In: Advances in Environmental Research. Volume 14 ISBN 978-1-61209-584-4
Editor: Justin A. Daniels, pp.

Short Communication

AN ECOLOGICAL APPROACH APPLIED TO THE BIRDSTRIKE PHENOMENON

C.Soldatini, [1][1], V. Georgalas, [1], A.Andreon, [2], P. Torricelli, [1] And Y.V. Albores-Barajas[1]

[1] Dept. of Environmental Sciences, University Ca'Foscari of Venice, Castello 2737/b, 30122 Venezia, Italy
[2] Aeroporto di Venezia Marco Polo S.p.A. SAVE Viale Galileo Galilei, 30/1 30173 Venezia Tessera, Italy

Since man has taken into the skies there has been a conflict with birds, resulting in large economic and life loss. During the first flights, as the number of aircraft flying was low, there were fewer birdstrike events. However, with the increase in the number of flights the probability of a birdstrike event to occur also increased, while in parallel, the introduction of larger aircraft was accompanied by an increase of the economic and life loss (Wright and Dolbeer 2003).

The flight phase when a birdstrike event is more likely to occur is below 500 ft (Wright and Dolbeer 2003; Dolbeer 2006) practically during take off and landing, and within the airport area. It is therefore clear that, in order to reduce drastically birdstrike events, it is necessary to concentrate management efforts on airports and create scenarios for proper management actions.

All airports share ecological characteristics (such as large open areas, including grasslands) that are attractive to many bird species. In particular species that can easily adapt to high levels of noise or that can take advantage of food availability and especially insect eaters. The primary food supplies at airports are grasses and other vegetation (Barras et al. 2000; Barras and Seamans 2002; Gleizer et al. 2005), insects, and strike victims (insects, birds and small mammals that have collided with aircrafts). Bird species frequenting airport areas are mainly herbivorous/seed eaters (ducks, geese, and some passerine species), insectivorous (kestrels, starlings, and other passerine species) and scavengers (corvids and

1 Correspondence to: Cecilia Soldatini. Dept. of Environmental Sciences, University Ca'Foscari of Venice, Castello 2737/b, 30122 Venezia, Italy. Fax +39 41 5281494, cecil@unive.it.

gulls). Herons and birds of prey on the other hand may be present, depending on the presence of amphibians or small mammals (Barras et al. 2000; Gleizer et al. 2005).

As mentioned before, most of the aircraft collisions with wild animals occur during take off and landing, however mammals and reptiles represent a small percentage of these events (<3%) (Wright and Dolbeer 2003) thus it is important to concentrate on the species that create the greater number of incidents: birds.

There are several methods used to control bird abundance inside the airport area: ranging from culling, air cannons, ultrasound, to falconry. The main problem with these methods is that they may be ethically unacceptable (culling), ineffective (such as ultrasounds, as birds cannot hear them), be subject to habituation (such as air cannons, flags etc) or it would be logistically impossible (a falcon cannot fly round the clock to keep birds away from the airport or birds would habituate to a raptor presence if it is continuous). It is important to manage the areas surrounding the airports and avoid activities that may attract birds, such as fish rearing, etc as stated on the ICAO Convention on Civil International Aviation (ICAO 1991), but that is not followed often. However, discussion of such methods is beyond the aim of the present commentary. We would like to compare instead, the existing methods for birdstrik risk analysis and propose further development of the techniques already in use.

Generally, at disturbed sites such as airports, lower densities of birds may result in higher foraging success because of lower competition for the same resources (Mallord et al. 2007a; Mallord et al. 2007b; Sutherland 2007). On the other hand, bird species that can be found inside an airport may vary greatly between airports due to their geographical locations. For instance, an airport located on the migratory route of some Passeriforme species will be at risk only during certain periods of the year, while an airport close to a water body will probably have a higher risk of a birdstrike with larger birds, such as egrets or gulls. There are several species often present at airports but not all of them have birdstrike events recorded. Therefore, the birdstrike history of the airport is of particular importance for defining the risk assessment. If a species has not had an impact on that airport it should not have a big weight in the risk analysis, without excluding that an impact may occur at any time.

Since the bird community on each airport is unique, and the birdstrike history (i.e. the number of birdstrike events and the species involved) also depends on this community, it is essential to carry out a detailed analysis for each single airport over a period of years.

Based on the data of species and birdstrike history, it would be thus possible to evaluate properly the birdstrike risk at a certain airport. The factors that should be considered when analyzing birds are several and include the airport management strategies (such as falconry, grass cutting, etc.) ,bird abundance, species richness, number of flights etc. Several attempts have been made to determine the birdstrike risk of a given airport (Dolbeer et al. 2000; Allan 2006b; Soldatini et al. 2010) with several other unpublished papers presented in various meetings, however most of the prediction models are focused on the economic part of the birdstrike phenomenon without taking into consideration the ecological aspect of the animals and habitats involved.

So far, there are three available methods joining aircraft movements and the ecological characteristics of birds. The first attempt was made by Dolbeer and colleagues (2000), when they proposed that not all species are equally hazardous for a birdstrike. They ranked species according to the birdstrike history of each species or group of species, meaning that if a species had caused a larger damage, it was ranked higher, compared to a species with the same number of impacts but with less damage provoked to the aircraft. After that, Allan

(2006) incorporated probability to the model and proposed a method where bird species were ranked according to the birdstrike history for that species, meaning that if a species has several impacts, it will have a large risk within the model. Finally, Soldatini and colleagues (2010) have gone one step further analyzing airport specific birdstrike history and birds community relating it to effective traffic and translating to an index (Birdstrike Risk Index) embodying information about gravity and probability of a collision. The Index trend enables managers to verify the periods of the year in which there has been a major exposal to the birdstrike risk, in order to evaluate its tolerability in time. It also allows to formulate provisional models based on traffic assessment when dangerous species are present in the airport.

From our point of view, birdstrike prevention has to take into consideration the ecological characteristics of the airport and the fauna it attracts. It also has to be considered the period of the year (as in migration periods, or seasonal changes in species flocking behavior; e.g. species that form flocks during some period of the year etc), the activities of maintenance within the airport (such as grass cutting etc.). Age of the individuals may also influences the birdstrike risk, in fact younger birds, that lack experience are more prone to get involved in a birdstrike event (Burger 1985), thus risk in the airport area may result higher in the post reproductive period.

It is also important to standardize the gravity of an impact and standardize the codification of effects produced (ICAO 1991) so that they can be compared between similar airports. With reference to ICAO coding in several studies authors considered effects on flight ranked from 0 to 5, with 0 being an impact with no damage to 5 being a complete loss of the aircraft and/or civilian deaths. Another important work the ICAO could help to endorse is the standardization of data collection. In our experience, one of the most important things is to standardize the data collecting and analysis methods on an international level, and, in a cooperative manner, improve the knowledge to decrease birdstrike risk.

The adoption of a common matrix for all risks - specially tailored on each airport, and based on the measurement of effect on flight and on the frequency of occurrence, or on the number of aircraft movements per time scale - enables the Airport Management to define probability and tolerability of a given risk. For example, since measurement of birdstrike risk with the BRI (Soldatini et al. 2010) formula is based on the same scale of gravity and probability as the other risks in the airport (tolerability matrix), the adoption of the BRI index would allow the Airport Authority to address each time the use of available resources towards more urgent safety measures.

Moreover, from the point of view of airport managers the ranking of the “reliability” of the airport is doubtlessly important. An airport ranked on a good position may be more attractive for airlines that perceive a lower risk, and may choose that airport over others nearby. At the same time, it would be an encouragement for other airports to improve their management actions and become more competitive. Being above a certain standard would also allow the airports the access to funding as in the case of the National Plan of Integrated Airport System (ICAO 1991). Evidence in positive safety management system gradients could also increase the contractual power of the Airport Management to negotiate insurance premiums.

Nowadays, some airports have implemented the use of modern technology, such as radars to determine migratory routes or the distribution of birds inside an airport, however, radars are costly and most of them still lack a high degree of detail to determine the bird species

from a radar image. On the other hand, in some cases such as during certain periods of the year, birds carry out short or long distance migrations through the same route year after year. With a more extensive use of radars it would be possible to determine the peak of the migration and take precautionary measures to lower birdstrike risk. Future research in this area should be focused on developing cheaper and more accurate radar technologies. In the meanwhile it is essential to use an airport specific analysis tool based on easy (and cheap) gathering of information on a standardized scale allowing comparison between airports and a general evaluation of the birdstrike risk among different geographic regions.

Larger detail for year round use of airport areas by animal species would be available through the implementation of more detailed studies on a biogeographical region scale. With the use of technology (GPS, radio-tracking, etc) it would be possible to determine the use of the airport area by the different species of wildlife. Once the information has been obtained, it would be thus feasible to concentrate available resources on the critical areas and species. Then the information could be shared on dedicated internet sites, where details on the species and their movements tracked by satellite or radio tracking can be followed.

In conclusion, we believe that birdstrike risk should be analyzed with a different objective, rather than only mere economic analyses. As pinpointed out in the present document, it is of particular importance to concentrate also on the ecological aspect of the birdstrike phenomenon. By ecological we mean taking in consideration the behavior and life history of the species using airports, the food availability, absence of predators in the area etc.

Eventually, through information sharing programs at an international cooperation level would become possible to lower the risk of wildlife strike on a global scale.

REFERENCES

Allan J (2006) A heuristic risk assessment technique for birdstrike management at airports. Risk Analysis 26: 723-729

Burger J (1985) Factors affecting bird strikes on aircraft on a coastal airport. *Biological Conservation* 33: 1-28

Dolbeer RA (2006) Height distribution of birds recorded by collisions with civil aircraft. *Journal of Wildlife Management* 70: 1345-1350

Dolbeer RA, Wright SE, Cleary EC (2000) Ranking the hazard level of wildlife species to aviation. *Wildlife Society Bulletin* 28: 372-378

ICAO (1991) Bird control and reduction. Airport services manual

Mallord JW, Dolman PM, Brown AF, Sutherland WJ (2007a) How perception and density-dependence affect breeding Woodlarks Lullula arborea Ibis 149: 15-15

Mallord JW, Dolman PM, Brown AF, Sutherland WJ (2007b) Linking recreational disturbance to population size in a ground-nesting passerine. *Journal of Applied Ecology* 44: 185-195

Soldatini C, Georgalas V, Torricelli P, Albores-Barajas YV (2010) An ecological approach to birdstrike risk assessment. European Journal of Wildlife Research. European Journal of Wildlife Research

Sutherland WJ (2007) Future directions in disturbance research. *Ibis* 149: 120-124

Wright SE, Dolbeer RA (2003) The national wildlife strike database for the USA: 1990 to 2002 and beyond 2003 Bird Strike Committee, Toronto, Ontario, Canada