Bird Strike Incidence at Addis Ababa Bole International Airport

Elizabeth Yohannes, Afework Bekele and Zerihun Woldu
Max Planck Institute for Ornithology, Von-der-Tann Str 7, 82346 Andechs, Germany

Abstract
The time and rate of bird strike incidents, species composition and number of birds involved in strikes, and the behaviour of birds were recorded at Bole International Airport from December 1994 to December 1995. The crop contents of the birds struck by aircraft were analysed. A total of 33 bird strikes were recorded during the study period. Fifteen species of birds were involved in the strikes. Pigeons (speckled pigeons, white-collard pigeons and red eyed doves together), black kites and Eurasian bee-eaters were responsible for 33, 24 and 18 % of all the strikes recorded respectively. Most bird strikes took place between September and October and fewest between May and June. The majority of bird strikes occurred in the early mornings when most flights leave or arrive. In 69% of the gut analyses carried out the crops were found empty, mainly because strikes occurred in early mornings before the birds had fed. The bird strike prevention measures suggested include biological and physical methods.

Résumé
Un nombre total de 33 collisions a été enregistré pendant la période d'étude. Quinze espèces d'oiseaux étaient impliquées dans ces collisions. Des Colombidés (Pigeon de Guinée, Pigeon à collier blanc, et Tourterelle à collier), le Milan noir et le Guêpier d'Europe ont causé respectivement, 33, 24 et 18 pour cent des collisions enregistrées. La plupart des collisions ont eu lieu entre les mois de septembre et octobre tandis qu'elles étaient moins fréquentes entre les mois de mai et juin. La plupart des collisions d'oiseaux ont eu lieu tôt le matin quand la plupart des avions atterrissent ou décollent. Dans 69% des cas d'analyses du tube digestif, les jabots étaient vides parce que les collisions ont eu lieu le matin avant que les oiseaux ne se soient déjà nourris. Les mesures de prévention des collisions d'oiseaux suggérées comprennent des méthodes biologiques ainsi que physiques.

Introduction
Bird strike, the collision between birds and aircraft, may result in death, injury and/or damage to property (Blockpoel 1976). Thorpe (1994) has summarized bird strike data
in major airports of the world for the years between 1986 and 1990. The data show that 1,310 engines were damaged and three airplanes were totally destroyed during this period. In addition to loss of human lives, there has been the high cost of repairs to aircraft (Smith 1986, Hild 1983a and b, and Harrison 1987). Moreover, grounded aircraft continue to incur operation costs such as crew salaries and parking fees.

Records of the Ethiopian Civil Aviation Authority (ECAA) indicate that Ethiopian Airlines spend more than 2.5 million dollars every year just to repair equipment damaged by bird strikes (personal communication). The incident in Bahrdar (northern Ethiopia) in 1988, where a 737 Boeing encountered a flock of speckled pigeons (Columbia guinea) during take-off is one of the major bird strike events recorded in Ethiopia. The aircraft was completely destroyed as a result of 15 pigeons ingested into the engine, resulting in the death of 35 people (Lewis 1995).

Many airports in different parts of the world have employed various techniques to scare away or reduce bird populations in their environments with the aim of minimizing bird strike incidence. The efficiencies of these techniques have been tested in many countries under locally prevailing conditions. Consequently, management of many airports have selected various environmental measures to make airports less attractive to birds.

The objective of the present study was to collect data on bird species composition, the time and rate of bird strike incidents and behaviour of birds at Addis Ababa Bole International Airport, with the aim of suggesting integrated environmental methods for reducing bird strikes.

**Materials and Methods**

The time and rate of bird strikes incidents and bird species involved were recorded along the runway on alternate days from 0700 to 1800h from December 1994 to December 1995. Carcasses of the birds hit by aircraft were collected and identified following Mackworth-Praed and Grant (1957a and b). The gut contents of these birds were analysed whenever possible. The physical, biological and environmental factors that might be attracting birds to the airport were noted. Multiple regression analysis was performed between number of strikes as a dependent variable, and number of flights and time as independent variables.

**Results and Discussion**

**Bird Strike Incidents**

Bird strike incidents observed during the study period are given in Figure 1. A total of 77 birds were killed in 33 strikes recorded. Fifteen species of birds were involved in these strikes: pigeons (speckled pigeons, white-collared pigeons and red-eyed doves), black kites and Eurasian bee-eaters caused 33, 24 and 18% of the registered strikes, respectively.

During the study period, there were an average of 12 flights per day. The highest numbers of strikes were recorded in September and October (Fig. 2), involving a total of 56 birds,
**Fig 1:** Bird strike incidence records by species

**Fig 2:** Bird strike incidence in each month of the year

**Fig 3:** Flight frequency from 06:00 to 19:00

**Fig 4:** Bird strike incidence from 06:00 to 19:00
84% of which were the migratory Eurasian bee-eaters. Pigeons were responsible for 29% of the strikes in September and 43% of the strikes in October. Pigeons were involved in all the strikes in November. All strike incidents in April were due to black kites. There were no bird strike incidents in May or June.

Eighteen percent of the strikes during the study period were caused by bee-eaters. In 60% of these, more than one bird was involved. Some of these birds were killed by the engine blast alone, without any visible damage to the bird’s body.

**Time of Strikes**
Most of the bird strikes occurred in the early mornings and late afternoons. The timing of flights at the airport and of the strike incidents are shown in Figures 3 and 4, respectively. Fifty-eight percent of the strikes occurred before noon. Pigeons caused 29% of the strikes in the morning and 33% in the afternoon, while black kites caused 67% of the strikes at noon.

Result of the Multiple regression analysis shows that number of strikes was significantly related (P = 0.042) to number and time of flights. The correlation between number of strikes and number of flights is 0.67, indicating that incidence of strike increases with number of flights. Hence it is misleading to suggest a time free of bird strike incidents. Nevertheless, observations on activities of some birds (e.g. pigeons) suggest that the hours between 1300 and 1600h appear to have few or no bird strike incidents at Bole. This may be due to the lower traffic density and low bird activity during these hours.

**Gut Analysis**
Fifty-nine percent of the birds struck by aircraft were torn apart, making gut content analysis practically impossible. In 82% of those cases where analysis was possible, the crops were empty. The stomachs of all the pigeons that were struck in the afternoons contained wheat grain, indicating that the strikes occurred after the birds had fed.

Pigeons and doves crossed the airport in the early mornings on the way to their feeding areas in the farmlands south and southeast of Addis Ababa. In late afternoons, they flew in the direction of the range of mountains north of Addis Ababa.

Open garbage dumps in and around the airport attracted many kites. Kites were also observed feeding on insects, earthworms, grasshoppers, lizards, snakes and small mammals around the airport. In most of the strikes observed, the whole bodies of the black kites were sucked into the engines.

The Eurasian bee-eater, a Palearctic winter migrant to Ethiopia, is highly gregarious and these were attracted to the runway by bees swarming on flowers, including *Bidens prestinaria* and *Bidens macroptera* in September and October, and on termite larvae.

Nocturnal animals such as owls and bats were also occasionally involved in collisions with aircraft. Birds such as flamingos and gulls, not encountered during data collection
at the airport, were also involved in the strikes. This would suggest that bird strikes could also occur at night when nocturnal birds are traversing the airport, as well as resulting from collision with less frequent bird visitors.

**Conclusions and Recommendations**

Speckled and white-collared pigeons and red-eyed doves, together with black kites, accounted for most of the strikes at Bole International Airport. The hours between 0800 and 1200h and from 1600 to 1800h experienced the highest number of bird strikes. There is a clear correlation between bird strike and the behaviour pattern of the birds. Air traffic is relatively heavy in the mornings, and the highest number of strikes occurred in September and October, while none occurred in May and June. Bird strikes were most prevalent when insects, mainly grasshoppers and termite larvae, were abundant and when the crops adjoining the airport fields were ready for harvest.

Ecological measures for controlling bird strikes should focus on birds that frequently visit and/or pass across the airport, although certain less frequent birds could also be hazardous. Modification of the airport environment with the aim of removing features that attract birds is vital. Based on this study the following measures are proposed:

- Proper use of garbage disposal systems and prohibition of agricultural activities in and around the airport. Other agricultural activities such as livestock and bee-keeping close to airports should also be discouraged.
- Airport personnel and pilots should be made aware and continually informed of bird activities at different times of the day and seasons of the year.
- A trade-off between grass height and the possible associated risk should be tested under the prevailing local conditions.
- Ditches and holes in and around the airport that might retain water should be plugged or drained.
- All possible perching and posting sites (including abandoned aircraft, electric and telephone poles, trees and shrubs) within the airport perimeters should be removed. Covering the ceiling of the hangar with wire mesh will prevent the roosting of birds in the hangar.
- Continuous and detailed monitoring of the environmental conditions and bird activities at Bole International Airport should be made. Bird strike statistics and other relevant data should be made available for analysis and monitoring.
- It should be noted that a new runway parallel to the old one is currently under construction and likely to increase flight frequency. This may aggravate the problem of bird strike if the conditions at Bole remain unchanged.
References
Thorpe, J. (1994). Bird Strike Data from World Regions. BSC E 22/wp 28 197-200
Acknowledgments
The research was made possible thanks to the unreserved cooperation of the Ethiopian Civil Aviation Authority, Ethiopian Airlines and the Biology Department of Addis Ababa University.