GROUND VERSUS AIR – SEASONAL CHANGES IS THE USE BY BIRDS OF AN IRISH AIRPORT

Gavin Fennessy Dr[1*], Thomas C. Kelly Dr[1,2], Ray Bolger[2], Sorcha Sheehy[1], Michael J.A. O'Callaghan Dr[3]

[1] Department of Zoology, Ecology and Plant Science, National University of Ireland Cork, Ireland.
[2] Dublin Airport Authority, Dublin Airport, Dublin, Ireland
[3] Department of Applied Mathematics, National University of Ireland, Cork, Ireland

* Corresponding Author:, Tel: +353214904343, fax:+353214270562,
E-mail: g.fennessy@ucc.ie

Abstract

Detailed surveys of the birds present on the field and over-flying the runways at Dublin Airport have been made for the last ten years. These data have now been collated to examine seasonal patterns of birds that are found on the field, and to compare these data with the profile of species (and their relative abundances) over-flying the runways at these times. This study highlights the relationship between species (and their relative abundances) in both data sets. Some comments are made about the pattern of bird strikes in relation to the species profile in both data sets.

1. Introduction

Dublin Airport (EIDW) is situated in north County Dublin (53'25.87N 006'15.20W), on the east coast of Ireland. It is an international commercial airport which carries 15-20 million passengers annually. It has two principal runways: 10/28 (2637x61m) and 16/34 (2073x61m). The passenger traffic has increased steadily over recent years and there are expansion plans for an additional main runway and terminal.

There is an active 'bird patrol' at the airport seven days a week. Cadavers of suspected strike victims are frozen for post mortem analysis. Ornithologists make regular counts of birds on and overflying the field. These data combined with strike statistics and studies of bird aircraft interactions have allowed a holistic approach to understanding and managing the bird strike problem at a busy commercial airport.

Several previous studies have developed methods for quantifying the birds in the vicinity of an airfield (Hahn & Weitz, 1998; Lensink *et al*., 2000; Poot *et al*., 2000; Bloise *et al*., 2003). Others have highlighted the benefits of systematic ongoing monitoring of the avian community at airports in order to better calibrate and implement strike hazard management strategies (e.g. Montemaggiori, 1998). Increasingly, quantitative methods are applied to inform risk analysis in relation to new airfield developments (Anagnostopoulos, 2000) with analysis and visualisation software applications becoming more important in practical management of existing airfields (de Hoon & Buurma, 2000; Oost *et al*., 2000).

Papers presenting results of behavioural observations, post mortem studies and the influence of environmental conditions on bird strike risk arising from research at Dublin Airport have been published over the last decade (e.g. Kelly *et al*., 1996, 1999, 2000, 2003; Sheehy *et al*., 2003, 2005; Fennessy *et al*., 2003, 2005). Elsewhere in this volume the field recording procedure used by researchers at Dublin Airport is detailed. This paper presents new information on the application of GIS techniques to visualise ground count data. The potential management benefits are discussed. We also examine the pattern of bird strikes at the airport in relation to the species found on the ground and air.

2. Methods

2.1. Ground Counts

Detailed ground counts have been conducted since 1995 upon the introduction of an alphanumeric grid system. A 200x200 metre grid system has been used to record the presence of flocks and individual birds on the airfield. Survey time, date and environmental conditions are also recorded in field notebooks.

2.2. Overflying Counts

The details of the field recording methods employed at Dublin Airport to record overflying birds are contained in another paper in these proceedings.

2.3. Data Handling

Information from ground counts recorded in notebooks in the field are subsequently collated and keystroked into a MS Excel spreadsheet. Overflying count data are also entered into a spreadsheet. Confirmed bird strikes are stored in a database (Corel Paradox).

The airfield alphanumeric recording system has been digitised and using ArcGis9 (ESRI) the ground count data may now be more readily visualised. Extraction of specific data subsets is accomplished by importing the MS Excel spreadsheets into a database (Corel Paradox) and the subsequent use of query-by-example (QBE). Figures and tables are prepared using MS Excel and MS Word.

3. Results

3.1. Ground Counts

In total 40 bird species were recorded on the airfield from 1995-2002. The average number of birds recorded in ground counts and the profile of the species encountered varies seasonally (e.g. Figure 2). Ground count totals were generally low reflecting the success of the long grass policy at the airport and the active implementation of the bird hazard management plan.

Rook, *Corvus frugilegus*, was the most abundant bird overall but even this species was relatively uncommon on the ground at the airfield at any time throughout the year. Certain problem species such as wading birds and gulls are present on the field (in any numbers) in a highly seasonal basis e.g. Golden Plover, *Pluvialis apricaria*.

A grid map was developed to match the original alphanumeric field map and this has allowed the visualisation of overall, seasonal, temporal and species specific patterns of distribution of birds on the airfield at Dublin Airport (Figure 3).

The application of GIS allows the investigation of seasonal trends in the congregation of birds on the field e.g. the winter counts indicate a concentration of birds on the eastern part of the field near the approach to runway 28.

Species-specific patterns of distribution could also be of value in understanding and managing the airfield bird hazard. For example, records of Corvids appear to be reasonably well distributed throughout the field but *Waders* and *Wildfowl* seem to have been more patchily distributed with concentrations near the approach to runway 28.

3.2. Overflying Birds

Overflying at Dublin Airport is dominated by Rook and Woodpigeon, *Columba palumbus*. Overflying rates may be expressed in several ways:

(i) Crossing events per hour (flocks treated as a single event)
(ii) Birds crossing per hour

(iii) By survey 'zone' normalised by chord length
   a. Crossings per hour per kilometre
   b. Birds per hour per kilometre

There are seasonal and zonal variations in overflying rates and in the profile of species overflying the airfield. Corvid species predominate throughout the year except for a short period in Autumn when Woodpigeon cross the airfield in greater numbers. It is interesting to note that in general the highest overflying rate has been in the zone west of the main runway – an area that extends like a panhandle into the agricultural land surrounding the airfield.

3.3. Profile of Strikes

The profile of strikes does not closely reflect the profile of species recorded in ground counts or in overflying records. For instance approximately 16% of the birds struck at the airfield are Black-headed Gulls, *Larus ridibundus* – relatively uncommon in either ground or overflying counts. In contrast less than 10% of bird strikes involve corvids which clearly predominate in both ground and overflying counts.

4. Discussion

Knowledge of the bird species present in the vicinity of an airfield provides those charged with the control of bird hazard with valuable information that can be incorporated into airfield management plans (e.g. Montemaggiori, 1998). It can provide a baseline for the monitoring of trends in species abundance and diversity on and overflying the airfield, for instance in tracking changes in avian activity related to new management practices or airfield developments. It can also be useful in highlighting areas where strike risk may be higher due to periodic concentrations of hazardous species.

Several effective methods have been developed to measure overflying rates in the vicinity of airports (e.g. Poot *et al*., 2000). Volume and panorama scans are frequently used to estimate the number of birds in the air in the vicinity of airfields. Small mobile RADAR units are also becoming more widely used for monitoring the amount of avian movement over short distances (e.g. Walls, 2005). The method we have adopted at Dublin Airport makes use of multiple observers and zones delimited by landmarks. One novel aspect of our method suggests that overflying rates between airfields (and even zones within airfields) could be compared by expressing the crossing rates relative to length of the survey area e.g. birds/hr/km.

In agreement with previous studies the species struck at an airport may not be in proportion to the occurrence of these species on the field or overflying the airport (Hahn & Weitz, 1998). Local land use affects the mass of birds in the air but knowledge about densities of birds in the air is not sufficient to determine the bird
strike risk (de Hoon & Buurma, 2000). The fact that certain species appear to be struck at a much higher rate than their local abundance would predict highlights the fact that behavioural research is necessary: in tandem with ongoing monitoring of avian abundance, diversity and flight-lines this holistic approach should generate a much more complete picture of the actual risk level and safety challenges facing individual airports.

5. Acknowledgements

We wish to thank Dublin Airport Authority for their continued support, especially the Chief Fire Officer and his staff. We would like to thank Helen Bradley, UCC for her assistance with ArcGis. Thanks to Eoin Mulholland for keystroking data.

6. References

Anagnostopoulos, A. (2000). Monitoring avifauna for risk analysis at Thens International Airport S.A. *Proc. IBSC 25*: AV3.

Bloise, C., Reis, S., Miravent, V., Cabral, H. & Rufino, R. (2003). Diurnal local bird movements in the area of the new Lisbon airport. *Proc. IBSC 26*: 33-48.

de Hoon, A. & Buurma, L.S. (2000). Influence of Land Use on Bird Mobility, a case study of Eindhoven Airport, 1998-1999. *Proc. IBSC 25*: WP-RS8.

Fennessy, G., Kelly, T.C., O'Callaghan, M.J.A., Bourke, P.D., Sheehy, S. & Bolger, R. (2003). Bird aircraft interactions in relation to ambient light conditions. *Proc. IBSC* 26: 353-360.

Fennessy, G., Sheehy, S., Kelly, T.C., O'Callaghan, M.J.A. & Bolger, R. (2005). Estimating the over-flying of birds at an airport: developing a methodology. *Proc. IBSC 27* (II).

Hahn, E. & Weitz, H. (1998). Bird strikes versus bird counts on airports – is there any correlation? *Proc. IBSC 24 Slovakia*: 73-84.

Kelly, T.C., Murphy, J. & Bolger, R. (1996). Quantitative methods in bird hazard control; preliminary results. *Proc. IBSC* 23: 227-233.

Kelly, T.C., Bolger, R. & O'Callaghan, M.J.A (1999). The behavioural responses of birds to commercial aircraft. Proceedings of Bird Strike 1999, Vancouver International Airport Authority, Vancouver: 77-82.

Kelly, T.C., Bolger, R. & O'Callaghan, M.J.A. (2000). Weather and Bird Strikes an investigation at a coastal airport. *Proc. IBSC 25*,

Kelly, T.C. & Bolger, R. (2003). The changing pattern of bird strikes caused by pigeons at an Irish airport. *Proc. IBSC* 26: 137.

Lensink, R., Poot, M.J.M., Tulp, I., de Hoon, A. & Dirksen, S. (2000). Bird Densities in the lower air layers, a case study on Eindhoven Airport 1998/99. *Proc. IBSC 25*, RS6.

Montemaggiori, A. (1998). The importance of bird monitoring at airports: the case of Fiumcino, Rome. *Proc. IBSC 24 Slovakia*, *:* 205-216.

Oost, L., Verboom, J & Pouwels, R. (2000). LARCH-AIRPORT: A GIS-BASED RISK ASSESSMENT MODEL. *Proc. IBSC 25*, RS9.

Poot M.J.M., Lensink, R., Tulp, I., van der Winden, J., Dirksen, S., de Hoon A. & Buurma, L.S. (2000). Spatial patterns of bird movements on and around an airport, a case study on Eindhoven Airport 1998-99. *Proc. IBSC 25*, RS7.

Sheehy, S., Kelly, T.C., Bourke, P.D., O'Callaghan, M.J.A., Fennessy, G., Bolger, R. (2003). A comparison of the injury syndromes associated with different sources of avian mortality. *Proc. IBSC 26*: 351.

Sheehy, S., Kelly, T.C., Fennessy, G., O'Callaghan, M.J.A., Bolger, R. (2005). Bird strike syndrome: towards developing an index of bird injury. *Proc. IBSC 27*: 152-160.

Walls, R. (2005). Monitoring avian movement using bird detection RADAR; impacts of nocturnal movement on flight safety at a military aerodrome. *Proc. IBSC 27*: 172.

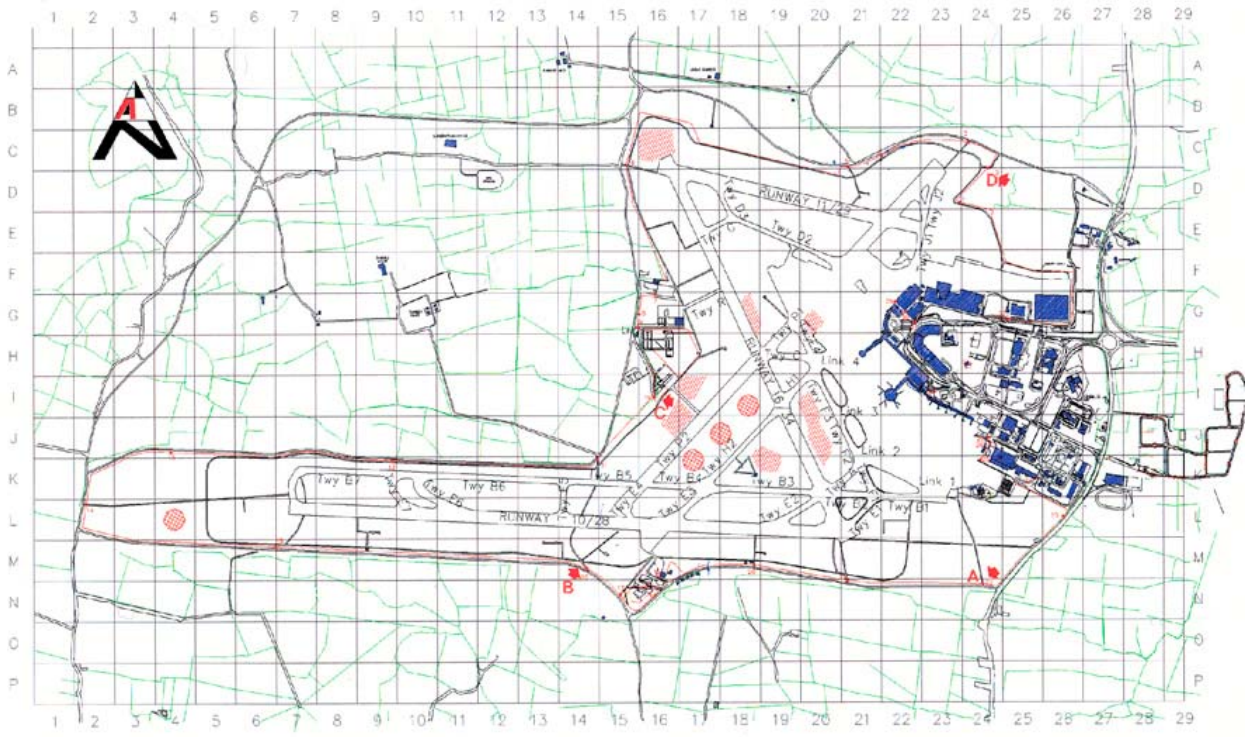

Figure 1. Alphanumeric grid used for recording ground count observations at Dublin Airport.

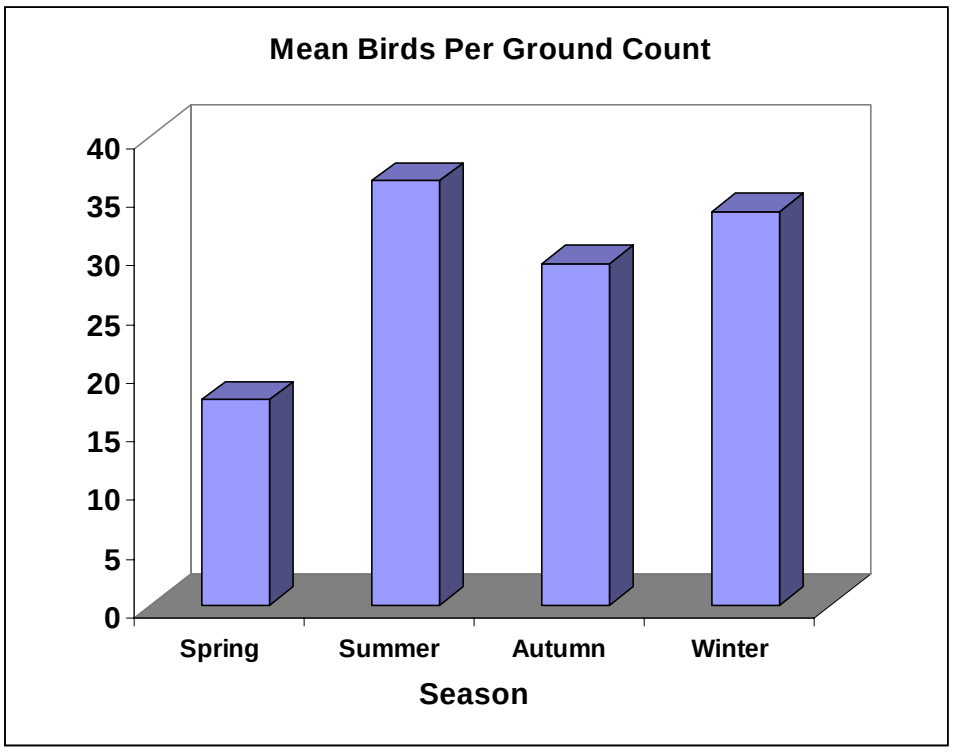

Figure 2. Seasonal pattern of average number of birds recorded on the field during ground counts 1995-2002.

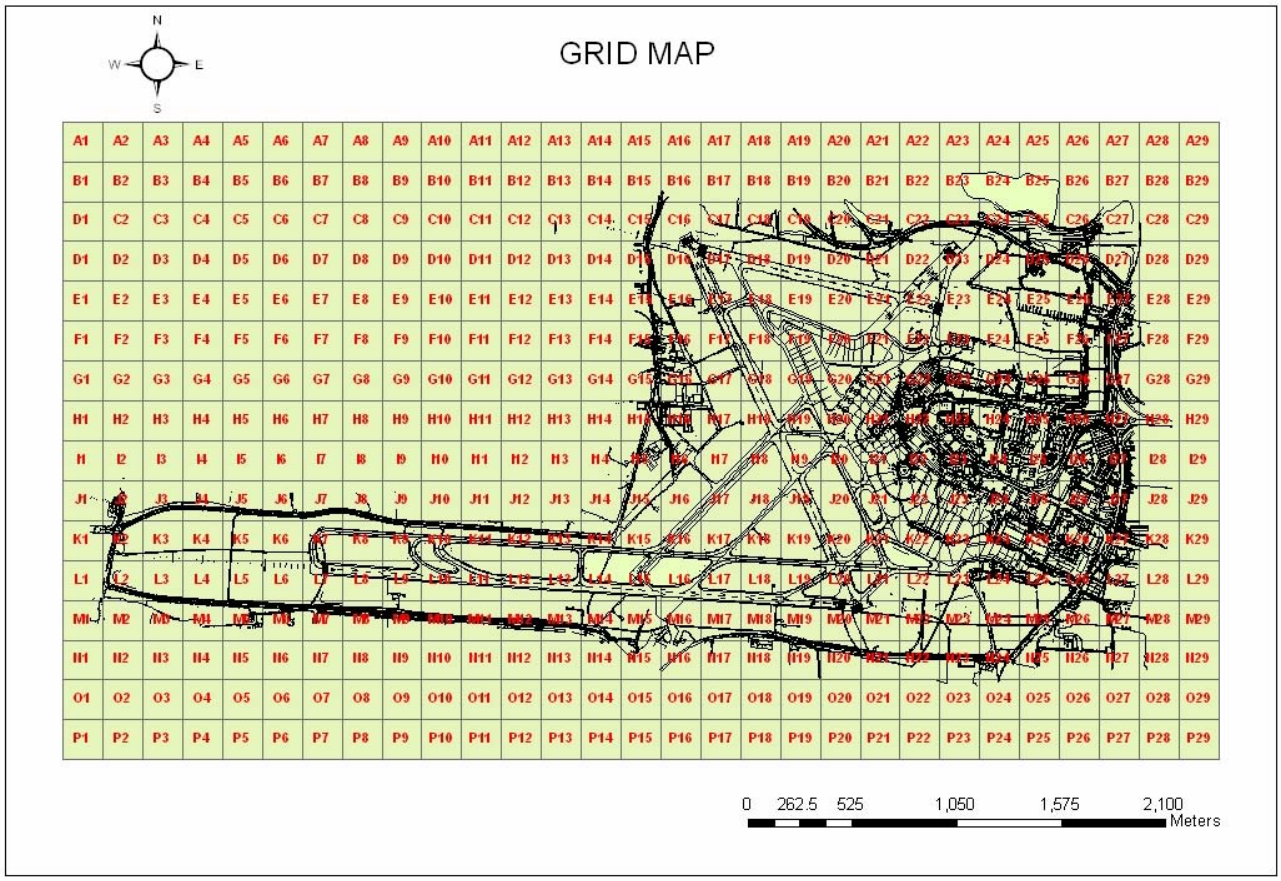

Figure 3. An alphanumeric grid adapted to display ground count data at Dublin Airport in ArcGis.