BIRD/WILDLIFE STRIKE CONTROL FOR SAFER AIR TRANSPORTATION IN NIGERIA

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Abstract

Bird strike has become a major threat to air safety globally. Over the years, collision between birds/wildlife and aircrafts has resulted in the death of hundreds of people and is responsible for annual losses worth about US $1.2 billion to the global aviation industry. This paper therefore, focuses on bird/wildlife hazard situation in Nigeria using data on reported bird/wildlife strikes in the country. Available data show that between 2005 and 2010, a total of 209 strike incidents were reported in the country. Kites and hawks were found to be responsible for 57% of reported strikes. Several factors including lack of adequate data, shortage of funds, inadequate training of staff and lack of public awareness about bird/wildlife hazard were found to be militating against effective control in Nigeria. The paper concludes by making recommendations towards reducing bird/wildlife hazard in the country. These include staff training and retraining, developing good data bank based on proper reporting and analysis, improved funding and creation of public awareness about bird/wildlife hazard in the country.

Keywords: *bird/wildlife, strike, aviation, hazard, control.*

Introduction

Bird strike has become a major threat to air safety globally. Since 1912 when the first fatal collision between bird and aircraft was recorded, over 500 people around the world have died from plane crashes caused by birds (Bird Strike Control Program, 2009a). The most fatal air crash caused by birds occurred in Boston, USA in 1960 killing 62 people (Celebrate Boston.com, 2008). Dolbeer *et al* (2005) estimated that between 1988 and 2004 about 200 people were killed and 140 civil aircrafts damaged as a result of bird strikes in various parts of the world. In monetary terms, it is estimated that about US $1.2 billion per annum is lost to bird strike by the global aviation industry. In the United States of America about $650 million is lost annually as a result of bird strike (Allan and Orosz, 2001 and Bird Strike Control Program, 2009a).

Some factors have accounted for increasing collision between birds and aircrafts. These include the fact that modern aircraft engines are quieter, with enhanced high speed and increasingly more difficult to be detected and avoided by birds. Also, conservation efforts especially in the developed countries have resulted in rapid expansion of population of many species of birds. Furthermore, many species of birds have also adapted to living in built-up areas including airport environment (Dolbeer *et al*, 2005). Meanwhile, increasing demand for air travel has been accelerated by increased global economic activity, rising disposable incomes (especially in the developed countries) and widespread deregulation of the global aviation industry (Graham, 1998). Today, the number of air passengers has increased to more than 3 million per day (Monckton, 2009). For instance, in the US alone it is estimated that about 7,000 bird strikes occur annually though; only about 14% of aircraft involved suffer damage (Bird Strike Control program, 2009a). A total of 1,393 cases of terrestrial wildlife strikes to civil aircraft worldwide were also estimated to have occurred between 1976 and 2005. However, large herbivorous animals were responsible for 51% of these strikes and accounted for 96% of severe aircraft damage or destruction (Dolbeer *et al*, 2005).

Small mammals and reptiles may not constitute direct threat to aircrafts. However, their presence or carcass when killed by aircraft may attract other larger animals creating hazard to aircraft (Engeman *et al*, 2007). In some instances small animals have been known to disrupt flight operations. For

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example, over 100 diamondback terrapin turtles moving across the runway caused flight delays at JFK International airport, New York (Guardian.com.uk, 2011).

Nigeria also records high incidence of bird/wildlife strikes. Apart from posing a serious danger to air transport and passengers, it increases airline operational costs. For example from 2005 to 2010 a total of 209 bird/wildlife strikes were reported in the country (Haruna, 2011). From about a figure of 17.4% in 2006 bird/wildlife strikes now account for 24% of air accidents in Nigeria (Nigeria Communications Week, 2011). It has been estimated that Nigerian airline operators lose about N15 billion to bird strikes annually (This Day Online, 2010). Various cases of terrestrial animal strikes have also been recorded in the country. For instance, in 2005 an Air France aircraft with over 200 passengers collided with a herd of cows while landing in Port Harcourt airport (AllAfrica.com, 2005). Also, in March 2011 another aircraft collided with a herd of cows and goats in Bauchi airport (AllAfrica.com, 2011). While no lives were lost in both incidents, the aircrafts involved suffered some damages. Various other incursions by cows, goats and other animals have been recorded in airport across the country. For example, in November 2005, three cows had to be shot dead by security personnel when they strayed onto the runway in Port Harcourt airport (All Africa.com, 2005). In July 2009, a Lagos bound Boeing 737 was hit by birds and the plane had to return to Port Harcourt to avert a crash (Birdstrike Control Program, 2009b).

In simple terms bird/wildlife strike refers to a collision between a bird (including bat) or a terrestrial animal and an aircraft (Gard *et al*, 2007). However, according to the International Bird Strike Committee (IBSC) (2006) bird/wildlife definition should cover three main categories. These include confirmed strikes, unconfirmed strikes and serious incidents. Confirmed strikes are the reported and unreported collisions where bird/wildlife remains are found or damage to aircraft are recorded. Unconfirmed strikes involve reported collisions with no physical evidence on aircraft or on the airfield. Serious incidents occur when normal flight is disrupted by presence of birds/wildlife on or around the airfield (IBSC, 2006). In Nigeria, bird/wildlife strike is deemed to have happened when a pilot, air traffic controller, aircraft maintenance crew or ground personnel report a strike occurrence or identify damage to aircraft caused by bird/wildlife strike. Secondly, when bird/wildlife carcass is found within 200 feet of the runway, except when there is proof that cause of death is due to other reasons. Thirdly when remains of bird/wildlife are found ingested into aircraft engines by maintenance staff (Haruna, 2011).

Four main groups of strategies are used to control the menace of bird/wildlife strike in the aviation industry today. These include flight schedule modification, habitat modification (management), exclusion techniques and repellant/harassment techniques (Haruna, 2011). Habitat modification technique involves changing the habitat to reduce the attractiveness to birds and other wildlife (Wired Magazine, 2005). Reducing the attractiveness of airfield to birds and other wildlife is very important in bird control. Successful habitat management requires removing or denying access to features attracting birds/wildlife (IBSC, 2006). The type of habitat management adopted will depend on the bird/wildlife species involved. It may however require improving drainage within and around the airfield, removing trees used for nesting and netting of water bodies. Other measures include manipulating the height or even introducing new vegetation species. (IBSC, 2006 and Froneman and Rooyan, 2003). Fitting of bird anti-perching spikes on runway and taxiway signage boards has also been used to prevent birds from using airfield infrastructure as perches (Froneman and Rooyan, 2003).

Active bird/wildlife control on the airfield involves the use of repellant and harassment techniques. Various deterrent devices are used to scare birds away from the airfield. These could be classified into visual, acoustic and lethal devices. They could also be mobile or static in nature (IBSC, 2006). Designated staff patrols the airside areas using chemical repellants, propane cannons, distress call

systems, shell crackers and pyrotechnic pistols to scare away the birds (IBSC, 2006 and Haruna, 2011).

Trained predators have also been effectively used for airfield bird control in various parts of the world. For instance, trained falcons have been used for birds' dispersal at the J.F. Kennedy International Airport (Wired Magazine, 2005). The use of specially trained dogs (Border collie) for bird control at Durban International Airport, South Africa reduced the number of bird strikes by 57% within 12 months (Froneman and Rooyan, 2003).

According to NCAA (2011) Bird Hazard Control Units have been established in all major airports in Nigeria to combat the menace of bird strike. Furthermore, increasing threats of legal action by Airline Operators of Nigeria (AON) to claim compensations for damages to aircrafts, has forced the Federal Airports Authority of Nigeria to find ways of upgrading its equipment (The Nation Online, 2011). In order to upgrade safety equipment and combat the menace of runway incursions by animals in Nigerian airports, the Federal Government recently obtained a loan of $46.65 from the World Bank. Part of the loan will be used to construct perimeter fences around Abuja and Port Harcourt airports (AllAfrica.com, 2011). Apart from acquiring more patrol vehicles, specialized equipment for controlling bird hazard are also being installed in some airports across the country. The government also intends to acquire advanced technical equipment such as the Merlin Aircraft Bird Strike Avoidance Rader System (ABARS) and Cordless Land Air/Wildlife System to be installed in major airports in the country (The Nation Online, 2011).

High incidence of bird/wildlife strikes in Nigeria has been attributed to the attraction of many species of wildlife to the airports due to the presence of thick bushes, waste dumps and farmlands around the airports (Leadership Online, 2011 and The Nation Online, 2011). It is against this background that this paper aims to examine the bird/wildlife strike situation in Nigeria and the control measures adopted to reduce the hazards in ensuring safer air transportation in the country.

Methodology

Study Area

Nigeria which covers a total area of 923,768 Km square is located between Latitudes 4°16'N and 13°52'N and between Longitudes 2°49'E and 14°37'E. The country is endowed with diversity of habitat types and wide variety of animal species. For instance, the country is known to be home to about 1,000 species of birds and about 370 species of mammals and reptiles (Federal Government of Nigeria, 2001). Some of these birds constitute serious risk to aircraft. For example, over 20 species of these birds have been reported to be involved in collision with aircrafts in the country (Haruna, 2011). With a total of 22 airports managed by the Federal Airports Authority of Nigeria (FAAN) and over 25 other airports and airstrips managed mostly by private companies and the Nigerian Air Force the challenges remain enormous (See figure 1).

Data Collection

Secondary data obtained from the Nigerian Civil Aviation Authority (NCAA) was used for the study. It covered reported cases of bird/wildlife strikes in the country from January 2005 to December 2010. The data were analyzed using frequency distribution, simple percentages and mean scores.

Results

From January, 2005 to December 2010 a total of 209 bird/wildlife strikes were reported in the country. As shown in table 1, the highest number of strikes (70 or 33.5%) was recorded in 2009, while the lowest number of strikes (18 or 8.6%) was recorded in 2006. The month of October records the highest number of strike incidents. Other months with high strike incidents are March, April, May and November. Table 1 further show that the Month of January records the lowest strike incidents with 3 reported strikes constituting just 1.4%.

The expected value (mean) of strikes for the period under study is 34.83 as indicated in table 2. The number of strikes recorded for 2009 and 2010 which are 70 and 53 respectively, are higher than the expected value. On the other hand the figures reported for 2005 to 2008 are lower than the mean value.

In 2005 and 2010, strike cases reported for seven months of the year are above the mean values (1.5 and 4.42 respectively) for those years. For 2007 only 3 months (April, May and November) have reported values above the mean value of 1.4 for the year. Table 2 further indicate that although, 2009 recorded the highest number of strikes only 5 months of that year recorded incidents above the mean value of 5.83 strikes for that year.

Various types of birds/wildlife were found to be involved in reported strike incidents in Nigeria within the period under study. For the 209 reported strikes between 2005 and 2010, the particular bird/wildlife species involve were only identified in 109 cases (As indicted in table 3).

These include 22 bird species and 1 terrestrial animal (antelope) specie. Table 3 further shows that, kites and hawks account for 57.1% of strikes recorded in the country. Next in importance are the cattle egret and lapwing both of which jointly account for about 13% of collision with aircrafts. According to the available data the only terrestrial wildlife involved in collision with aircraft is the antelope (0.9%).

Discussion

The low number of strike cases recorded from 2005 to 2008 could be as a result of poor reporting of strike incidents at the period. On the other hand, the decline in strike incidents in 2010 can be attributed to increasing official efforts to reduce bird/wildlife hazards in the country's aviation industry. The high incidents of strikes experienced from the months of March to May (27, 28 and 28 respectively) and October and November (32 and 27 respectively) are attributable to changes in season. The period from March to May mark the start of the rainy season depending on the location in the country. On the other hand the month of November signifies the beginning of the dry season in most parts of the country. As expected migration of many bird species would be high at these periods leading to higher risk of collision with aircrafts.

Various constraints are militating against effective bird/wildlife hazard control in Nigeria. These include lack of funds, inadequate data, inadequate training of staff, absence of a National Committee on Bird/wildlife hazard Control and lack of public awareness about bird strike hazard.

Inadequate funding of airports remains a major constraint because, other control activities like fencing, habitats modification and staff's training are dependent on availability of funds. Lack of enough funds is a major problem in the country's aviation industry. This has resulted inability to acquire modern equipment, low level of staff motivation and low productivity. While the government statutory allocation is inadequate for tackling the financial needs of the airports, the average of N25 billion derived annually as internally generated revenue is too low to make any significant impact (Birdstrike Control Program, 2009c).

The Director of Air Transport Regulations of NCAA recently observed that inadequate and irregular data is a major problem in the country's aviation industry. This has continued to be an obstacle to proper formulation of policy and planning in the country's aviation industry (Champion Online, 2011). A lot of strike incidents are not reported. For those that are reported information do not exist on the species of birds involved in many cases. For instance, it is in only about 50% of strike incidents in the country that the species involved have been identified (Haruna, 2011). This prevents proper interpretation of bird strike data. The result is that bird strike management efforts may be directed at the wrong species of birds ((IBSC, 2006).

Infrastructure deficit in Nigerian airports reduces effectiveness of the use of exclusion techniques to control wildlife and at times even provide attraction for birds and other wildlife. Inadequate fencing of airports has remained a very serious obstacle to preventing runway intrusions by wildlife and domestic animals. Meanwhile, inadequate drainage, presence of open waste dumps and farmlands within and around airfields continue to attract various types of animals (The Nation Online, 2011). Presence of farmlands, waste dumps and other related land use around airports are known to be incompatible with the goal of reducing bird strikes (McKinnon, 1996).

Shortage of staff and inadequate training of staff are also important limitations to effective bird/wildlife hazard control in the country (Federal Airport Authority of Nigeria (FAAN), 2011 and Haruna, 2011). Other operational problems include inadequate working equipment and lack of operational vehicles for effective patrol of airfields (FAAN, 2011).

Another constraint to effective bird/wildlife strike control in Nigeria is lack of public awareness about birds strike hazard. Various activities of people within and around airports contribute to animal incursions into airport in the country. For example, cattle herders were responsible for the collision with cows in Port Harcourt and Bauchi airports. Also wastes generated by airlines are often disposed around the airports. Presence of waste points is known to constitute great attraction for birds and other wildlife to airports (Birdstrike Control Programme, 2009b).

Conclusion and Recommendations

Most importantly airports in the country should be adequately funded. This will help to ensure acquisition of modern safety equipment in the airports. This will also allow adequate maintenance of vehicles, proper habitat management, adequate fencing and regular training and retraining of bird/wildlife hazard control officers.

Furthermore, effective bird/wildlife hazard control requires reducing the attractiveness of airports' environment to birds and other animals. This is very important for achieving a successful bird/wildlife hazard control. Thus, airport authorities in the country should embark on programmes that will make airports unattractive to birds and other wildlife. The environmental situation of individual airfields must be put into consideration in developing suitable habitat management Programme for each area. Generally, airfields should be devoid of puddles and ditches. Where presence ditches and water channels are unavoidable within airfield environment, exclusion netting could be installed to prevent access to sources of attraction. Bird spikes should also be placed on exposed airport equipment and infrastructure which could serve as resting area for birds. Where particular plants and seeds within an airport area are seen to attract birds and/or other animals, they may need to be removed and replaced with other plant varieties. Furthermore, grasses should be mowed regularly and maintained at suitable heights. The height of vegetation should be such that could not expose invertebrates or attract small mammals that would attract birds and bigger animals.

Effective bird/wildlife detection and dispersal system should be developed for all airports in the country. Bird/wildlife control officials should be properly trained and well equipped to modern standards. Modern training and retraining programmes must be developed to bring control officials abreast with modern control knowledge. Specialized bird hazard control equipment like the Merlin Aircraft Bird Strike Avoidance Radar System (ABASRS) and the Cordless Land Air/Wildlife System should be installed immediately, in all major airports in the country. Regular airfield mobile patrols operated by well trained and fully equipped officials, would also ensure that all hazardous birds/wildlife are immediately dispersed from the airfield.

There is also the need to develop an accurate and reliable data base on strike incidents for each airport. National bird/wildlife statistics must be well collated and properly harmonized. All strikes should be reported and the species of animals struck properly documented. This will ensure that control efforts are directed at the correct species. Also, proper analysis of strike data should be taken seriously. For instance, information on altitude of strike, those that occur at approach and those that occur at climb makes it possible to easily determine the most effective management efforts required.

The use of trained predators for birds' dispersal should also be considered. Trained dogs can be integrated into existing bird dispersal programmes in major airports and later introduced to other airports in the country.

Bird/wildlife hazard control efforts can not be limited to airport premises alone but should be combined with off the airfield management activities. Successful strike management

requires that airport authorities have to collaborate with governments at all levels. The Federal Government should therefore expedite action on the proposed National Committee on Bird/wildlife Hazard control. All relevant agencies and ministries should be represented in the committee. Apart from The NCAA, FAAN and the Federal Ministry of Aviation, the Federal Ministry of Environment and the Wildlife Unit of Ministry of Agriculture and Natural Resources should be involved. Local Committees on Bird/wildlife Hazard Control can also be established for each airport. These would be made up of members from relevant state ministries and representatives from local government councils in which the airports are located.

There is also the urgent need to embark on a massive public enlightenment campaign on bird/wildlife strikes in the country. The general public should be educated on the unfavorable implications of some human activities within and around the vicinity of airfields. For example, people should be enlightened on the negative effects of having refuse dumps, farmlands and rearing of animals around airports. This will help in reducing the attractiveness of airfields to birds and other wildlife and also eliminate incursions of domestic animals into airfields in the country.

While the menace of birds and terrestrial animals has become a major threat to air safety globally, the phenomenon is difficult to control in Nigeria because of the serious infrastructural deficit characterizing our airports. Thus, the lack of modern equipment, presence of open drains, waste dumps and farmlands within and around airport vicinity continue to attract animals to the airfields.

However, airport operators in the country must realize that, they are legally responsible for minimizing the risk of birds/wildlife infringing on the safety of aircrafts and passengers. Airport operators must work towards ensuring that aircraft operational areas especially within and around airport boundaries are safe for all aeronautical activities. There is therefore the need to develop a more comprehensive bird/wildlife hazard management action plan for the country. This should be fully designed towards minimizing the risk of animal collision with aircraft especially in aircraft operational areas.

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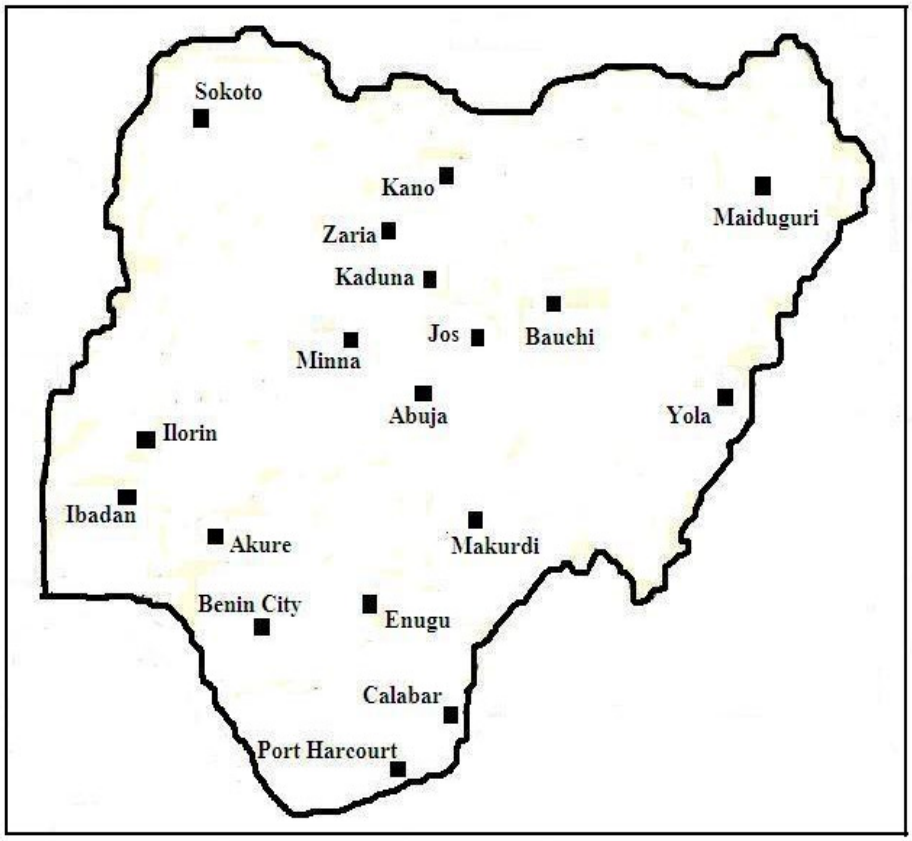

Figure 1: Major Airports in Nigeria

Table 1 Reported incidents of Bird/Wildlife Strike in Nigeria (2005-2010)

Month	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**Total**	**%**
January	0	0	0	0	3	0	3	1.4
February	3	1	0	1	3	5	13	6.2
March	5	8	1	0	2	11	27	13.0
April	2	1	7	0	12	6	28	13.3
May	4	1	6	2	8	7	28	13.3
June	1	0	0	4	4	5	14	6.7
July	1	1	0	2	5	0	9	4.3
August	1	1	0	0	6	1	9	4.3
September	0	1	0	1	4	0	6	3.0
October	2	1	0	6	13	10	32	15.3
November	2	2	3	7	8	5	27	13.0
December	3	1	0	4	2	3	13	6.2
Total	24	18	17	27	70	53	209	100
%	11.5	8.6	8.1	13.0	33.5	25.3	100	

Source: NCAA, 2011.

Table 2 Expected Values of Bird/Wildlife Strike Incidents in Nigeria (2005-2010)

Year	2005	2006	2007	2008	2009	2010	2005-2010
Mean	2	1.5	1.42	2.25	5.83	4.42	34.83

Source: Computed from NCAA, 2011.

Table 3 Identified Bird/wildlife types involved in reported cases of collision with aircrafts in Nigeria (2005-2010)

	English Name	Family Name	Binomial Name	Number of cases	%
1	Kites	*Accipitridae*	*Milvus migrans*	47	43.1
2	Hawk	*Accipitridae*	*Accipiter striatus*	15	14
3	Cattle Egret	*Ardeidae*	*Bubulcus ibis*	7	6.4
4	Lapwing	*Charadridae*	*Vanellus armatus*	7	6.4
5	Vulture	*Accipitridae*	*Gyps fulvus*	5	4.6
6	Kestrel	*Falconidae*	*Falco tinnunculus*	4	3.7
7	Eagle	*Accipitridae*	*H. leucocephalus*	3	2.8
8	Pied Crow	*Corvidae*	*Corvus albus*	2	1.8
9	Owl	*Strigiformes*	*Athene noctua*	2	1.8
10	Francoline	*Phasianidae*	*Franco Francdinus*	2	1.8
11	Bat	*Chiroptera*	*Corynorhinus townsendii*	2	1.8
12	swallow	*Hirundinidae*	*Cecropis daurica*	2	1.8
13	Quails	*Phasianidae*	??	1	0.9
14	Gull	*Laridae*	*Larus delawarensis*	1	0.9
15	Falcon	*Falconidae*	*Falco berigora*	1	0.9
16	Giunea Fowl	*Nunididae*	*Numida meleagris*	1	0.9
17	Heron	*Ardeidae*	*Egretta thula*	1	0.9
18	Grey Heron	*Ardeidae*	*Ardea cinerea*	1	0.9
19	Saker Falcon	*Falconidae*	*Falco cherrug*	1	0.9
20	Pigeon	*Colunbidea*	*Columba livia*	1	0.9
21	Swift	*Apodidae*	*Apus apus*	1	0.9
22	Osprey	*Pandionidae*	*Pandion haliaetus*	1	0.9
23	Antelope	*Antilocapridae*	??	1	0.9
	Total			109	100

?? Not available.

Source: NCAA, 2011 (% computed by authors).