EFFECTIVENESS OF BEST PRACTICE BIRD CONTROL ON LANDFILL SITES IN RELATION TO GULL FEEDING BEHAVIOUR

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Abstract

This paper aims to show how bird behaviour can be used to guide best practice bird management plans for landfill sites. Bird hazards at landfill sites represent one of the most significant yet predominantly controllable off-airfield concerns for flight safety. ICAO standards provide airport operators with the opportunity to attempt to eliminate such hazards from the environment surrounding their aerodrome.

Bird numbers were recorded at five landfill sites with active integrated deterrence regimes in place and at a landfill site with bird exclusion netting. Both netting and integrated strategies delivered highly effective levels of control although breakdown frequencies and amounts varied. Behavioural observations of birds showed that active systems can be significantly improved by ensuring dawn to dusk, seven day a week deterrence is implemented and that netting systems can be improved by ensuring adequate maintenance and back-up control is specified within management plans. Irregular failures in control do not generally result in birds utilising a site. Nevertheless, failures should be rectified immediately if birds are noted around a site or within 3 hours if not. Gulls required only 20 minutes of cumulative foraging time on a landfill site to meet their daily energy requirements. Spot checks of, for example, one hour are thus ineffective at highlighting failures in techniques. Airport operators need to ensure several full day visits are undertaken on random occassions. Bird management should be available seven days a week, 365 days a year from ”before birds arrive until after birds leave” as a pose to ”dawn to dusk”. Birds that roost near to a site can still gain sufficient foraging time to feed pre-dawn and post dusk when deterrence is removed. Standards within a management plan may allow some tolerance towards small numbers of birds, however, they should always include targets for zero tolerance.

Key words: landfill, bird control, ICAO standards, foraging time, bird control targets.

1. Introduction

Landfill sites can pose a significant risk to flight safety when large numbers of birds pass through the same airspace as aircraft on their way to roost or breeding sites (Baxter 2001). Domestic, commercial or industrial rubbish site operators are thus coming under increasing pressure from national regulators to deter birds. This often occurs in relation to factors such as disease transmission between birds, livestock and people, on-site health and safety and, of course, birdstrike risk. ICAO standards now provide airport operators with the opportunity to ensure that any sites implementing control measures do so to a standard suitable for reducing flight safety hazards.

In the UK alone there are over 400 potentially bird attractive landfill sites situated within 20 miles of aerodromes. Gulls regularly commute this distance between feeding and roosting sites (Horton 1983). It is clear, therefore, that many more sites than those currently reviewed as part of the planning process (within eight miles of an aerodrome in the UK) could be creating a birdstrike risk.

The UK planning process can prevent the extension, or even the development of landfill sites due to the prospect of scavenging bird populations within this safeguarded area. Sites that are permitted may require stringent bird management processes to eliminate the potential risk of birdstrikes. Techniques frequently used range in cost, for example, from around 250 euro's for the least expensive bird scaring kites, to around 60,000 euro's per year for professionally implemented, seven day a week active deterrence. Fixed systems such as netting exclosures can range in cost from c.1 million to six million euro's. Whilst different techniques and methods may be effective for deterring birds at different sites (Baxter 2001*), it is essential that sites are bound by practicable standards that ensure any failures in a system can be rectified and that flight safety is not compromised. The probability of movements of birds between landfills and roost sites can often be predicted (Baxter *et al* 2003). Understanding the ecology of scavenging birds in relation to landfill sites and the time they require to gain sufficient food to survive each day is thus critical to setting appropriate standards and targets for deterrence. Herring gulls on landfill sites are thought to require 30 minutes of active foraging each day to gain sufficient calories to survive (Coulson *et al* 1987). There is little data to show how long Black-headed gulls, a frequently struck bird in Europe, require and thus how long they need to be deterred from a site each day.

The upgrading of the International Civil Aviation Organisation (ICAO) recommendations to a series of standards in November 2003, has provided airports with the opportunity to review the impact scavenging birds have on their birdstrike risk. The specific standard within Annex 14 relates to the requirement to remove any bird-attracting developments in the vicinity of an airport:

"Garbage disposal dumps or any such other source of attracting bird activity on, or in the vicinity of, an aerodrome should be eliminated or their establishment prevented, unless an appropriate aeronautical study indicates that they are unlikely to create conditions conducive to a bird hazard problem".

The implications of these standards have effectively been ratified in the UK as any domestic waste landfill site within eight miles of an airfield. It is unlikely that existing sites will be eliminated from the environment. A standard will therefore be required that ensures effective bird management measures are put in place where appropriate. This paper provides a baseline standard showing the effectiveness of professionally implemented bird deterrence and relates this to a standard that is achievable, and is based on the foraging behaviour of scavenging birds on landfill sites.

2. Methods

2.1 Control systems

A trial bird exclosure netting system was evaluated during winter 1997 / 1998 (Jackson 1999). The system enclosed all waste deposited for a 10 week period during which large numbers of birds would normally utilise the landfill for foraging. Active deterrence was evaluated between April 2003 and March 2004 (Baxter 2004). Active deterrence included falcons, blank shot, pyrotechnics, distress calls and bird scaring kites and was implemented under site operating hours or from dawn to dusk each day. Scavenging birds under both regimes were recorded on each hour between dawn and midday or midday and dusk on a randomly selected morning and afternoon each week. Bird numbers were recorded on the tipping area, covered waste, circling, loafing, bathing, and in surrounding fields on one

morning and one afternoon each week. Numbers of birds and the time they were present foraging was recorded whenever breakdowns in deterrence occurred. Times during which control was implemented were compared to numbers of birds attempting to forage.

2.3 Foraging behaviour

Foraging behaviour of adult Black-headed Gulls was observed on landfill sites during winter 2001/02 in northern England. Number of pecks made and items eaten during active foraging spells within timed periods was recorded. Calorie intake rate was calculated using data from Hunt, 1972 based on "average garbage mix". All food items swallowed were observed. Size of food taken was recorded based on comparison to bill length and from 10 appropriately sized food items that were taken from the tip and weighed. Number of pecks made and items eaten during 178 x two-minute observation periods of individual birds were recorded. Flock size and proportion of birds foraging was also recorded. Temperature, wind direction and weather conditions was also recorded.

3. Results

3.1 Netting

Gull numbers on the landfill site were consistently high (max 2893) prior to installation of the netting exclosure. A mean of 1022 birds (Standard deviation=799) was recorded. When the net was operational, a dramatic decline in the number of gulls on site occurred. The mean decreased to 29 (SD=234.28, Kruskal-Wallis $p<0.00001$). During the net-on phase, the proportion of gulls flying over the site was 12.2% and loafing on the site was 72.3% suggesting that birds present were awaiting foraging opportunities. After the net was removed, gull numbers increased again to a mean 487 (SD = 399). Corvid numbers fell throughout the study suggesting a natural decline in numbers at that time of year was occurring. Pre control mean 125 (SD=105.37), net on mean 77 (SD=59.23), net off mean 55 (SD=34.52). Netting resulted in a rapid decline in gull numbers although breakdowns did occur.

3.1.1. Breakdowns in netting

High winds and limited working space resulted in rips in the netting system. This in turn allowed birds access to the refuse within the net and a breakdown in the control. At its peak, this involved 460 gulls and 260 corvids foraging on the waste for two days. Additionally the operating system involved a door on the net that was left open overnight. This resulted in a similar breakdown with 408 gulls and 220 corvids present on the waste the following day. When these controllable breakdowns were removed from the results (i.e. when the net was being operated correctly and was in full working order), mean peaks of just 4 gulls and 50 corvids were present on or around the site.

3.2 Active Deterrence

3.2.2. Dawn to Dusk Control

The mean number of gulls and corvids present on or around landfill sites with dawn to dusk active deterrence in place was 19 and 66.85 birds respectively. Of these a mean of 11.75 gulls and 99.59 corvids were present on the landfill. 98.1% of all counts at dawn to dusk sites involved less than five gulls. 98.4% of all counts involved less than 20 gulls and only 1.1% of counts involved more than 100 gulls. Birds were only recorded for more than 20 cumulative minutes on just three occassions per site per year. 36% of hourly counts involved less than 5 corvids. 72% of counts involved 50 or less corvids and 16% of counts involved more than 100 birds.

3.2.3. Operational Hours Control

The mean number of gulls or corvids present on the landfill site was 12.84 birds and 99.69 birds per hour respectively. Over 100 or each species group was present around the site. 91.4% of hourly counts during operational hours involved less than five gulls. 95.9% of all counts involved less than 20 gulls and only 0.7% of counts involved more than 100 gulls. Groups of more than 20 gulls on-site were observed during operational hours once every six days. 47.6% of hourly counts involved less than 5 corvids. 82.5% of counts involved 50 corvids or less. 8.59% of counts involved more than 100 birds on-site. Operational hours deterrence resulted in birds gaining access to forage at the site outside the periods when control was in place.

Figure 1 – Gulls and Corvids on or around landfill during dawn to dusk active deterrence

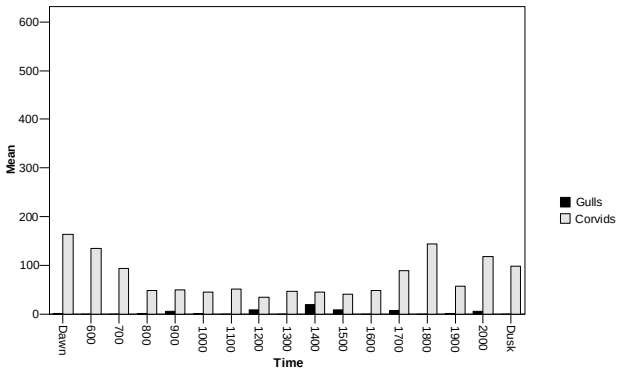
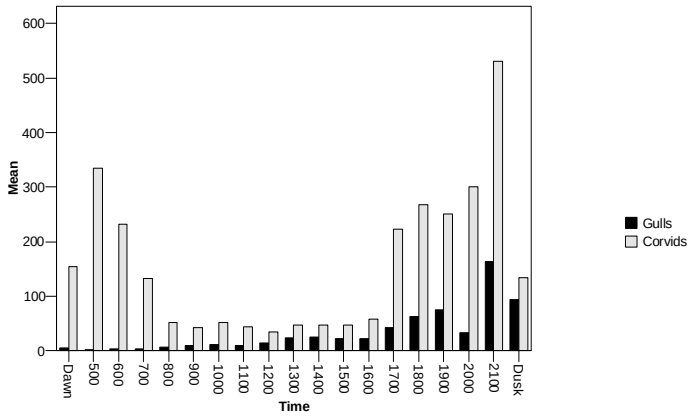


Figure 2 – Gulls and Corvids on or around landfill during operational hours deterrence



When hours of deterrence are limited numbers of gulls and corvids present is higher than when dawn to dusk deterrence is implemented. Significantly less numbers of birds are present outside operational hours on sites where dawn to dusk deterrence is implemented (Gulls U = 12.44 P <0.0001, n = 963, Corvids U = 5.23 P <0.0001, n = 963). Birds are thus adopting new foraging strategies and demonstrating their adaptability when access to foraging resources is still available. Figures 3 and 4 demonstrate similar impacts when control measures were removed on Saturdays and Sundays.

Figure 3 – Presence of gulls and corvids when dawn to dusk deterrence implemented.

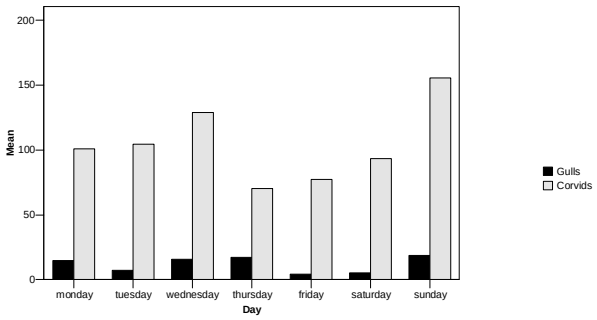
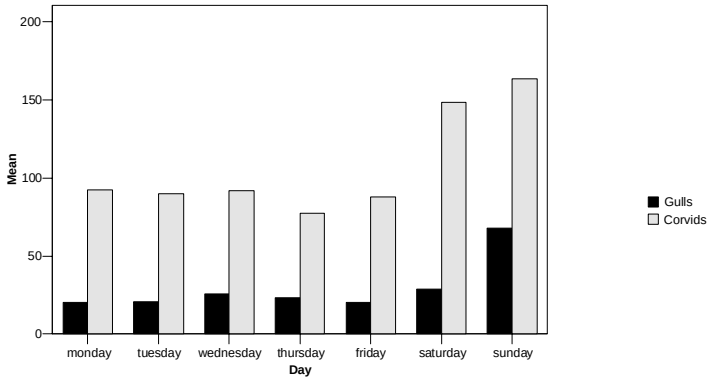


Figure 4 – Presence of gulls and corvids between 8am and 5pm when operational hours deterrence implemented.



Gulls and corvids are more likely to forage outside operational hours and on days when control is not present. Control was implemented between 8am and 5pm on weekdays. No control was in place on a Saturday and Sunday during the operational hours regime. Corvids were present in significantly higher numbers throughout the weekend (Corvids U = 12.414 P <0.0001, n = 2024) with gull numbers increasing substantially on Sunday's (Gulls U = 8.48 P <0.0001, n = 2024). No significant difference was observed between weekends and weekdays for gulls or corvids at sites operating dawn to dusk deterrence. Gulls U = 0.382 P =0.702, n = 1283; Corvids U = 1.186 P =0.236, n = 1283.

3.2.1. Breakdowns in control

Breakdowns in active deterrence occurred throughout the study period and resulted in small numbers (<100) of birds gaining access to forage at sites approximately once each week. These breakdowns were short lived (mean = less than 3 minutes) and were generally caused by deterrence staff preferring to fly falcons. Preparation time of falcons (attachment of radio-tags, flying jesses etc), and transport of birds to a suitable point on site often resulted in delays of 10 to 15 minutes. This allowed small groups of overflying birds to land on the site. Only when this enthusiasm was compounded by flying in inappropriate weather conditions, did significant breakdowns occurred. On 30 occassions (at three sites) staff departed a site to retrieve birds over the 12 month study period. This led to breakdowns that involved more than 20 gulls feeding for more than 20 minutes on 9 occassions in total (3 per site). Two of these occasions were caused by on-site injuries to birds. All departures over 3-hours resulted in breakdowns.

Further breakdowns occurred due to the proximity of sites to roosting areas. Yet again, bird behaviour impacted on the success of sites that ran equivalent bird deterrence regimes. Birds that fed at one landfill and roosted approximately 13 miles distant, arrived later and departed earlier from the landfill. This contrasted significantly with birds that roosted only two miles from another landfill. The following figures contrast the actual hours when birds were observed feeding with the hours required to prevent feeding and show that at one site, success was achieved whilst at the other, birds were able to continue to forage after deterrence was removed at the end of the day. These anomalies only occurred during summer.

Figure 5 –Start times for UK landfill deterrence vs times birds present.

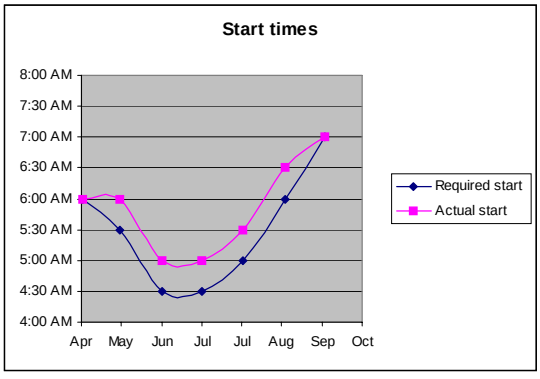


Figure 6 – Finish times for UK landfill deterrence vs times birds present.

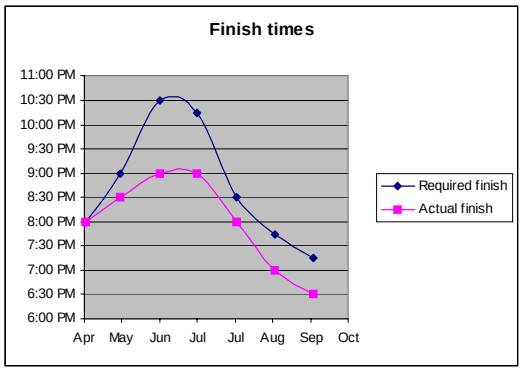


Figure 7 – Presence of birds at site 2 miles from roost.

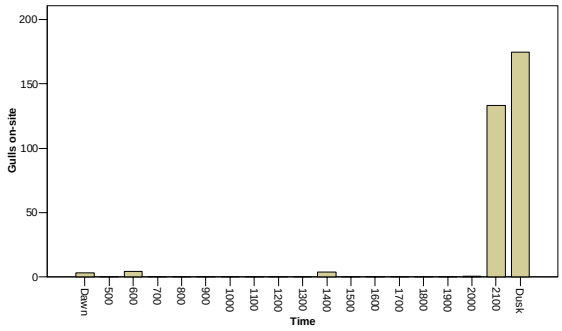
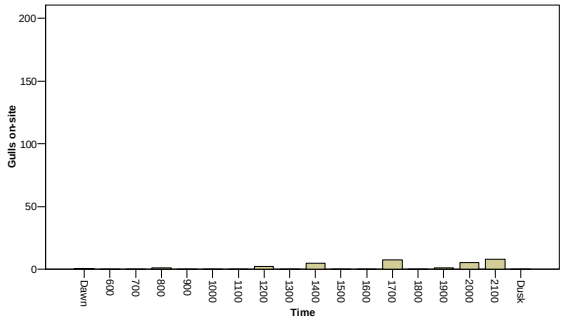


Figure 8 – Presence of birds at site 13 miles from roost.



Figures 5 – 8 demonstrate how identical deterrence implemented to the same standard and over the same periods does not necessarily result in identical results. The proximity of roosting sites to landfill sites needs to be carefully considered when developing management plans to deter hazardous birds from landfills close to airports.

3.3 Foraging behaviour

Mean flock size of Black-headed gulls was 235 (n=11). Mean number foraging during monitoring sessions was 35.25 birds. Mean temperature during the monitoring periods was 7.28^{o}C. Black-headed gulls were observed for a total of 178, two-minute sessions over an 11 day period. Birds made a mean of 25.42 pecks every two-minutes. The number of food items eaten ranged between four and 18 with a median of 11. The mean weight of an item of food eaten was estimated at just 0.188g (n=10) based on size in relation to bill length. Calorific content of garbage "average mix" is quoted at 154 cal/100g (Hunt, 1972). Thus one item of garbage = 154/(100/0.188) = 0.290 calories. The calorific value of a two-minute foraging session to a Black-headed gull on a landfill site would therefore be 3.190 kcal. Lasiewski and Dawson (1967) predict that a bird weighing 275g - the average weight of a Black-headed Gull (Brough, unpublished data) - would have a energy requirement of 30.79 kcal per day. This equates to 19 minutes, 18 seconds active foraging on a landfill to gain sufficient resources to survive the day.

Discussion

Reducing the bird hazards present at landfill sites close to airports requires the setting of stringent standards. These standards must be based on bird behaviour and should not, for example, allow a breakdown of 30 minutes to occur before being rectified. Effort should be made to prevent all birds from landing on a site at all times (Zero tolerance). Good bird deterrence and effective bird netting exclosures should result in birds vacating an area completely. Should this be the case, birds will not frequent an area and any subsequent breakdowns in control are unlikely to result in large numbers of birds attempting to forage at a site. The behaviour of scavenging birds is thus key to ensuring successful implementation.

Both netting and active control proved effective at reducing birdstrike risks when implemented to a high standard. Netting systems, when properly operated, are the most effective bird control systems available. They do, however, need to be operated correctly and maintained effectively to continue exclusion. Breakdowns can occur and could involve large numbers of birds if a problem was not rectified or additional measures put in place. Deterrence systems were also highly effective but suffered more frequent breakdowns involving fewer birds. The use of falcons enhanced the effectiveness of other techniques by reducing their requirement and preventing habituation from occurring. This correlates well with observations of birds habituating to single techniques when used independently (Baxter 2001). The use of falcons did, however, result the majority of breakdowns when they were flown at inappropriate times. Poor weather conditions need to be included within management plans to ensure that the selection of individual techniques within an integrated system is undertaken with a greater emphasis on bird deterrence. Both active and netting systems need to ensure that any breakdown is rectified immediately if birds are present, or within 3 hours if not. In active regimes, several sub 3-hour breakdowns occurred that did not result in birds gaining access to the site. All breakdowns over 3-hours did result in a breakdown. This may suggest that some birds, at least, are scouting the site each day.

For effective bird control to be implemented it requires full exclusion of birds throughout daylight hours. The utilisation of landfill sites by gulls is often linked to the hours during which a site is operational and taking domestic waste (Coulson et al). Whilst the operational day may provide the best foraging opportunities for gulls they are still sufficiently adaptable to be able to make use of the foraging opportunities presented by covered waste. If birds are prevented from gaining access to a site during its operational hours they will forage during early mornings, evenings and at weekends when daylight hours permit. Only the use of a regulation covering of not less than 150mm of inert cover was sufficient to prevent birds feeding on covered waste (Baxter unpbl).

Black-headed gulls can survive by actively foraging on a landfill site for approximately 20 minutes each day during winter. This is similar to the 30 minutes required by Herring gulls when they are visiting landfill sites (Coulson et al). Birds will often spend all day at the same landfill site foraging (Baxter 2005). The implications for successful bird deterrence are that whilst any foraging is likely to benefit an individual, they are unlikely to rely on a site if they are unable to forage for twenty cumulative minutes each day. Deterrence thus needs to ensure this does not occur.

Many existing management plans specify dawn to dusk, seven-day week deterrence. Care is needed to ensure that dawn to dusk covers all periods when birds may be attempting to forage. Results from these studies show that proximity to roosting or breeding areas can have a significant impact on the hours required to deter gulls. If sites are situated adjacent to, or within minimal flying time of, a roost birds will forage until close to nightfall prior to departing a site. They may thus be able to feed for the required 20 minutes after pest control staff have left. This was particularly noteworthy when pest control staff left one particular site at 9.15pm in the evening with no birds within view. On departure, over 1000 birds that were loafing approximately 1.5 miles from the site, would fly to the landfill and successfully forage for over 30 minutes. Pest control staff were unaware of any continued use of the site by gulls. Management plans that specified a presence or regular checking to last light would have prevented this from occurring.

Summary

Management plans should allow for no-notice visits lasting for several hours and including out of hours visits as requested. The adaptability and opportunism of gulls to different foraging circumstances show that bird control measures at landfill sites need to be implemented to a strict regime to ensure

birdstrike risk is minimised. Zero tolerance should be applied in an attempt to try and stop birds from viewing a site as a viable foraging attraction. Account should be taken of proximity to roost or breeding sites and the terms “dawn to dusk” substituted with “first and last light” where appropriate. Should any gulls use a site for a cumulative twenty minutes it should be considered a breakdown. Should more than twenty birds land on a site it should be considered a breakdown unless they are immediately dispersed. This therefore suggests that 19 gulls, for a cumulative 19 minutes each day is the achievable standard that bird management regimes on landfill sites should not exceed. Should breakdowns of more than 20 gulls for 20 minutes foraging on site occur more than three times a year, additional management measures should be implemented to ensure effective bird control is maintained.

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