

Bird Electrocution and Collisions with Power Infrastructure in Elgazeira, Kassala and Gadarif States, Sudan

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Abstract

This study was conducted at Elgazeira, kassala and Gadarif states, covered two seasons in exception of Gadarif state studied in the last season only. The first season from 28/6/2015 to 6/7/2015, and another season from 24 December 2015- 6 January 2016, to assess the bird's mortality caused by the power lines.

Objectives of this study are: Describe types of killer power lines, and determine numbers of bird species, that are killed by collisions or electrocutions.

There were 43 lines traversed in the study area, as follow:

20 lines in the Gaziera state, 9 lines in Gadarif and 14 in kassala. Line transects was adopted to cover the targeted lines.

Types of these lines that used were 11 Kilo volte, 33 kilo volte, and 66 kilo volte.

Lines were intensive studied by four members under and at the both sides of the line to cover about twenty meters at each side. Dead birds found at an area of 20 meters beneath the line recorded by location using GPS, then classified and documented by digital camera, a photo taken for the poles with its surround habitat. Electrocuted birds distinguished by the signs like burning, injures or the location of the birds from the pole. Dead birds after been registered collected to avoid replication.

Number of dead birds was 357 individuals classified into 23 species most are member of the order Falconiformes which comprised a total of 257 individuals, about 72% of the whole percentage. The proportion of Ciconiiformes was 64

individuals of 18%. Less proportion was Passeriformes and Charadriiformes. Electrocutted birds were 301 individuals 84.3% higher than collision 56 birds 15.7%.

It should be noticed that birds of prey were more affected by power lines mainly at Kassala state, Lesser kestrel 20.7%, Black kite 16.3% Common kestrel 15.1% while Pied crow suffered more in Gaziera state 31 individuals of 8.7%. The total number of birds not reflects the exact real because there are many factors such as Scavengers and carnivores or removing by ploughing or humans.

Keywords: Collision; Electrocuttion; Poles; Energized; Soaring; Power lines

Introduction

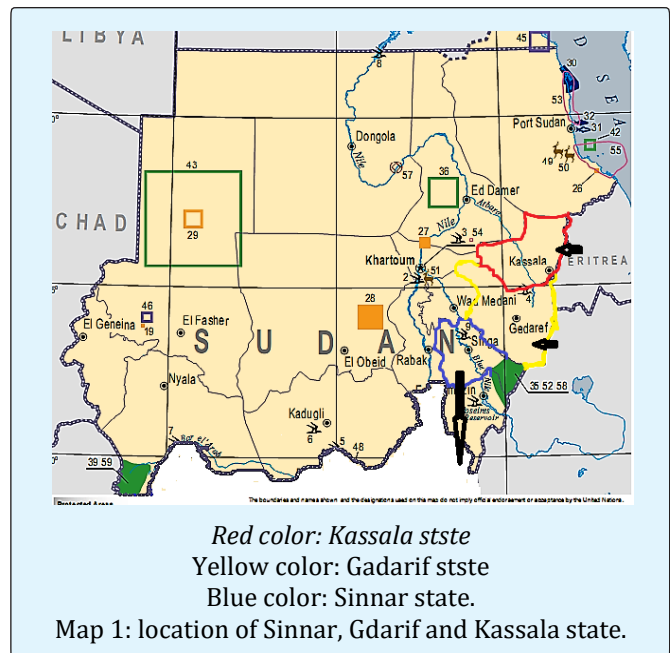
Power lines are one of the major causes of unnatural deaths for birds in a large part of the African-Eurasian Flyways with, for example, an estimated many millions of collision victims each year in Germany alone [1]. The Rift Valley/Red Sea flyway is the second most important flyway for migratory soaring birds (raptors, storks, pelicans and some ibis) in the world, with over 1.5 million birds of 37 species, including 5 globally threatened species, using this corridor between their breeding grounds in Europe and West Asia and wintering areas in Africa each year. Electrocuttion and collision with power lines are considered to be a major cause of death for some avian species [1-4]. Electrocuttion can occur when a bird perches on a cross-arm and completes an electrical circuit with two or more body parts. Electrocuttion can also happen when the bird comes between two energized components or an energized and an earthed (also called 'grounded') component of the pole structure.

Collisions, on the other hand, happen when birds fly directly into electrical lines, poles and pylons and the bird is typically killed when it collides with such obstructions and the subsequent impact with the ground, or it dies from the resulting injuries [5-9]. However, birds die either from the impact of hitting the line or from electrocuttion when they contact two lines simultaneously and complete the electrical circuit [10].

Several studies have shown that electrocuttion from power lines is a serious conservation problem and is one of the principal causes of mortality among many threatened species of birds [7,11,12].

In some areas, it is considered to be the main reason for the decline of endangered species [12-14]. Collisions may kill anything between hundreds of thousands to 175

million birds annually, and power lines electrocute tens to hundreds of thousands more birds annually.



Methodology

Power lines o the three states were intensively studied in two seasons, from 28/6/2015 to 6/7/2015, and another season from 24 December 2015-6 January 2016.Three compilers walking under and at the both sides of the power line to cover about twenty meters at each side.

Dead birds were counted and recorded by location using GPS, then classified and documented by digital camera, and a photo taken for the poles with it's around habitat.

Several studies have already mentioned the importance of counting bird carcasses by the power lines even if this does not represent the actual number or the actual species affected by the power lines, especially the small species [15]. The majority of lines covered on food because most areas ploughed from last season with remain of dura, cotton, vegetables, or bare land. Less proportion covered by car where the lines goes along roads and open areas where the car find its way slowly and more difficulty.

A questionnaire is used to collect information from the local people in the three states, while a form used for cases of dead birds, collision and Electrocutation typical copy of which prepared (Bird life international) by Avian demography in South Africa.

Discussion & Results

The study covered a total of 43 lines, Table 1, distributed as follow: 20, 14 and 9 lines for Gaziera, Kassala and Gadar if respectively, which all reflected the affected lines. The numbers of poles that counted are 3935 poles, Table 2, which they distributed along the lines in states as follow: 1351 poles in the Gaziera are 2127 poles in Gadarif and 457 poles in Kassala. The total number of birds' species is varied the three states, Table 3 Kassala has high number of species during the two seasons followed by Gadarif, the second season 2016 is

higher than the first one 2015. In general, the total number of dead species for the whole study is 23 species Table 4. And it will be mention that this may not the real number of species, since the small species may be burned, eaten, burrowed by soil or even pulled away by wind action.

State	First season	Second season	Total
Gaziera	9	11	20
Kassala	7	7	14
Gadarif	0	9	9
Total	16	27	43

Table 1: Number of Power lines studied during the study period at the three states.

State	Number of poles
Gaziera	1351
Kassala	457
Gadarif	2127
Total	3935

Table 2: Number of poles in the three states.

State	First season	Second season
Gaziera	3	9
Kassala	12	13
Gadarif	0	12

Table 3: Total number of dead bird's species.

No	Species	First season 2015			Second season 2016				Percentage
		Gaziera	Kassala	Gadarif	Gaziera	Kassala	Gadarif	Total	
1	Pied crow	8	1	0	15	2	5	31	8.7
2	Brown necked raven	0	1	0	0	0	0	1	0.3
3	Lesser kestrel	0	26	0	5	19	24	74	20.7
4	Common kestrel	0	4	0	0	21	29	54	15.1
5	Sacker falcon	0	0	0	0	8	0	8	2.2
6	Black kite	0	7	0	2	14	35	58	16.3
7	Yellow billed kite	0	4	0	0	0	0	4	1.1
8	Un identified vulture	0	3	0	0	0	0	3	0.8
9	White backed vulture	0	5	0	0	2	0	7	2
10	Red necked buzzard	0	0	0	0	4	3	7	2
11	Levant sparrow hawk	0	0	0	0	0	2	2	0.6
12	Abdims' stork	8	17	0	4	8	3	40	11.2
13	White stork	0	0	0	1	2	0	3	0.7
14	Black headed heron	1	3	0	0	2	1	7	2

15	Grey heron	0	0	0	1	0	2	3	0.8
16	Cattle egret	0	0	0	2	0	6	8	2.2
17	Eagle owl	0	0	0	1	10	0	11	3.1
18	Grayish Owl	0	27	0	0	0	0	27	7.6
19	Un known owl	0	0	0	0	2	0	2	0.6
20	Marabou stork	0	0	0	1	2	0	3	0.8
21	Spur winged lapwing	0	1	0	0	0	0	1	0.3
22	Abyssinian roller	0	0	0	0	0	1	1	0.3
23	African mourning dove	0	0	0	0	0	2	2	0.6
	Total	17	99	0	32	96	113	357	

Table 4: Occurrence and number of bird's species.

The total number of dead birds is 357 birds. Although this number probably does not represent the actual bird mortality due to electrocution or collision with the power lines, the occurrence of predators, where tracks of a large of dogs, Common genet (*Genetta genetta*) African civet (*Civettictis civetta*) and scavengers in many sites were seen along the power lines, could confirm this fact which stated by Shobrak [16]. The type of effect on birds (Collision and electrocution) is shown in Table 5. It reveals that collided birds were 56 individuals of proportion 15.7% while the Electrocutated birds were the

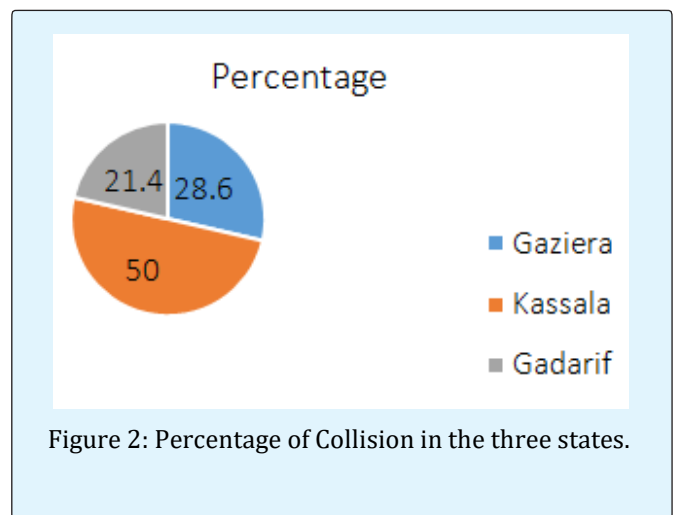
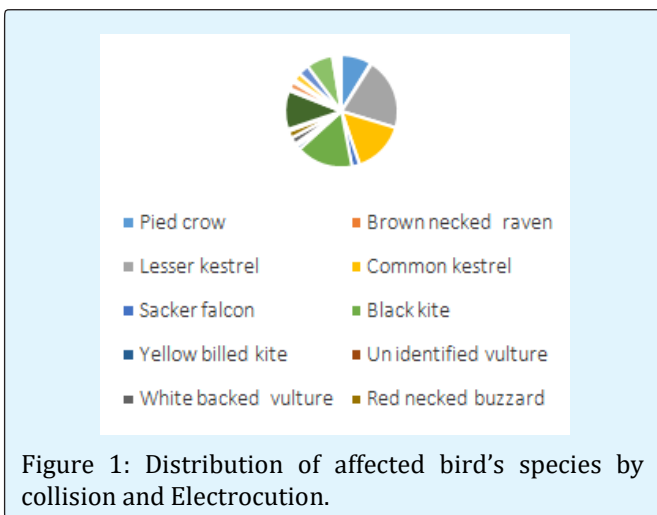
most dominant 301 individuals of 84.3%. The remarkable things that both collision and Electrocutation were increased in the second season, which can be big challenge in the future. The effect of collision and Electrocutation is varied between the states for the same period, Table 5, Figures 2 & 3. Kassala always has a high mortality of birds either for collision or Electrocutation at Awadat lines (begins N: 15 46 384 E36 29 713 and end at N: 15 46 031 E: 366 33 436).

State	First season	Second season	Total		First Season	Second Season	Total	
	ELEC	ELEC			COLL	COLL		
Gaziera	11	22	37	12.3	6	10	16	28.6
Kassala	80	87	167	62.1	19	9	28	50
Gadarif	0	101	101	33.6	0	12	12	21.4
Total	91	210	301		25	31	56	
Percentage			84.3				15.7	

Table 5: Percentage of collision and electrocutions.

ELEC: Electrocutation

COLL: Collision



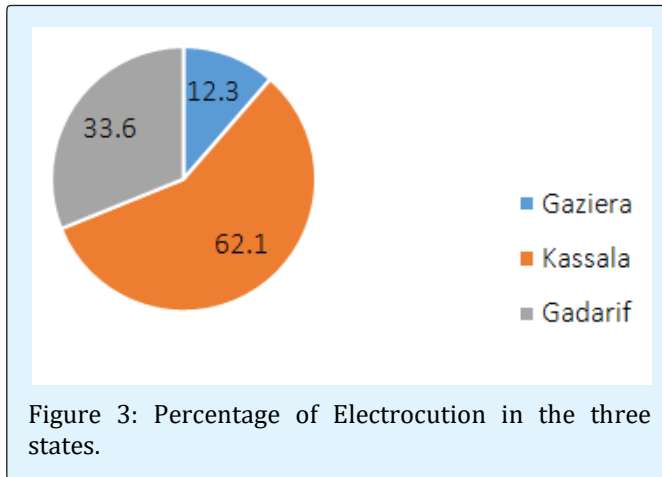


Figure 3: Percentage of Electrocution in the three states.

The other line begins at the same point and goes parallel to two kilometers before separate, they consider fatal lines for birds, in spite they are shorter and less number of poles, Table 2, compared to the other states. Gazira state recorded high mortality for collision after kassala while Gadarif came after Kassala in electrocution. The reasons beyond variation in dead number of birds are exactly un known which were determined by the specific factors around the events seasonally (temporary) or annually (permanent) [17,18] stated that birds from the family Corvidae Passeriformes and Storks (Ciconiiformes), most vulnerable to electrocution. Raptors and Crows represented 62% of the losses caused by electrocution. Similar results were presented in the research of Demerdzhiev, et al. [18], carried out in four IBAs in Southern Bulgaria, where electrocution of diurnal birds of prey and Crows was suspected for 53% of all detected carcasses. In different parts of Spain these two systematic groups represent 80% to 96% of the suspected electrocutions [19,20]. Similar results were reported in southeastern France, where raptors and Crows represent 85% of suspected electrocution [7]. The high mortality rates of these species are related to their ecology, as they use electric poles as roosts or perches for hunting [18]. Perching on the poles, the birds sometimes get in contact with parts of the pylons or conductors and die from electrocution [18,21-23].

The study agreed with the previous studies above that some species are more valuranable to electrocution in

many part of the year. The most threatened bird's species were a group of birds of prey, Figure 4, these are: Lesser kestrel (*Falco naumanni*) 20.7%, Black kite 16.3, Common kestrel (*Falco tinnuculu*), 15.1%, Abdims' stork (*Ciconia abdimii*) 11, 2%, Pied crow (*Corvus albus*) in Gaziera state with percentage of 8.7%. Albania line N: 14 00 794 E: 33 25 233 to Abu amna N: 14 04 73 E: 33 23 426 and Grayish Owl (*Bubo cinerascens*) of 7.6%. for most birds the conservation status and the globally population trends are least concern (LC) according to the Red list of International Union of Conservation of nature (IUCN) 2018, in exception of lesser kestrel which is internationally threatened. With Grayish owl.

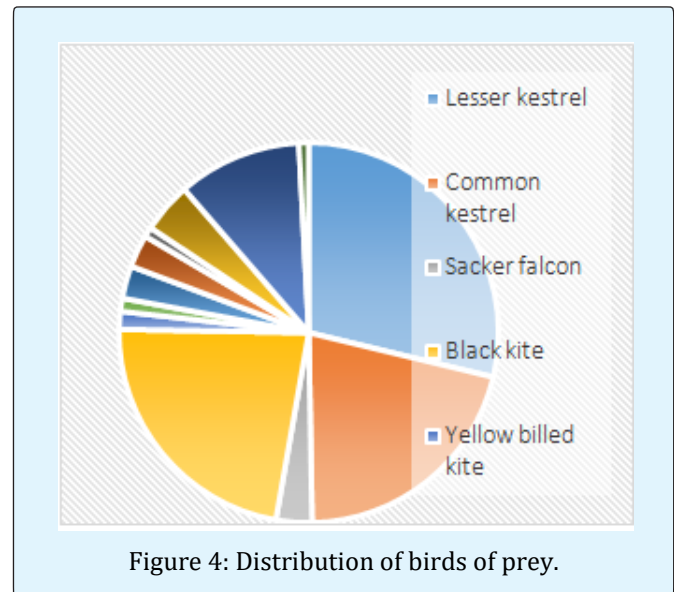
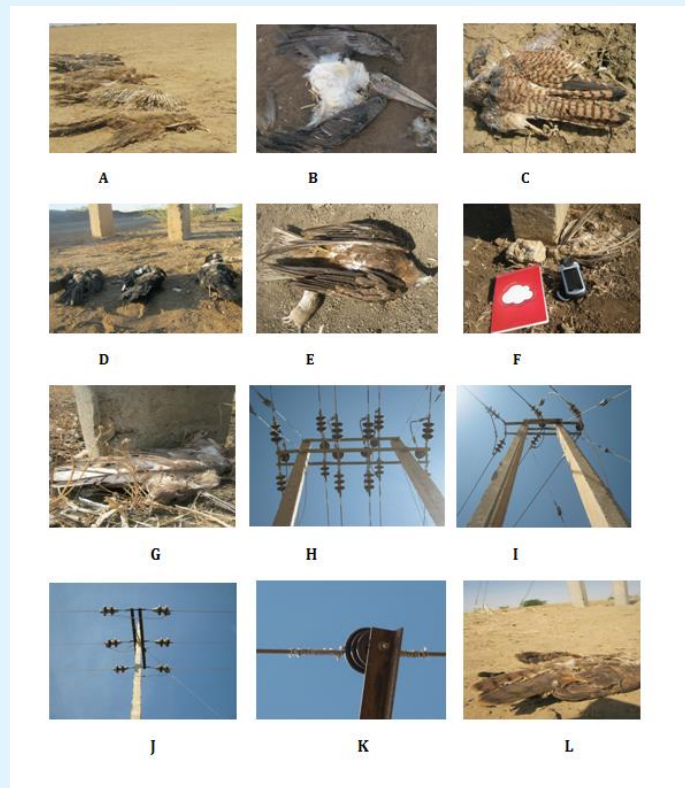


Figure 4: Distribution of birds of prey.

Specific and separated data form for collision and electrocution filled directly in the field at the site of incidence by coordinates indicated that most lines are crossing or passes near agricultural field, the majority are un irrigated.

In most cases the pylons are the higher altitude, animal Caraca s and canals and slouther houses are contribution factors in the vicinity. The type of pole designation used in Sudan (Insulator up) may be important factor never be neglected for increasing bird death (Plates 1-12).



Plates: A: Common kestrel in Kassala; B: Marabou stork in Gaiera state; C: Lesser kestrel in Gaziera state; D: Pied crow in gaziera state; E: Black kite in Gadarif state; F: Lesser kestrel in Gadarif state; G: Red necked buzzard in Gadarif state; H: Type of pole; I: Type of pole; J: Type of pole; K: Insulator; L: Common kestrel in Kassala.

Habitat around the cases mostly were agricultural land, irrigated for dura in Egaziera or unirrigated for sesame and dura in Gadarif, kassala and few cases are fallow land. In one different site is Forest of *Acacia Seyal* at Abu amna village where pied crow aggregated. Most common shrubs and small trees are Sayal, (*Balanites aegyptiaca*), (*Acacia nilotica*), (*Ziziphus spina Christi*) in Elgaziera and miskeet in kassala.

The most remarkable thing that most electrocution under the double poles sometime reach 11 birds in one double poles in Gadarif state, and the collision varied between under the wire and to about 15 meter may the distance depending on the flying speed, wind action or other factor shifting the Caracas.

The historical information from the personnel of electricity corporation stated that they were suffering more from the birds during the rainy season, they explained that large birds with their high wing span ratio

like storks, Herons and birds of prey caused electric outage when they are perching on the double poles, in this time of the year correspond with growing season begins in July and harvesting of crops on October, surprisingly this period coincides with migration season of many birds species to Sudan.

Species with less mortality may not indicate the real number of death, dogs and other carnivores around, beside the other contributing factors and the variation in the amount of rain fall which affect availability of food and consequently the number of birds that using habitat.

Obviously the study indicate that birds suffered extremely from power lines and need protection and urgent conservation measures in the three states, especially Kassala, where the greatest threat falls on the birds of prey, especially Lesser kestrel and Abuamna area where the crow killed. The death of birds in these areas can be justified that lines in the Kassala station (Awadat)

distributes in a network of parallel lines that consist of large number of poles, especially dabble poles where birds perch and nest. Abomna area there is a forest for trees *Acacia seyal* where the crow is nesting and feeding from the villages around. It is very difficult to obtain accurate and detailed information to predict the occurrence of electrocutions and collision makes it difficult to know how it happened and the circumstances associated, this situation cause growing concern over time about birds not only in this area, but in many part of Sudan as whole.

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