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Assesment Of Bird Species Abundance And Their Effect On Aircraft Safety At Makurdi Airport (Naf Base) Makurdi, Benue State

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Abstract: ***This study assessed the presence and abundance of various birds spercies as well as the potential threat each species poses to aircraft safety at makurdi airport, line transect and point count method of bird census was used to collect data for ecological analysis. There was no information on trends in bird strike occurrence at the airport from Federal Airport Authority of Nigeria. A total of 33 bird species representing 18 families were recorded during the study. Shannon wierner diversity index value of 2.788 was recorded in the wet season. species were more evenly distributed during the wet season with a value of 0.5077.species richness was highest during the wet season with a value of 3.657, The black kite was the highest ranked bird, followed by the purple glossy starling, The birds were a potential threat to aircraft safety at the airport.***

Keywords: Abundance, presence, potential threat, safety.

I. INTRODUCTION

Birds in their diversity constitute part of the natural environment and play functional role such as agents of flower pollination and seed dispersal, sources of food chain and agents in breaking seed dormancy (Nason, 1992). Birds are highly specialized flying machines, and their ability to fly allows them to range widely in search of food and escape predators easily. The invention of airplanes, which was a fundamental turning point in history, came into being about a century years ago from the principles of avian flight. The success of the aircraft invention and the consequent improvements upon it brought about more technological changes. (Oduntan.et.al 2012). Before the advent of aircraft, birds, bats and insects used the skies. Sharing the skies and the environment with aircraft has often times resulted in collision of aircrafts, wildlife and birds. The main problem being the collision between birds and aircraft or the ingestion of birds into the engines of the aircraft, this phenomenon is widely known as Bird strike. Bird strike has posed threat ranging from cracked windshields, dented wind edges and minor fuselage damage to air crashes, since the first ever reported birdstrike on September 7, 1905 when an Orville Wright ran into a flock of birds while flying near Dayton, Ohio. Between 1960 and 2004, bird strikes have resulted in at least 333 military aircraft destroyed and over 150 military personnel killed (Shobakin, 2009). Over the years, aircraft designs and performance has changed radically as birds‟ population and migration have increased (Dolbeer and Seubert, 2009). The occurrence of birds at airports varies according to habitat type, weather and the time of the day and the season of the year (Weisbein and Shy, 1999). Usually, the combination of several attractants, are responsible for the presence of birds at an airport. These include availability of food, water, loafing and breeding sites. Many airports support an abundance of food like seeds, grasses, shrubs, berries, earthworms and small

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mammals to birds. Birds of preys are attracted to airport because rodents, small birds and other small animals that are harbored by tall poorly maintained grass stands or bush are present. The objectives of the study were to assess birds species presence and abundance and rank the observed birds according to the aviation safety risk value.

II. METHODOLOGY

A. STUDY AREA

The study was conducted in Makurdi Airport, located at Nigeria Airforce Base Makurdi Benue State Nigeria.The airport has 1 runway, which is 2996m long. The geographic coordinates of this airport are 7º42'14'' north and 8º36'50'' east. Makurdi Airport is 113m above sea level. The vegetation of the area is made up of predominantly grasses namely Andropogon gayanus, Impereta cylindrical grasses and trees such as Combretum nigricans,Gmelina aborea, Anogeissus leiocarpus. Ficus sur, Daniella olivieri, Prosopis Africana, Ficus sycomorous, Burkea africana. The two major features of the climate of the study area are the division into wet and dry season and the variability from year to year. The wet season extends from may to October. The mean annual rainfall is approximately 1238mm and relative humidity is usually over 76%. The temperature of makurdi airport is highest during the dry season and lowest during the rainy season with the mean monthly maximum temperature ranging between 39.4 ºc and 30.6ºc and the mean monthly minimum temperature ranging between 26.7 ºc and 18.4ºc. (Nimet 2016-2017).

B. METHOD

A preliminary survey of the area was carried out in the first week of the study with a view of recognizing the site. The study was conducted from May 2016 to April 2017. Line transects and point count method of bird census technique was used. Line transects Suitable for abundance which involves moving along a fixed route (transect) and recording the bird species seen and heard on both sides of the transect. The transects varies in length with transect three been the longest covering a distance of 2996m while transect one is 900m, two is 220m and four is 120m with each transect having a width of 50m on either sides of the line. Four line transects each were surveyed twice daily fortnightly. Point count methods of birds' census involves standing at a fixed point and recording the bird species seen and heard within a radius of 50m. (Bibby et.al 1992).A total of 28 sample points with each 150m apart were sampled during the census. Bird counts were carried out in the morning's between7.00-9.00hrs and in the evening 16.00-18.00hrs.To minimize disturbance during the count, a waiting period of 3 to 5min prior to counting was applied (Hosteler 2001; Sutherland 2000). A pair of 10 by 50 binoculars was used for sighting. For every bird seen, the following parameter were recorded; activity of the bird when first sighted, the number of bird species at every sighting, field guide was used to confirm the identification of the birds located by sight, Birds species were identified and their taxonomic groups were properly categorized based on field guides. (Alan & Kemp 2001; Sinclair & Ryan 2003; Stevenson & Fanshawe 2002).

DATA ANALYSIS

Species diversity was calculated using Shannon–Weaver (1963) index of diversity.

One-Way Analysis of variance as adopted by was used to test bird species composition for morning and evening for Wet and Dry season in the study area as well as bird species abundance for morning and evening for during the wet and dry season and also bird species abundance for late and early dry season and late and early Wet season in the study area, T test was used to test for Variation in Bird species composition and abundance between Wet and Dry Seasons in the study area.

In evaluating and ranking the risk of birdstrikes species, the Aviation Safety Ranking Value (ASRV) postulated by International Bird Strike Committee (IBSC, 2002) and adopted by Dukiya and Ahmed, 2014 was used. This ranking value separates birds into five levels according to the potential impact and cost to aircraft. Level 1 without significant impact on air traffic safety, Level 2 has low potential danger, Level 3 intermediate potential danger; Level 4 has high potential danger, while Level 5 has very high potential danger. These levels are evaluated based on size of each bird species, the social pattern and behaviour of the species, and its movements (short and long distance) and the activities in the airport. Based on the internationally accepted approximation criterion of size classification, birds are classified small (5-25 cm), medium (25.1-39.9 cm) and large (40-80 cm) (Morgenroth, 2003).The study also used the Aviation Safety Risk Value (ASRV) in classifying birds in five levels that represent the potential danger that each of these birds poses to aviation based on the flight safety relevance of bird species (Morgenroth, 2003).

III. RESULTS

A. BIRD SPECIES COMPOSITION

A total of thirty two (32) bird species and one (1) bat species were identified in eighteen (18) families in the study area, twenty three (23) species out of the identified birds species occurred across both seasons while three (3) species occurred only during the wet season and six (6) species occurred during the dry season alone. The most dominant bird species during the wet season was the fruitbats with relative abundance of 14.4% and followed by Bronze mannikinn with relative abundance of 14.1% and the least was the Grey hornbill and the Cattle egret with a relative abundance of 0.1%each and the most dominant bird species during the dry season was the Senegal firefinch with a relative abundance of 28.6% followed by the Purple glossy starling with 13.1% and the least was the Ringed plover with a value of 0.1%.

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S/N	Common Name	Scientific Name	Families	RBMW	RBMD	RBEW	RBED	RBW	RBD
1	Cattle egret	*Bubulcus ibis*	Ardeidae	0.1	3.8	0	3.9	0.1	3.8
2	Black headed weaver	*Ploceus melanocephala*	Ploceidae	2.0	0	1.7	0	1.9	0
3	Black kite	*Milvus migran*	Accipitridae	1.6	3.5	1.8	2.2	1.7	3.0
4	Black magpie	*Ptilostomus afer*	Corvidae	1.6	5.3	2.0	5.6	1.4	5.5
5	Blue capped cordon bleu	*Uraeginthus cyanocephalu*	Estrildidae	4.2	0	6.5	0	5.0	0
6	Bronze manikin	*Lonchura cucullatus*	Estrildidae	13.8	0	14.7	0	14.1	0
7	Common garden bulbul	*Pycnonotus barbatus*	Pynonotidae	0.6	3.7	0.5	3.7	0.5	3.7
8	Double spurned francoline	*Francolinus bicalcaratus*	Phasianidae	1.8	1.5	0.6	2.0	1.3	1.7
9	Fruitbats	*Pteropus vampyrus*	Pteropodidae	18.4	0	8.0	0	14.5	0
10	Grey hornbill	*Ocyceros birostris*	Bucerotidae	0	0.2	0.1	0.4	0.1	0.3
11	Grey plantain eater	*Crinifer piscator*	Musophagidae	2.4	3.3	2.4	2.4	2.4	2.9
12	Helmeted guinea fowl	*Numida meleagris*	Phasianidae	3.1	6.2	2.4	4.0	2.9	5.3
13	Laughing dove	*Streptopelia senegalensis*	Columbidae	2.9	10.4	4.6	11.0	3.5	10.7
14	Little ringed plover	*Charadrius dubius*	Charadriidae	0.1	0	0.1	0	0.1	0
15	Lizard buzzard	*Kaupifalco monogrammicus*	Accipitridae	0.3	0.1	0.6	0.4	0.4	0.2
16	Long tailed glossy starling	*Lamprotornis caudata*	Sturnidae	0.2	0	0.2	0	0.2	0
17	Long tailed shrike	*Corvinella corvine*	Laniidae	0.1	1.6	0.6	1.1	0.3	1.4
18	Pied crow	*Corvus albus*	Corvidae	0.6	2.0	1.0	0.3	0.8	0.7
19	Pigmy goose	*Nettapus auritis*	Anatidae	0.5	0	0.3	0	0.4	0
20	Purple glossy starling	*Lamportornis purpureus*	Sturnidae	8.9	13.6	5.7	12.4	7.7	13.1
21	Red bishop	*Euplectes orix*	Ploceidae	2.6	0.3	3.1	0.7	2.8	0.5
22	Ringed plover	*Charadrius hiaticula*	Charadriidae	4.1	0.1	7.2	0	5.2	0.1
23	Rufus cane warbler	*Acrecephalus rufescens*	Sylviidae	12.1	0	17.0	0	13.9	0
24	Senegal coucal	*Centropus senegalensis*	Cucolidae	8.3	0.8	8.5	0.5	8.4	0.7
25	Senegal firefinch	*Lagonosticta senegala*	Estrildidae	0	26.5	0	31.0	0	28.6
26	Splendid sunbirds	*nectarinia coccinigaster*	Nectariniidae	0	3.3	0	3.6	0	3.4
27	Unidentified			2.3	3.0	3.4	3.7	2.7	3.3
28	Vinaceous dove	*streptopelia vinacea*	Columbidae	1.7	4.6	3.0	5.3	2.1	4.9
29	Vulture			0.5	0	0.2	0	0.4	0
30	White rumped swift	*Apus caffer*	Apodidae	0.1	3.8	0	3.9	2.5	5.3
31	Yellow bellied fruit pigeon	*Treron waalia*	Columbidae	0	0.4	0	0	0.1	0
32	Yellow mantled whydah	*Macronyx croceous*	Motacillidae	1.4	0.8	0.6	0.3	1.1	0.6
33	Yellow throated logclaw	*Macronyx croceous*	Motacillidae	0	0.8	0	0.7	0.3	0.3

Key=Rbmw=relative abundance morning wet season. Rbmd= relative abundance morning dry season, Rbew= relative abundance evening wet season, Rbed= relative abundance evening dry season, Rbw= relative abundance wet season, Rbd= relative abundance dry season.

Table 1: Birds Species Composition And Their Relative Abundance At Makurdi Airport

B. FAMILY COMPOSITION

A total of 18 families were recorded in the study area. The result shows that Columbidae was the most dominant family represented by four species followed by sturnidae with (3) three species and the least was Ardeidae, Bucerotidae, Cucolidae, Nectariniidae, Pynonotidae and Sylviidae with one species each.

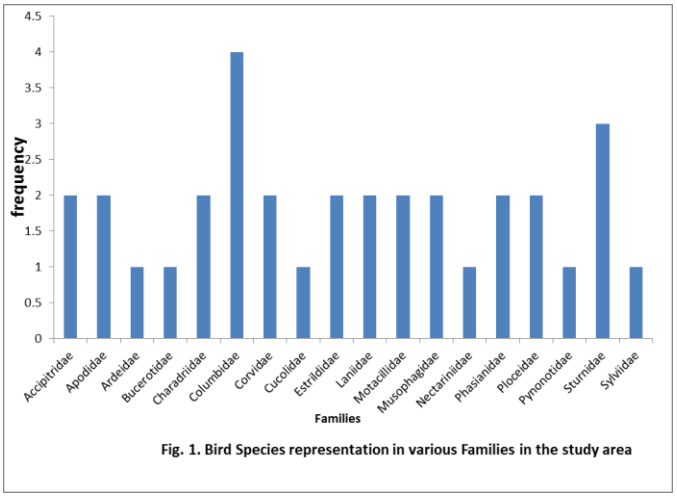

Fig. 1. Bird Species representation in various Families in the study area

C. SPECIES DIVERSITY, RICHNESS AND EVENNESS INDICES

The result of the study revealed that for Shannon wierner diversity index birds' species diversity was higher during the wet season as compared to the dry season and Furthermore richness of bird species was higher during the wet season as compared to the dry season and Furthermore bird species were more evenly distributed during the wet season as compared to the dry season.

Variables	MW	MD	EW	ED	WET	DRY	Morning	Evening_
Taxa_S	29	24	29	22	32	23	24	22
Individuals	3020	1652	1758	1227	4797	2860	1652	1227
Shannon_H	2.728	2.531	2.778	2.424	2.788	2.471	2.531	2.424
Evenness_e^H/S	0.5275	0.5234	0.5545	0.5133	0.5077	0.5143	0.5234	0.5133
Margalef	3.494	3.104	3.747	2.953	3.657	2.764	3.104	2.953

Key: MW=Morning wet season, MD=Morning dryseason, EW=Evening wet season, ED=Evening dry season,

Table 2: Bird species diversity across the Study Area

D. HAZARD RANKING

The result of the study as presented in table (10) ten revealed that (27) twenty seven species out of the identified birds were resident birds while (5) five were migrant species. The highest ranked bird species according to the Aviation safety risk value was the Black kite and it's followed by the Purple glossy starling and the vulture while the least ranking bird species included the Grey hornbill, Yellow throated logclaw, Common garden bulbul,Fruitbats, Black headed weaver and Vinaceae dove.

S/N	SPECIES NAME	SCIENTIFIC NAME	BODY SIZE(cm)	RANGE	STATUS	RANKING
1	Pied crow	Corvus albus	M	h,r	R	3
2	Bronze mannikin	Lonchura cucullatus	S	fc,	R	3
3	Red bishop	Euplectes orix	S	f	R	1
4	Purple glossy starling	Lamprotornis purpureus	M	fc,	R	4
5	Double spurned francoline	Francolinus bicalcaratus	M		R	2
6	Little ringed plover	Charadrius dubius	S	f,s	Mi	3
7	Rufus cane warbler	Acrecephalus rufescens	S	fc,	R	1
8	Vinaceous dove	Streptopelia vinacea	S	f,fc	R	1
9	Senegal coucal	Centropus senegalensis	M	f,	R	2
10	Ringed plover	Charadrius hiaticula	S	f,s	Mi	3
11	Grey plantain eater	Crinifer piscator	M	f,fc	R	2
12	unidentified plovers	q	S	f,s	Mi	3
13	Lizard buzzard	Kaupifalco monogrammicus	M	r	R	3
14	Yellow mantled whydah	Euplectes ardens	S	f,s	R	1

15	Laughing dove	Streptopelia senegalensis	S	fc	R	1
16	Fruitbats		M	fc	R	3
17	White rumped swift	Apus caffer	S	fc	R	1
18	Black magpie	Ptilostomus afer	S	fc,	R	2
19	Helmeted guinea fowl	Numida meleagris	L	fc	R	3
20	Pigmy goose	Nettapus auritis	M		Mi	3
21	Black headed weaver	Ploceus melanocehala	S	fc,	R	1
22	Black kite	Milvus migran	M	h,r	Mi	5
23	Common garden bulbul	Pycnonotus barbatus	S	f	R	1
24	long tailed shrike	Corvinella corvina	S	fc,	R	2
25	Long tailed glossy starling	Lamprotornis caudata	M	f,s	R	2
26	Vulture		L	h	R	4
27	Cattle egret	Bubulcus ibis	M	fc,	R	3
28	yellow throated logclaw	Macronyx croceus	S	F	R	1
29	Senegal firefinch	Lagonosticta senegala	S	fc,	R	3
30	Splendid sunbirds	Nectarinia coccinigaster	S	fc,	R	1
31	Grey hornbill	Ocyceros birostris	M	f,s	R	1
32	Yellow bellied pigeon	Treron waalia	M	f,s	R	1
33	Blue capped cordon bleu	Uraeginithus cyanocephalus	S	fc,	R	3

Key:M=medium,S=small,L=large,Mi=Migrant,R=Resident,h=high/soaring,fc=flocking,r=raptor,f=fieldbirds,s=scarce

Table 3: Hazard Ranking; Aviation Risk Safety Value (ARSV)

IV. DISCUSSION

The distribution of bird species is largely dependent on the availability of food, water, and cover. The most dominant bird species during the study was the Senegal firefinch and was followed by the fuitbats, Bronze manikin and then the Purple glossy starling. Analysis of variation in bird species composition and abundance between wet and dry Seasons in the study area was not significantly different at $p>0.05$ and these is because seasonality plays a major role in determining the abundance and distribution of birds, seasonality affect food and cover availability to birds population which inturns affect breeding success and survival of the birds species (Mengesha and Bekele. 2008). Habitat control and population management methods of birds control have been adopted by the airport authorities, these control measures carried out by the airport authorities has play a significant role in the types of birds species available across both season, Andropogon gayanus was the dominant grass species in the study area and it favours the survival of passerines. There was no confirmed case of birdstrike during the period of the study and there was also no available secondary data on birdstrike incidence in the study area. These is as a result of lack of proper understanding between the Nigeria Airforce personnel and the Federal Airport Authority of Nigeria as the staff of federal airport authority are not given access to the runways and the Nigeria airforce not keeping data on incidence of birdstrike in the study area even though there were strikes. According to the ranking the bird species that poses a potential threat to aircraft safety in the study area are Black kite, Purple glossy starling, Vulture, Helmeted guinea fowl, Senegal firefinch, Pied crow, Bronze manikin, Cattle egret, Pigmy goose, Lizard buzzard, Blue capped cordon bleu, Ringed plover and Little ringed plover.

V. CONCLUSION

A significant number of a variety of bird species was observed in the vicinity of Makurdi airport. The propensity of these birds to collide with aircraft is real and this is a menace to the aviation industry. The Federal Airport Authority of Nigeria and the Nigeria Airforce should make effort towards striking a working understanding so as data on birdstrike incidence can be gathered as these data together with research of these natures can give a better insight of the best control measures to be adopted.

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