Laser dispersal of gulls from reservoirs near airports

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Abstract

Gull numbers roosting at two waterbodies close to a military airfield in central England were monitored at dusk and dawn for four weeks during November 2006. Approximately 25,000 and 8,000 gulls were present at each site respectively. Two LEM 50 laser torches mounted on tripods were then deployed to disperse the roost at one of the sites. No effect was observed before dusk or after dawn. Beams were scanned approximately 0.5 to 1metre above the surface of the water across an arc of approximately 200^{o} during a three minute period. The process was repeated continuously for one hour from dusk. Gulls were successfully dispersed and left the site. Large numbers were still present, however, by dawn on all following mornings. Deployment rates were increased, firstly to include three equally spaced deterrence sessions per night, then subsequently to scans every half hour throughout the night. Gull numbers were reduced to zero overnight with none present at dawn. Numbers increased at the alternative waterbody. Birds continued to arrive before dusk to roost and dusk dispersal was always required. The technique cleared all gulls whenever it was deployed but could not eliminate the arrival of birds that would attempt to roost each afternoon.

Presenters Bio

Andy has been working for the UK Central Science Laboratory to develop and implement evidence based risk management strategies to reduce birdstrikes around airports for the last ten years.

INTRODUCTION

Uncovered water storage reservoirs are a widely documented source of bird activity (FAA 2004, Transport Canada 2001). Countries that have not filed a difference to the United Nations International Civil Aviation Organisation (ICAO) Chicago convention (Annex 14) stating that: “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”, should therefore be looking for data that can be used to support their arguments for management that can be implemented to reduce risk at sites close to airports.

Lasers (Light Amplification by Stimulated Emission of Radiation), were first developed as a non-lethal bird repellent three decades ago (Lustik 1973) and may be of value for longer range deterrence across water bodies. Initial research on the effects of lasers on birds relied on concentrated laser beams (454-514nm, ≥500 mW) that would exceed current permissible exposure levels for animals and humans (OSHA 1991, IEC 2001). However, modern advances in technology have made available lasers that now pose less risk of eye damage and can be safely used to disperse birds. Their development has now resulted in modules being deployed on some airfields (Briot & Bataille 2003).

Their use to deter birds on waterbodies has not been studied in the UK. Passive measures such as netting exclosures, wiring systems and habitat modifications can be difficult to apply to large expanses of water (Duffiney 2006). Alternatively, the deployment of pyrotechnics, distress calls and other hazing measures can require the use of extensive manpower, including boats, to achieve successful dispersal (Gosler *et al.* 1995). By targeting an array of measures at gulls during the afternoons, roost arrivals can be prevented. It is not clear, however, whether such deterrence prevents roost development or whether gulls continue to roost but arrive at a site later at night. In such circumstances, only the time of risk to aircraft will be amended. Systems that can be used to prevent the nocturnal use of a site by hazardous birds would thus be beneficial for the reduction of risk that occurs at night (Dolbeer 2006).

Laser deterrents may therefore provide an option for nocturnal deployment across sizeable waterbodies. Unlike conventional techniques their silent operation could be beneficial in built up areas and their directional characteristic may allow the beam to be aimed at specific target species (e.g. gulls) at a roost. If effective at deterring gulls from roosting at night they may reduce the numbers of birds arriving to attempt to roost and thus result in a reduced need, or complete negation of the need, for other active deterrence measures to be used during the afternoon (i.e. roost abandonment).

AIMS

This study therefore aimed to answer four principle questions:

1. Whether gulls would be affected by the use of lasers
2. Whether lasers would be suitable for long range deployment across waterbodies.
3. Whether nocturnal usage would prevent the arrival of gulls at a site during afternoons.
4. Whether the system is likely to result in habituation

Trials were conducted at a large reservoir in the UK with an established winter gull roost of "several thousand birds" present over the past decade. A smaller waterbody located approximately 5 kilometres from the main site was also recorded as a gull roost.

Monitoring

Gull monitoring was undertaken on at least two afternoons and two mornings each week between the 11th December 2006 and the 22nd February 2007. Birds were identified and numbers of each species recorded during a three hour period prior to dusk and a two hour period from dawn. Gulls were counted each hour. Black-headed (Larus ridibundus) and Common gulls (L. canus) were amalgamated into a "Small gull" category. Similarly, Lesser Black-backed gull (L. fuscus), Herring gull (L. argentatus) and Great Black-backed gull (L. marinus) were amalgamated into a

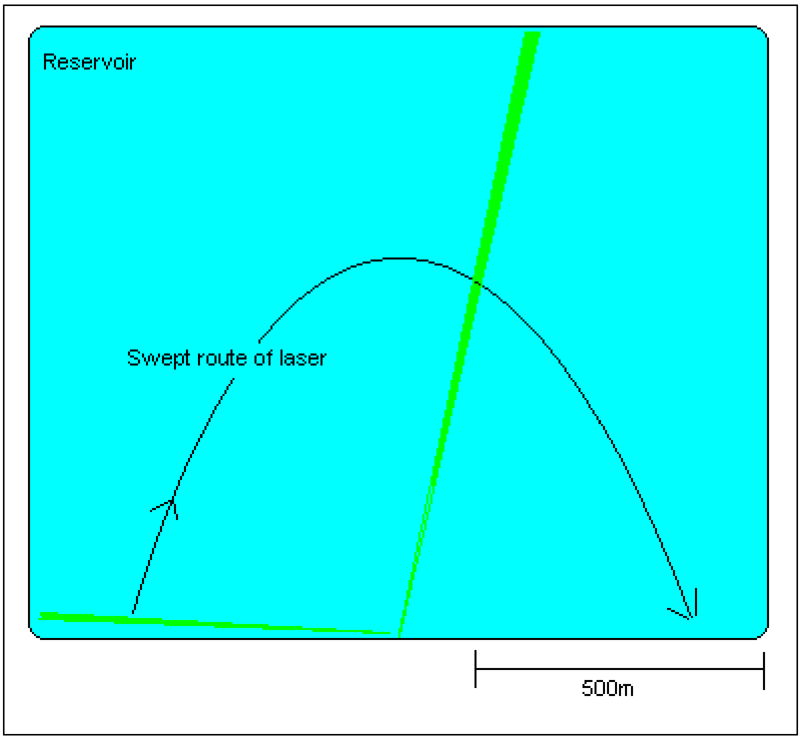
"Large gull" category. All birds were identified and counted using *Leica* or *Swarovski* 8 or 10x binoculars or *Kowa* 22 or 30x telescopes mounted on tripods.

Deterrence

1. Dusk deterrence

The first period of bird deterrence targeted the complete deterrence of all gulls from the main roost. Implementation was undertaken on the evenings of the 10th to the 15th January 2007 and again on the 17th and 18h January. Lasers were deployed from the central point of one bank. Two *Lord-Ingerie Lem 50* laser torches were mounted in a bespoke metal holding bracket fitted to the head of a Manfrotto tripod and deployed at a height of approximately 1.5 metres above bank level. Start time occurred approximately 20 minutes after sunset using human visual observation to confirm the line of the beam could be seen along its full length when directed 100m out onto the water. The beam was then adjusted to start a scan across the whole site by aligning it with the reservoir embankment at a height of approximately 0.5m above water level. The beam was then swept slowly (approximately 45 degrees of arc per minute) across the area of the reservoir where the main gull roost was present. The effect was observed through a *Cobra* 5x nightvision monoscope.

Figure 1 – Representation of sweep protocol.



The movements of disturbed gulls were followed using the nightvision equipment whilst laser sweeps of the reservoir continued until all target birds had vacated the water. Sweeps of the reservoirs were continued for a total of 60 minutes. The process was repeated for five consecutive nights.

2. Dusk with limited night deterrence

Monitoring from the initial deterrence confirmed gulls had returned to the site by dawn on every morning. Visits to the site during the nights of the 17th and 18th

January identified the presence of gulls after they had initially been dispersed. Lasers were therefore deployed for the initial 60-90 minute dusk period, then again at 10:30pm and 01:30am for 30 minutes on each occasion (until any returned birds had been dispersed). Visual monitoring using night vision equipment was continued as per the pre-deterrence period.

3. Regular night deterrence

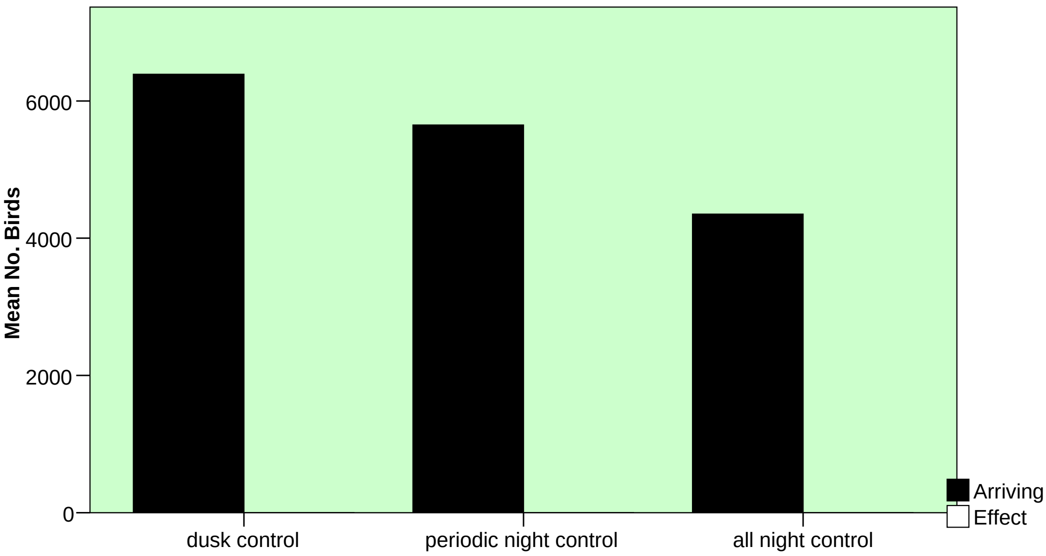
Methods were modified again to implement all night deterrence following continued failure to prevent a dawn presence through limited night deterrence. Scaring was continued as per previous trials with an initial deployment for upto 60 minutes from dusk. Deterrence was then re-established at 10.30pm and continued at half hourly intervals throughout the night until dawn. Night vision equipment was used to check whether gulls were present on the water. When no gulls were present, deterrence was not implemented. Laser sweeps during the night lasted between 4 and 8 minutes when gulls were observed on the water. Two periods of continuous nighttime deterrence were deployed. A period of six nights deterrence starting on the 31st January was completed to evaluate whether gulls would be prevented from returning overnight to roost on the site using this mechanism. This was then followed by a further 12 nights starting on the 12th February to determine whether successful overnight deterrence of gulls would stop their arrival during the afternoons. Visual observations were completed in line with pre-deterrence monitoring methods during this period.

RESULTS

Effect of lasers on gulls at roost

No response was noted in daylight (prior to human visual confirmation that the beam could be seen along its full length). Following this, during the hours of “darkness”, gulls immediately lifted from the water as the beam moved to within c.5m of any individual. Birds near the centre of a large group routinely responded to the movement of other gulls rather than the beam itself. Initial sweeps resulted in gulls wheeling into the air and departing, or moving across the water and settling at a new location. Further sweeps of the laser across the water resulted in similar responses. A maximum of four sweeps (approximately 20 minutes) was required to move all gulls from the site. On each and every occasion that lasers were deployed, all gulls that had arrived to roost were successfully deterred. On cessation of initial, or subsequent overnight sweeps, no gulls were recorded back on the site for at least 60 minutes.

Figure 1. Initial effect of each laser deployment

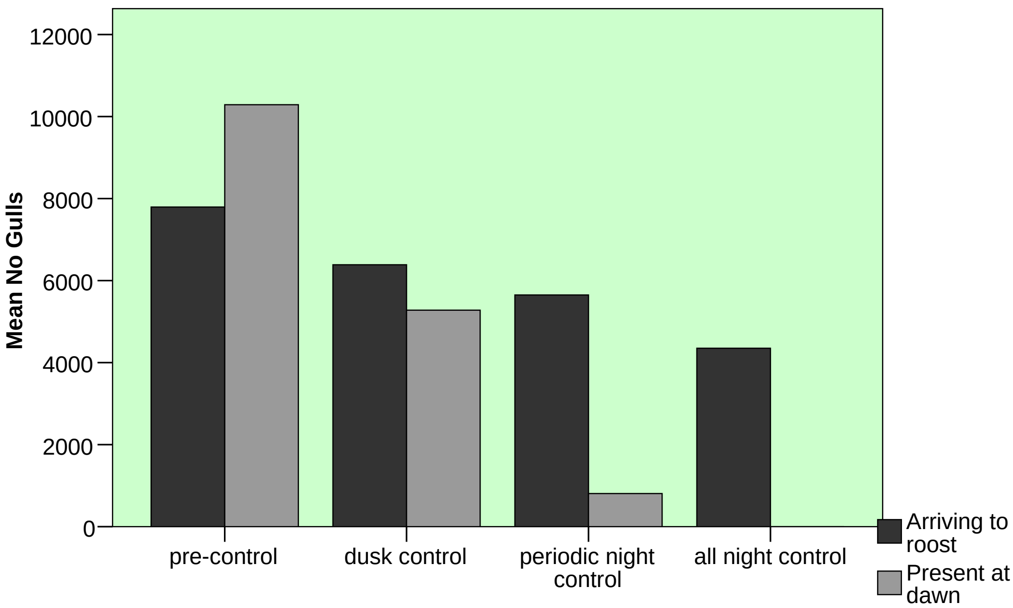


All gulls were successfully deterred from the site at all times. A maximum of five sweeps of the waterbody were required to prevent gulls from exhibiting lifting / re-alighting behaviour and achieve successful dispersal.

Range of lasers.
The waterbody on which deterrence was implemented measured approximately 1.5km across. Gulls responded at all times to the deployment of the laser regardless of their distance from the laser. Maximum test distance was estimated at 1.35km when gulls were roosting adjacent to the most distant embankment. Maximum effective distance was not determined as the waterbody was not big enough.

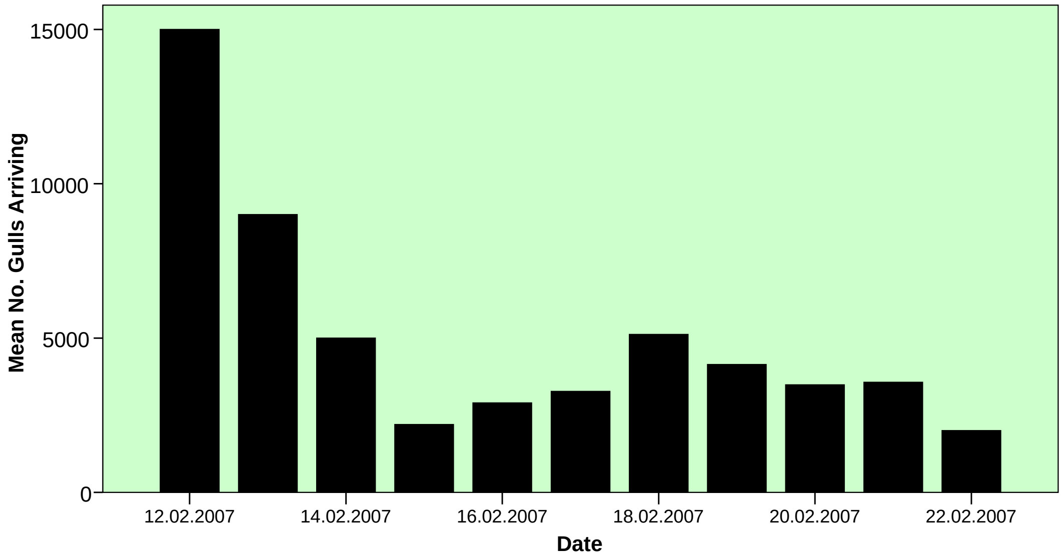
Arrival and overnight return of gulls to site.
The following figure confirms the effectiveness of each deployment regime on the numbers of gulls present at dusk and the numbers remaining at dawn.

Figure 2. Mean gull numbers at dusk and dawn.



No significant difference was observed between "arriving to roost" and the numbers "present at dawn" for the pre-control period (U = 1.512, P = 0.130), the dusk control period (U = 0.734, P = 0.463), or the periodic night control (U = 1.342, P = 0.180). A significant difference was observed between "arriving to roost" and "present at dawn" during the all night control period (U = 3.724, P < 0.001). Gulls arrived to the roost on all afternoons regardless of the use of preceding overnight laser deployment. Numbers arriving declined with regular use of the system over time.

Figure 3. Gull numbers arriving to roost prior to consecutive all night control.

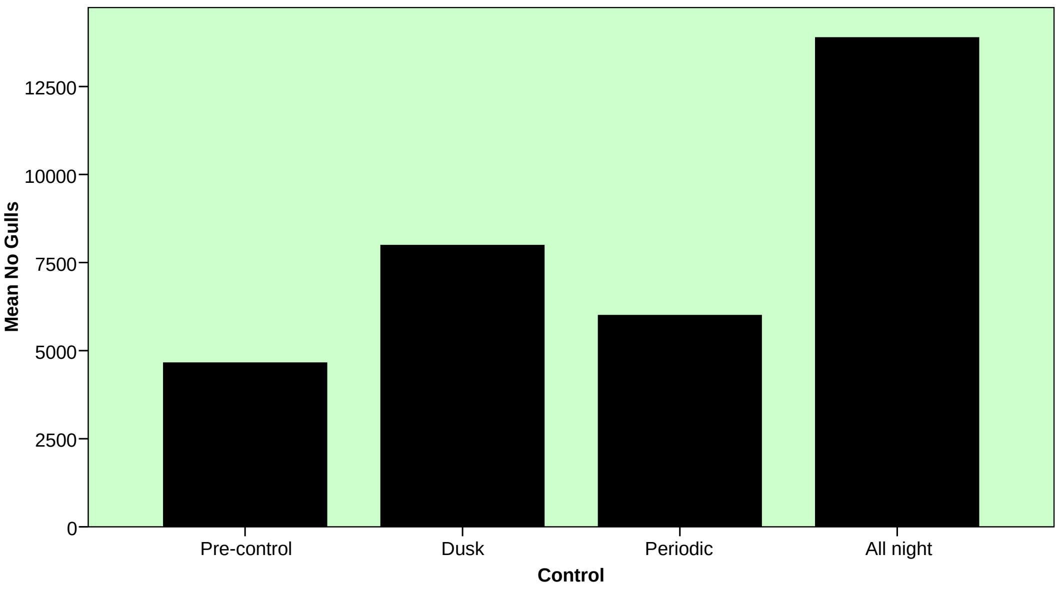


The number of birds arriving at the site to attempt to roost declined during the trial period (U = 2.245, P = 0.024). Declines ceased after the fourth night of deterrence with no further reductions achieved in arrival numbers (U = 0.7, P = 0.429).

Routine sweeps of the site every 30 minutes throughout the night prevented any birds returning either overnight or by dawn. The overnight total number of birds seen with night vision equipment or disturbed from the water with lasers peaked at 300 individuals in total. Just 20 birds attempted to come in between dusk and dawn on the final night of deterrence. A total of seven sweeps of the waterbody were made during the final night, four of which were undertaken to check that the zero count undertaken using night vision equipment was actually true.

Use of alternative sites

During the deterrence period, evening roost arrivals were monitored at an alternative site present approximately 5km distant. Numbers at this site increased from c.5,000 gulls to 22,000 gulls during the period of the trials.



No significant difference was observed between mean peak counts for total number of roosting gulls at the alternative site between the pre control period and the dusk control period (U = 1.722, P = 0.085) or the pre-control period and periodic deterrence period (U = 0.389, P = 0.769). A significant difference was observed in the numbers present during the all night control (U = 4.148, P <0.01).

Habituation.

A total of 26 nights where deterrence was implemented across the dusk, periodic and all night control periods were monitored. The response of gulls to the deployment of lasers remained the same throughout the period. No indifference to the lasers was observed by any gulls. Individual response times remained instantaneous upon detection of the beam. Reductions in the numbers of gulls attempting to return to the roost occurred as each night wore on. The majority of half hourly sweeps across the waterbody during the night did not indicate a presence of gulls. No gulls were present within half an hour of a successful sweep suggesting deterred birds did not rapidly return. Longer term studies would be required to confirm whether gulls could habituate to lasers, however, indications of behavioural responses suggest this would be unlikely.

Discussion

Gulls responded to the use of lasers at night and were dispersed, without exception, on all occasions it was used. As several sweeps were initially required to disperse all the birds, it was hypothesized that gulls that did not see the beam were not affected. By watching the behaviour of birds rough night vision equipment, the edge of the flock did not respond until the beam was within an estimated five metres. Either birds were unable to see the beam prior to this, or they did not respond to it. Observations suggest the former hypothesis as their response that did not include an ‘alert’ phase (birds did not lift their heads and “watch” the approaching beam). Instead gulls moved immediately to the ‘lift’ and ‘disperse’ phases of response as described by Baxter *et al.* 1999. This would account, therefore, for the apparent “shock” created by the beam each time it was used. Subsequent sweeps of the reservoir would then have allowed gulls that had been initially disturbed due to the activity of birds at the edge of the flock to be subjected to the laser presence. Whilst impossible to follow individual gulls in a large flock at range and at night, it is thought that once birds had observed the beam they departed the site.

Deterrence of gulls could not be achieved directly by the use of lasers during daylight hours. Kelly (pers comm.), confirmed that lasers could be used in low visibility conditions such as fog but, despite trials being undertaken in central England in winter, such conditions did not occur. The results of these studies suggest that any bird management programme designed to reduce nocturnal strike risks at a waterbody close to an airport would need to implement additional control measures during daylight hours to prevent birds building up in the first place. It is possible that continued overnight deterrence using lasers could result in total abandonment of a site in respect of arriving gulls but this could not be confirmed by our studies and would require longer term assessments to be made. Previous studies at large sites (Gosler *et al.* 1995), suggest that arriving gulls can be prevented using pyrotechnics and distress calls. In combination with laser use overnight, both the normal daytime and the nocturnal risks of birdstrikes such as those described by Dolbeer (2006), could be alleviated.

Monitoring formed a key role in evaluating the effect of lasers during this study. Without regular nocturnal and first light monitoring, the results of the initial dusk study would have been perceived as successful. All birds were cleared and none returned within the following 60 minutes. Birds were, however, present by the following morning. Monitoring also confirmed that adding in two bursts of deterrence equidistant through the night also failed to prevent birds being present at dawn. Only when routine sweeps of the site were undertaken every 30 minutes throughout the night was full deterrence and no morning presence achieved. Gulls then abandoned the site and no longer attempted to return to roost. The presence of an alternative roost site in the near vicinity of the study site (c.5km distant), appeared to provide an ideal alternative and numbers here certainly increased during the effective nocturnal control trials. The site therefore provided a safe site to which gulls could easily disperse in the event of deterrence. The success of lasers may thus have been more easily achieved than if no alternative site was available nearby. In contrast, however, the site may have been close enough to allow unsettled gulls to return to the control site. Gulls can commute distances of over 50km each way between roosting and feeding sites (Baxter *et al.* 2003) hence the energetic expenditure of returning may not, therefore, have been significant.

It is recommended, therefore, that additional longer term studies of laser deterrents to disperse gull roosts are undertaken and that attempts are made to disperse more isolated roosts. Longer term trials would assist with understanding whether habituation is of concern and if not, whether initial all night deployment rates could subsequently be reduced as birds learn that sites are unfavourable.

This study resulted in a successful deterrence of gulls from a large waterbody using laser deterrents. Without exception, gulls were successfully dispersed and their overnight return was completely prevented by regular overnight deployments. Their use during these trials did not, however, prevent birds returning on subsequent afternoons to attempt to roost. Complete deterrence of gulls from this site would require either longer term use of lasers, or deployment in conjunction with conventional techniques to disturb birds on arrival during daylight hours to prevent them landing in the first place.

Acknowledgements
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