AERONAUTICAL STUDIES TO DETERMINE THE SPATIAL MOVEMENTS OF HAZARDOUS BIRDS.

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Abstract

Deterring birds from an attractive site in the vicinity of an aerodrome has the potential to increase risk if birds subsequently move to more hazardous areas. Aeronautical studies should be undertaken to determine the likely impact of bird management at sites within commuting distance of an aerodrome. This paper reports on a comprehensive aeronautical study to review hazardous bird movements between different foraging habitats and roost sites within 25 miles of an aerodrome in southern England.

1200 gulls were marked at a landfill site ten miles north of London Heathrow Airport. Their movements were monitored over a 12 month period in an attempt to predict the potential impacts of implementing bird deterrence at the site. Birds were recorded at 12 other landfill sites in the region, 7 sewage treatment works and 8 roost sites. Movements between some sites were confirmed using bird detection radar. Individual birds frequently used the same roost unless affected by environmental change such as reservoir drainage, freezing weather or unintentional disturbance. Birds showed a preference for the same foraging habitat. Movements throughout the area between landfill facilities and roost sites are presented. The flight safety risks posed by these movements are discussed and the influence of implementing bird deterrence at one or more of sites can be predicted. This study shows that, as some bird species may travel significantly greater distances than a safeguarding circle, aeronautical studies should be extended to cover distances traveled by particular species as a pose to distances covered by safeguarding circles.

Introduction

Scavenging birds are well known long distance travelers and will commute upwards of thirty miles between suitable feeding and roosting sites (Horton et al 1983). Flightlines of birds are most likely to occur between landfill sites and roost sites that are separated by the least distance (Baxter *et al* 2003). Whilst there is a general flight safety risk posed by the roost and foraging locations themselves by birds circling over a site (CAA 1998), it is the movements of birds between sites that frequently cause the greatest concern. Large numbers of birds numbering several thousand will travel in groups along the same air corridors over short periods of time (Parr 1968). These “flightlines” of birds often occur shortly after dawn and before dusk on a routine basis. Birds may move to pre-feeding sites following departure from a roost, or to pre-roosting sites following departure from a feeding site. These deviations from what may otherwise be a straight line movement between two locations can be of significant concern for flight safety.

Gull reliance on landfill feeding opportunities varies by season (Mudge & Ferns 1982). Estimates suggest that up to 90% of Herring gulls wintering in the UK depend upon landfill foraging opportunities compared with, for example, only 10% of Black-headed gulls. The availability of landfill becomes increasingly important during adverse weather periods. When freezing conditions occur, worms in pasture or parkland move deeper into the soil column and become unavailable to foraging gulls (Elkins 1983). Individual birds are known to utilise different feeding habitats (McLeery 1986) although time spent in each is not well documented and may change between different regions. Specialisation may occur between days (Coulson et al 1987) and are not well understood. If birds are reliant on landfill sites, it is important to know the location of alternative sites in order to predict the likely impacts of deterring birds from one or another site. In addition, it is important to understand whether birds already move to these sites on different days and whether changes in the availability of foraging locations are

likely to influence roosting behaviour and the associated flightlines that may occur.

A landfill site situated 10 miles north north-west of an airport was identified as attracting large numbers (upwards of 10,000 birds per day) of scavenging gulls. Initial spot checks confirmed that birds from this site were roosting within 2 miles of the airport, but did not appear to be passing through the approaches. The risk of a birdstrike was considered low. In addition, the opportunity to request deterrence of birds via the traditional UK planning process for sites within 8 miles of an airfield was unavailable. The landfill was, however, subsequently requested to implement bird deterrence measures due to complaints about the nuisance and defecation the birds were causing rather than flight safety concerns. It was not clear what impact deterring birds from this feeding site would have on the birdstrike risk. Alternative foraging areas and roost site fidelity were not well understood. The birdstrike risk would be increased if birds continued to roost close to the airport but began to commute across it.

Movements between adjacent roost sites were thought to occur but it was not understood whether these posed a birdstrike risk. Birdstrikes with gulls did, however, represent the number one strike issue at this airport. Over nine strikes a year were recorded with different species of gulls in 2004. Given the numbers of birds thought to use the landfill, and the fact that they were currently roosting within two miles of the airport, it was clear that the removal of the site could reduce numbers using the area. Understanding where birds deterred from this site would be likely to forage, and how this would impact on flight safety, was essential to determine whether the implementation of a bird management plan would be acceptable.

This study therefore examines how birds behave when they are influenced by different environmental conditions, reviews existing movements throughout an area and attempts to predict the impact of deterring birds from a landfill site on the birdstrike risk at an airport.

Methods

Scavenging gull numbers and movements were monitored using traditional visual observations at 13 landfill site, 40 wetland areas, 8 reservoirs, 34 sewage treatment works, 20 areas of parkland and from over 30 vantage points situated along flightline corridors between feeding and roosting sites.

Standard ornithological count techniques (Bibby et al 2000) were used to monitor both numbers and movements of birds throughout the area. Half day visits between dawn and midday, or midday and dusk were made on one randomly selected day each week to the main landfill site. Attempts were made to visit all other landfill and roost sites within a 30 mile commuting distance (Horton et al 1983) of the main roosting area on a monthly basis and all other sites on a quarterly basis.

A team of 10 people undertook a total of eight cannon netting capture sessions on two days in November 2003 and two days in January 2004. All gulls were marked at the main landfill site with an individually inscribed metal ring and painted on the head, nape and breast with a saturated solution of crystalline picric acid in ethanol (a permanent yellow orange plumage stain). A specific licence was obtained to do this. Orange colour rings were also used to mark Black-headed, Common, Herring and Lesser Black-backed gulls with an individually identifiable number. Numbers and behaviour of marked birds were then recorded at all sites whenever they were visited. Observations of marked birds within flightlines were recorded. 10 birds were fitted with radio-transmitters on November 21st 2003 and tracked whenever their signals were detected.

Reliance on landfill and other habitats was determined by overall count data from different foraging or roosting sites in combination with the numbers of marked birds present and observations of marked bird movements. Bird detection radar was implemented at the main roost site and the study landfill site for 3 days each during late March 2004. Data was processed and used to confirm visual observations of movements (Walls 2005).

Results

Significantly more birds utilised the main landfill site over the course of a week than peak counts suggested. Bird movements to and from the site showed that approximately 1.36 x mean daily peak count of birds were present on a site each day. Radio-tracking data also confirmed the presence of birds on or around the landfill site at which they were trapped. 9 out of 10 tagged birds were recorded

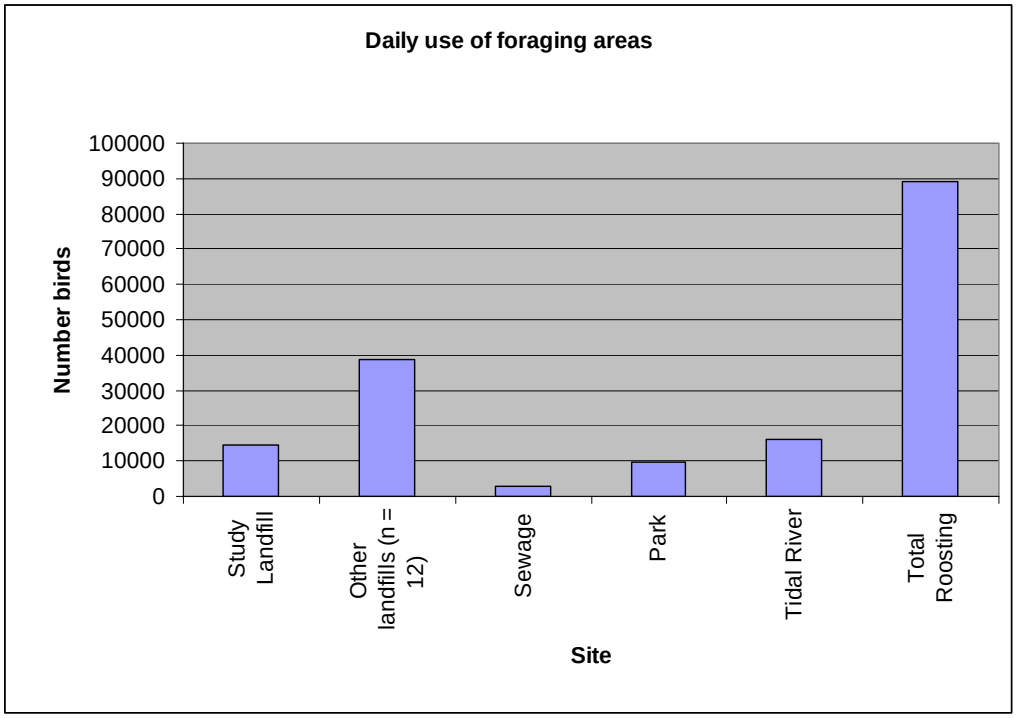
at the site on average once every 2.54 days (n = 44) throughout the winter period (November – February).

Table 1. Total No. gulls using study site each day.

	Jul	Aug	Sept	Oct	Nov	Dec	Jan	Feb	Mar	Apr
Total	4668	7998	8524	10498	10588	14604	12764	10094	12213	1202

The study site was responsible for attracting large numbers of gulls throughout the winter months. Between October and March, more than 10,000 birds were present on a daily basis. Total numbers of birds within 30 miles of the major roosting area were also recorded at other landfill sites, sewage works, parkland and tidal riverbeds. These are compared to the total number of birds estimated to be roosting in the area. The use of specific habitats can thus be assessed. Counts estimate 89,000 gulls to be present roosting in the area during this period.

Figure1. Daily use of different foraging areas



A mean daily total of 14,604 gulls were using the study site. 38,541 birds were using the other 12 landfill sites in the area on a daily basis. 65% of all foraging gulls located were thus present at landfill sites. This compares with just 3.5% foraging at sewage works, 11.6% feeding in parkland, and 20% feeding on tidal mudflats. Approximately 8% of birds recorded at roost were not located. Significant interchange between different landfill and roost sites was noted through the mark re-sighting studies undertaken. The following table compares the percentage of each species present in each area.

Table 2. Percentage of each gull species in different habitats.

	BHG	CG	LBB	HG	GBB	Mean peak
Landfill	76%	1%	4%	17%	1%	
Other landfill	69%	2%	15%	13%	1%	4,088
Sewage	93%	6%	>1%	>1%	>1%	312
Parkland	96%	3%	>1%	>1%	>1%	210
River	99%	>1%	>1%	>1%	>1%	11,046

The proportion of each species present and the numbers of birds present in each habitat (figure 1 and table 2), show that Black-headed gulls and Common gulls utilise the greatest range of habitats. Large gulls show a significant preference for landfill sites. The greatest diversity of gulls is present on landfill sites. Small gulls, however, do not appear to change habitat use between landfills and river. This was evaluated by reviewing presence of marked birds between different habitats. Results are presented based on large (Herring, Lesser black-backed & Great black-backed gulls) and small (Black-headed and Common) gulls.

854 observations of marked birds were recorded to Jan 2005. Of these, 607 involved birds within 30 miles of the main roosting area. 152 out of 559 marked small gulls, and 180 out of 559 marked large gulls were observed at least once, foraging at landfill sites. 33 marked small gulls were recorded in parkland, 7 in sewage treatment works and just 4 on tidal rivers. This contrasts with 21 marked large gulls in parkland, 2 in sewage works and none on rivers. The high numbers of birds using landfill sites, of which 272 were located at other landfills and 160 at the study landfill, suggests that birds already move regularly between different landfill sites within an area.

Flightlines of gulls were also observed and depicted below. 187,706 birds were recorded along 175 different flightline corridors.

Fig 2. Gull flightlines to and from study landfill site.

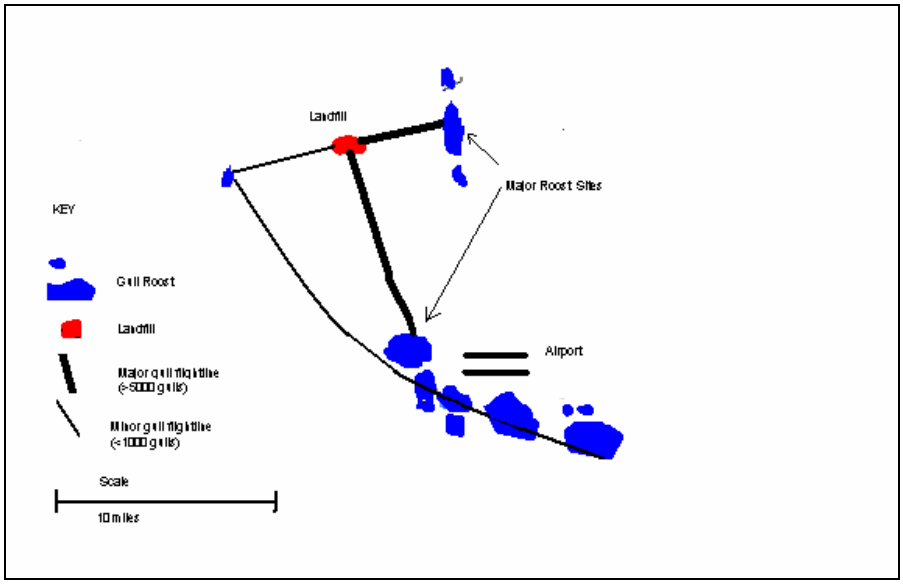
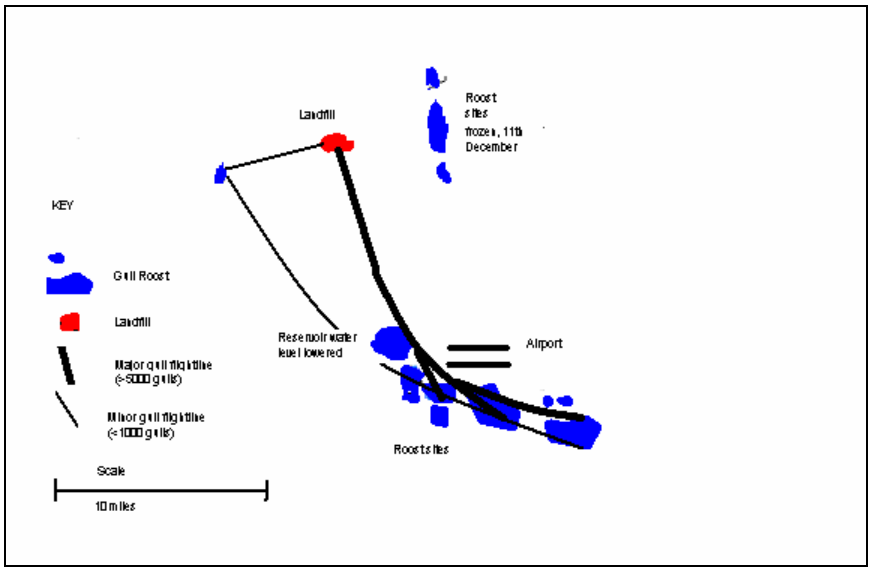


Figure two shows the major movements of gulls confirmed by monitoring at the landfill site, roost sites and vantage points. Smaller flightlines involving less than 1000 gulls are depicted using narrow lines. Confirmation of all flightlines shown was achieved when radio-tagged birds and colour marked birds were recorded using these routes. Other movements of birds moving less than a mile to surrounding fields occurred at the landfill site throughout the day. The closest roost sites to the south and east of the landfill were used as expected. The major flightlines of birds did not appear to cross the airport or its approaches. Some birds did continue onwards to roost at sites further south and south- east but did so at altitudes of less than 50m, approximately 2-3 miles from the runway head (Confirmed using radar).

Birdstrike risk was significantly increased, however, due to changes in the availability of roost sites during mid December. A period of freezing weather conditions resulted in the roost site to the north east of the landfill becoming frozen. Birds immediately ceased roosting there. At the same time, water levels were lowered for reservoir maintenance at the southern site. Gulls thus continued onwards, flying through the approaches to the airfield to roost sites to the south of the airfield. Figure 3. better depicts these changing movements.

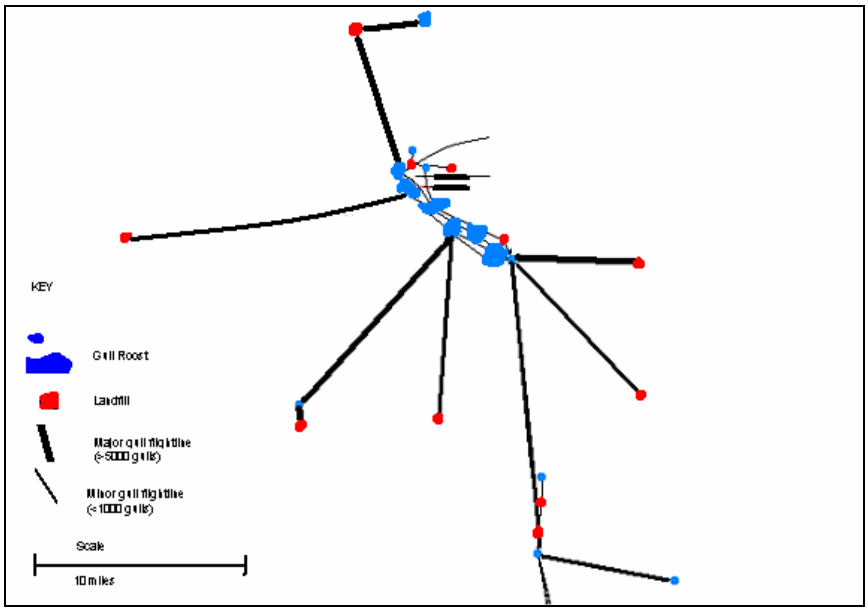
Fig 3. Gull flightlines in to and from landfill site during cold weather period.



The result of this cold weather spell and lowered water levels was a significant increase in the risk posed by birds from the landfill site. Birds still continued to fly over the southern roost and did not fly over the airfield, however they did fly through the approaches at altitudes of over 100m. Subsequent to this, several birds fed at other landfill sites to the south east of the airport. Given that the availability of roost sites changed the movements of birds, and that this in turn changed where birds fed, the removal of the study landfill itself would be likely to result in significant changes in roost and foraging behaviour. It was necessary, therefore, to determine the location of other landfill sites in the area and review the movements of birds to and from these sites. This would therefore provide an indication of where gulls would forage should they be deterred from the study site. Should birds roost to the south of the airport and locate foraging opportunities to the north east, the situation could significantly deteriorate.

The following flightlines were observed to and from other landfill sites in the area, all of which were located between the south-east, and west of the airfield.

Fig 4. Gull flightlines to and from alternative landfill sites in the vicinity.



Movement patterns correlated with predicted movements. Birds utilising alternative landfill sites almost always roosted at the most convenient sites. As with the main study site, some inter roost movements were observed but these occurred at low altitude and did not cross the approaches to the airfield. This fluidity of movement between different reservoirs within the same complex suggests that the whole area acts as one “super roost”. Results from radio-tagged individuals confirm that six of the eight roost sites were used by tagged birds. This included birds that were site faithful to feeding and roosting sites in the north relocating under environmental pressures to feeding and roosting sites to the south of the airport.

Discussion

Many individual birds appear to specialize on the same food resources within an area. This correlates well with findings by Harris 1970, showing that large gulls that feed on tips rarely indulge in predation. Gulls will, however, utilise different landfill sites (the same resource) throughout a given area.

When reduced water levels and freezing conditions prevented birds from using their regular roost site, they demonstrated their adaptability by utilising other roosting sites within the vicinity. Coulson *et al* 1987, suggested that birds determine where they are going to forage for the day prior to departing from the roost. This may provide the reason why gulls from the main study landfill used other landfill foraging opportunities during freezing conditions. The use of these alternative roost sites by other gulls may have drawn some birds to forage at different landfill sites located closer to the alternative roosts.

Species such as gulls, that pose a significant birdstrike risk, continue to use the same foraging environment but in different locations. Almost no interchange of birds caught at landfill sites was found to occur with birds feeding on tidal river mudflats despite this being the second largest habitat used by foraging gulls in the area. Interchange did occur for parkland and pasture where gulls were observed searching for worms. Individual birds that are able to exploit different foraging locations should benefit when their regular sites become unusable. In the case of landfill facilities, this may be due to closure, implementation of bird control, or reduced tipping of suitable waste due to high wind conditions etc. In the case of parkland and pasture, it is likely to be due to weather conditions such as freezing ground. Apart from the influence of tide, the mudflats along the river do not freeze over and are thus available to foraging birds throughout the winter. It would appear, therefore, that birds foraging at traditional coastal mudflats do not need to adapt to forage in different environments. Within a radius of thirty miles from a roost, freezing conditions are likely to affect all grassland areas and as such landfill may be more important to these birds than other foraging habitats during winter.

Species attracted to forage at existing landfill sites will, if available, utilise other landfill sites on a regular basis within the same area. Should birds remain at an existing roost site, following deterrence at a landfill facility, direct flightlines to new sites can be plotted to determine whether they will increase or decrease the birdstrike risk to an airport. When alternative roost sites exist in closer proximity to alternative landfill sites, birds are more likely to move to both the new roost and feeding site. If this does not occur, then deterrence measures at the roost sites can always be implemented in conjunction with deterrence at a landfill. The removal of landfill foraging opportunities in the vicinity of an aerodrome will result in a change in bird behaviour that may or may not be of benefit to flight safety. The common assumption that any bird attractive habitat in the vicinity of an aerodrome should be removed needs to be carefully considered. Unless there are no other such sites in an area, or all such sites within the vicinity can be removed, suitable studies need to be undertaken to show that new flightlines will not create additional risk.

Where a site has been identified as causing a potential risk to flight safety, it is now clear that birds will rapidly exploit the same resources within the area assuming they are not already at carrying capacity. Birdstrike risks posed by the development or removal of bird attractive habitats need to be evaluated in relation to the distances species of concern will travel. In this case, the landfill site at which studies were undertaken was situated outside the conventionally accepted distance from an airfield at which airport operators have the opportunity to insist on management. Should a site have existed to the north east of the airport and control had been implemented, the risk to the airport could have been significantly increased. It is recommended, therefore, that airport operators be aware of all sites that attract birds within 30 miles of their aerodrome and request consultation should any change in bird management or habitat use be planned.

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