	**Endangered**	Least concern	Moderate
3	Pallas's Sandgrouse	Resident breeder	Least concern	Least concern	Moderate
4	Short-toed Snake Eagle	Breeding visitor, passage migrant	Least concern	**Endangered**	Moderate
5	Cinereous Vulture	Resident breeder	**Near threatened**	Least concern	Low/Moderate
6	Lammergeier	Resident breeder	**Near threatened**	**Vulnerable**	Low/Moderate
7	Great Bustard	Passage migrant	**Vulnerable**	**Vulnerable**	Low/Moderate
8	Upland Buzzard	Resident breeder	Least concern	Least concern	Low
9	Eastern Buzzard	Passage migrant	Least concern	Least concern	Low
10	Long-legged Buzzard	Passage migrant	Least concern	Least concern	Low
11	Demoiselle Crane	Breeding visitor?, passage migrant	Least concern	Least concern	Low
12	Northern Raven	Resident breeder	Least concern	Least concern	Low
13	Horned Lark	Resident breeder	Least concern	Least concern	Low
14	Lesser Kestrel	Breeding visitor, passage migrant	Least concern	Least concern	Low
15	Golden Eagle	Resident breeder	Least concern	Least concern	Low
16	Mongolian Ground Jay	Resident breeder	Least concern	**Vulnerable**	Not significant
17	Himalayan Griffon	Summer visitor	**Near threatened**	Least concern	Not significant
18	Eurasian Sparrowhawk	Passage migrant	Least concern	Least concern	Not significant
19	Blyth's Pipit	Passage migrant	Least concern	Least concern	Not significant
20	Olive-backed Pipit	Passage migrant	Least concern	Least concern	Not significant
21	Richard's Pipit	Passage migrant	Least concern	Least concern	Not significant
22	Common Swift	Passage migrant	Least concern	Least concern	Not significant
23	Pacific Swift	Passage migrant	Least concern	Least concern	Not significant
24	Little Owl	Resident breeder	Least concern	Least concern	Not significant
25	Mongolian Filch	Resident breeder	Least concern	Least concern	Not significant
26	Mongolian Finch	Resident breeder	Least concern	Least concern	Not significant
27	Asian Short-toed Lark	Breeding visitor?, passage migrant	Least concern	Least concern	Not significant
28	Siberian Rubythroat	Passage migrant	Least concern	Least concern	Not significant
29	Little Ringed Plover	Passage migrant	Least concern	Least concern	Not significant
30	Greater Sandplover	Breeding visitor?, passage migrant	Least concern	Least concern	Not significant
31	Hen Harrier	Passage migrant	Least concern	Least concern	Not significant
32	Rock Dove	Resident breeder	Least concern	Least concern	Not significant
33	Hill Pigeon	Resident breeder	Least concern	Least concern	Not significant
34	Little Bunting	Passage migrant	Least concern	Least concern	Not significant
35	Amur Falcon	Passage migrant	Least concern	Least concern	Not significant
36	Common Kestrel	Resident breeder	Least concern	Least concern	Not significant
37	Taiga Flycatcher	Passage migrant	Least concern	Least concern	Not significant
38	Crested Lark	Resident breeder	Least concern	Least concern	Not significant
39	Barn Swallow	Passage migrant	Least concern	Least concern	Not significant
40	Booted Eagle	Passage migrant	Least concern	Least concern	Not significant
41	Brown Shrike	Passage migrant	Least concern	Least concern	Not significant
42	Isabelline Shrike	Passage migrant	Least concern	Least concern	Not significant

43	Steppe Grey Shrike	Breeding visitor?, passage migrant	Least concern	Least concern	Not significant
44	Chinese Grey Shrike	Passage migrant	Least concern	Least concern	Not significant
45	Pallas's Grasshopper Warbler	Passage migrant	Least concern	Least concern	Not significant
46	Black Kite	Passage migrant	Least concern	Least concern	Not significant
47	White Wagtail	Passage migrant	Least concern	Least concern	Not significant
48	Grey Wagtail	Passage migrant	Least concern	Least concern	Not significant
49	Citrine Wagtail	Passage migrant	Least concern	Least concern	Not significant
50	Yellow Wagtail	Passage migrant	Least concern	Least concern	Not significant
51	Desert Wheatear	Breeding visitor?, passage migrant	Least concern	Least concern	Not significant
52	Isabelline Wheatear	Passage migrant	Least concern	Least concern	Not significant
53	Northern Wheatear	Passage migrant	Least concern	Least concern	Not significant
54	Pied Wheatear	Breeding visitor?, passage migrant	Least concern	Least concern	Not significant
55	Eurasian Tree Sparrow	Resident breeder	Least concern	Least concern	Not significant
56	Rock Sparrow	Resident breeder	Least concern	Least concern	Not significant
57	Daurian Redstart	Passage migrant	Least concern	Least concern	Not significant
58	Common Redstart	Passage migrant	Least concern	Least concern	Not significant
59	Dusky Warbler	Passage migrant	Least concern	Least concern	Not significant
60	Red-billed Chough	Resident breeder	Least concern	Least concern	Not significant
61	Siberian Accentor	Passage migrant	Least concern	Least concern	Not significant
62	Siberian Stonechat	Passage migrant	Least concern	Least concern	Not significant
63	Lesser Whitetroat	Passage migrant	Least concern	Least concern	Not significant
64	Green Sandpiper	Passage migrant	Least concern	Least concern	Not significant
65	Eyebrowed Thrush	Passage migrant	Least concern	Least concern	Not significant
66	Red-throated Thrush	Passage migrant	Least concern	Least concern	Not significant
67	Naumann's Thrush	Passage migrant	Least concern	Least concern	Not significant
68	Dusky Thrush	Passage migrant	Least concern	Least concern	Not significant
69	Ruddy Shelduck	Passage migrant	Least concern	Least concern	Not significant
70	White's Thrush	Passage migrant	Least concern	Least concern	Not significant
71	Common Tern	Passage migrant	Least concern	Least concern	Not significant
72	Common Sandpiper	Passage migrant	Least concern	Least concern	Not significant
73	Tufted Duck	Passage migrant	Least concern	Least concern	Not significant
74	Kentish Plover	Passage migrant	Least concern	Least concern	Not significant
75	Pallas's Bunting	Passage migrant	Least concern	Least concern	Not significant
76	Reed Bunting	Passage migrant	Least concern	Least concern	Not significant
77	Eurasian Hobby	Passage migrant	Least concern	Least concern	Not significant
78	Crested Honey Buzzard	Passage migrant	Least concern	Least concern	Not significant
79	Great Cormorant	Passage migrant	Least concern	Least concern	Not significant
80	Pallas Leaf Warbler	Passage migrant	Least concern	Least concern	Not significant
81	Yellow-browed Warbler	Passage migrant	Least concern	Least concern	Not significant
82	Wood Sandpiper	Passage migrant	Least concern	Least concern	Not significant
83	Common Redshank	Passage migrant	Least concern	Least concern	Not significant
84	Common Shelduck	Passage migrant	Least concern	Least concern	Not significant
85	Eurasian Hoopoe	Resident breeder	Least concern	Least concern	Not significant
86	Mongolian Lark	Resident breeder	Least concern	Least concern	Not significant

VANTAGE POINT SURVEY

Introduction

We selected 9 vantage points showed in table 1. Due to methodological restrictions, we did not combine this survey with other ornithological studies. We followed VPS methodology specified by the BBMM (2014).

The purpose of VPS was to collect data on target species in order to determine:

a). time spent in the defined survey area for high sensitive species,

b). relative use of different parts of the survey area,

c). time spent in the defined survey area for high sensitive species,

d). proportion of flight time spent near overhead lines,

e). flight height of the High Sensitive species, and

f). designing of future monitoring programme and mitigation measures.

Identification and duration of observation of birds

Before selecting vantage points, we drove slowly through the study site and selected 9 appropriate vantage points. These sites were chosen to avoid disturbances to birds and their activity from transmission lines. Each vantage point site is situated on the high elevated ground (e.g. hilltop) with open view to surrounding areas. The selection criteria of each vantage point were the maximized visibility of nearest proposed transmission lines and the minimized effects on bird movement and activity. Each VP provides 360° arc view (Scottish Natural Heritage, 2014).

The duration of our observation was 36 hours for each vantage point per season, covering all activities of birds. Each observation duration for a vantage point was limited to 3 hours in different weather conditions like snow and dust storms, baking hot, mist, and rain.

Identification and duration of vantage points

Our field team conducted the Vantage Point surveys on 07-27 April; 04-25 May; 21-29 June; 02-08, 16-30 July; 06-24 August; 06-28, 30 September; 01-05 October; 16 October - 11 November 2020; and 26 January - 9 February 2021.

The duration of our observation on each Vantage Point from April 2020 to February 2021 was 144 hours.

Survey results

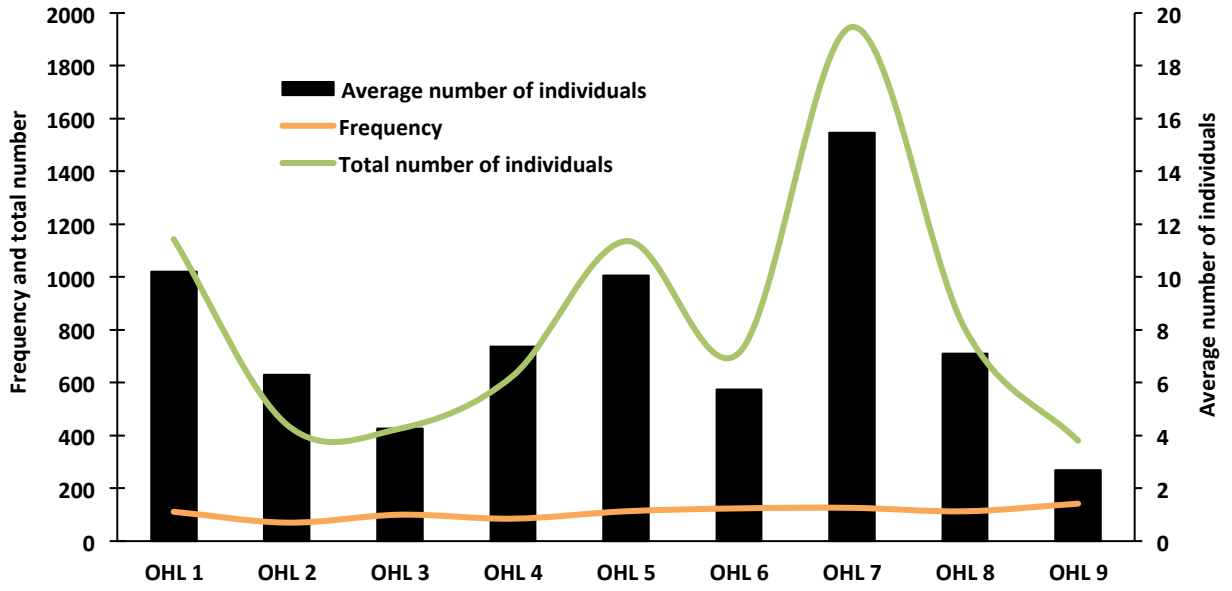
Flight height and time spent in the survey area

Out of 85 species recorded at the study site and surrounding areas, 45 species were observed during the Vantage Point surveys: Cinereous Vulture, Northern Raven, Brown Shrike, Richard's Pipit, Horned Lark, Black Kite, Eastern Buzzard, Amur Falcon, White Wagtail, Upland Buzzard, Saker Falcon, Citrine Wagtail, Asian Short-toed Lark, Lesser Kestrel, Desert Wheatear, Siberian Rubythroat, Common Kestrel, Daurian Redstart, Little Ringed Plover, Taiga Flycatcher, Pallas's Sandgrouse, Rock Dove, Demoiselle Crane, White's Thrush, Eurasian Hobby, Long-Legged Buzzard, Barn Swallow, Eurasian Hoopoe, Great Bustard, Golden Eagle, and Mongolian Lark.

Average flight duration of the above mentioned species was 52.5 sec. (±71.8SD, min. 1, max. 650 n=989) from April 2020 to February 2021. Average flight height of these individuals was 32.2 m (±36.7 SD, min. 0.5, max. 700, n=989) from April 2020 to February 2021.

We have not documented any large flock of birds with high frequency during the survey period. A total of 3,090 individuals (n=238) of birds were sighted near OHL1 and OHL7, caused by the high number of Pallas's Sandgrouse and Horned Lark near OHL1, OHL5, and OHL7 areas (graph 6, map 4).

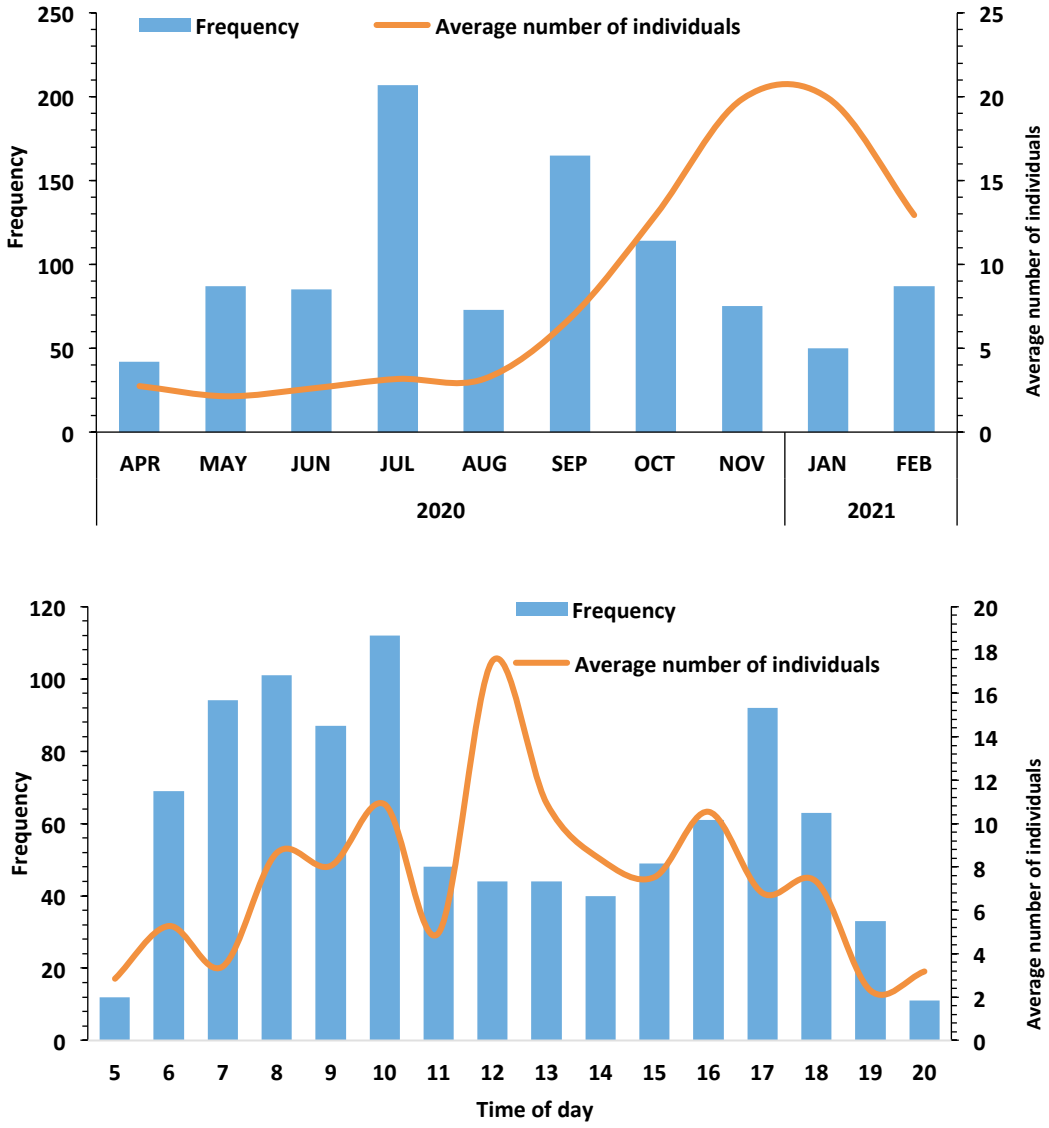
Graph 6. Frequency, and total and average number of individuals at all VPs in April 2020-February 2021



There was a significant difference between the frequency of observed birds by months ($F_{9,975}$=15.3, p < 0.05). The frequency was much high in July (mean=3.17, min. 1, max. 30, n=207), September, and October than other months. The mean number of Pallas's Sandgrouse and Horned Lark was a higher in January (mean=19.92, min. 1, max. 107, n=50) and November (mean=19.8, min. 1, max. 200, n=75) than other months (graph 7, map 4).

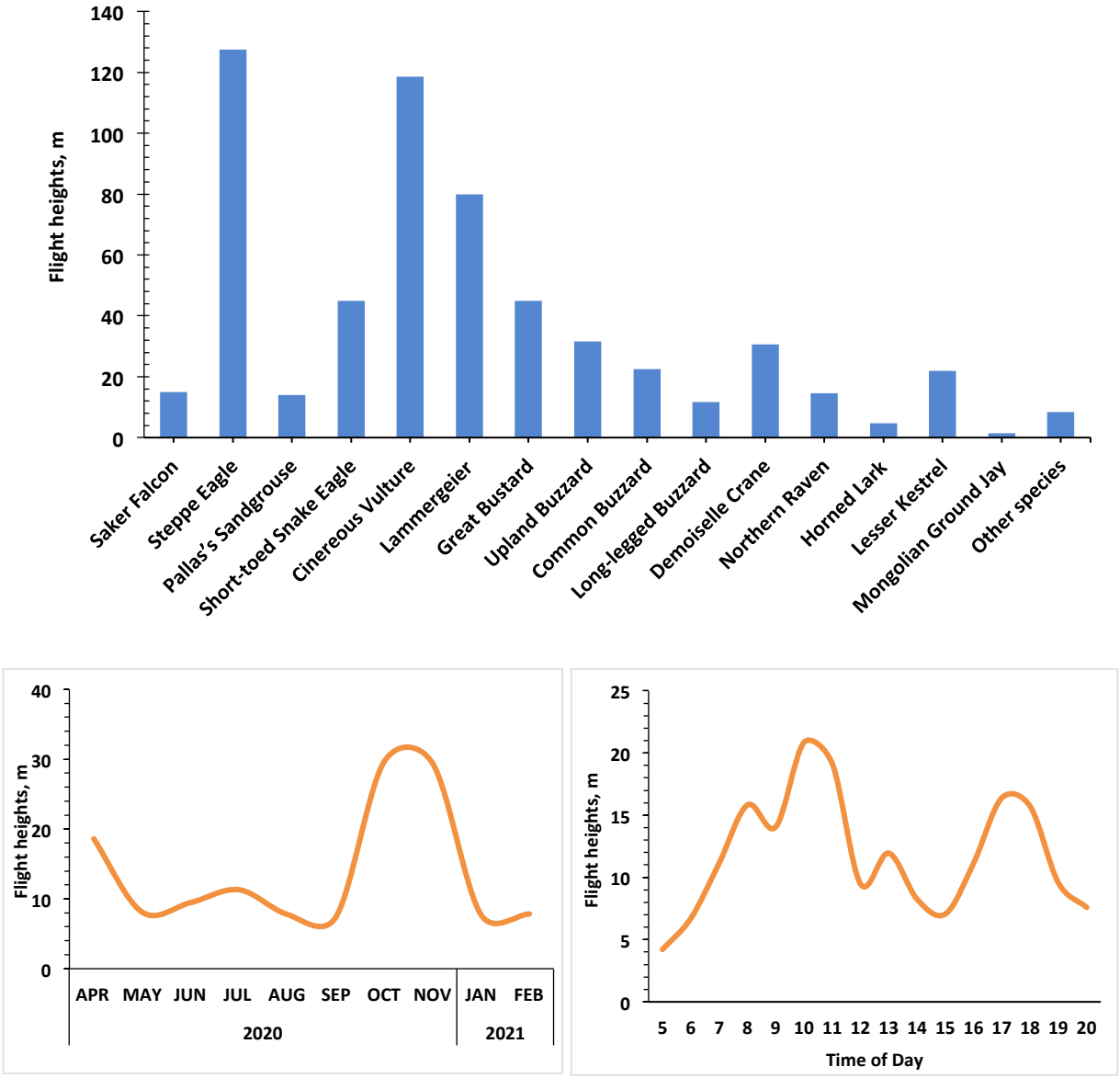
Our statistical analysis showed that there is no significant difference between mean number of individuals and the time of the day ($F_{15,963}$=1.6, p < 0.05). The most active time of the species is between 7:00-10:00 and 16:00-18:00 o'clock. The highest frequency of the species was documented at 10:00 AM o'clock (mean 10.9, min. 1, max. 122, n=416).

Graph 7. The mean number of individuals and frequency for the VPS observations at the study area (April 2020-February 2021)

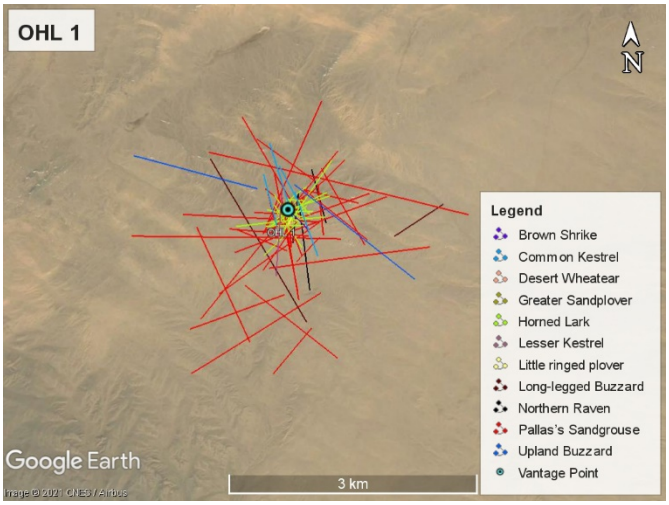


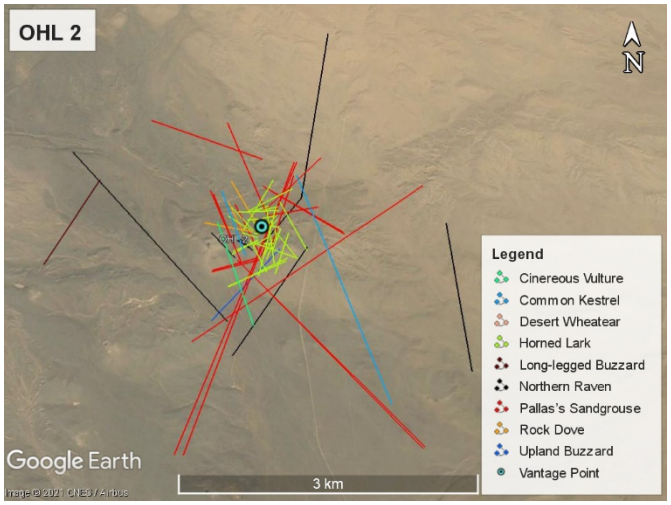
The mean flight height for all recorded species was 32.1 m (±36.9SD, min. 1, max. 450, n = 991) above ground. The mean flight height was varied between species ($F_{20,950}$=33.2, p<0.05). Cinereous Vulture, Golden Eagle, and Upland Buzzard flew a higher than others. Average flight height of all observed birds was differed by months ($F_{9,981}$=5.8, p<0.05). High flight of Cinereous Vulture was observed in winter. We also discovered that there was a significant difference between flight height and time of the day ($F_{15,968}$=0.94, p<0.26). The birds flew a higher in the morning and evening than other time of the day (graph 8, map 4).

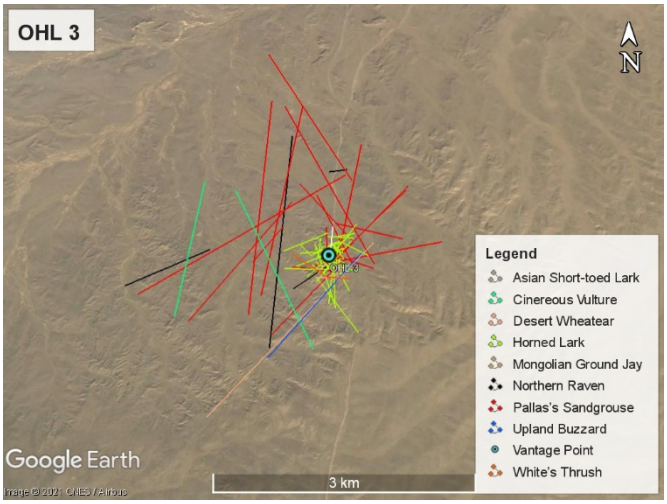
Graph 8. Mean flight heights of all species at VP at the the study area (April 2020-February 2021)

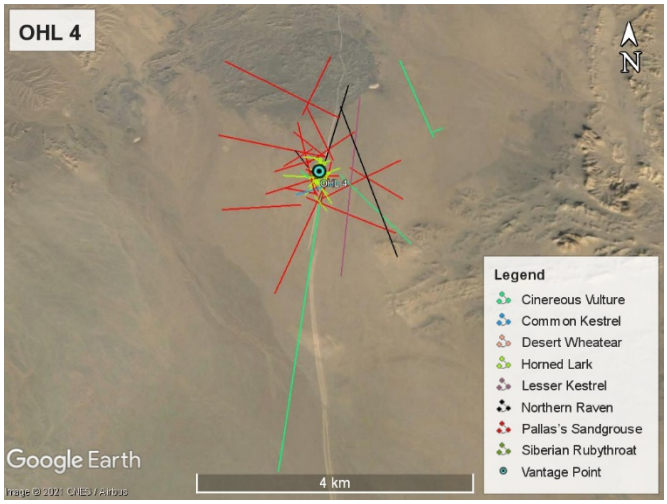


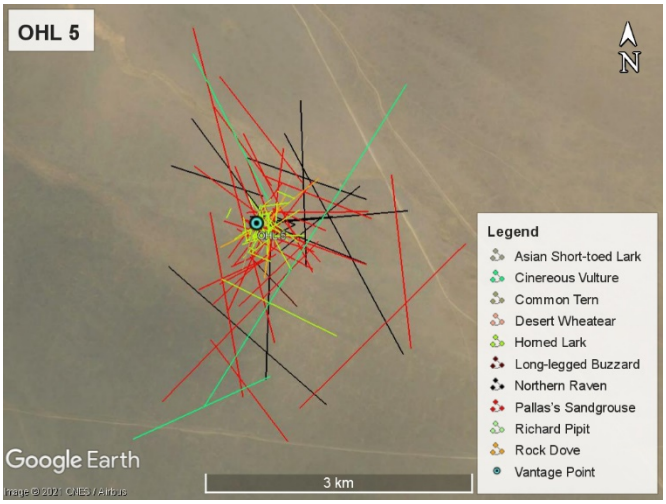
Map 4. Occurrence and distribution of all recorded species in OHL1-OHL9 from April 2020 to February 2021

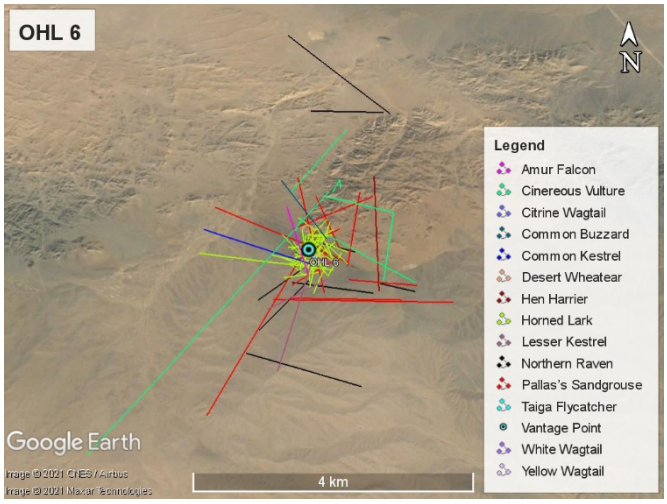


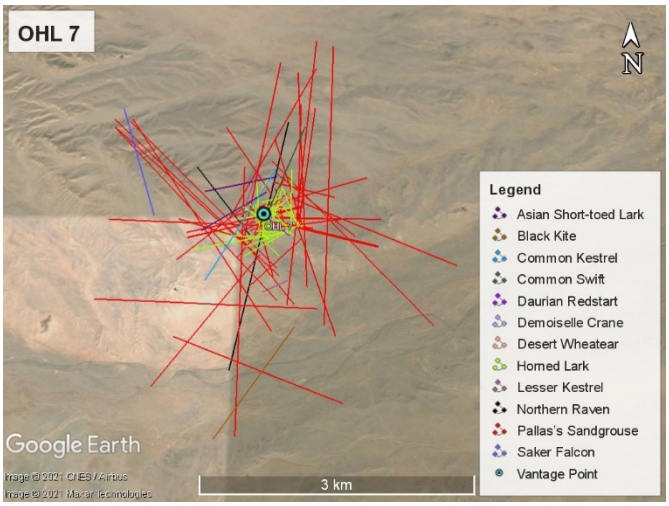


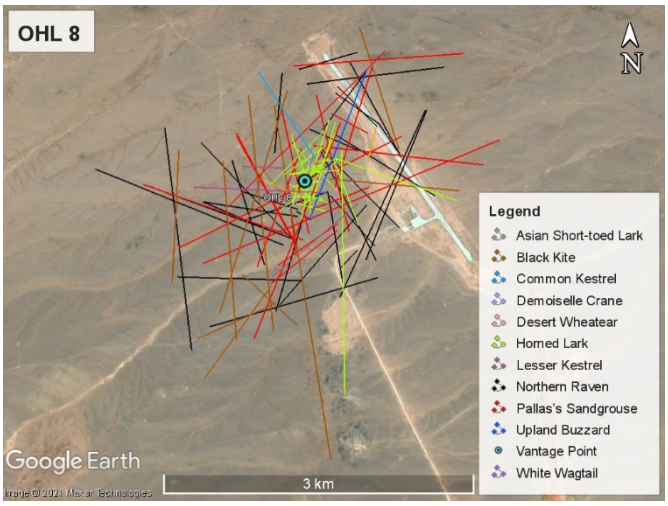


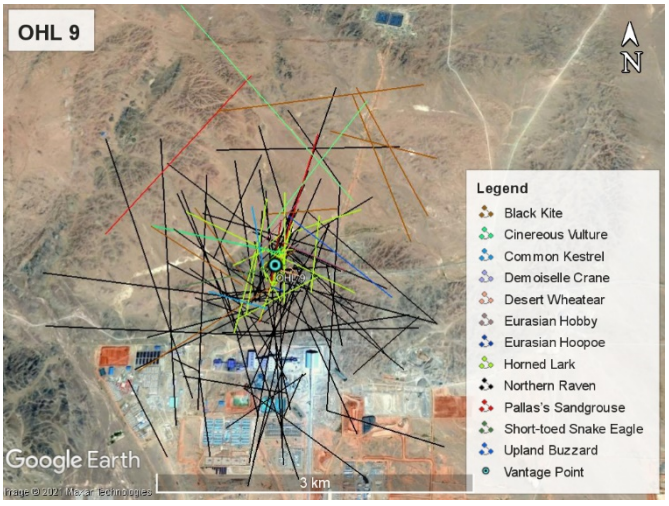







OHL 7
N
Legend
Asian Short-toed Lark
Black Kite
Common Kestrel
Common Swift
Daurian Redstart
Demoiselle Crane
Desert Wheatear
Horned Lark
Lesser Kestrel
Northern Raven
Pallas's Sandgrouse
Saker Falcon
Vantage Point
Google Earth
3 km


OHL 8
N
Legend
Asian Short-toed Lark
Black Kite
Common Kestrel
Demoiselle Crane
Desert Wheatear
Horned Lark
Lesser Kestrel
Northern Raven
Pallas's Sandgrouse
Upland Buzzard
Vantage Point
White Wagtail
Google Earth
3 km


OHL 9
N
Legend
Black Kite
Cinereous Vulture
Common Kestrel
Demoiselle Crane
Desert Wheatear
Eurasian Hobby
Eurasian Hoopoe
Horned Lark
Northern Raven
Pallas's Sandgrouse
Short-toed Snake Eagle
Upland Buzzard
Vantage Point
Google Earth
3 km

MIGRATING BIRD SURVEY

Spring migration

The observation date spanned all spring migration periods. We documented a total of 48 migratory species and showed in table 8 (photograph 2). We did not see any large flocks of migratory species. This result was associated with the lack of suitable habitats for migrants and residents like open water, planted and natural trees, and patched forest at the study site.

We documented the following migratory raptors: Black Kite (n=4); Eastern Buzzard (n=1); Hen Harrier (n=1); Lesser Kestrel (n=7); Long-legged Buzzard (n=1); and Steppe Eagle (n=1) at the site.

We observed Common Swift, Daurian Redstart, and White's Thrush were documented in small numbers (n=1-5) in late May. Breeding visitors, such as Asian Short-toed Lark, Desert Wheatear, and Greater Sandplover, were often recorded in the site.

From spring migration survey results, we can conclude that the overhead line will not have a high impact on migratory birds in accordance with other previous studies of similar areas and directions that published in Gombobaatar *et al.* (2011), Gombobaatar and Bayanmunkh (2016), and Munkh-Erdene (2017).

Autumn migration

The observation date covered all autumn migration periods. We documented 34 migratory species and showed in table 9 (photograph 2). We could not see any large flocks of migrants. This result was associated with the lack of suitable habitats for migrants and residents.

We documented the following migratory raptors: Black Kite (n=40); Common Kestrel (n=1); Crested Honey Buzzard (n=1); Hen Harrier (n=1); Lesser Kestrel (n=11); Long-legged Buzzard (n=7); and Steppe Eagle (n=1) at the site.

We also observed Asian Short-toed Lark, Barn Swallow, Citrine Wagtail, Common Redshank, Common Sandpiper, Common Shelduck, Desert Wheatear, Demoiselle Crane, Eyebrowed Thrush, Great Cormorant, Kentish Plover, Pacific Swift, Siberian Rubythroat, Tufted Duck, White Wagtail, White's Thrush, and Wood Sandpiper in late August-September. Breeding

visitors, such as Asian Short-toed Lark, Desert Wheatear, and Greater Sandplover, were often recorded at the study site.

From autumn migration survey results, we can conclude that there will not be high impacts on migratory birds.

Table 8. Records of spring migrating species through monitoring site in April-May 2020

№	Common name	Notes
1	Amur Falcon	Recorded two individuals once in April and May.
2	Asian Short-toed Lark	Observed 44 individuals in 19 times in April and May.
3	Barn Swallow	Four individuals observed on 23 May.
4	Black Kite	Four individuals observed four times in April.
5	Blyth's Pipit	Observed 11 individuals 4 times in April and May.
6	Booted Eagle	Observed once in April.
7	Brown Shrike	One individual observed in May.
8	Chinese Grey Shrike	Recorded one individual once in May.
9	Citrine Wagtail	We observed 1 individual in May.
10	Eastern Buzzard	One individual observed on 23 April at OHL6.
11	Common Redstart	Observed once in May.
12	Common Swift	Six individuals observed three times in May.
13	Daurian Redstart	Observed 4 individuals twice in May.
14	Demoiselle Crane	Two individuals observed once in May at OHL9.
15	Desert Wheatear	We observed 5 individuals in April and May.
16	Dusky Thrush	Recorded one individual once in May.
17	Dusky Warbler	Documented 2 individuals on 11 May.
18	Eurasian Sparrowhawk	Documented one time during spring migration.
19	Eyebrowed Thrush	One individual observed in May.
20	Greater Sandplover	Recorded one individual once in May.
21	Green Sandpiper	Observed one individual once in May.
22	Grey Wagtail	Recorded two individuals once in May.
23	Hen Harrier	Documented one time during spring migration.
24	Isabelline Shrike	One individual observed on 13 April.
25	Isabelline Wheatear	We observed 1 individual in May.
26	Lesser Kestrel	Observed 8 individuals seven times on the migration, potentially breeds within the surrounding areas.
27	Lesser Whitethroat	Recorded one individual once in May.
28	Little Bunting	Five individuals observed two times in April and May.
29	Little Ringed Plover	Observed two individuals twice in May.
30	Long-legged Buzzard	Two individuals observed twice in April and May.
31	Naumann's Thrush	Recorded one individual once in May.
32	Northern Wheatear	Observed 2 individuals in May.
33	Olive-backed Pipit	Documented once on spring migration.
34	Pacific Swift	Eight individuals observed once in May.
35	Pallas's Grasshopper Warbler	Recorded one individual once in May.
36	Pied Wheatear	Observed one individual once in May.
37	Red-throated Thrush	Four individuals observed twice in May.
38	Richard's Pipit	We observed 5 individuals once in April.
39	Ruddy Shelduck	Observed 2 individuals in April.
40	Siberian Accentor	Recorded one individual once in May.
41	Siberian Rubythroat	Documented one time during spring migration.
42	Siberian Stonechat	Observed one individual in May.

43	Steppe Eagle	We observed one individual once in April at OHL4.
44	Steppe Grey Shrike	Recorded one individual once in May.
45	Taiga Flycatcher	Documented one time during spring migration.
46	White Wagtail	Observed 2 individuals in May.
47	White's Thrush	Twelve individuals observed one time in May.
48	Yellow Wagtail	One individual observed in May.

Table 9. Records of autumn migrating species through the monitoring site in August-September 2020

№	Common name	Notes
1	Asian Short-toed Lark	Observed 12 individuals 2 times in September.
2	Barn Swallow	Three individuals observed once in August.
3	Black Kite	Documented 40 individuals 19 times in August and September.
4	Citrine Wagtail	Documented one time during autumn migration.
5	Common Kestrel	Recorded one individual once in September.
6	Common Redshank	Observed one individual once in August.
7	Common Sandpiper	Observed once in August.
8	Common Shellduck	Recorded 10 individuals two times in August.
9	Crested honey buzzard	Recorded one individual once in September.
10	Demoiselle Crane	Recorded 13 individuals 3 times in August.
11	Desert Wheatear	We observed 50 individuals in August and September.
12	Dusky Warbler	Documented 2 individuals once in September.
13	Eurasian Hobby	Observed 3 individuals 3 times in August and September.
14	Eurasian Hoopoe	Two individuals observed two times in August.
15	Eyebrowed Thrush	One individual observed once in September.
16	Great Cormorant	Documented one individual once in September.
17	Green Sandpiper	Observed one individual once in August.
18	Grey Wagtail	Recorded five individuals two times in August and September.
19	Hen Harrier	Documented one time during autumn migration.
20	Kentish Plover	Documented 16 individuals on 21 August.
21	Lesser Kestrel	Observed 11 individuals in August and September.
22	Long-legged Buzzard	Seven individuals observed seven times in August and September.
23	Olive-backed Pipit	Documented once on autumn migration.
24	Pacific Swift	Five individuals observed once in May.
25	Pallas's Bunting	Two individuals observed in September.
26	Pallas's Leaf Warbler	Observed one individual once in September.
27	Reed Bunting	Recorded one individual once in September.
28	Red-throated Thrush	One individual observed once in September.
29	Siberian Rubythroat	Two individuals observed two times in September.
30	Steppe Eagle	Documented one time during spring migration.
31	Steppe Grey Shrike	Observed 2 individuals in September.
32	White Wagtail	Observed 13 individuals eight times in August and September.
33	White's Thrush	Two individuals observed two times in autumn migration.
34	Wood Sandpiper	We observed one individual once in August.

GENERAL CONCLUSION

1. The majority bird species that recorded at the study site were passage migrants in low density. Impacts on migratory birds from this transmission line are comparatively lower than other wind farm areas near forest steppe, mountain steppe, and steppe that we monitored.
2. Most abundant species at the area were common resident species, such as Horned Lark, Pallas's Sandgrouse, and Northern Raven. These species are not considered as globally and nationally threatened. Globally and nationally threatened resident and migratory species (Saker Falcon, Cinereous Vulture, Lammergeier, Steppe Eagle, and Mongolian Ground Jay) with low density (n=1 up to 16 on average) inhabit the area.
3. The number of the recorded raptors (Cinereous Vulture, Upland Buzzard, Hen Harrier, Saker Falcon, Common Kestrel, and Lammergeier) has not significantly changed over the monitored periods at preconstruction phase.
4. Ornithological monitoring results at pre-construction phase support the location and length of previously planned track line of the transmission line from MWSP to Oyu Tolgoi mining.
5. Temporary small ponds after heavy rain and spring snow melt (1.7 km south of OHL8) and hilly habitats with rocks and bushes (between the vantage points OHL5-OHL6 and OHL7-OHL8) in/near the area attract the breeding raptors and Pallas's Sandgrouse along the planned powerline. The company shall concern to monitor these sites at construction and operational phases.
6. Depending on seed abundance and precipitation of coming years, large flock of the Pallas's Sandgrouse can be occurred at the area both non-breeding and breeding seasons. This requires further monitoring and assessment of the species at construction and operational phases.
7. Moderate Sensitive species, such as Saker Falcon and Pallas's Sandgrouse that flew with the height of risk near transmission line area (OHL1 and OHL7) shall be the major concern for further monitoring programme.
8. To reduce the collision risk of frequently recorded species (Saker Falcon, Steppe Eagle, Pallas's Sandgrouse, Short-toed Snake Eagle (moderate risk), and Cinereous Vulture, Lammergeier, Great Bustard (low-moderate risk)) at the power line area, the company shall consider the mitigation actions (diverters, monitoring etc…) in the General Mitigation Action Plan that we have suggested.

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ANNEX

Annex 1. Field data form

Study site (GPS):_____ **Start at:_____**

Date:_____ **Finished at:_____**

No	Target species	Time first observed	Time last observed	Duration of over-fly (min)	No. of Ind.s	Age/ sex	Flight Direction (°)		Flight Height (m)		Distance from observer (m)		Activity during each flight	Weather condition	Habitat	Study site	Notes
							from	to	min	max	first time	by the time disappeared					
1																	
2																	

Annex 2. Risk analyses and impact significance matrix

Status			Receptor sensitivity (Vulnerability)			
			Negligible	**Low**	**Moderate**	**High**
		Description	Common/abundant locally. Not important to other ecosystem functions	With a Regional designation of 'Near Threatened' or below. Not critical to other ecosystem functions (e.g. as prey to other species or as a predator to potential pest species). Common nationally.	A species population which has designated conservation status at an international or national scale of 'Vulnerable'. A species population which has designated conservation status at a Regional-scale of Vulnerable' or above.	A species population which has designated conservation status at an international or national scale of 'Endangered' or above.
Impact Magnitude (number and occurrence)	**Negligible**	Indiscernible from natural variability	Not significant	Not significant	Not significant	Low
	Low	A low magnitude impact on a species affects a specific group of localized individuals within a population over a short time period (one generation1 or less), but does not affect other tropic levels or the population itself.	Not significant	Low	Low moderate	Moderate
	Moderate	The impact affects a portion of a population and may bring about a change in abundance and/or a reduction in the distribution over one or more generations*, but does not threaten the long-term integrity of that population or any population dependent on it. The size and cumulative character of the consequence are also important. A moderate magnitude impact multiplied over a wide area would be regarded as a high magnitude impact.	Not significant	Low moderate	Moderate	High
	High	Impact on a species that affects an entire population to cause a decline in abundance and/or change in distribution beyond which natural recruitment (reproduction, immigration from unaffected areas) would not return that population or species, or any population or species dependent upon it, to its former level within several generations, or when there is no possibility of recovery.	Low	Moderate	High	High

		Receptor Sensitivity (vulnerability and value)			
		Negligible	**Low**	**Moderate**	**High**
Impact Magnitude (extent, timing & frequency, reversibility, duration)	**Negligible**	Not significant	Not significant	Not significant	Not significant / Low
	Low	Not significant	Low	Low / Moderate	Moderate
	Moderate	Not significant	Low / Moderate	Moderate	High
	High	Low	Moderate	High	High