

Evaluation of two perch deterrents for starlings, blackbirds and pigeons

THOMAS W. SEAMANS¹, SCOTT C. BARRAS², & GLEN E. BERNHARDT¹

¹United States Department of Agriculture, Animal Plant Health Inspection Service, Wildlife Services, National Wildlife Research Center, Ohio Field Station, Sandusky, OH, USA, and ²United States Department of Agriculture, Animal Plant Health Inspection Service, Wildlife Services, National Wildlife Research Center, Mississippi Field Station, Mississippi State, MS, USA

Abstract

Bird–aircraft collisions are costly and potentially deadly to people and wildlife. From 1990 through 2004, 57 702 bird collisions with aircraft were reported within the USA to the US Federal Aviation Administration. Approximately 82% of the strikes occur below 305 m height above ground level; therefore bird deterrents on airfields that reduce the quality of the birds' habitat are critical to safe airport operation. One management approach is to reduce perching sites within the airport premises. We tested two anti-perching devices (BirdwireTM and BirdBloxTM) in an aviary setting. As an ancillary test, we determined which wire in a standard three-strand security array was preferred by blackbirds and starlings. Red-winged blackbirds (*Agelaius phoeniceus*), brown-headed cowbirds (*Molothrus ater*), and European starlings (*Sturnus vulgaris*) were deterred from sitting on a perch when anti-perching wire was installed 5 cm above the perch. These same species preferred the top wire of the three-wire security array. Red-winged blackbirds, common grackles (*Quiscalus quiscula*), brown-headed cowbirds, European starlings, and rock pigeons (*Columba livia*) were deterred from perches protected by BirdBloxTM. Because our tests were conducted in a captive situation, we recommend field testing the products to determine if bird use of airport structures may be reduced in an operational setting.

Keywords: *Agelaius phoeniceus*, anti-perching, airports, BirdBloxTM, blackbirds, brown-headed cowbird, *Columba livia*, deterrent, common grackle, European starling, *Molothrus ater*, red-winged blackbird, *Quiscalus quiscula*, rock pigeon, *Sturnus vulgaris*, wildlife strikes

1. Introduction

Bird–aircraft collisions (bird strikes) pose serious safety hazards to aircraft. From 1990 through all of 2004, 57 702 bird strikes with aircraft were reported to the US Federal Aviation Administration. These cost civil aviation at least \$496 million annually in the USA (Cleary et al. 2005). Approximately 82% of all bird strikes occurred below 305 m height (above ground level, AGL) and 93% occurred below 914 m AGL (Cleary et al. 2005; Dolbeer 2006). Eighty-one percent of bird strikes with damage reported to the aircraft occurred below 610 m AGL (Cleary et al. 2005). Concerns over airworthiness standards and high-speed departures of commercial aircraft in these zones of high bird activity (Dolbeer and Eschenfelder 2002; Dolbeer 2006) increase the need for sound management techniques that reduce birds' use of habitats in and around airports.

Due in part to their particular behavioural characteristics of flocking, blackbirds (Icterinae), European starlings (*Sturnus vulgaris*), and doves (Columbidae) are species of special concern at airports (Dolbeer

et al. 1993, 2000; Cleary et al. 2005; Blackwell and Wright 2006). Effective anti-perching techniques are an important aspect of bird control in and around airports, buildings, walkways, signs, fences, carparks and other like structures (Fitzwater 1994; Johnson and Glahn 1994). Blackbirds and starlings are commonly observed perching on airport structures or feeding in vegetation on airports but have been reported in only 4% of bird strikes resulting in damage (Cleary et al. 2005). However, there is an increasing trend of reported blackbird and starling strikes from 1990 to 2001 (Barras et al. 2002). Additionally, due to their large populations, flocking behaviours, and body density (Dolbeer and Stehn 1979; Seamans et al. 1995; Sauer et al. 2005) blackbirds and starlings have caused some of the most devastating aircraft accidents related to bird strikes in the USA (Cleary and Dolbeer 2005) and elsewhere (Thorpe 1996, 1998).

Birds perching on fences, signs, light fixtures and ledges are a problem at airports and other locations where these birds are not desired (see US Federal Aviation Administration 2004; Hazardous wildlife

attractants on or near airports. Advisory Circular No: 150/5200-33A; Cleary and Dolbeer 2005). Large-scale killing of nuisance birds is often undesirable or impractical (Dolbeer 1986, 1998; Smith et al. 1999); thus, there is considerable demand for effective, non-lethal techniques to deter bird use of these sites. Reduction of perching sites should make airports less attractive to birds and thus reduce the risk of damaging bird strikes (Dolbeer 1984). Numerous harassment, management, and frightening techniques are available for reducing human–bird conflicts (Wright 1967; Feare and Swannack 1978; Good and Johnson 1978; Feare and Wadsworth 1981; Lyon and Caccamise 1981; Dolbeer 1984, 1994; Cleary 1994; Solman 1994; Dolbeer et al. 1995; Belant et al. 1998; Seamans et al. 2001, 2002; Blackwell et al. 2002; Avery and Genchi 2004; Seamans 2004). A perch exclusion that is often suggested is the placement of strands of wire or specialized pointed products (Lefebvre and Mott 1987; Johnson and Glahn 1994). Many of these suggested bird management tools have not been subjected to any formal scientific study, but are recommended due to incidental observations.

Overhead wires have been effective in keeping gulls (Larinae) (Amling 1980; Blokpoel and Tessier 1984; McLaren et al. 1984; Dolbeer et al. 1988; Steuber et al. 1995; Belant and Ickes 1996), Canada geese (*Branta canadensis*) (Fairizal 1992), and great cormorants (*Phalacrocorax carbo sinensis*) (Keller 1997; Schmidt 1998) from landing on water bodies, landfills, rooftops, and other broad expanses. This technique can be modified to include the placement of single or double strands of wire (Birdwire™, Bird Barrier America, Inc., Carson, CA, USA) across ledges, fence tops or other perching locations. However, no studies on the efficacy of these wires for different species or on variations of wire placement above perches have been published. Another anti-perching device (Birdblox™, Lena, IL, USA), a plastic form that fits over rafter lumber in pole buildings, either physically blocks space or presents a row of sharp points that have minimal surface area for perching. No studies on the efficacy of this product have been published. Additionally, knowledge of where birds prefer to perch is important so that anti-perching devices may be placed in preferred perch locations. No studies were found that quantitatively demonstrated perch preference on three-strand security arrays. We replicated artificial perches in a captive setting to evaluate the perch preference and the efficacy of Birdwire™ and Birdblox™ exclusion devices on different species of birds.

2. Methods

Our studies were conducted in 2001 and 2002 at the US Department of Agriculture's, Wildlife Services, National Wildlife Research Center, Ohio Field Station at National Aeronautical Space Administra-

tion Plum Brook Station (PBS), Erie County, Ohio, USA (41°27'N, 82°42'W). PBS is a 2200-ha fenced facility with large tracts of open, fallow fields, interspersed with woodlots, and surrounded by agricultural fields.

2.1. Anti-perching wire

We conducted each of three different experiments (perch height, two-choice, and wire array) in 2001 using brown-headed cowbirds (*Molothrus ater*), European starlings, and red-winged blackbirds (*Agelaius phoeniceus*). These birds were live-trapped using decoy traps (Dolbeer 1994). They were attracted to the traps using a white millet/sunflower seed bait mixture and captive cowbirds as decoys. Birds were housed at an outdoor aviary at PBS (Woronecki et al. 1988). The aviary consisted of a netted, roofed pavilion (12.6 × 6.6 m) containing two 2.4 × 2.4 × 1.9-m holding pens. The birds were fed a mixture of millet and sunflower seeds and supplemented with commercial turkey ration. Birds were fed and given fresh water daily.

Experiments were conducted in 24, 0.5 × 1.0 × 1.9-m cages, suspended from the ceiling of the aviary. Perches used in this evaluation were constructed of barbless wire 1.9-m long of identical gauge (12-gauge) and design as that used on security fences. Barbless wire was used to reduce the risk of injury and undue pain to experimental subjects. The exclusion device was a commercial product called Birdwire™ exclusion system. This system consists of 0.7-mm nylon-coated stainless steel wire elevated above the area to be protected by posts of varying heights.

After setting up the perches, one bird was assigned to each cage at least 24-h prior to the initiation of experiments to allow the bird to acclimate to the cage. Two blinds were established about 10 m from either side of the aviary. An observer in a blind conducted a spot count of each cage once every 3 min for 1 h (20 observations/cage per h) and recorded where the bird was in the cage at the instant of the observation. These observations were conducted twice daily, at 10:00 and 14:00 h, using the same procedure.

2.1.1. Perch height experiment. To determine the appropriate height for use of exclusion wires over perches in this study, we presented each bird with a single perch and varied the height of the exclusion wire above that perch. Perch height experiments were conducted with brown-headed cowbirds on 8–11 May 2001, red-winged blackbirds on 11–19 April 2001, and with European starlings on 22–26 October 2001. The exclusion wire was first established 10–15 cm above the perch, depending upon the perching height of the species evaluated. The wire was lowered by 2.5 cm on successive days using the same birds in each of five or six successive tests until the exclusion wire was 2.5 cm above the perch. We plotted bird use of perches under each exclusion height to determine graphically the height at which

perch use was lowest. We used a paired *t*-test to determine if there were differences in perch use (Cody and Smith 1991). A Wilcoxon signed ranks tests was used in cases where data were not distributed normally (Zar 1984).

2.1.2. Two-choice experiment. The two-choice experiments were conducted with brown-headed cowbirds on 16–18 May 2001, red-winged blackbirds on 24–26 April 2001, and with European starlings on 30 October–1 November 2001. We established two 1.9-m perches such that the perches were about 0.4 m apart in each of 24 cages (described above). One perch per cage was randomly selected to have an exclusion wire placed above the perch at a height determined to best exclude the species involved during the wire height test. We conducted observations twice per day for three consecutive days to determine if the birds chose or avoided the perch treated with the exclusion wire. We used a paired *t*-test to determine if there were differences in perch use (Cody and Smith 1991). A Wilcoxon signed ranks tests was used in cases where data were not distributed normally (Zar 1984).

2.1.3. Wire array experiment. We conducted aviary tests to determine if birds preferentially used individual strands of barbed wire in standard three-strand arrays atop security fences, depending upon the location of the wire in the array. The three-wire experiments were conducted with brown-headed cowbirds on 23–25 May 2001, red-winged blackbirds on 3–5 April 2001, and with European starlings on 9–11 October 2001. We replicated the angle (40°) and spacing (13 cm) of wires from a standard security fence design within each of 24 experimental cages described above. We then placed one bird in each cage and conducted observations twice per day for three consecutive days. To determine whether the birds showed a preference for any perch, we compared the number of observations of birds on each strand. We compared bird use of the three strands using a Kruskal–Wallis test because data did not meet the assumption for normality under requirements of parametric tests (Zar 1984).

2.2. BirdBlox™

Brown-headed cowbirds, red-winged blackbirds, common grackles (*Quiscalus quiscula*), and rock pigeons (*Columba livia*) were captured in April 2002, and European starlings were captured in October 2002 in northern Ohio using decoy and walk-in traps. All birds were held and fed in two 2.4 × 2.4 × 1.9-m cages as described above. Experiments were conducted in the 20, 0.5 × 1.0 × 1.9-m cages described above.

2.2.1. Two-choice experiment. We established two parallel, 1.9-m perches in each of the 20 experi-

mental cages such that perches were about 0.4 m apart. One perch consisted of BirdBlox™ covering the 5-cm side of a 1.9-m, 5 × 10-cm board. The second perch was constructed of barbless wire of identical gauge (12-gauge) and design as that used on security fences. Birds readily perch on the wire (see results of anti-perching wire), and because it provided the only other perch it was considered an acceptable alternative perch. After placing the perches, one bird was placed into each cage 24-h before observations began to allow the bird to acclimate to the cage.

Observations were conducted from a vehicle 10 m from the experimental cages. An observer in the vehicle conducted a spot count of each cage once every 3 min for 1 h (20 observations/cage per h). These observations were conducted twice daily, for 4–5 days, at 10:00 and 14:00 h. Data recorded were the location of the bird at the moment of observation.

2.2.2. No-choice experiment. At the conclusion of the two-choice experiment, the barbless wire was removed from each cage. The bird from the two-choice experiment was left in the cage because it was habituated to that cage. Observations were started 72 h later and were conducted as in the two-choice experiment for 3–4 days.

Due to the magnitude of difference between counts of birds using the BirdBlox™ perch and either the other perch or rest of the cage, statistical tests were not conducted. Descriptive statistics are provided.

3. Results

3.1. Anti-perching wire

3.1.1. Perch height experiment. Perch use generally decreased with decreasing height of the exclusion wire for all three species (Figure 1). For all three species, perch use appeared to reach a lowest asymptote at 5 cm, and actually approached zero use for red-winged blackbirds and starlings. Therefore, we selected 5 cm as the exclusion height to be used for all three species in the two-choice experiment.

3.1.2. Two-choice experiment. Perch use by red-winged blackbirds ($5.30 \leq t \leq 6.98$, $df = 23$, $P < 0.01$), brown-headed cowbirds ($7.69 \leq t \leq 9.08$, $df = 23$, $P < 0.01$), and European starlings ($33 \leq t \leq 60$, $df = 23$, $P < 0.01$) was nearly eliminated in each of the three daily experiments for each species by the exclusion wire in the two-choice test (Figure 2). Brown-headed cowbirds were observed on the excluded perch only 2.4% (69 of 2880 observations) of the time compared to 46.7% of time (1345 observations) spent on control perches. Red-winged blackbirds were observed on the excluded perch only 1.6% (46 of 2880 observations) of the time compared to 39.8% of time (1147 observations)

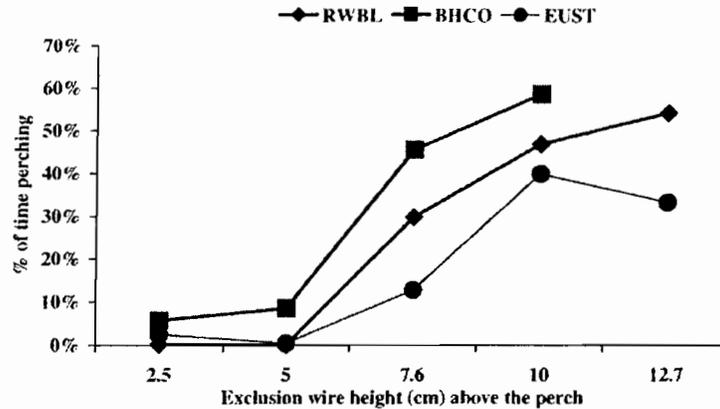


Figure 1. Percent of observations periods when brown-headed cowbirds (BHCO), European starlings (EUST), and red-winged blackbirds (RWBL) were observed using a single perch with an exclusion wire mounted at different heights above the perch.

spent on control perches. European starlings were observed on the excluded perch only 0.1% (three of 2880 observations) of the time compared to 14.0% of time (402 observations) spent on control perches.

3.1.3. Wire array experiment. Use of top, middle, and bottom strands of the fence array differed for red-winged blackbirds ($49.61 \leq \chi^2 \leq 51.30$, $df = 2, 23$, $P < 0.01$), brown-headed cowbirds ($42.73 \leq \chi^2 \leq 49.92$, $df = 2, 23$, $P < 0.01$), and European starlings ($17.22 \leq \chi^2 \leq 51.58$, $df = 2, 23$, $P < 0.01$) in each of the three daily experiments (Figure 3). Individuals of all three species overwhelmingly used the top wire during most observations that involved perched behaviour. Of the 1333 observations (out of 2880 total) where brown-headed cowbirds were observed to be perching on one of the three wires, 88% (1177) were on the top wire, 5% (67) on the middle wire and 7% (89) on the bottom wire. For red-winged blackbirds, 92% (1591), 5% (94), and 3% (48) of the 1733 perching observations were on the top, middle, and bottom wire, respectively. For European starlings, 87% (766), 8% (70), and 5% (42) of the 878 perching observations were on the top, middle, and bottom wire, respectively.

3.2. BirdBlox™

3.2.1. Two-choice experiment. European starlings, red-winged blackbirds, and common grackles were observed on BirdBlox™ in only 21, 5 and 1 of the 17 600 spot counts, respectively. Brown-headed cowbirds and rock pigeons were not observed on Birdblox™. In contrast to the Birdblox™, birds were observed on the unprotected perch in 2482 (14.1%) of the counts (Figure 4).

3.2.2. No-choice experiment. We conducted a total of 15 480 spot counts. Red-winged blackbirds were observed on Birdblox™ only 22 times and European starlings three times. Common grackles,

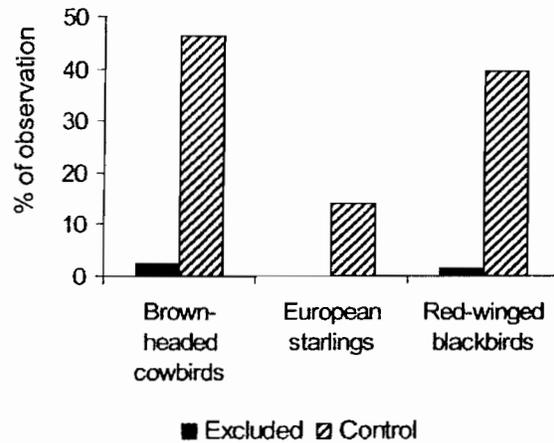


Figure 2. Percent of observations (2880 observations for each species) when birds were observed using either a perch with an exclusion wire mounted at 5 cm above the perch or a second (control) perch without an exclusion wire. Differences were statistically significant ($P < 0.01$).

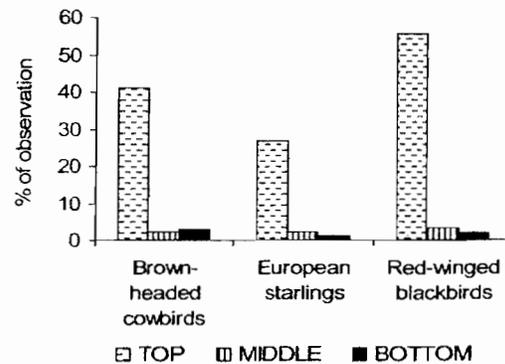


Figure 3. Percent of observations (2880 observations) when birds were observed using either the top, middle, or bottom wire on a simulated fence-top array. Use of the top wire was greater ($P < 0.01$) than use of the others.

brown-headed cowbirds, and rock pigeons were not observed on Birdblox™ (Figure 5).

4. Discussion

We found anti-perching wire and BirdBlox™ to be effective perching deterrents when tested in an aviary setting. The height at which bird wire excluded blackbirds and starlings most effectively from simulated fence perches (5 cm) is probably a function of the size of the birds and their perching posture. At 5 cm, we observed the exclusion wire to contact the lower abdomen of birds that attempted to land on perches. This contact may have been uncomfortable

or prevented the birds from assuming a normal posture. The upper height at which exclusion first began to occur was probably dictated by the same factors. Although exclusion was overwhelmingly effective at 5 cm, all species tested were approximately the same size, and the effective exclusion height may be different for larger birds.

Birds may have preferred the highest perch in the three-strand experiment because it provided an enhanced view of their surroundings or a better singing and display post without interference from wires higher than head level (Stokes 1979; Feare 1984; Beletsky 1996). This advantage may have been especially important for red-winged blackbirds and brown-headed cowbirds, which were evaluated during their breeding seasons. Although the responses for European starlings were similar in pattern to those of red-winged blackbirds and brown-headed cowbirds, starlings spent relatively little time on the perches. These birds use many habitats and spend a great deal of time on the ground on airfields (Feare 1984; Thorpe 1998) while foraging for insects.

In aviary tests, Birdblox™ was effective at keeping five species of common pest birds from perching on a desired perch. Red-winged blackbirds and European starlings showed the greatest ability to use the perches. However, even in the rare instances when birds chose to sit on a Birdblox™ perch, the time was momentary. We never observed a bird to sit for more than 5 s on a Birdblox™ protected perch, an observation commonly made on the untreated perch.

Each experiment described above was limited to aviary conditions. However, because the devices showed dramatic reductions in perching with all four species tested in no- and two-choice tests, we believe that the products will reduce perching. We recommend field testing of the products to confirm our aviary studies.

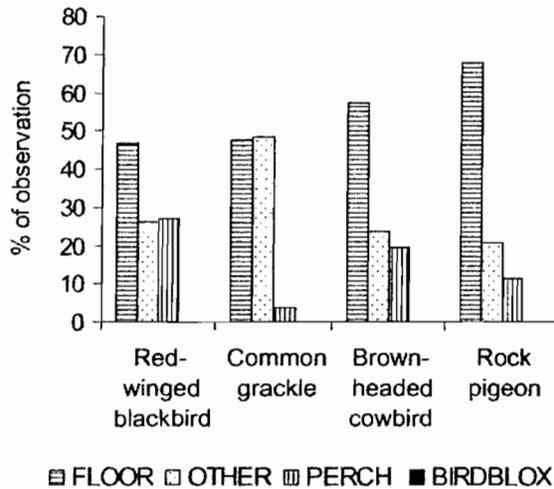


Figure 4. Percent of observations of birds using a perch protected by Birdblox™, an unprotected perch, the cage floor or some other area of a cage (two-choice test).

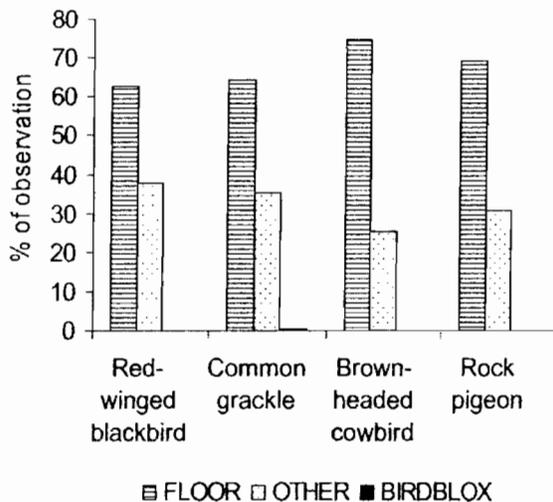


Figure 5. Percent of observations of birds using a perch protected by Birdblox™, the cage floor or some other area of a cage (no-choice test).

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Notes

Mention of companies or commercial products does not imply recommendation or endorsement by the US Department of Agriculture over others not mentioned. The US Department of Agriculture neither guarantees nor warrants the standard of any product mentioned. Product names are mentioned here solely to report factually on available data and to provide specific information. The National Wildlife Research Center Animal Care and Use Committee approved procedures before the start of the study.

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