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Adopting an integrated, flexible approach to reducing the birdstrike risk from Canada Geese.

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Abstract

Canada Geese overflying the runways at London's Heathrow Airport have been struck on eleven occasions by aircraft during the last ten years. Four of these occurred during the pre-breeding season and seven during the post moult period. A monitoring study was initiated in 1999 to evaluate the movements of geese around the airport and determine appropriate mitigation strategies to reduce the risk of birdstrike.

Moult sites within 13km of the airport were identified. 4,900 moulting geese were caught and fitted with colour rings and radio-transmitters between 1999 and 2004. 2,500 visits were made to over 300 sites resulting in over 10,000 sightings of known individuals. Birds that crossed the airport approaches whilst moving between roost sites and feeding areas in newly harvested cereal crops were identified. Throughout the monitoring period efforts were made to control the risk, but by 2003 it was estimated that 10,000 bird transits of the approaches involving almost 700 individuals occurred during a 50 day period.

The knowledge of the movements of ringed and tagged birds was used to inform a revised habitat management, daily roost dispersal and on-airfield bird deterrence programme in 2004. By adopting a flexible approach to management, an estimated 70% reduction in bird transits was achieved. This paper discusses the techniques used to achieve this reduction.

Introduction

A single Canada goose (*Branta canadensis gigantea*) from a small flock was struck in the approaches to London Heathrow Airport in 1994 (CAA 1995). Observations at the time suggested numbers of birds in the surrounding area may be increasing but the event was considered to be an isolated incident. In 1998 there was a second, more serious birdstrike involving several birds crossing the runways. Investigations suggested these birds were transiting the airfield to feed in recently harvested cereal crops immediately north of the airport.

Canada Geese in the United Kingdom are descended from birds originally introduced from North America in 1665 (Allan *et al* 1995). Their numbers did not, however, begin to expand rapidly until a relocation scheme was implemented by the wildfowl trust and wildfowler's association between 1953 and 1957 (Ogilvie 1969). Their numbers have subsequently increased to over 64,000 individuals by 1991 (Rehfisch *et al* 2002) and may well now exceed 120,000 individuals. They have adopted a residential strategy and do not undergo long distance migrations; if all a bird's requirements can be met in one region and it has no traditional route to follow it will stay where it is. This has occurred to such an extent that some UK birds stay on the

same water body throughout the year. In recent years, Canada Geese in the USA have adopted similar behaviours, remaining at more southerly latitudes throughout the year, possibly attracted by the increasing amount of suitable habitat in urban and semi-urban environments such as city parks, etc.

Populations around London Heathrow airport may have mirrored this national trend. Birds have been observed in Royal parks, country estates and along the River Thames corridor for decades. Systematic census has only, however, been available since the turn of the century (Budgey et al 2000). Moulting populations within 13km of the airport were then estimated (following review) at approximately 3,750 birds. The birdstrike record at the airport shows that the peak periods for Goose activity around the airport occur during the early spring and autumn.

The four spring birdstrikes that occurred were presumed to be associated with general movements of birds seeking breeding grounds. Each of these occurred more recently and could be correlated with an overall population size increase. The remaining birdstrikes all occurred in autumn with the particular reason for movements at this time of year remaining unknown. Studies were therefore undertaken to census the overall population, determine the movements of marked birds in autumn, and evaluate the most effective ways of reducing the birdstrike risk that occurred.

Methods

A pilot research programme was initiated by BAA in 1999 to determine whether birds in the surrounding environment could be marked and the movements of individuals determined. Following the success of this study, the programme was expanded to mark and monitor bird behaviour during subsequent years.

In order to limit the survey area to a practicable range, the aviation safeguarding circle (thirteen kilometres from the airport in question), was used to create an artificial boundary within which Canada goose habitat would be surveyed. Canada Geese were caught on the shores of water bodies during their moulting period. Standard round-up methods involving trained canoeists corralling geese into a specifically designed holding pen were used. Birds were then held whilst they were fitted with individually identifiable metal and colour rings before released.

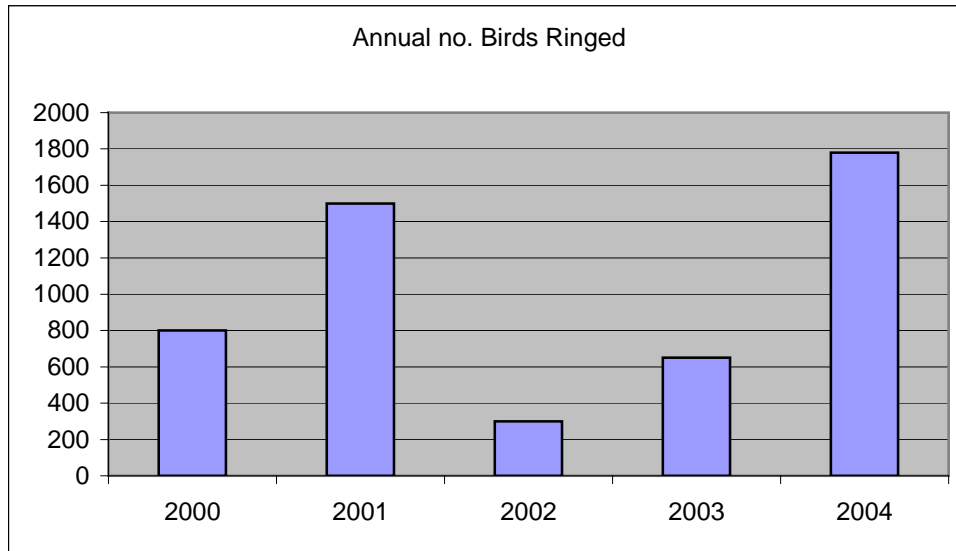
In summer 2000, over 800 Canada Geese were caught near the Airport and marked with coloured leg rings. A further 1500 Canada Geese were marked in summer 2001, 300 in 2002, and 1700 in 2004. Eight birds were fitted with tail-mounted radio tags in 2002. In 2003 waterbodies to the west of the study area were visited with 650 birds being caught and ringed and 13 fitted with improved neck-mounted radio collars.

Moulting flock movements were monitored throughout the year through visual observations using binoculars and a telescope along with a Telonic TR4 radio-receiver to track collared birds. Visits were made to foraging areas around the airfield throughout the autumn. Monitoring was undertaken between dawn and dusk and movements evaluated during the critical period during which birds overflowed the airport or its approaches. The numbers of geese in each locality were recorded, and their arrival / dispersal movements noted. Tagged birds within these flocks assisted greatly in locating the night time roost sites, day roosts and feeding sites used during this period.

Results

The numbers of birds caught and ringed has varied between years due to the areas targeted for ringing. During 2000 and 2001, major moult flocks were targeted in the safeguarded area. In 2002, small moult flocks were targeted, with moult flocks outside the area (Reading) targeted in 2003. Birds along the full length of the River Thames were targeted for the first time in 2004. Almost 1500 out of a possible 1700 birds present on the river within the study area were marked.

Figure 1.



In total 4900 birds were ringed at 55 moult sites between 1999 and 2004. There have been 2,500 visits to over 300 sites to review population movements. This has resulted in over 60,000 observations of Canada Geese. Almost 10,000 re-sightings of identifiable ringed birds have been made including many multiple sightings of the same birds.

The total population in the vicinity of the airport during the moult period was evaluated through capture and observation between the 18th June and 15th July each year. Not all sites were visited in all years. Totals present between years at comparative sites, and including estimates for the whole vicinity, are as follows.

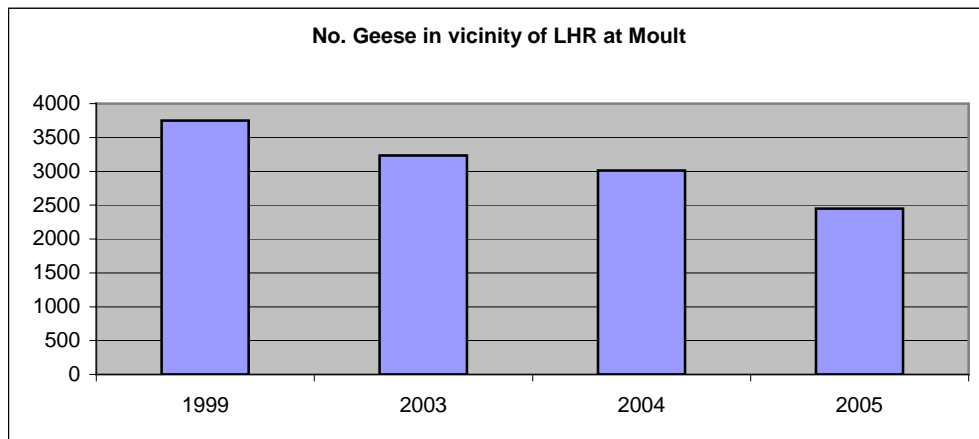
Table 1. No.s Geese at Moulting in Vicinity of London Heathrow

Site number	Moult count (1999)	Moult count (2003)	Moult count (2004)	Moult count (2005)
Runnymede	0	0	55	33
Colnbrook Lake	0	3	0	0
Low Farm	5	23	0	0
Stanwell Moor	8	34	4	0
Stockley Park	10	30	6	19
Langley Park	14	1	0	0
Osterley Park	50	93	78	43
Thorney Park,	13	7	0	0
Prince's Ski Club	48	12	0	6
Wexham Park Hospital	33	40	30	26
River Thames Eton Bridge	87	210	181	159
St Anne's Lake	45	7	5	9
Bedfont Lakes	96	7	0	17
Halliford Mere	102	70	7	25
Elk Meadows	58	8	4	4
Wraysbury BA Sailing	39	5	/	14
Sheephouse Farm Sailing Lake	38	0	nk	nk
Thorpe Park	111	112	119	25
Stoke Place	27	15	0	35
River Thames, Staines / Laleham	200	107	80	27
Upton Lake	54	51	51	0
Virginia Water	98	119	150	88
Littleton Lake	76	39	24	0
Farlow's Lake	49	0	0	5
Wraysbury GP1	53	10	/	18
Wraysbury GP2	87	70	140	48
Shepperton GP1	52	23	14	10
River Thames, Bray Marina	139	87	60	0
Comparative total	1592	1183	1008	611

/ = amalgamated under Wraysbury GP2

Census data shows a consistent trend of reducing goose numbers in the environment. At comparable sites, a 38% reduction has occurred since 1999 although interchange to alternative moulting sites may account for some of this reduction.

Figure 2. Estimated total number geese in vicinity of Airport



The total number of geese in the vicinity of the airport appears to be declining in direct contrast to the expected population rises noted elsewhere in the country. Changes in the status of Canada Geese as a controllable pest bird, and actions to reduce the breeding success of this species that occur throughout the London Region appear to be resulting in a gradual decline in numbers. Approximately 2500 birds are still, however, present in the vicinity of the airport.

Over 96% of Canada Goose movements recorded during this study period were less than 20km. Of the 650 birds marked during the moult to the east of the study area in 2003, only three were subsequently noted in the study area. Only one bird was found to have moved moult areas from a site over 300km north-north west of the study area.

Figure 3.

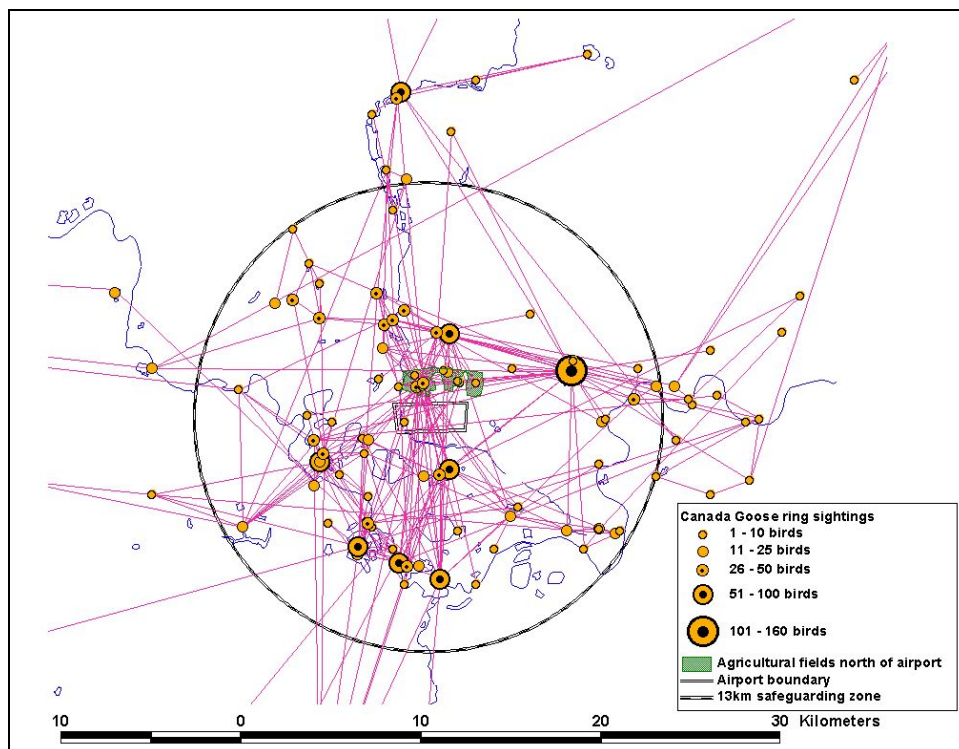
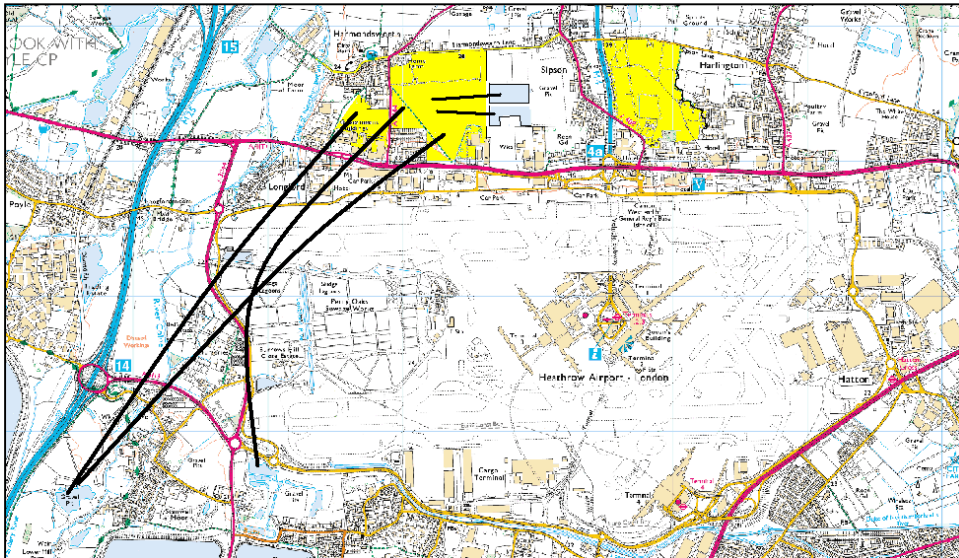


Figure three presents the movements of birds from the moult sites at which they were marked. Movements shown may have been undertaken on a single day or over the full period of the study and do not, therefore, represent specific flightlines. Despite this, the overall movements suggest not only that the population in the vicinity of the airport is relatively closed, but that movements across the airfield predominantly relate to a north-south orientation. They also identify an agricultural area to the north of the airfield where significant numbers of birds were observed. Further analysis revealed that these fields were only visited between August and October.

Observations of marked birds in the fields to the north of Heathrow indicated the moult locations of these birds. Revisits to these sites between August and October, however, did not reveal their presence. Birds were instead located on waterbodies that were shallow, had islands, and were close to the foraging area. Overall movements during this period were thus identified as follows.

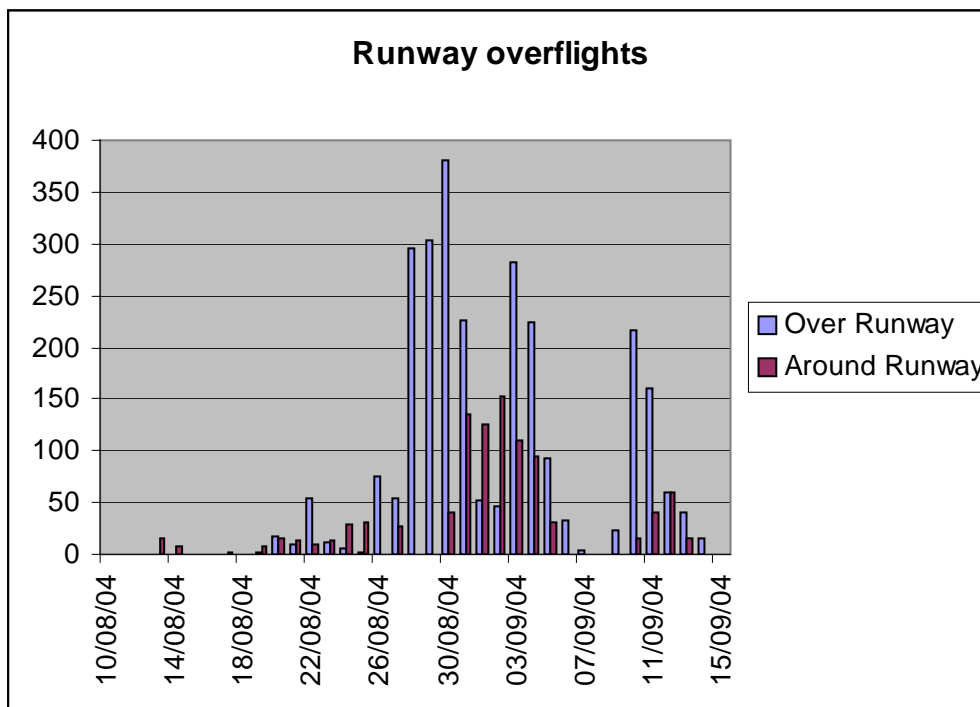
Figure 4.



Overflying birds

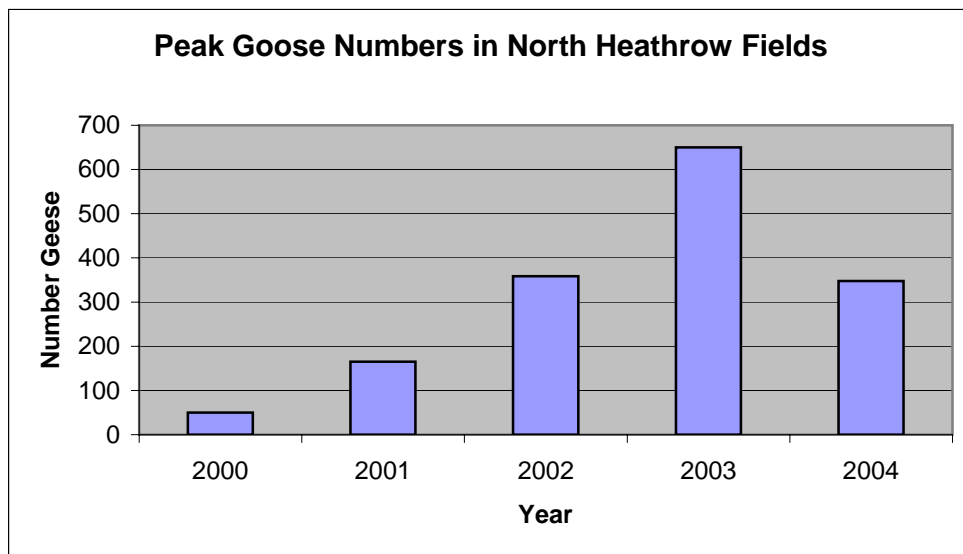
The removal of overflying birds through on and off-airfield shooting was carefully coordinated with off-airfield monitoring, and the management of foraging / roosting sites during 2004. Tentative results suggest that significant reductions in the number of birds overflying the airfield (and therefore the birdstrike risk) were achieved.

Figure 5.



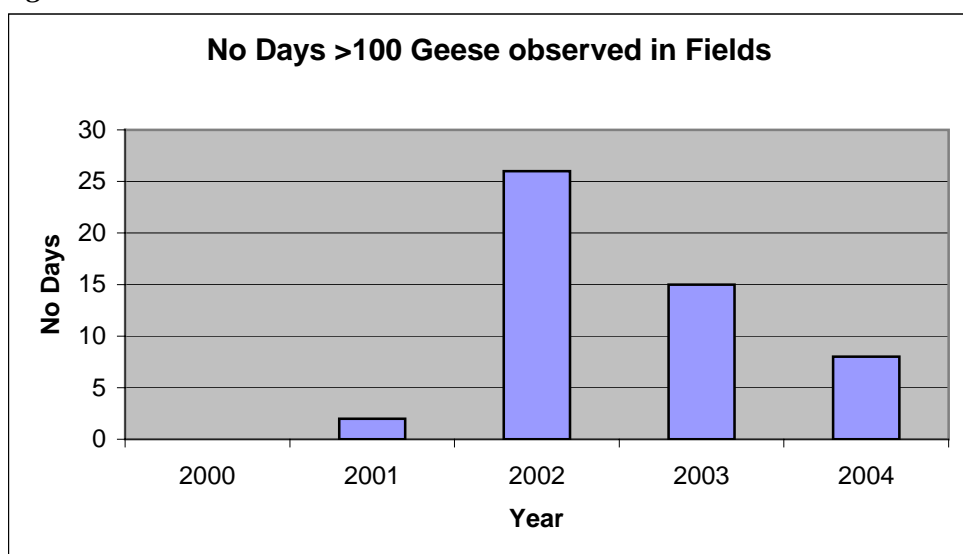
Overflights of the runways occurred on 26 days and involved between 1 and 380 birds. Overflights involving more than 100 birds occurred on 8 days. Increased monitoring effort in 2004 may have resulted in a significantly higher recording of geese. This did, however, provide a greater understanding of movements during the critical period due to combined on and off-airfield monitoring. Geese were rarely noted flying back and forth across the runways during the day. Geese fed in fields on three or four occasions each day and day loafed to the north of the airport. Previous deterrence measures often resulted in birds being prevented from staying in the area each day. They therefore flew over or around the airport more frequently each day. Reduced deterrence in the foraging area in 2004 compared with other years may have reduced overflights by 50%. The number of birds present between 2003 and 2004 was also reduced by c.50%.

Figure 6.



Weather conditions could have had an impact on numbers, with noticeably different patterns of persistent wet weather in August 2004 compared to consistent dry conditions in August 2003. 2004 did, however, represent the first year along a consistent trend during which the peak numbers of birds present in the fields fell since recording began in 2000.

Figure 7.



Total numbers of birds, and the number of days in which over 100 birds were recorded on the fields, also appeared to be significantly lower in 2004 than 2003. It is not clear why this should be the case other than the reduced numbers attempting to forage at the sites in the first instance. Efforts to reduce numbers on the fields were reduced significantly during 2004 hence it was expected that the numbers of days birds were present in large numbers would have increased.

Overflight Management

In 2003, a management plan to prevent all geese from foraging in fields to the north of the airport was instigated. This area was confirmed as the main reason for overflights of the airport and the principle of prevention fitted with the general flight safety consensus to maintain a bird free environment in the vicinity of an airfield. Attempts were also made to disturb geese from the roost site to the north of the airfield in an attempt to completely prevent both feeding and roosting throughout the area.

Unfortunately this proved extremely difficult as the area covered approximately 4km x 2km with fields spread throughout a built up area. Whenever birds were disturbed from one field, they either flew back to a roost site on the other side of the airfield, or departed on sorties to other fields in the locality. Persistent chasing and dispersal from fields often resulted in a return to roost sites back across the runways. Subsequently, birds would return to several fields at once resulting in attempts to cross the airport at several different locations. The attempts to prevent birds roosting to the north of the airport were effective, but also resulted in birds roosting on the south side of the airfield. Any subsequent return to attempt to forage in fields resulted in birds flying over the runways. Additional resources were therefore deployed on airfield similar to that described by Dolbeer (2001), in order to either remove birds that attempted to overfly the airfield, or to deter them from flying directly over the runways. This proved successful in diverting birds through the approaches to the runways only when they flew over the airport in specific places. Their low altitude local flight movements generally took them below approaching or departing aircraft movements.

A change in emphasis came in 2004 based on observations made during 2003. Birds were deterred from the gravel pit roost site to the south of the airfield in conjunction with leaving birds undisturbed on the roost site to the north and on the first field cropped to the north west. Birds remained on that field and did not attempt to forage on other available fields in the area. Bird movements were monitored throughout daylight hours. Birds were observed roosting and feeding on the same side of the airport and did not, therefore, fly over the runways. This policy worked extremely well until late August when the water levels to the north of the airport changed and birds no longer selected this site to roost. A sharp increase in overflying occurred. On-airfield deterrence was again deployed resulting in a rapid change in bird movements around the airport as per 2003. Consideration was given to attempting dispersal on the fields, however it was decided that evidence from 2003 showed that this would most likely result in additional attempts to cross the runways throughout the day rather than a single arrival and return journey. With nine fields available to feed in, it was not considered practicable to be able to guarantee that all birds could be prevented from accessing all sites.

Following the movements of birds through the approaches to the airport rather than over the runways, the geese subsequently switched to a second, previously unused, roost site at a reservoir to the south of the airfield. Throughout our monitoring studies, no birds had ever used these steep sided water retention reservoirs to roost before. On inspection, the water had been drained from the site resulting in a large shallow water body with muddy spits and islets, and shielded from disturbance: an ideal roost site. Birds again began to fly over the airfield with on-airfield deterrence causing some birds to circumnavigate the airfield and others to continue over the airport in different

locations. The main fields were therefore ploughed in with the result that overflights ceased almost immediately. Two final fields remained, however, and after approximately five days, birds located this field and began foraging again. Agricultural practice had prevented these fields being ploughed in as the stems had collapsed during rains and the ploughing had been unsuccessful. As the total area available for foraging was thus reduced to just two sites, and as those birds that were flying over the airport from the roost sites were now doing so from two different roost sites, effort was concentrated on preventing birds foraging at these sites. Shooters were placed in the fields and any birds attempting to land from dawn onwards were deterred. This was undertaken for just three days after which birds stopped attempting to foraging in the fields. These fields were ploughed approximately 3 days after that with no further goose observations recorded.

Discussion

Heathrow airports bird control teams provide round the clock deterrence on the airfield. Canada Geese, however, are only ever involved in overflights of the airport and their management requires an integration of strategies off airfield. The area surrounding Heathrow provides a variety of habitats suitable for Canada Geese. Specific waterbodies, that are used as moult sites and have been identified as supporting birds that overfly the airport during the post-harvest period, have had physical management efforts recommended. These have included allowing grass to grow to a longer length, erecting fences and wiring to prevent birds from gaining access to feeding areas alongside the water and, in some cases, reducing the likelihood that any new developments will attract geese to the area. Whilst this has been implemented at some sites, but has not been practicable at others.

Canada geese in the area around London Heathrow generally move short distances and rarely moult or breed outside the study area. Monitoring results show that the local moult population is, therefore, relatively confined. Census studies undertaken suggest that the overall population is falling and that the risk of birdstrike during, for example, the breeding season when birds move around the area in pairs searching for nesting sites, is reducing. Efforts to control overflying birds have been vastly enhanced by adopting a flexible strategy to deal with the day to day movements of birds. A variety of environmental factors affected choice of roost site and feeding site.

It is clear that adopting a “zero tolerance” strategy in the vicinity of the airport should provide the best chance of reducing the birdstrike risk. Unless that tolerance can be effectively applied to all areas affected by geese, its implementation could have *increased* the risk to aircraft by increasing the numbers of movements of birds across the airfield. A secondary strategy has thus been adopted to attempt to ensure zero-tolerance to the *habitat* geese prefer during the post moult period.

Since 2004, agricultural areas directly north of the airport have been put into alternative non-cereal crops to assess whether the attraction to geese can be reduced. Lupin, Linseed or Field Beans have been sown in spring 2005. No evidence that Lupins or Linseed are attractive to geese when cereal crops are available elsewhere has been found. From our observations since 2000, geese have fed in cereal crops or on grassland at all times and were never observed in field bean crops when a preference was available. Two fields had already been planted with cereal crops by the time agreement was reached suggesting that some goose attraction will still exist

in 2005. These, and other, fields will be ploughed in immediately after harvest and sprayed with round-up as appropriate to prevent new growth providing an attraction. Agreement has been attained to ensure that best bird management practice as a pose to good agricultural practice is used to determine when fields should be ploughed.

Habitat management measures have been suggested and implemented at a series of roost and breeding sites throughout the area. These have included recommendations for steep sided banks, vegetation removal at breeding sites, erection of goose proof netting and new grass management regimes. Many moulting groups of birds have now abandoned their traditional sites, thereby reducing the numbers of birds adjacent to the airport during this period. This has not, however, prevented these sites being used as a roost sites from which dangerous overflights could occur during the post moult period.

Managers at these roost sites, which are often situated within working gravel pits, are thus being pressured to de-water, or alternatively amend their landscapes to ensure only steep sided, deep water without islands is present. The overall attraction of the area would then be significantly reduced. Until confirmation that the attraction of the critical foraging area has been eliminated, cereal fields away from the airport on the south side will be managed to ensure disturbance does not occur so that geese have the option of flying away from the airport to forage.

This is a unique scenario specific to this particular problem and whilst effective at reducing the risk of birdstrike during the short term at this site, we cannot think of any other circumstance where we would recommend tolerating habitat suitable for birds in the near vicinity of an airfield.