EFFICACY OF INTEGRATED BIRD MANAGEMENT STRATEGIES AT UK LANDFILL SITES.

ANDREW T. BAXTER, Central Science Laboratory, Bird Management Unit, Sand Hutton, YORK, YO41 1LZ, UK

Abstract: Scavenging birds that are attracted to feed at domestic waste landfill sites may transmit disease, cause nuisance and noise, carry garbage from sites, impact on areas of conservation concern, defecate on amenity grassland, neighbouring property and drinking water reservoirs, and pose problems for flight safety. Local planning controls may be used to prevent the establishment of potentially hazardous bird populations at such sites by implementing bird control measures as part of site licensing or management plans. It is crucial, therefore, to understand how best to implement the various techniques available on the market to achieve cost effective reductions in scavenging bird numbers. The UK Central Science Laboratory has scientifically evaluated a series of automated and actively implemented bird deterrence techniques over a period of four years. By evaluating the various factors that have caused breakdowns in individual systems, combinations of complimentary techniques have now been applied at a series of sites throughout England. Suites of automated systems, systems operated by site staff, and professionally implemented combinations of deterrence have been deployed and monitored. This paper describes the results of this study, the findings of which could be equally well applied to the deterrence of scavenging gulls and corvids from waste management facilities in North America.

Key words: bird control, *Corvidae,* corvids, distress calls, falconry, gulls, *Laridae,* landfill.

Proceedings of the 10th Wildlife Damage management Conference. (K.A. Fagerstone, G.W. Witmer, Eds). 2003

INTRODUCTION

Birds are well known visitors to landfill amenities (Threlfall 1968, Harris 1970). Members of the gull (*Laridae*), and to a lesser extent corvid (*Corvidae)* families, are the predominant species that forage on garbage dumps in the UK (Mudge and Ferns 1982). These species cause a variety of problems for landfill site operators, local residents and the local environment. Birds may cause nuisance problems such as defecation on machinery windows, and noise (Baxter 1999), transmit and carry disease (Ortiz and Smith 1984), defecate and transfer litter off site (Ecoscope 2000), impact on nature conservation areas and create a birdstrike hazard to aircraft (MacKinnon 2001). Congregations of corvids at landfill sites may be of particular concern due to their role in the spread of West Nile Virus. Corvidae accounted for 90% of birds found to be carrying the virus (CDC 2003).

Various issues may therefore necessitate the implementation of landfill bird control. The level of deterrence required to solve particular problems may vary (Baxter 2002). Deterring birds that cause nuisance to site staff may not require implementation of control at all times. Reductions rather than total eliminations of

birds may be sufficient to prevent the impact of scavenging birds on areas of conservation concern. Preventing large flocks of birds from congregating either on-site, or in the local area, may reduce their impact on nearby residential areas. Stringent deterrence measures that ensure the exclusion of all birds may, however, be required at sites in the vicinity of an airfield (CAP 680 1998). The potential for different standards to be required at different sites suggests that bird management regimes can be tailored to specific sites.

In addition to the background reasons for deploying bird management techniques, the success of regimes may be influenced by the presence of other bird rich areas in the environment. The presence of roosting reservoirs, breeding colonies and the coast are known to impact on the presence of gulls at landfill sites in Europe (Baxter and St. James, unpublished data; Pons 1992). Gulls are known to commute over 30 miles a day (Horton et al. 1983) and corvids over 15 miles a day (Sharp 2001) between roosting and feeding sites. Seasonal migrations of various species and the geographic location of a site may also influence the numbers of birds present in an area at different times of year (Baxter 2001). Food availability and site management measures such as covering waste with inert materials may also influence numbers (Personal observation), as can the presence of other landfill facilities in the vicinity of a site (Coulson et al. 1987). Effective deterrence of birds from some landfills may therefore be achievable with less intensive control strategies than at others. This may have significant cost implications for the operator.

This paper provides a summary of the results of recent studies undertaken in the UK on the efficacy of various combinations of bird scaring techniques used at a series of landfill sites within different local environments and seasons. The techniques used in this study are those that are most readily available in the UK.

METHODS

Deterrence was implemented at six sites using two different operational protocols. Method one (Operational hours control) deployed deterrence from 0730 to 1645 from Monday to Friday. Method two (Dawn to dusk control) deployed deterrence from first light to last light seven days a week. Combinations of deterrence measures were deployed based on the results obtained during studies of individual techniques (Baxter and St. James 2003), and on the likelihood that less intensive combinations could be successful when targeted at sites that attracted fewer birds. A single, specialist bird control company implemented deterrence according to manufacturers instructions. Where non-automated equipment was used, bird control staff aimed to prevent scavenging birds from feeding or loafing on or around a site. The following combinations of control were deployed.

Automated control systems

Automated control systems that required minimum staff input (and thus cost), included a static distress call unit, an Artificial Sound Generating System (ASGS), Rope Bangers and Helium Filled Bird Scaring Kites. The kite and rope bangers were used on all days where possible and combined with either an ASGS or Distress Call Unit on alternate days.

Joint control systems

Automated systems as detailed above were combined with alternate days of full control (Methods section 4).

Manual control systems

Manual control systems utilised personnel operated equipment. Systems were essentially the same as automated equipment but were directly targeted at birds as required. In addition to the continued use of kites, a hand held distress call unit replaced the static distress call or ASGS. Bird scaring rockets and blank rounds from a starting pistol replaced the rope banger. Manual control systems were implemented using manufacturers recommendations where available and "best judgement" from bird control staff.

Full control systems

Full control systems included the use of trained birds of prey (*Falconidae*) and live rounds from a shotgun in addition to manual control systems.

Deterrence was implemented during two periods; "summer" – from April to August, or "winter" – from October to February inclusive. The following results provide summaries of summer and winter control periods at different sites using different systems.

RESULTS

Deterrence data were obtained from six UK landfill sites between March 2001 and March 2002. No control data were obtained between April 1999 and February 2001. The following results were obtained. See Table 1 and Table 2.

Table 1. Pressure category of landfill relating to gulls during summer.

Site Name	Mean Hourly Count	Category
Peckfield	164.8	Medium
Pilsworth	391.3	Medium
Whitehead	252.7	Medium
Heathfield	1976.4	High
Erin	94.6	Low
Risley	231.3	Medium

Table 2. Pressure category of landfill relating to gulls during winter.

Site Name	Mean Hourly Count	Category
Peckfield	1024.9	High
Pilsworth	1147.5	High
Whitehead	817.3	Medium
Heathfield	5375.8	High
Erin	1099.2	High
Risley	739.3	Medium

The number of birds present during winter was higher than the numbers of birds present during summer. Sites were assigned to "pressure" categories where low pressure sites had a mean hourly count of below 100 gulls, medium pressure sites between 100 and 1,000 gulls, and high pressure sites over 1000 gulls on site per hour.

Automated systems

Automated systems were implemented at a low and medium pressure site during summer and two medium pressure sites during winter. During winter, the techniques failed to prevent highly significant increases in both gull numbers ($U=8.29$, $P<0.001$) and corvid numbers ($U=4.09$, $P<0.001$ (All tests Mann-Whitney U-tests)).

The following results show the mean hourly count per month achieved during summer at the low and medium pressure sites. (See Figure 1 and Figure 2). Gull numbers decreased at the low pressure site ($U=3.96$, $P<0.001$) but returned to pre-control numbers within 10 weeks at the medium pressure site ($U=1.74$, $P<0.169$). Observations showed small numbers of gulls present on surrounding water bodies at the low pressure site throughout the study period. On removal of deterrence numbers of gulls rapidly increased, suggesting that birds were still in the environment during the period of deterrence. Corvid numbers showed significant increases ($U=2.37$, $P<0.05$) at the low pressure site, but showed

no change at the medium pressure site (U=0.39, P<0.696).

Figure 1. Summer low pressure sites.

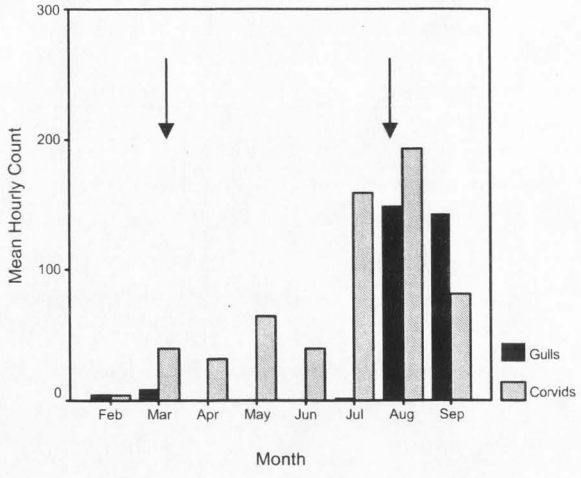
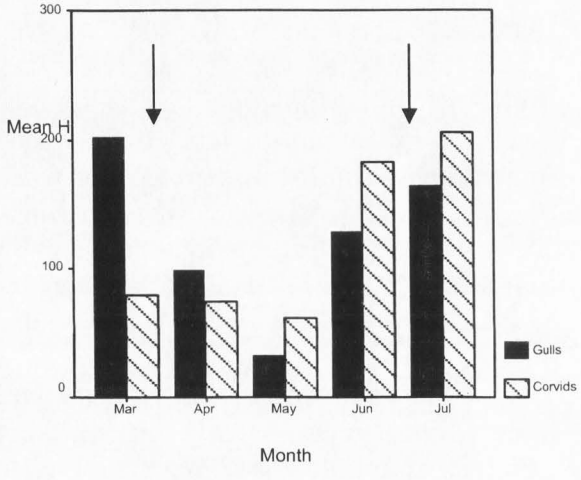


Figure 2. Summer medium pressure sites.



Joint Control

Alternate days of full control and automated techniques were integrated from early and late December following breakdowns in the efficacy of automated systems. Joint control systems were in place from early and late December respectively (See Figure 3 and Figure 4).

Gull numbers were highly reduced (U=13.24, P<0.001) from pre-control levels. Corvid numbers increased (U=2.08, P<0.037). Using automated systems within a joint regime may signal the presence of full control systems and be an effective way of reducing bird control costs at landfills.

Figure 3 Winter low pressure sites.

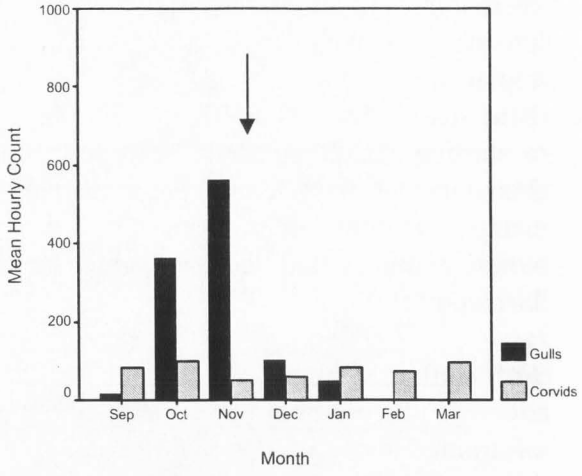
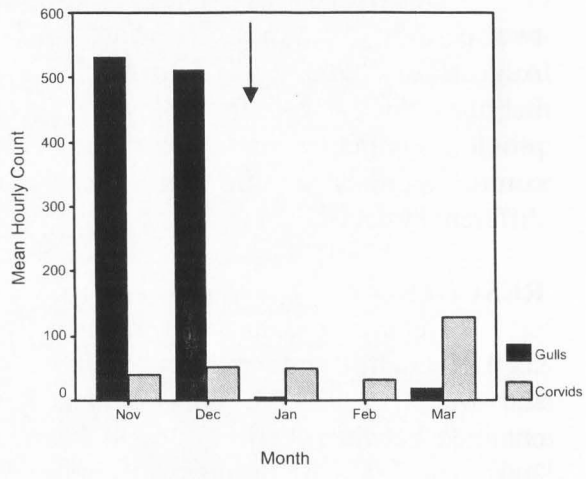


Figure 4. Winter medium pressure sites.



Manual control systems

Manually operated control resulted in significant reductions in bird numbers during summer at medium pressure sites (Gulls U = 5.19, Corvids U = 3.65, P<0.001), and to a lesser extent high pressure sites (Gulls U = 3.12, P<0.01, Corvids U = 2.02, P<0.05). The following results show their effectiveness at medium and high pressure sites during winter. (See Figure 5 and Figure 6).

Figure 5. Winter medium pressure sites.

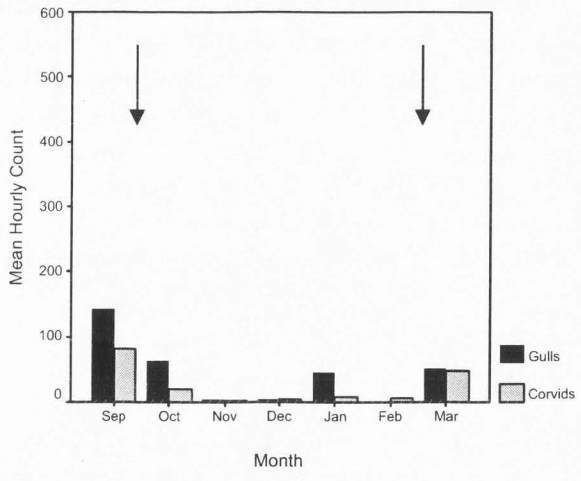
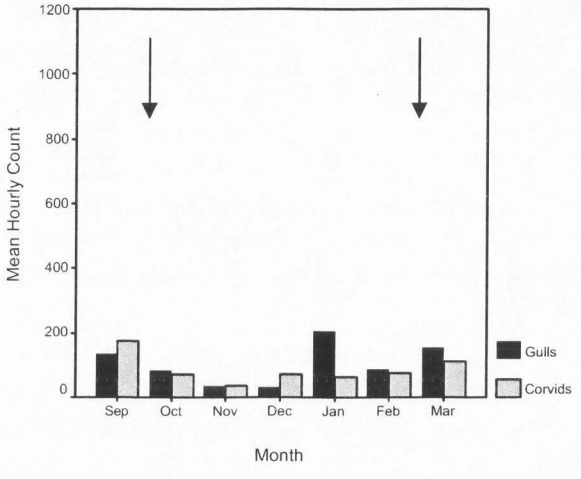


Figure 6. Winter high pressure sites.



Control was implemented from early October until late February at each site. Gull and Corvid numbers were highly reduced at the medium pressure site (Gulls U = 6.51, Corvids U = 12.03, P<0.001). Results from January do, however, show that a mean of 42 gulls per hour were present. At the high pressure site, the mean hourly count of birds on the landfill site frequently exceeded 50 or more gulls or corvids per hour. Control still resulted in highly significant reductions (Gulls U = 6.78, Corvids U = 6.11, P<0.001) but did not eliminate birds from the site.

Full control systems

Control was implemented from early April to September during summer and October to the end of February during winter at two high pressure sites. (See Figure 7 and Figure 8).

Figure 7. Summer high pressure sites.

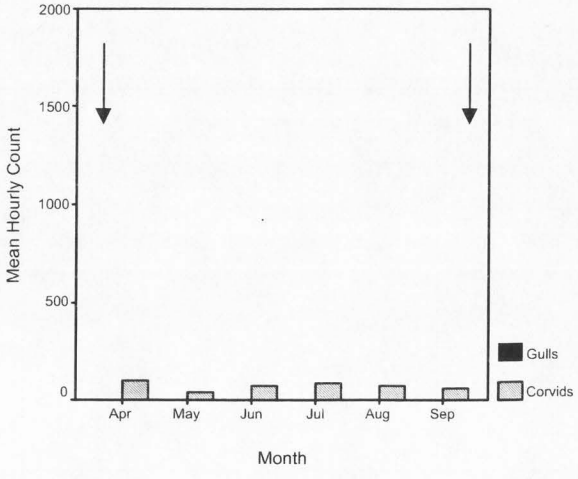
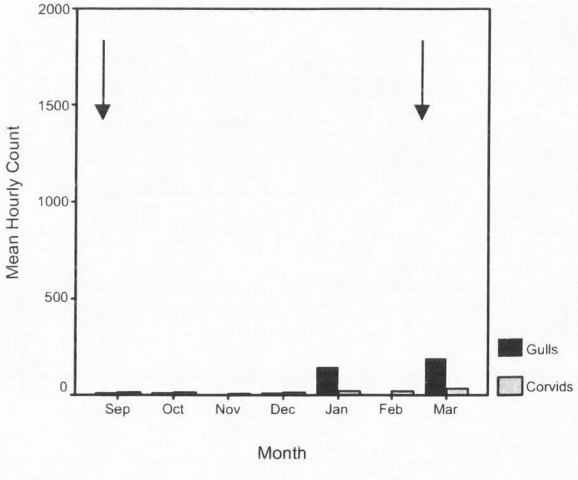


Figure 8. Winter high pressure sites.



Virtually no gulls (summer $\bar{x}$ = 4, U=9.36, P<0.001, winter $\bar{x}$ = 21.4, U =3.44, P<0.001) were present during summer and winter studies. A mean of nearly 150 gulls per hour did, however, occur during early January. Bird control staff took leave during the Christmas and New Year period when the site itself was closed to new refuse. Despite this, birds returned to feed at the site

and initially peaked at 1186 birds in early January when the site re-opened. Corvid numbers were also significantly reduced (summer $\bar{x}$ = 66.7, U=5.36, P<0.001, winter $\bar{x}$ = 11.7, U=2.33, P<0.02). Stringent control is required at all times in order to prevent breakdowns such as this from occurring. (See Figure 9 and Figure 10).

Figure 9. Gull and corvid numbers present on landfill sites using operational hour's deterrence regimes.

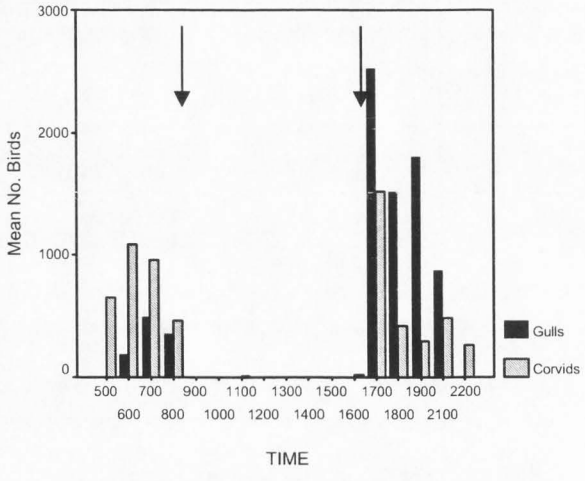
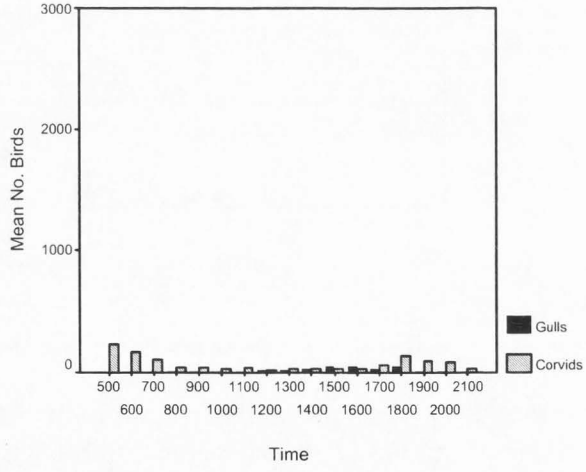


Figure 10. Gull and corvid numbers present on landfill sites using dawn to dusk deterrence regimes.



The effect of implementing operational hours only control, in comparison to dawn to dusk control, can be clearly seen. Both results are taken from similar sites that implemented manually operated control over the same summer period. When control was implemented during operational hours (Figure 9), birds were present during early mornings and late evenings. Consistent levels of deterrence were achieved when control was implemented from dawn to dusk. When complete deterrence is required, control may thus need to be implemented from dawn to dusk.

DISCUSSION

Location and season affected the level of deterrence that could be achieved using different systems. Automated control was effective against gulls at low pressure sites during summer. Trials at medium or high pressure sites failed to deter birds. Manual control was effective at medium pressure sites and reduced, but could not eliminate bird populations from high pressure sites in winter. No studies were made of joint control during summer. They were, however, effective at reducing gull numbers at medium pressure sites during winter.

Full control was capable of complete deterrence of gulls and corvids during both summer and winter. Breakdowns did occur and were caused by short term removals of control (Christmas / New Year break). High pressure sites require consistent and unbroken deterrence regimes to maintain successful control.

The success of automated techniques, when used within a joint regime, was surprising. Following breakdowns in the ability of automated systems to reduce bird numbers at medium or high pressure sites, it is assumed that they must have acted as a signal for full control when used in combination. Cost savings could result through alternating automated equipment with more active deterrence. It is unclear what degree of active deterrence would be required to maintain the efficacy of automated systems within a joint regime.

Further cost savings could be realised by using suitably trained site staff to deploy manually operated systems. At medium pressure sites, almost complete control was possible during winter but required a continual presence. Site staff who have other duties to undertake may not, however, be able to dedicate sufficient time to be able to deter birds to a satisfactory level using manually operated techniques. Despite achieving significant reductions both gulls and corvids were consistently present and continued to gain access to feed throughout the winter.

Combining different combinations of regimes at different sites clearly has the potential for reducing costs whilst maintaining high levels of deterrence. The cost of implementing any human operated control should also be significantly less under an operational hours regime than for a dawn to dusk regime. Operational hours control may be suitable for those sites where the management of bird numbers is required to prevent on-site problems during the working day, e.g. defecation on vehicle windows. In situations that impact on, for example, airfields it would be essential to implement dawn to dusk control and prevent birds using a site at any time.

Conservation concerns may drive the need for deterrence. Implementing operational hours control during summer could actually cause birds to shift their activity to other areas and they may then spend the operational day foraging in the local environment. The risk to nature reserves where species of high conservation value were breeding, could thus be increased. Dawn to dusk deterrence to prevent birds from establishing themselves in an area would be required. The level of control that would need to be implemented would, of course, be dependent on the numbers of birds that were known to visit the site.

Neither automated, nor joint measures were effective against corvids during these studies. Manually operated or skilled control would thus be required where these birds were present in artificially high numbers that affected the agricultural environment or were of concern in relation to the transmission of West Nile Virus. There are clearly opportunities to develop bird management practices further and combine both active and passive control measures alongside additional techniques that may be locally available to create the most cost-effective yet efficient means of reducing bird problems on landfill sites.

SUMMARY

Bird deterrence at landfill sites is driven by the nuisance or hazard factors associated with individual sites. The level of deterrence required is therefore dependent on both the ecological factors affecting the numbers of scavenging birds present in an area and the reductions required to avoid nuisance. The intensity of bird control and, therefore, its cost could be reduced at some sites yet still achieve satisfactory levels of deterrence.

ACKNOWLEDGMENTS

This study was funded via the UK governments landfill tax credit scheme under Entrust approval. Sincere thanks go to the landfill site managers and operators for allowing us to study bird management issues at their sites and to the various CSL ornithologists for collecting the data required for this paper.

LITERATURE CITED

BAXTER, A.T. 1999. Evaluation of bird control techniques on landfill sites. North West Environmental Trust News 4:7-11.

_____. 2001. Gull Movements in Europe. North West Environmental Trust News 8:7-10.

_____. 2002. Fight or Flight – tackling bird control on landfill sites. Journal of Waste Management 2:52-55.

_____, AND K. ST. JAMES, 2003. Update as bird control study enters its final year. North West Environmental Trust News 2:7-10.

_____, _____, AND H. LAYCOCK. In Press. Predicting the bird hazard to aircraft from landfill sites. Proceedings of the International Bird Strike Committee, May 2003, Warsaw, Poland.

CDC. 2003. Provisional surveillance summary of the West Nile virus epidemic, United States, January-November 2002. Centers for Disease Control and Prevention, Superintendent of Documents, U.S. Government Printing Office (GPO), Washington, D.C., USA.

CAP 680. 1998. Aerodrome bird control. Civil Aviation Authority, London, UK.

COULSON J.C., J. BUTTERFIELD, N. DUNCAN, AND C. THOMAS. 1987. Use of refuse tips by adult British herring gulls *Larus argentatus* during the week. Journal of Applied Ecology 24:789-800.

ECOSCOPE. 2000. Wildlife management and habitat creation on landfill sites: a manual of best practice. Ecoscope Applied Ecologists, Muker, UK.

HARRIS, M.P. 1970. Rates and causes of increases of some British Gull populations. Bird Study 17:325-334.

HORTON, N., T. BROUGH, AND J. ROCHARD, 1983. The importance of refuse tips to gulls wintering in an inland area of south-east England. Journal of Applied Ecology 20:751-765

MACKINNON, B. 2001. Sharing the skies. An Aviation industry guide to the management of wildlife hazards. Transport Canada. Ottawa, Canada.

MUDGE, G.P., AND P.N. FERNS. 1982. The feeding ecology of five species of gulls (Aves: Larini) in the inner Bristol Channel. Journal of Zoology 197:497-510.

ORTIZ, N.E. AND G.R. SMITH. 1984.. Landfill sites, botulism and gulls. Epidemiological Infection 112:385-391.

PONS, J.M. 1992. Effects of changes in the availability of human refuse on breeding parameters in a Herring gull (*Larus argentatus*) population in Brittany, France. Ardea 80:143-150.

SHARP, J. 2001. Studying corvid flight lines in North Yorkshire, at dawn, during the winter of 2000/2001. Internal report, Central Science Laboratory, York, UK.

THRELFALL, W. 1968. The food of three species of gulls in Newfoundland. The Canadian Field-naturalist 82:176-180.