Summary on project results to assess bird mortality caused by electricity power lines in Mangistau Region, Kazakhstan



Steppe eagle (*Aquila nipalensis*) electrocuted at a power pole with metal dovetailed crossbar owned by JSC KazTransOil.

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Mortality caused by electrocution on power lines is the main limiting factor for birds of prey throughout the Former Soviet Union, this applies especially to unforested areas in the arid and semi-arid zones.

In the course of project execution, we conducted two seasonal surveys along power lines (6-10kV) in Mangistau Region (autumn 2014 and spring 2015). All surveyed lines with a total length of 440 km belong to the state energy companies JSC KazTransGas (250 km) and JSC KazTransOil (190 km) and were located along the existing oil and gas pipeline network. It should be noted that there is a difference in the design of the power line structures owned by these companies: JSC KazTransGas most often uses concrete poles with horizontal metal crossarms and pin insulators that are also equipped with «distractive» T-shaped perches and «anti-perching» spikes (Figure 1); the power line poles owned by JSC KazTransOil have metal dovetailed crossbars and suspended insulators (Figure 2) - these structures are not equipped with bird protection devices.



Figure 1. Most commonly used reinforced concrete pole with horizontal metal crossarm and pin insulators that are also equipped with «distractive» T-shaped perches.

Figure 2. Reinforced concrete structure with metal dovetailed crossbar and suspended insulators.

The survey was carried out using an offroad vehicle. The car drove along power lines at a distance of 5-40 m and with a speed of up to 40 km/h. Some sections of the power network in inaccessible terrain were inspected on foot. This survey method is effective for inspecting long power line sections in a relatively short period of time, and in terrain with low and often sparse vegetation under power structures it enables detection of the majority of the remains of medium and large birds electrocuted in the past 2 years. Some carcasses of small birds and remains of birds killed in previous years were also revealed.

Data collected during the power line survey included: type of power pole, design features of cross arms, insulators and wires, photographs of power line structures and small metal tags with the pole/transformer's identification number. If a bird's remains were found below power pole or lines, the following data were recorded: rough estimate of date of bird's death (based on level of decomposition of carcass), species or genus of bird killed (identification depends on the degree of carcass decomposition), photographs of bird remains with GPS Garmin to record the coordinates of the place of encounter and also photographs of bird remains in front of the power structure that caused the bird's death. We took into account the remains of birds killed in the past 2 years. Earlier remains were not recorded. All data were recorded in a field diary. During the surveys we found carcasses of 123 birds of 30 species that were killed by power lines in the last two years (**Table 1**).

Bird species	Number of birds killed by power lines			Extent of damage, USD	
	JSC KazTransGas 250 кm	JSC KazTransOil 190 кт	Total	per ind.	Total
Steppe eagle Aquila nipalensis	15	2	17	128	2176
Imperial eagle Aquila heliaca	2		2	639	1278
Golden eagle Aquila chrysaetos	3		3	2556	7668
Eagle (species unidentifiable) <i>Aquila sp.</i>	37		37	128	4736
Short-toed eagle Circaetus gallicus	1		1	2556	2556
Saker falcon Falco cherrug	2		2	4473	8946
Long-legged buzzard Buteo rufinus	3		3	64	192
Buzzard (species unidentifiable) Buteo sp.	9	1	10	64	640
Cinereous vulture Aegypius monachus	1		1	64	64
Common kestrel Falco tinnunculus	3		3	32	96
Black kite Milvus migrans	3		3	32	96

Table 1 - Results of the surveys undertaken along power lines (6-10kV) in MangistauRegion in 2014-2015

Eagle owl	8	1	9	2556	23004
Bubo bubo					
Raven	3	1	4	32	128
Corvus corax					
Eurasian rook	3	2	5	32	160
Corvus frugilegus					
Greater flamingo *	1		1	2556	2556
Phoenicopterus roseus					
Common spoonbill *	1		1	1278	1278
Platalea leucorodia					
Common quail *	1		1	6	6
Coturnix coturnix					
Mute swan *	1		1	320	320
Cygnus olor					
Mallard *	1		1	6	6
Anas platyrhynchos					
Common shelduck *		1	1	6	6
Tadorna tadorna					
Passeriformes (11 species) *	14	3	17	32	543
Total	112	11	123		56455
Birds killed by electrocution and collision per 10 km of power line	4.5	0.6			
Birds killed by electrocution per 10 km of power line	3.7	0.4			

* Birds killed by collision with the power lines

Falconiformes, *Strigiformes* (eagle owl) and *Corvidae* (raven and Eurasian rook) were killed by electrocution (81,3%) when they tried to perch on reinforced concrete poles with metal crossarms and pin suspension insulators.

Greater flamingo, common spoonbill, mute swan, mallard, common shelduck, common quail and 11 species of small passerine birds (song thrush *Turdus philomelos*, lesser short-toed lark *Calandrella rufescens*, calandra lark *Melanocorypha calandra*, Isabelline wheatear *Oenanthe isabellina*, desert wheatear *Oenanthe deserti*, ortolan bunting *Emberiza hortulana*, great grey shrike *Lanius excubitor*, paddyfield warbler *Acrocephalus agricola*, desert warbler *Sylvia nana*, bluethroat *Luscinia svecica*, robin *Erithacus rubecula*) were killed by collision with power lines (18,7%). Greater flamingo and common spoonbill are listed in the Red Book of Kazakhstan.

The electrocuted birds recorded were: 59% - eagles from *Aquila sp.* (³/₄ of which were steppe eagles *Aquila nipalensis*), 13% - buzzards from *Buteo sp.*, 10%- other diurnal raptors, 9%- eagle owls (*Bubo bubo*) and 9% are from *Corvidae* family. All *Aquila* species, saker falcon, short-toed eagle and eagle owl are listed in the Red Book of Kazakhstan and made up 71% of the birds killed. This indicator is very high and underlines the need for an immediate solution to the problem of electrocution.

The survey results have indicated varying degrees of risk to the birds depending on the different types of crossbar and insulator. Inspection of 250 km of power line with widely

used poles with horizontal metal crossarms and pin insulators (power line owner- JSC KazTransGas) revealed the remains of 93 electrocuted birds or 3.72 ind. per 10 km. During our field work along 190 km of power line section with metal dovetailed crossbars and suspended insulators (power line owner- JSC KazTransOil), we only found the remains of 7 electrocuted birds (2 steppe eagle, 1 buzzard, 1 eagle owl, 1 raven and 2 rooks) or 0.37 ind. per 10 km. Thus, it is evident that the latter power line structures are approximately 10 times less dangerous to the birds in terms of the probability of being electrocuted.

However, this type of crossbar still does not entirely solve the problem of bird electrocution, particularly in respect of large raptors as was confirmed by the detection of two recently electrocuted steppe eagle carcasses with characteristic burn marks: charred feet and head (Figures 3, 4 and 5).



Figure 3. Steppe eagle (*Aquila nipalensis*) electrocuted at a power pole with metal dovetailed crossbar owned by JSC KazTransOil.



eagle (Aquila electrocuted at a power pole with dovetailed crossbar. metal dovetailed crossbar.

Figure 4. Charred head of a steppe Figure 5. Burned feet of a steppe eagle (Aquila nipalensis) nipalensis) electrocuted at a power pole with metal

The birds received these injuries when they bridged the gap between the horizontal part of the crossbar and the live upper wire. It is obvious that dovetailed crossbars coupled with exposed current-carrying wires need to be retrofitted with effective insulating sleeves. Speaking about the results of these surveys that were carried out twice within one year, one needs to consider them as conservative estimates since a significant number of birds killed (up to 50% or more) are consumed by animal predators and scavengers (Pestov et al., 2012). In addition, based on some anecdotal evidence, we cannot exclude the possibility of collection and removal of bird remains along power lines by employees of the companies that own these lines.

During fieldwork along the pipeline owned by JSC KazTransGaz we found two sections of power line retrofitted with insulated bird protection devices. The first section is located in the vicinity of the village of Akzhigit (Beineu district) on the power line going to Uzbekistan. The second section is to the south of the city of Zhanaozen (Karakiya district) on the power line going to Turkmenistan. The length of each section is only a few kilometers.

It should be noted that only the protective devices installed on the line section close to the village of Akzhigit provide adequate protection for large birds, as these insulating sleeves have sufficient length, isolating at least 1 m of the current-carrying wire near the insulator (Figure 6). The insulating sleeves on the second section in the Karakiyan area are too short, isolating only about 0.5 m of the current-carrying wire near the insulator, which does not ensure the safety of large birds with a wingspan of more than 1 m (Figure 7).

From unofficial sources we can estimate that the total length of 6-10kV power lines in the Region is about 4,000 km. If all collected data are extrapolated for the entire territory of Mangistau Region, we can roughly estimate a minimum number of 1000 birds electrocuted in Mangistau Region annually. The extrapolation is necessarily a simple one in the absence of more data on the relative abundance of at risk birds in the different areas of the power line network. Given the incompleteness of the data regarding disposal of bird remains by predators and scavengers, as well as the possible removal of bird carcasses by people, the actual figures can obviously be much higher.

According to existing legislation in the RoK, the annual damage from avian deaths caused by electrocution on power lines in Mangistau Region is estimated at around 500,000-1,000,000\$. If the owners of power lines were forced to pay comparable penalties to compensate the actual damage, the problem of bird electrocution on power lines would be solved much more quickly. However, in reality this does not happen.



insulating sleeves of sufficient length in the vicinity of the village of Akzhigit (Beyneu District), Mangistau Region.



Figure 6. A power line section with effective Figure 7. Insulating sleeves that are too short, isolating only about 0.5 m of the current-carrying wire near the insulators on power lines in the Karakiyan district, Mangistau Region.

Based on analysis of the data collected, the following conclusions and recommendations are presented:

- In Mangistau Region, as well as throughout the Former Soviet Union, there is a • problem of mass electrocution on medium voltage power lines (6-10 kV) of raptors including species that are listed in the Red Book of Kazakhstan. It is estimated that at least 1,000 birds are killed by electrocution every year in Mangistau Region, causing significant damage to rare species and threatening their survival. In this regard, the steppe eagle populations are under the greatest pressure.
- This situation is a violation of RoK legislation and in urgent need of correction. At • the same time the existing regulatory framework needs to be updated and should formulate specific requirements for the design, construction and operation of medium voltage power lines to prevent birds from being electrocuted and ensure their safety.
- Currently the most widely used reinforced concrete poles with horizontal metal • crossarms and pin insulators are the most dangerous structures for birds and need to be retrofitted with effective bird protection devices. Other common structures with

metal dovetailed crossbars and suspended insulators are also not safe for birds and need to be modified with bird protection devices.

- In the design, approval and construction of new medium voltage power poles (6-10kV) preference should be given to avian-safe facilities that will include protective devices and these will not need to be retrofitted. In accordance with RoK legislation, companies that operate medium voltage power lines have to develop and implement programs to prevent bird electrocution on power lines within a realistic timeframe.
- Governmental environmental agencies need to organize comprehensive monitoring of bird electrocution on power lines with experts' involvement from NGOs and establish effective control over compliance with environmental legislation.

On May 13, 2015 in Aktau we conducted a meeting on the protection of birds and mitigation measures to reduce bird mortality caused by electrocution on power lines (6-10kV) in Mangistau Region. Representatives of state environmental agencies (Mangistau Department of Natural Resources and Environment, Regional Environmental Prosecutor's Office, Forestry and Hunting Inspectorate, Ustyurt State Nature Reserve), regional authorities, energy companies and journalists attended this meeting. Our colleague Mark Pestov presented the keynote report. All participants in the meeting supported the need to address the issue of bird mortality from electrocution and expressed their willingness to tackle this problem in stages. A " JSC KazTransGas" representative stated that this company was planning to retrofit 250 km of power lines with insulating bird protection devices in 2015-2016. Following the meeting a media release was prepared and distributed to journalists. As a result, there have been several publications in the media:

http://tumba.kz/novosti-kazaxstana/49-%D0%BD%D0%BE%D0%B2%D0%BE%D1%81%D1%82%D0%B8-%D0%BA%D0%B0%D0%B7%D0%B0%D1%85%D1%81%D1%82%D0%B0%D0%BD%D0%B0/8479-stepnojj_orel.html

http://www.lada.kz/aktau_news/ecology/page,1,2,28042-mark-pestov-v-mangistau-populyaciya-stepnogo-orla-sokratilas-na-90-procentov.html#comment

As part of this project, we drew up a draft Resolution "On approval of the requirements to prevent wildlife mortality in the design, construction, operation, repair and modification of power lines (6-10kV) in the Republic of Kazakhstan". The text of the draft is based on similar documents approved in some regions of Russia. A draft Resolution has been discussed and agreed with leading experts in Kazakhstan and Russia and submitted to the Government of Kazakhstan.

A poster on bird interaction with power lines with the Rufford Small Grants Foundation (RSGF) logo has been published and distributed to target groups (energy/oil companies, environmental agencies and educational institutions).

We believe that the main goals and objectives of our project to assess bird mortality caused by electricity power lines in Mangistau Region, successfully implemented or are in progress. We deem it advisable to continue to seek opportunities to further monitor the situation with bird mortality caused by electrocution in the Mangistau Region in the coming years, as well as implementation of similar projects in other parts of Kazakhstan, especially in the steppe and desert zones. We are also planning to carry out a similar study in Uzbekistan in the future.