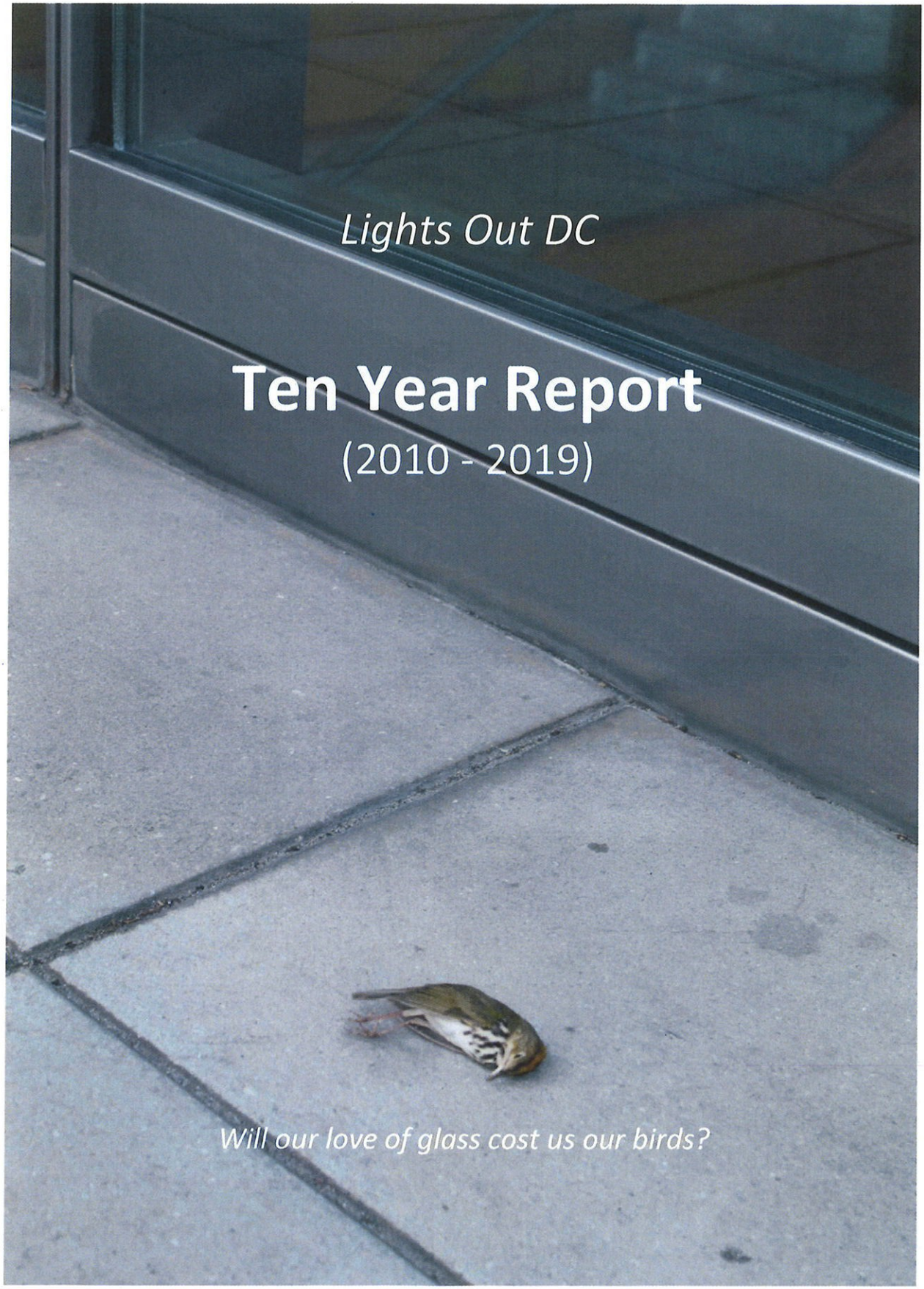

Lights Out DC

Ten Year Report

(2010 - 2019)

Will our love of glass cost us our birds?

City Wildlife's *Lights Out DC*
Bird/Glass Collision Monitoring Project
Ten Year Report (2010 - 2019)
October 8, 2020

Report Summary

Will our love of glass cost us our birds?

Bird/glass collisions in the U.S. are estimated to cause as many as one billion bird deaths each year. These deaths are one of the factors most responsible for the estimated 29 percent decline in North American bird populations since 1970.

City Wildlife is a Washington, D.C.- based nonprofit whose mission is to protect wildlife and wildlife habitat in the District of Columbia. In 2010, as part of its mission, City Wildlife began its *Lights Out DC* bird/glass collision monitoring project in order to determine the extent of these collisions in a limited downtown area of the city and to identify ways these collisions could be reduced. Volunteers have monitored this area during spring and fall bird migrations for ten years. This report presents their findings and recommendations for remediation and further action to reduce these collisions.

Findings:

- During the ten-year period from 2010-2019, volunteers documented 3,067 bird strikes. Most of the birds were found in the area monitored. The majority of these birds (84 percent) were found dead or died soon after being found. Only 16 percent of the birds were able to be released.

- These numbers almost certainly represent a small percentage of the fatal bird/glass collisions occurring in the District of Columbia. One scientist estimates that each building in the U.S. kills up to ten birds per year.

- The birds killed in these collisions are overwhelmingly migratory birds, many of whose populations are in serious decline. Common year-round resident birds were seldom found.

- The project documented 102 bird species, including 28 of the District of Columbia's 58 Species of Greatest Conservation Need (SGCN). Of the birds found, 26 percent of the total (784 birds) were SGCN.

- About twice as many bird strikes occur in fall than in spring because, with young birds joining their parents on the journey south after the breeding season, there are more birds in the air in the fall.

- Five buildings accounted for 40 percent of the total birds found. Collectively, these buildings incorporate several features that are known to cause collisions: large expanses of transparent glass; night lighting; trees or plants behind the glass; walls that converge toward the glass; and glass reflectivity, which can look like trees and open sky to birds during certain times of day.

- Glass buildings continue to be built throughout the District of Columbia, and volunteers are finding numerous birds at these new buildings. The building community does not seem to be aware of the problem—or at least is not incorporating bird-safe features in these projects.

Solutions:

- Artificial night lighting attracts birds to cities and should be minimized throughout the city. Steady red lights are particularly disruptive to bird navigation and should be either eliminated or changed to another color.

- It is easier and more economical for buildings to incorporate bird-safe measures during initial construction rather than afterward. Incorporating bird-safe features in a building need not increase the construction cost. Bird-safe features such as sunscreens, louvers, or patterned glass are often incorporated in buildings for reasons other than bird safety, such as sun control, glare reduction, or even aesthetics.

- There are effective techniques for retrofitting existing problem buildings. Retrofit products, such as bird-safe film, tape, netting, and "zen wind screens" are readily available and effective. (Example: the Walter E. Washington Convention Center installed bird-safe film at its L Street overpass in November, 2016. Since then, bird strikes there have declined by 85 percent.)

- Effective patterns for bird safety adhere to the "2 x 4 Rule," which specifies that birds will not fly through a space that is less than 2" high or 4" wide. Bird-safe features are best installed on the outside of the glass in order to reduce the mirror effect.

Recommendations:

The pace of development in the District of Columbia, as well as insufficient awareness and concern among members of the building community, suggests there will be an increasing number of untreated glass buildings and even more bird fatalities unless steps are taken to address this problem.

The District already offers two optional credits for bird-safe design in its revised Green Construction Code. In addition, we recommend that the District of Columbia join New York City and other leading jurisdictions by considering bird-safe legislation, at least for all new and substantially remodeled D.C. government buildings and, optimally, for all such buildings.

Lights Out DC

Ten Year Report

(2010 - 2019)

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City Wildlife's *Lights Out DC*
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Ten Year Report (2010 - 2019)
October 8, 2020

Will our love of glass cost us our birds?

Background

Bird/glass collisions in the U.S. are estimated to cause up to one billion bird deaths each year.[1] This figure represents approximately five percent of the entire fall migratory bird population in the U.S. and contributes significantly to the overall decline in North American bird populations, which has recently been estimated to be 29 percent since 1970.[2] Bird/glass collisions are one of the primary causes of bird mortality, after habitat destruction and cat attacks.[3]

Imprint of a collision

City Wildlife, Inc. is a nonprofit organization in the District of Columbia whose mission is to protect wildlife and wildlife habitat. In 2010, City Wildlife began its *Lights Out DC* program with the goals of determining the extent of bird/glass collisions in D.C. and working with representatives of problem buildings to reduce these tragic and upsetting collisions.

Lights Out DC Monitoring Protocols

Patterned on other urban monitoring programs,[4] *Lights Out DC* enlists volunteers to walk a designated area of downtown D.C. in the early morning during spring and fall migration

seasons. The volunteers pick up any dead or injured birds that have collided with glass. Dead birds are collected and saved; stunned or injured birds are brought to City Wildlife's Rehabilitation Center for treatment. Birds that can be rehabilitated are released back to the wild. City Wildlife operates this program under a special Migratory Bird Permit from the US Fish and Wildlife Service.[5]

Volunteers monitor their assigned routes from April 1 - June 5 in the spring and from September 9 - November 9 in the fall, but the end dates can be extended if there are still large numbers of migrants passing through.

Volunteers generally work singly or in pairs on each route, and each volunteer is assigned a route and a day of the week. They begin monitoring before dawn on their assigned day and end in the early morning. They carry bird nets, small paper bags to carry stunned birds, zip lock bags for the carcasses of dead birds, and Sharpie markers to write the date, species, location found, and their initials on the bag for each bird found. After completing their route, volunteers enter their results—either the birds found or a zero count—on an online database. They also enter the hours spent in travel and monitoring, as well as any relevant notes or photos.

All bird carcasses are frozen in one of several central locations and saved until the end of the year, when volunteers assemble to tag the birds with identification numbers that correlate to the master database, which is derived from the online entries. In some years, volunteers also take a group photo of all the birds found that year. These photos are used for publicity purposes.

Photo: Abby Milberg

Tagging Day 2019

Most birds listed in the master database have been collected by *Lights Out DC* volunteers on their routes. However, some collision victims (both dead and alive) come in from other sources: members of the public who are aware of the program, residents with injured birds from their homes, or D.C. Animal Care and Control. If the bird is a confirmed victim of a glass collision and was found in the District of Columbia, it is included in the database.

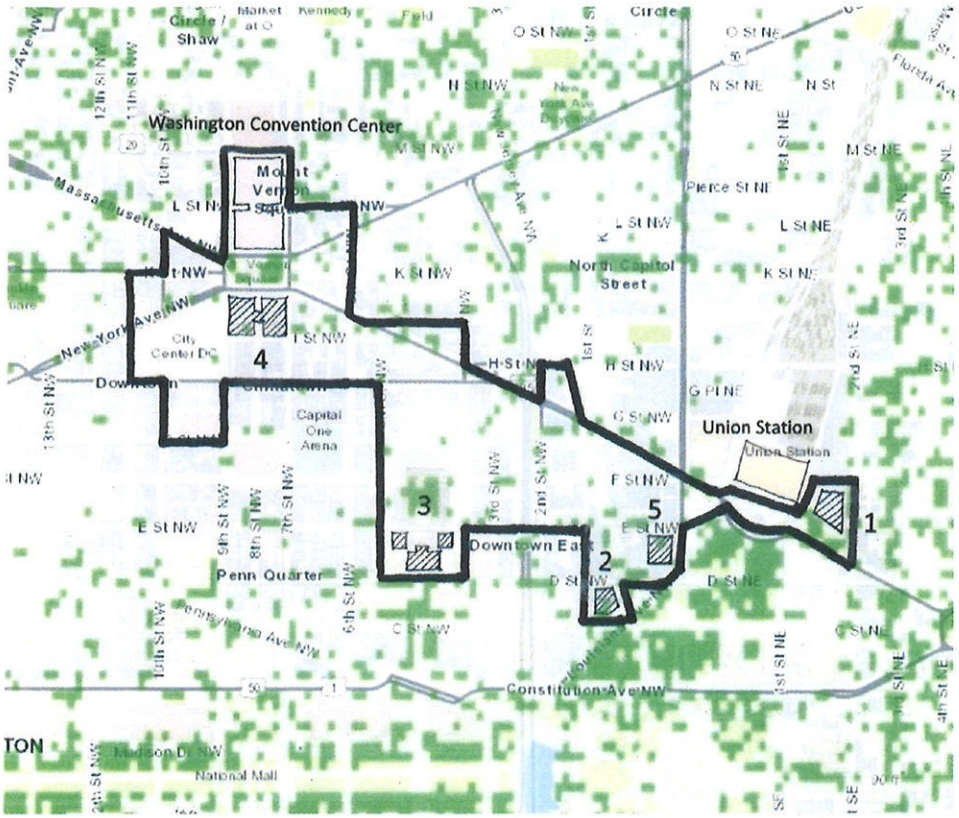
City Wildlife's federal permit requires that all carcasses be donated to an approved scientific facility, which in the case of *Lights Out DC* is the Smithsonian Migratory Bird Center. Recently, with the Smithsonian's permission, we have donated the carcasses of certain species to other approved research institutions, such as the Bird House at the National Zoo (also part of the Smithsonian), which tests their fat scores, and the Genoscape project at UCLA,[6] which identifies genetic markers in birds in order to map their migratory routes and breeding grounds. This information aids in bird conservation.

Lights Out DC Birds, 2016

The Routes

The original route, known as the "Union Station Route," was selected in 2010 because, at the time, it contained both green space with mature trees (the Mall and Senate Parks), several water features, and a high concentration of glass buildings. Hundreds of birds were—and still are—found on this route. However, it soon became clear to volunteers that the area around Mt. Vernon Square was sprouting a new glass building each year, and the original volunteers could no longer complete their route before the building maintenance staff started hosing the sidewalks and removing the birds—or predators made off with the carcasses. By 2014, it was

obvious that *Lights Out DC* needed a second route. This new route, known as the "Chinatown Route," now includes all the new glass buildings near the Convention Center, as well as the new City Center project.



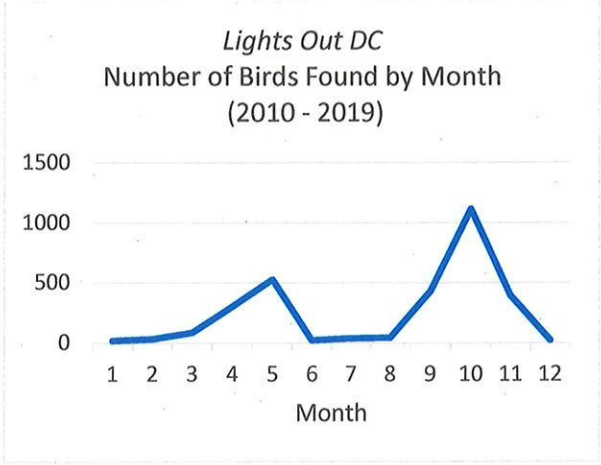
Area monitored by *Lights Out DC*
showing tree cover and five problem buildings

From time to time, buildings were eliminated from both routes if they were too far away or if birds were seldom found. For example, volunteers found numerous birds at the Hart Senate Office Building, but it was somewhat distant from the main route and was eliminated in favor of adding 430 E Street, N.W. For several seasons, volunteers monitored a section of Foggy Bottom, but the route was abandoned because maintenance workers often cleaned sidewalks in the very early morning before volunteers arrived, thus preventing an accurate count of bird strikes. The Martin Luther King Library was eliminated when remodeling began since the construction fencing prevented volunteers from gaining access to the building.

Findings

During the ten-year period from 2010 through 2019, *Lights Out DC* volunteers collected 3,067 birds, of which 84 percent were dead or died within hours. Only 16 percent were able to be released. More birds are found in the fall than in the spring (35 percent in the months of April

and May, and 65 percent in the months of September, October, and early November) because there are more birds migrating south after breeding season than moving north after the winter.



Note: volunteers monitor only during the months of April, May, September, October, and November, so birds strikes for other months may be underrepresented.

The vast majority of the birds found were migrants, including many neotropical migrants. House Sparrows (74), European Starlings (46), and Rock Doves (or Pigeons, 30), which are the only birds not protected under the Migratory Bird Treaty Act, accounted for only 4.6 percent of the birds. Species of Greatest Conservation Need (SGCN) as identified in the District of Columbia's 2015 *Wildlife Action Plan* made up 26 percent of the birds (784).[7] *The Wildlife Action Plan* lists 58 different bird species as SGCN. Out of the total of 102 species found, 28 of these species were SGCN.

Many of these species' populations are in decline. Of particular concern are the large number of Ovenbirds (284, mortality rate 81 percent), American Woodcocks (233, mortality rate 87 percent), Black-and-white Warblers (40, mortality rate 95 percent), and Wood Thrush (43, mortality rate 84 percent). The Wood Thrush is the District's Official Bird, and its flutelike

Wood Thrush, the District's Official Bird

song is considered to be one of the most beautiful. Its populations are estimated to have declined by 50 percent since 1966 and are further declining by two percent each year.[8] Reports from other Lights Out programs around the country confirm that the Wood Thrush is a common victim of collisions, thus contributing substantially to its decline.[9] This is only one of many examples of a declining neo-tropical migrant species affected by collisions.

In terms of species, *Lights Out DC's* most numerous victims are the same as those found in other jurisdictions by other monitoring programs.[10] White-throated Sparrows (370), Common Yellowthroats (367), Ovenbirds (284), American Woodcocks (233), Song Sparrows (135), and Gray Catbirds (128) top the list of *Lights Out DC*'s victims. These species are also among the most commonly found victims elsewhere (in Toronto, Chicago, New York and Baltimore, to name a few). Little is known, however, about why certain species are more likely to hit glass than others.

Common Yellowthroats (f. and m.), found together

The vast majority of the birds found are in good condition, not debilitated or showing any signs of disease. Many have substantial body fat, stored in preparation for migration, and it is rare to find an emaciated bird. In 2011, to determine whether young birds might be more prone to collisions than older adults during fall migration, ornithologists from the Maryland Ornithological Society studied our birds as well as those picked up by *Lights Out Baltimore*. The results showed about equal numbers of hatching-year (HY) birds and after-hatching-year (AHY) adults. In D.C., 49 percent of our fall victims were HY; Baltimore showed a slightly greater number of HY birds at 59 percent.[11]

It is important to note that *Lights Out DC* monitors only a small area of the District for just two or three hours a day and that these birds account only for the birds found, not those that may have been taken by predators,[12] swept away by maintenance personnel, missed by our volunteers, or that may have collided later in the day. Also, our database does not count stunned birds that were able to fly away when approached. Although volunteers do note these

in their comments, unless a bird can be picked up by a volunteer, it is not counted in the final tally.

It is difficult to determine the total number of birds killed annually in the District, but 3,067 almost certainly represents a small percentage of the total bird/glass collisions in the city. One scientist has estimated that each building in the U.S. kills up to ten birds each year.[13] At that rate, annual bird strikes in the District could be in the thousands.

Rehabilitation Issues

Birds that are stunned or injured are taken to City Wildlife to be checked—even if they appear robust after a few hours—because sometimes their injuries are not readily apparent and can affect their ability to survive in the wild. In a presentation to the American Veterinary Medical Association (AVMA) in 2019, City Wildlife's clinic director Dr. Kristy Jacobus, DVM, described the most common of these injuries, based on our data from 2017 to mid-2019 (approximately 230 cases).

People will often say a bird "broke its neck" when colliding with glass, but in fact the most common cause of death from a collision is head trauma (contusion or concussion).[14] Blood from the beak is an indication of this injury and is common in the birds we find. Even birds that survive the collision may still have some neurological impairment: 17 percent of the birds brought to City Wildlife were suffering from some degree of head trauma or spinal cord injury. Spinal cord injury in these birds seldom resolves; head trauma prognosis is variable depending on the severity.

American Woodcock showing blood from beak

Eye injuries are also common: 23.6 percent of City Wildlife's collision victims came in with ruptured eyes or retinal detachment (both causes for euthanasia) or corneal lesions (many of which can be cured). Woodcocks are particularly prone to these eye injuries because their eyes are so prominent and the force of their impact so strong. Additional injuries from collisions include fractures and luxations (dislocations), found in 11 percent of our collisions victims. Most of these involved the coracoid or clavicle, both parts of the shoulder system.

A substantial number of these injured birds were able to be rehabilitated: during this period, City Wildlife was able to release 41.6 percent of the 230 collision victims treated. But overall, the survival rate of birds who strike windows is low, only about 16 percent.

Causes of Collisions

The causes for these collisions are well known: birds are unfamiliar with cities, migrate at night and are attracted by city lights, have poor depth perception, and simply do not see glass. They are fooled either by its transparency—when they try to fly to something beyond the glass, or by its reflectivity—when the glass acts as a mirror, reflecting trees or other attractions that the birds perceive to be real. In some cases, the same glass will appear transparent at one time of day and reflective at another. Diagnosing the problem often requires observing the glass at different times of day.

Many scientists worldwide are working on the problem of bird/glass collisions and how to prevent them.[15] Christine Sheppard, PhD, an ornithologist with the American Bird Conservancy, is one of the most knowledgeable sources for scientific bird/strike information in the country and has contributed substantially to the science of collisions, bird-safe design, and product testing. She has been an invaluable resource for this project and provides guidance throughout the country on remediation techniques. However, there is no "magic bullet," and as has often been noted, *each building has its own pathology.*

The Buildings

As noted above, 40 percent of all the birds collected have been found at five buildings. Long-term monitoring allows an analysis of these buildings that is based on consistent findings over a decade, so the data cannot be dismissed as an aberration. Long-term monitoring also provides opportunities to observe how and where the collisions occur at each building; in some cases, volunteers have actually witnessed the collisions:

> I heard the wing noise of a woodcock and turned to see it flying east to west across the plaza to the north of the building, then it turned and crashed into the 2nd floor above the Milk Bar, which I had just walked past. It seemed to have been killed instantly.
>
> *Lights Out DC* volunteer
> 11/9/2019

300 New Jersey Avenue, N.W. (#2 on map)

300 New Jersey Avenue, N.W. is a LEED-gold-certified building that was completed in 2009. It accounts for the largest number of bird deaths of all the buildings monitored: 323 bird strikes resulting in 287 deaths, for a mortality rate of 89 percent. Several features of the building make it dangerous for birds:

- Interior/exterior ambiguity: A ten-story glass atrium connects the original part of this building (the Acacia Building) to its modern addition across a plaza. The atrium's glass wall separates interior from exterior but is invisible to birds. Certain architectural elements, such as the original wall of the Acacia Building and a large yellow steel truss, appear to penetrate the glass wall, creating a spatial ambiguity that confuses the birds. It is likely that the birds interpret some of the tree-like structural elements on the inside as perches and fly into the glass trying to reach them.

- Night lighting: Until recently, the atrium has been fully lit at night with tube lighting along the interior walkways, several large downlights overhead, and up-lighting grazing the original Acacia Building wall. Since nighttime lighting attracts birds, both the design and the amount of night lighting at this building have increased its hazard for migrating birds.

300 New Jersey Avenue, N.W.

- Converging walls: The exterior walls of the original building and the new addition converge toward the glass atrium on the plaza. There is also a large projecting overhang at the top of the building, completing the "funnel" effect. Scientists believe that converging walls may guide birds toward the "outlet," just as a row of dense trees might guide a bird to a clearing in a forest.

- Red "Exit" light: Until recently, an illuminated red "Exit" light inside the entry was clearly visible to birds through the glass. Scientific studies confirm that constant red lights both attract and disorient birds.[16] Hummingbirds, in particular, are attracted to red because it suggests a flowering food source. *Lights Out DC* has collected 8 dead Ruby-throated Hummingbirds at the building and the maintenance staff told us of others found before 2010.

Concerned about these bird strikes, the building management has considerably reduced its nighttime atrium lighting and has changed the red exit light to green. It is too soon to know the results, but these measures should help.

The Thurgood Marshall Federal Judiciary Building (1 Columbus Circle, N.E. (#1 on map)

The Thurgood Marshall Building has accounted for the largest number of bird strikes of the buildings monitored but has a lower mortality rate than some of the other buildings: 346 bird strikes leading to 224 fatalities, for a mortality rate of 65 percent.

This building stood out as a problem from the beginning of monitoring by *Lights Out DC.* In 2010, more birds hit this building than any other, and the reason was clear: the tall glass wall at its entry gives full view of two large stands of live bamboo inside the atrium—and these trees were brightly lit all night. Adding to the problem, the building's exterior walls converge toward the atrium. A guard at the building said he could see birds flying across the circle toward the glass wall, heading for the trees and a certain collision. Soon afterward, City Wildlife contacted the Architect of the Capitol (AOC), which oversees this building, to discuss the issue. AOC personnel responded quickly by turning out all but the necessary safety lights in the atrium during migratory seasons, and by 2011, bird deaths at the building had decreased by two-thirds. However, large numbers of strikes have continued because the trees are still visible to the birds.

Thurgood Marshall Federal Judiciary Center (1 Columbus Circle, N.E.)

AOC continues to maintain its reduced lighting levels and is testing other solutions to prevent these strikes.

There are several possible ways to explain the lower mortality rate for birds hitting this building: birds may be decelerating as they approach because they are preparing to land in the bamboo; construction activity around the building may have diverted the birds from a direct

head-on approach; and volunteers often monitor this building first on their route, which may mean more birds are still alive when found. Some birds may not even have hit the glass but are found exhausted on the ground, fluttering up against the glass in repeated attempts to reach the trees.

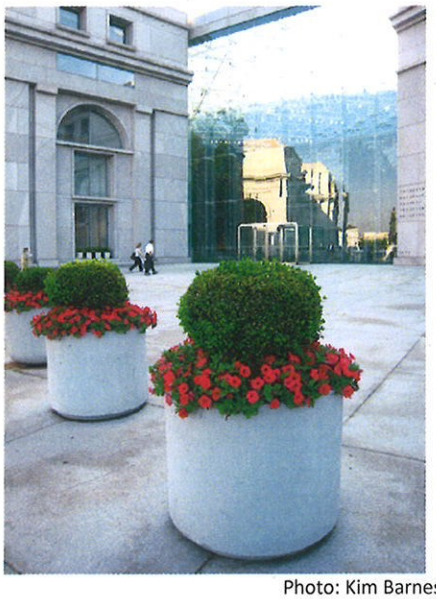


Photo: Kim Barnes

Thurgood Marshall building showing mirror effect in the morning

<u>430 E Street, N.W. (D.C. Courts, entry pavilion) (#3 on map)</u>

In 2009, the D.C. Courts added a large glass entry pavilion to its historic classical courthouse on Judiciary Square. Almost immediately, a staff member in the building started to find dead birds outside the pavilion and alerted City Wildlife. Since then, volunteers have documented 268 strikes leading to 263 deaths, for a mortality rate of 98 percent.

D.C. Courts
430 E Street, N.W.

This building is particularly deadly because it is entirely transparent. Birds simply do not see the glass and attempt to fly to the trees on either side of the pavilion, colliding with the glass at full speed. An unusually high number of woodcocks and hummingbirds have hit this building. When notified of the problem, the Court's building managers readily agreed to dim the pavilion lights during migratory seasons, but the strikes and high mortality rate have continued. The Courts are continuing to explore ways to reduce the number of bird strikes.

National Law Enforcement Museum (444 E Street, N.W.)

In October of 2018, the new National Law Enforcement Museum opened next to the D.C. Courts building. The museum itself is largely underground, but its two above-ground pavilions are all-glass structures, adding to the hazards for birds in this area. Volunteers have documented at least seven bird strikes, five fatal, at these two new pavilions.

800 K Street, N.W. (Techworld) and 700 K Street, N.W. (Anthem Row) (#4 on map)

800 K Street, N.W.
Mirrored glass overpass

This complex consists of two separate buildings connected by a mirrored glass overpass over what is technically Eighth Street but is now a pedestrian plaza. Until 2017, significant numbers of birds were hitting the overpass and falling directly below to the plaza. The building managers were notified of the problem in 2015, but they advised City Wildlife that the building was about to be remodeled. City Wildlife suggested that, as part of the job, film be installed on the overpass to cut down on its high reflectivity. Construction on the east building (700 K Street, N.W.) began in 2017 and is now complete, but the building was re-clad with even more glass and the overpass has remained unchanged. Recorded bird strikes were lower during construction but have now resumed not only at the overpass, but around the newly clad

building as well. Between 2010 and 2019, 185 strikes were recorded at this complex, leading to 159 deaths, for a mortality rate of 86 percent.

Yellow-billed Cuckoo (found under the 800 K Street overpass)

400-444 North Capitol Street, N.W. (Hall of the States) (#5 on map)

Lights Out DC started monitoring this building in 2013 because numerous birds were found at the base of the building. The glass on this facade is highly reflective and mirrors with astonishing reality the trees in Senate Park across the street. A volunteer documented this condition one morning at 7 a.m. When shown the photo, even humans find it hard to determine where reality leaves off and illusion begins, and so do the birds. Glass railings around the roof terrace may add to the hazard. Volunteers have documented 104 strikes at this building with 84 fatalities, for a mortality rate of 81 percent.

400-444 North Capitol Street, N.W., 7 a.m.

Newer buildings

As noted above, during *Lights Out DC's* ten-year period of monitoring, several large glass complexes have been constructed in our monitoring area. While it is too soon to draw conclusions, results to date show substantial problems at some of these new buildings:

City Center

City Center is a high-end project bordered to the east and west by Ninth and Eleventh Streets, N.W.; to the north by New York Avenue; and to the south by H Street, N.W. It contains large amounts of glass, several see-through glass overpasses, and a plaza with landscaping and water features that attract birds. The glass and the overpasses have created problems for birds throughout the complex, especially American Woodcocks. Since it opened in 2015, 46 birds have been collected, 33 of them dead, for a mortality rate of 72 percent. Seven were woodcocks. Since woodcocks sometimes roost in fields and clearings, it is possible that the open plaza along New York Avenue may attract them to this complex.

City Center, showing overpasses

Mt. Vernon Square East

This fast-growing area has added four major glass buildings in as many years. Addresses monitored by volunteers include 655 New York Avenue, N.W.; 650 K Street, N.W.; 655 K Street, N.W.; 600 Massachusetts Avenue, N.W.; 601 Massachusetts Avenue, N.W.; 640 Massachusetts Avenue, N.W.; and 650 Massachusetts Avenue, N.W. At 655 K Street, N.W., eight birds have been found floating in an ornamental pool that appears continuous from inside to outside, separated only by a glass wall that is invisible to birds—another example of architectural interior/exterior ambiguity that confuses birds. *Lights Out DC* has documented 92 strikes with 83 fatalities at these combined addresses, for a mortality rate of 90 percent.

200-250 Massachusetts Avenue, N.W. (Capitol Crossing)

Volunteers have already documented 23 strikes, 17 of them fatal, at this very large project, and the project is still under construction. Capitol Crossing is expected to receive LEED platinum certification and has been described as the District's first eco-district, but it already contains two known hazards to birds: a transparent glass skywalk at the second-floor level, and two glass-enclosed pavilions on the plaza (possibly eco-chimneys for the parking levels) that contain living walls of plants.

200-250 Massachusetts Avenue, N.W. (plaza)

Renderings show other features that are likely to create hazards for birds when adjacent to the building's reflective glass facades: abundant street trees, heavily landscaped rooftop terraces, and indoor plants. Birds already found at this site include two American Woodcocks, two Black-and-white Warblers, one Chimney Swift, two Ovenbirds, and one Yellow-billed Cuckoo, all Species of Greatest Conservation Need in the District. We encourage the developers of this project to incorporate bird-safe design features in the remaining buildings to be constructed before they too become hazards.

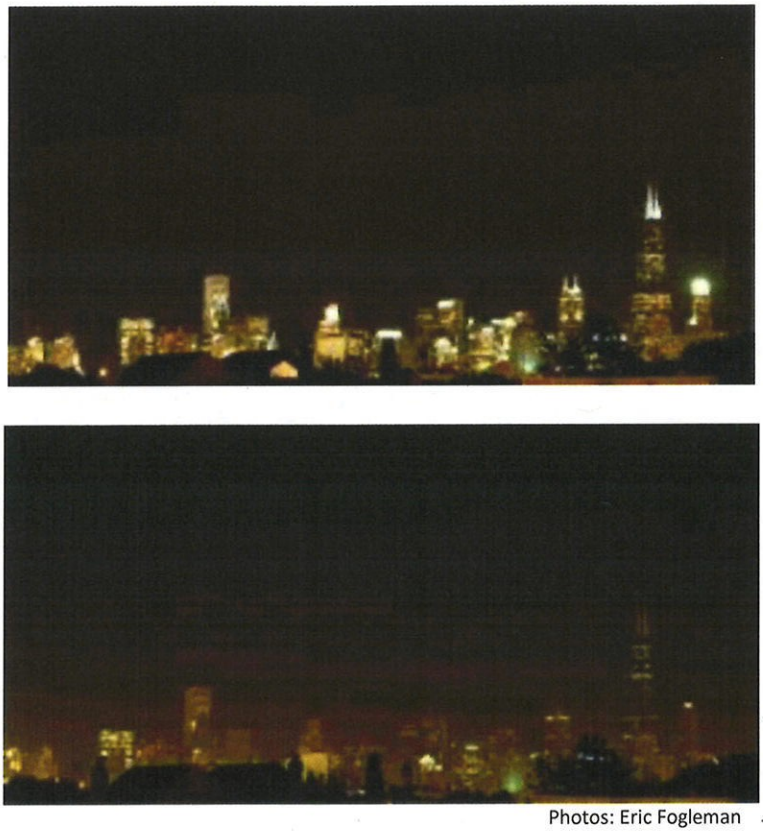
Solutions

Reduce nighttime lighting

Artificial night lighting attracts migrating birds.[17] Many birds migrate at night and are attracted by the "urban glow" of cities when they come down to rest in the early morning hours. In this unfamiliar urban environment, birds can be disoriented by lights in individual buildings and are prone to colliding with glass. Reducing nighttime lighting will attract and disorient fewer birds and is therefore critical to reducing collisions. Using motion detectors, computerized lighting controls, localized task lighting, and dark sky fixtures—and eliminating decorative lighting on the exterior—are all measures that can be taken to save birds' lives.

Constant red lights are especially disruptive to bird navigation and can often be eliminated or changed to another color such as blue or green, which are less disorienting. (For example, the District of Columbia building code permits green exit lights.)[18] Flashing lights are generally less disruptive but may not be acceptable to people in an urban environment.

Reducing night lighting can also save energy. Data confirmed for the Thurgood Marshall Building and the D.C. Courts show reductions of 28 percent and 15 percent respectively in energy use for atrium lighting when the lights are dimmed to save birds.



Photos: Eric Fogleman

Chicago skyline before and after a voluntary Lights Out program took effect

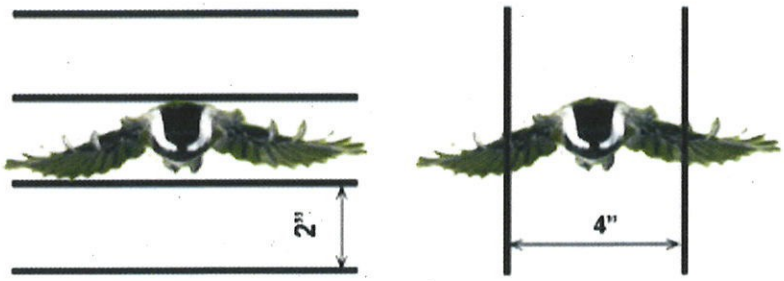
Implement bird-safe design

Bird-safe design is no longer in its infancy, and there are several excellent sources for bird-safe design principles and techniques. The best known is the American Bird Conservancy's *Bird-Friendly Building Design*, 2015 edition.[19] Manufacturers are now aware of this growing market and are rapidly creating new products for bird-safe design, including several different types of bird-safe glass and films.[20] Architects are finding that bird-safe construction need not add any additional project cost, and sometimes bird-safe features (such as patterned glass, louvers, or exterior screening) are included in new buildings for reasons other than bird safety, such as sun control, glare reduction, energy conservation, and even aesthetics. Sensitivity to design

features that pose hazards to birds, such as trees or vegetation behind glass, walls that converge to glass, and see-through overpasses, need not diminish architectural creativity. There are many handsome new buildings in the city that are also safe for birds, such as the Shaw and Anacostia neighborhood libraries, the Tenley-Friendship Public Library, and the D.C. Consolidated Laboratory Forensic Project at Fourth and E Streets, SW.

It is always easier and more economical for buildings to incorporate bird-safe measures during initial construction, but there are also effective techniques for retrofitting problem buildings.

A number of retrofit products are available and more are being developed. Some are films, some are rolls of tape, and one consists of lengths of parachute cord hung vertically at 4-inch intervals from the tops of windows—some call it a "zen wind curtain."[21] All these products are inexpensive and effective if they are installed properly. All are based on the field-tested principle known as the "2 x 4 rule," which requires that any pattern on glass, or any grid in a screen or lattice, be a maximum of two inches apart if horizontal or four inches apart if vertical. These intervals will deter birds from attempting to fly through glass.



The 2 x 4 Rule

Analyzing the building during different times of day indicates whether the problem is transparency or reflectivity, or both. Because reflectivity is often a problem, all products are best installed on the outside of the glass in order to break up the reflected image or obscure the reflection. Screens or shades on the inside can help in certain situations but can also create a hazardous mirror effect, making things worse. Trees and plants behind large expanses of glass are also dangerous, especially if lit at night.

Considering all the available options for the problem buildings we have identified, reducing night lighting and installing bird-safe film would seem to be the most practical and cost-effective choices. City Wildlife obtained rough estimates from one contractor for installing bird-safe film at the Thurgood Marshall Building and at 300 New Jersey Avenue, N.W. The estimated costs were:

1. Thurgood Marshall Building: *est.* $45k - $50k plus lift rental.
2. 300 New Jersey Avenue: *est.* $40k - $45k plus lift rental

Amortized over the five- to nine-year life expectancy of the product, this cost would be between $4,500 and $10,000 annually, possibly a small amount relative to these buildings' annual maintenance budgets.

The Convention Center Experience

One building in D.C. is already leading the way—The Walter E. Washington Convention Center.

Walter E. Washington Convention Center
L Street overpass

In the early years of *Lights Out DC*, many birds were found at the base of the Convention Center's all-glass L Street overpass. By the fall of 2016, *Lights Out DC* volunteers had documented 135 bird strikes at the building, most at this overpass, even though the Convention Center had started dimming its overpass lights during migratory seasons.

In November 2016, to address this persistent and upsetting problem, the Convention Center installed bird-safe film on the exterior surface of its overpass glass. The results have been dramatic: an 85 percent reduction in bird strikes at this overpass between 2017 and 2019, including no strikes in 2018. Moreover, the film is nearly invisible, consisting of a clear film with fine translucent vertical stripes at four-inch intervals. One volunteer who attended a meeting at the Convention Center after the film was installed glanced at it in passing and later asked the staff when they were planning to install it. The Convention Center is pleased with the film and says it has caused no problems.

Bird-safe film installation on the Convention Center overpass

We thank the Convention Center and Events DC for their concern and leadership and hope other buildings in the District follow their example.

The Human Cost

Most bird/glass collision studies do not address the emotional cost to humans of these tragic bird collisions. Yet in our work, we are told time and time again how sad people are to hear the unmistakable thud of a bird colliding with glass, or to find a dead bird at the base of a building. Maintenance workers have often supported our effort to collect birds because they witness the collisions during their morning routine and are upset to see the birds die. In our presentations, we often ask how many people in the room have seen or heard a bird collide with glass. Invariably, all hands go up. The experience is universal and upsetting. And chronic collisions at a workplace can affect a worker's overall attitude toward the job, especially if management turns a blind eye to the problem.

In April, 2018, over a period of several days, 53 Cedar Waxwings collided with glass in the courtyard of the Shining Stars Montessori Public Charter School, an elementary school in Northeast D.C. A *Lights Out DC* volunteer hastened to the site to install post-it notes on the glass, but it was too late. The children had been traumatized by the experience and were being kept away from the courtyard so they wouldn't see the birds hitting the glass and dying on the ground. The next year, the concerned and creative school principal hung flags and children's art over some of the glass in the courtyard and the incident wasn't repeated.

The Future

Incidents like the one at Shining Stars have a substantial human cost in addition to the environmental cost of losing billions of birds. Although evidence of the bird/glass collision problem has been covered in the media for two decades, the building community has yet to address the problem in most new construction. Like all policy-driven changes in construction and design (handicapped accessibility, energy efficiency, green construction), it takes time for architects, clients, building managers, and contractors to embrace something new. However,

the need to adopt new building standards to protect birds is urgent, since their populations are declining so rapidly.

Many jurisdictions are now implementing, or considering, bird-safe measures. San Francisco, Oakland, Cook County (IL), Howard County (MD), Toronto, and most recently New York City have all passed bird-safe legislation. New York's law has the broadest reach: most new buildings and substantially remodeled buildings, including residential structures, must meet certain bird-safe standards.[22] The State of Maryland is currently considering bird-safe requirements for government buildings,[23] and the District of Columbia now offers two bird-safe credits in its revised Green Construction Code.[24] These credits are based on the LEED Pilot Credit 55, Bird Collision Deterrence, which the U.S. Green Building Council has said is its most popular pilot credit ever. The latest appropriations bill for the National Park Service includes direction to start installing and designing for bird safety, and a bill sponsored by Rep. Quigley of Illinois to mandate bird-safe construction for new and substantially remodeled federal buildings passed the U.S. House of Representatives in July, 2020.[25]

Once bird-safe measures are widely adopted, they will become part of all building programs, as have handicapped accessibility and energy efficiency. The laws are definitely trending in this direction. But in the meantime, these fatal collisions are continuing in our city and everywhere around the world. We are losing far too many birds every year and adding to the anxiety of people who care about them. In time, we hope to render our *Lights Out DC* program obsolete because buildings will be safe and there will no longer be collision victims for our volunteers to collect, but this requires prompt action on the part of government, business interests, the building community, and the public. Scientists have already sounded the alarm.

For these reasons, we recommend that the District of Columbia join New York City and other leading jurisdictions by considering bird-safe legislation for at least all new and substantially remodeled D.C. government buildings and, optimally, for all such buildings.

Wood Thrush

With gratitude to the dedicated Lights Out DC volunteers whose tireless work and commitment have made this report possible.

[1] Daniel Klem, Jr., Christopher J. Farmer, Nicole Delacretaz, Yigal Gelz, and Peter G. Saenger, "Architectural and Landscape Risk Factors Associated with Bird-glass Collisions in an Urban Environment," *The Wilson Journal of Ornithology*, 121(1): (2009): p.126; and:

Scott R. Loss, Tom Will, Sara S. Loss, and Peter Marra, "Bird-building collisions in the United States: Estimates of annual mortality and species vulnerability," *The Condor: Ornithological Applications* (Cooper Ornithological Society), Volume 116, (2014): pp. 8-23. (City Wildlife was one of the organizations that contributed its data for this study.)

[2] Kenneth V. Rosenberg et al,. "Decline of the North American Avifauna," *Science,* Vol. 366, Issue 6461 (October 4, 2019): pp. 120-124.

[3] U.S. Fish & Wildlife Service, "Threats to Birds: Migratory Bird Mortality, Questions and Answers," www.fws.gov. This source includes data as of 2017. Cats attacks are now cited as the most significant anthropogenic cause of bird mortality after habitat loss. See Peter P. Marra and Chris Santella, *Cat Wars: The Devastating Consequences of a Cuddly Killer* (Princeton University Press, 2016).

[4] *Lights Out DC* follows the protocol established by FLAP (Fatal Light Awareness Program) of Toronto, Ontario (www.flap.org) in its "Volunteer Training Manual," February 2012.

[5] Federal permit #MB0068A-0, Department of the Interior, US Fish and Wildlife Service, Federal Fish and Wildlife Permit, Special Purpose - Salvage.

[6] Since 2015, City Wildlife has donated its Common Yellowthroats to the Genoscape Project, UCLA Institute of the Environment and Sustainability, www.ioes.ucla.edu or www.birdgenoscape.org. The Yellowthroat is one of 17 species that are the focus of this project.

[7] District of Columbia, Department of the Environment, "Chapter 2: Species of Greatest Conservation Need," *District of Columbia Wildlife Action Plan,"* (July 2015): p. 22-23.

[8] American Bird Conservancy, www.abcbirds.org/bird/wood-thrush/

[9] Scott R. Loss et al., "Bird Building Collisions in the Unites States, Estimates of annual mortality and species vulnerability," p. 16.

[10] Ibid.

[11] Mark S. Johnson, Leslie R. Eastman, Robert J. Werrlein, and Jay M. Rubinoff, "An Evaluation of Species Diversity and Age Structure during Fall Migration Mortality from Urban Structures in Baltimore, Maryland and Washington, District of Columbia," *Maryland Birdlife* (Maryland Ornithological Society), Volume 64, Number 2 (Fall 2015).

[12] Travis Longcore, Catherine Rich, Pierre Mineau, et al., "An Estimate of Avian Mortality at Communication Towers in the Unites States and Canada," *PLoS 1,* (2012): Table 2. This bird collision study estimates loss of carcasses to predators at communication towers to range from 10 to 70% daily, depending on the height of the tower and habitat type. City Wildlife has noted predators, especially crows and gulls, waiting for a collision around buildings that reliably kill birds. We have even witnessed crows removing carcasses as we approached.

[13] Daniel Klem, Jr., "Collisions Between Birds and Windows: Mortality and Prevention," *Journal of Field Ornithology 61(1),* (1990): pp. 120-128.

[14] Daniel Klem, Jr., "Bird Injuries, Cause of Death, and Recuperation from Collisions with Windows," *Journal of Field Ornithology* 61(1), (August 1989): p. 119.

[15] Chad L. Seewagen and Christine Sheppard, *Bird Collisions with Glass: an Annotated Bibliography,* American Bird Conservancy, Washington, D.C., (April, 2018). This is an excellent summary of many research papers on issues related to bird/glass collisions. Contact CSheppard@abcbirds.org

[16] Joelle Gehring, Paul Kerlinger and Albert M. Manville II, "Communication Towers, Lights, and Birds: successful methods of reducing the frequency of avian collisions," *Ecological Applications,* (Ecological Society of America), 19(2), (2009): pp. 505-514, and:

Joop Marquenie, Maurice Donners, et al., "Bird-Friendly Light Sources: Adapting the Spectral Composition of Artificial Lighting," *IEEE Industry Applications Magazine*, (March/April 2013): pp. 56-62.

[17] There is extensive research to confirm this statement. Some of these scientific articles are included in the Seewagen/Sheppard bird collision bibliography cited above.

[18] DCRA/Fire and Emergency Medical Services (FEMS) Department confirmation by e-mail, April 4, 2020, citing Section 1011, Exit Signs, International Fire Code 2012 Edition.

[19] Available in hard copy from the American Bird Conservancy, or online at http://abcbirds.org/wp-content/uploads/2015/05/Bird-friendly-Building-Guide_2015.pdf

[20] e.g. Solyx Bird-Safety window film (www.decorativefilm.com); Feather Friendly Window Markers film (www.featherfriendly.com); Collidescape film (www.collidescape.org); ABC bird tape (www.abcbirds.org); Ornilux glass (www.ornilux.com); AviProtek glass (www.walkerglass.com); etc.

[21] This product, called the Acopian Birdsaver, can be purchased in custom dimensions from www.birdsavers.com. It can also be made at home following the instructions on this site. It is particularly suited to residential applications.

[22] New York City Council Initiative 1482B-2019, enacted January 10, 2020.

[23] Maryland Bird-Safe Building Act HB192, SB299, Maryland General Assembly, pending.

[24] LEED Pilot Credit 55, available for BD+C; O+M, US Green Building Council.

[25] H.R. 919, Bird Safe Buildings Act of 2019, passed by U.S. House of Representatives 7/20/20 as H.R. 2, Moving Forward Act, (www.congress.gov), enter HR919 or HR2.

Appendices:

Appendix 1: Total Bird Strikes by Species (2010 - 2019)

Appendix 2: Total Bird Strikes by Month (2010 - 2019) (with graph)

Appendix 3: Five Building Survey by Species (2010 - 2019)

Appendix 4: Five Building Survey by Year (2010 - 2019)

Appendix 5: Graph of Bird Strikes at Five Buildings vs. All Bird Strikes (2010 - 2019)

Appendix 6: Convention Center Survey by Year (2010 - 2019)

Note:

Our data can be sorted in many way to obtain detailed information. For inquiries, please contact:

City Wildlife, Inc.
info@citywildlife.org
(202) 882-1000

Appendix 1
City Wildlife *Lights Out DC*
Total Bird Strikes by Species (2010-2019)

Species	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	Total	Dead	Released
Acadian Flycatcher						1					**1**	1	
American Bittern						1					**1**		1
American Crow				2		1		1		2	**6**	6	
American Goldfinch	1		1		1	1			1	1	**6**	4	2
American Kestrel						1					**1**		1
American Redstart			1		1	1	1	3	1	3	**11**	9	2
American Robin		2	1	1	4	5	3	4	3	7	**30**	25	5
American Woodcock	4	6	7	10	23	26	15	55	35	50	**231**	201	30
Barred Owl						1					**1**	1	
Bay-breasted Warbler					1						**1**	1	
Belted Kingfisher					1	1				1	**3**	3	
Black-and-white Warbler		5	2	2		5	6	6	7	7	**40**	38	2
Blackpoll Warbler	1	1			2	1	4	1	1		**11**	11	
Black-throated Blue Warbler	2	4	3	1	4		2	1	1		**18**	17	1
Black-throated Green Warbler	1	1		1		1	1	1		1	**7**	6	1
Blue-gray Gnatcatcher							1				**1**		1
Blue Jay					1				3		**4**	4	
Brown Creeper	1	3	4	1	2	3	2		1	1	**18**	16	2
Brown Thrasher	2				2	2	1			2	**9**	9	
Brown-headed Cowbird				1	1					1	**3**	3	
Canada Warbler						1	1	1	2		**5**	5	
Cape May Warbler		1	1		1				3		**6**	6	
Carolina Wren						2					**2**	2	
Cedar Waxwing			1			1		1	55	1	**59**	59	
Chestnut-sided Warbler						1		2		1	**4**	3	1
Chimney Swift	1	2	1				1	16	1	2	**24**	20	4
Chipping Sparrow			1		3						**4**	4	
Common Grackle					2	1	1	1			**5**	5	
Common Yellowthroat	16	37	21	19	58	25	31	43	39	78	**367**	295	72
Cooper's Hawk				3	1	3		2	4	2	**15**	10	5
Dark-eyed Junco	4	3	4	5	10	3	4	4	8	13	**58**	54	4
Downy Woodpecker			2		1	1	1		1	3	**9**	9	
Eastern Towhee		1	1	1	2	4	2	2	1	6	**20**	15	5
Eastern Wood Pewee										1	**1**	1	
Empidonax (sp.), Flycatcher		1				1		1	2	3	**8**	6	2
European Starling	2	2	4	3	3	11	6	6	3	6	**46**	42	4
Field Sparrow		1	1	2	3	3	1	3	1	4	**19**	17	2
Fox Sparrow					3		2			3	**8**	8	
Golden-crowned Kinglet		3	2		5		1	2	8		**21**	18	3

Appendix 1
City Wildlife *Lights Out DC*
Total Bird Strikes by Species (2010-2019)

Species	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	Total	Dead	Released
Grasshopper Sparrow			1	1	1	2	2		3	1	**11**	10	1
Gray Catbird	7	13	8	14	18	17	11	9	15	16	**128**	99	29
Gray-cheeked Thrush		1	2	1			1			2	**7**	7	
Hermit Thrush	4	7	7	10	12	3	5	6	7	23	**84**	62	22
House Finch		1	2		1	3	2	2		3	**14**	14	
House Sparrow		3	4	8	13	11	8	8	9	10	**74**	66	8
House Wren						1	1	1	1		**4**	2	2
Indigo Bunting	2	1	1		2		2	2	1	1	**12**	10	2
Kinglet (sp.)			1								**1**	1	
Lincoln's Sparrow	3	5		2	3	5	2	3	5	5	**33**	26	7
Louisiana Waterthrush			1	1	1		1				4	3	1
Magnolia Warbler	1				2	1	3	3	1	3	14	12	2
Mallard				1		3		1			**5**	4	1
Marsh Wren						1	1			1	**3**	3	
Mourning Dove		1	5	3	4	3	6	4	6	6	**38**	29	9
Mourning Warbler		1			1						**2**	2	
Nashville Warbler			1	1				1			**3**	2	1
Northern Cardinal		1		2	1			2	3	2	**11**	11	
Northern Flicker	1	1	2	1	3	5	3	8	5	4	**33**	30	3
Northern Mockingbird				2		1			1	1	**5**	4	1
Northern Parula Warbler		3			1	1	2		2	2	**11**	8	3
Northern Saw-whet Owl				1							**1**	1	
Northern Waterthrush	1	1	2		3	2	2	2	1	4	**18**	16	2
Nuthatch (sp.)	2										**2**	2	
Orange-crowned Warbler					1	1		1			**3**	2	1
Ovenbird	17	20	26	15	43	21	48	28	22	44	**284**	231	53
Palm Warbler					1		3	2	1	1	**8**	8	
Pied-billed Grebe	1										**1**	1	
Pileated Woodpecker									1		**1**		1
Pine Warbler		2						2	1	1	**6**	3	3
Red-bellied Woodpecker			5	1	2	2	2	2	2	3	**19**	13	6
Red-breasted Nuthatch			4						1		**5**	5	
Red-eyed Vireo	1	3	1	2	1		2	2	1		**13**	12	1
Red-shouldered Hawk						1		1			**2**		2
Red-tailed Hawk						1	1		1	2	**5**	2	3
Rock Dove (Pigeon)	1		1	1	3	7	5	2	5	5	**30**	23	7
Rose-breasted Grosbeak				2				2	1	1	**6**	4	2
Ruby-crowned Kinglet			1		1	1	1		1	1	**6**	6	
Ruby-throated Hummingbird	1	5	4	3	4	8	5	8	5	8	**51**	48	3

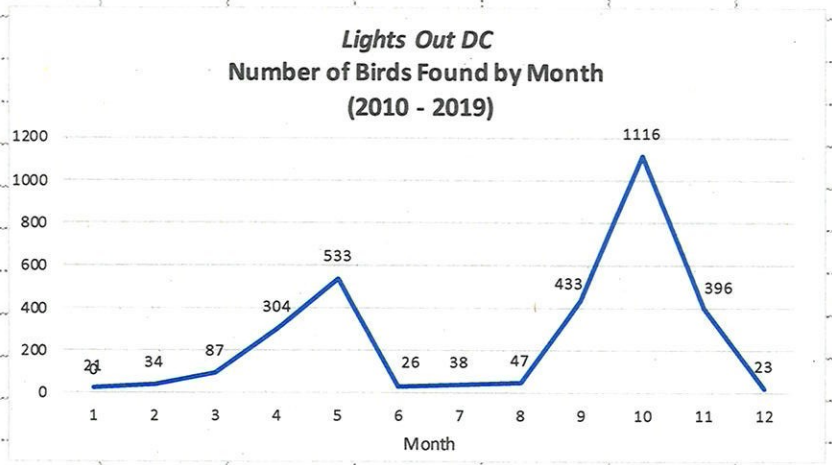
Appendix 1
City Wildlife *Lights Out DC*
Total Bird Strikes by Species (2010-2019)

Species	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	Total	Dead	Released
Savannah Sparrow			3			1					**4**	4	
Scarlet Tanager			1	1	2	1	2				**7**	6	1
Sharp-shinned Hawk						1	1				**2**	2	
Song Sparrow	5	4	7	12	28	20	15	6	12	26	**135**	119	16
Sora			1	1				1			**3**	3	
Sparrow (sp.)	1	5	3	12	7	5	7	9	5	11	**65**	53	12
Summer Tanager								1			**1**		1
Swainson's Thrush		4	4	1	5	4	3	2	3	3	**29**	26	3
Swamp Sparrow	11	6	11	2	13	8	4	10	8	8	**81**	72	9
Tennessee Warbler		3		1	4				1	4	**13**	13	
Thrush (sp.)			1	2	1		1	1	3		**9**	6	3
Tufted Titmouse					1		1				**2**	2	
Unidentified					2	5	13	26	9	9	**64**	63	1
Veery	2	1	1	1	1	1	2			1	**10**	9	1
Virginia Rail								1	1		**2**	1	1
Warbler (sp.)		1	2	2	2	7	4	7	14	5	**44**	39	5
Whip-poor-will		1									**1**	1	
White-breasted Nuthatch			2		2		1	1		1	**7**	7	
White-eyed Vireo									1		**1**	1	
White-throated Sparrow	21	27	28	33	65	32	46	24	30	64	**370**	303	67
Winter Wren						2				2	**4**	2	2
Wood Thrush	3	8	5	5	8	1	4	4	4	1	**43**	36	7
Woodpecker (sp.)				1	1	1		1	2		**6**	6	
Worm-eating Warbler				1	1		1				**3**	1	2
Wren (sp.)					12				2		**14**	13	1
Yellow Warbler								2	1		**3**	3	
Yellow-bellied Flycatcher		1					1				**2**	2	
Yellow-bellied Sapsucker	4	5	3	2		6	8	5	20	13	**66**	57	9
Yellow-billed Cuckoo	1	1						1	3	6	**12**	9	3
Yellow-breasted Chat		1					1				**2**	2	
Yellow-rumped Warbler		2	1	4	2	2	4		2	2	**19**	14	5
Yellow-throated Warbler									1		**1**		1
Total all species	**125**	**212**	**210**	**205**	**414**	**306**	**325**	**360**	**405**	**505**	**3067**	**2591**	**476**
Mortality Rate												84%	
Species of Greatest Cons. Need (SGCN)	34	55	55	44	94	75	94	122	83	128	**784**	664	120
SGCN Mortality Rate												85%	

Appendix 2
City Wildlife Lights Out DC
Total Bird Strikes by Month (2010 - 2019)

Month:	Jan	Feb	March	April	May	June	July	Aug	Sept	Oct	Nov	Dec	Total
Year:													
2010				10	20				11	75	8	1	125
2011	1	2	4	18	24	3	4	1	38	106	9	2	212
2012		1	4	21	33	1	2	4	39	91	14		210
2013	3		2	18	42		3	7	27	68	33	1	204
2014		3	7	31	84	1	7	3	62	175	38	3	414
2015	11	5	8	29	54	5	6	10	34	108	32	4	306
2016	1	3	12	26	112	3	5	5	24	93	36	1	321
2017	1	5	24	31	43	7	3	7	71	110	55	1	358
2018	3	10	10	82	60	2	3	5	56	119	49	4	403
2019	1	5	16	38	61	4	5	5	71	171	122	6	505
Total:	21	34	87	304	533	26	38	47	433	1116	396	23	3058

Note: Totals may add up to less than the total number of birds found that year (see Appendix 1) because a few dates are unknown.



Appendix 3
City Wildlife *Lights Out DC*
Five Building Survey by Species (2010-2019)

Species	Thurgood Marshall Building	300 New Jersey Avenue, NW	430 E Street, NW	700-800 K Street, NW	400-444 North Capitol Street, NW	Total Five Buildings	Total All Buildings
American Bittern				1		1	1
American Crow		1				1	6
American Goldfinch				1		1	6
American Redstart	2		1	2		5	11
American Robin		1	6			7	30
American Woodcock	7	3	19	6	3	38	231
Black-and-white Warbler	1	2	3	2	2	10	40
Blackpoll Warbler		1		1	1	3	11
Black-throated Blue Warbler	2	1		3	1	7	18
Black-throated Green Warbler				1		1	7
Blue-gray Gnatcatcher	1					1	1
Brown Creeper				3	1	4	18
Brown Thrasher			1	3	1	5	9
Canada Warbler					2	2	5
Cape May Warbler			1			1	6
Cedar Waxwing		1				1	59
Chestnut-sided Warbler				1		1	4
Chimney Swift			2	1		3	24
Chipping Sparrow	2		1			3	4
Common Yellowthroat	33	44	44	17	13	151	367
Dark-eyed Junco	10	3	17	5	1	36	58
Eastern Towhee	3	3	1		2	9	20
Empidonax (sp.), Flycatcher			2			2	8
European Starling	2	5	2	2	1	12	46
Field Sparrow	3	3	5	1		12	19
Fox Sparrow	2	1	2			5	8
Golden-crowned Kinglet					2	2	21
Grasshopper Sparrow	3		2	1	1	7	11
Gray Catbird	25	25	12	5	5	72	128
Gray-cheeked Thrush	1	2		2		5	7
Hermit Thrush	13	9	3	3	4	32	84
House Finch					3	3	14
House Sparrow	2	2	3	6	1	14	74
Indigo Bunting		2		3	1	6	12
Kinglet (sp.)				1		1	1
Lincoln's Sparrow	4	8	3	3	1	19	33
Louisiana Waterthrush			2		1	3	4
Magnolia Warbler	2	2	1	2		7	14

Appendix 3
City Wildlife *Lights Out DC*
Five Building Survey by Species (2010-2019)

Species	Thurgood Marshall Building	300 New Jersey Avenue, NW	430 E Street, NW	700-800 K Street, NW	400-444 North Capitol Street, NW	Total Five Buildings	Total All Buildings
Marsh Wren			2			2	3
Mourning Dove			1	3		4	38
Mourning Warbler	1	1				2	2
Nashville Warbler	1					1	3
Northern Cardinal	1					1	11
Northern Flicker			1	4		5	33
Northern Mockingbird	1	1				2	5
Northern Parula Warbler	1	1	1			3	11
Northern Saw-whet Owl				1		1	1
Northern Waterthrush	3	1		3		7	18
Nuthatch (sp.)				1		1	2
Orange-crowned Warbler				1	1	2	3
Ovenbird	47	29	18	30	13	137	284
Palm Warbler	1		1		1	3	8
Pine Warbler				1	1	2	6
Red-bellied Woodpecker				6		6	19
Red-breasted Nuthatch				3		3	5
Red-eyed Vireo				2		2	13
Rock Dove (Pigeon)				1		1	30
Rose-breasted Grosbeak			1			1	6
Ruby-crowned Kinglet	1	1				2	6
Ruby-throated Hummingbird	3	8	15	5	2	33	51
Savannah Sparrow	2	2			1	5	4
Scarlet Tanager	1		1			2	7
Song Sparrow	25	29	29	3	4	90	135
Sparrow (sp.)	11	9	3	3		26	65
Swainson's Thrush	3	3		1	2	9	29
Swamp Sparrow	15	15	10	3	4	47	81
Tennessee Warbler		2	1	2		5	13
Thrush (sp.)	2	2				4	9
Tufted Titmouse				1		1	2
Unidentified	12	3	1	3		19	64
Veery	1		1		1	3	10
Warbler (sp.)	1	5	1		3	10	44
White-breasted Nuthatch				2		2	7
White-throated Sparrow	85	81	43	21	20	250	370
Winter Wren			1			1	4
Wood Thrush	6	5	2	3	1	17	43

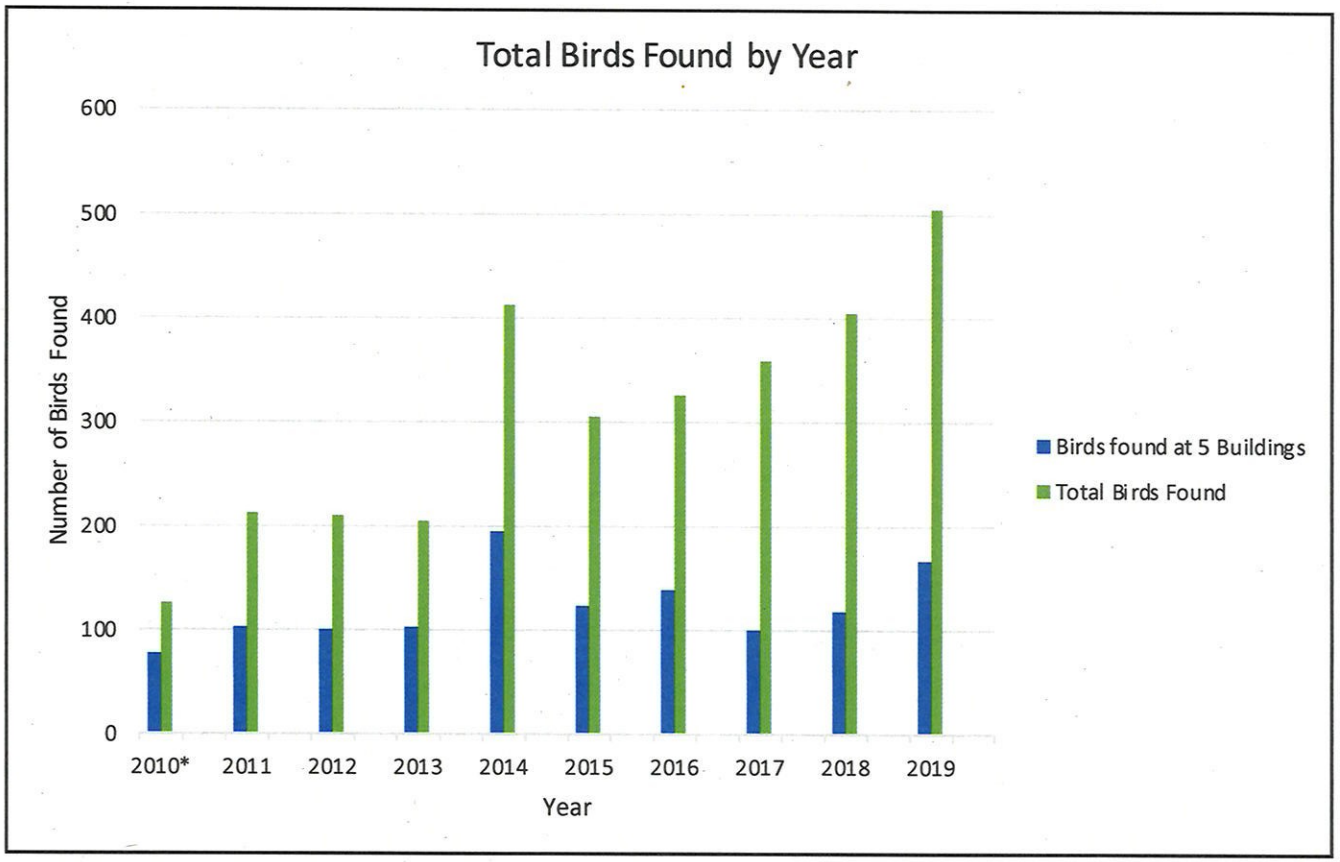
Appendix 3
City Wildlife *Lights Out DC*
Five Building Survey by Species (2010-2019)

Species	Thurgood Marshall Building	300 New Jersey Avenue, NW	430 E Street, NW	700-800 K Street, NW	400-444 North Capitol Street, NW	Total Five Buildings	Total All Buildings
Worm-eating Warbler				2		2	3
Wren (sp.)		1				1	14
Yellow-bellied Sapsucker		4	1	2	3	10	66
Yellow-billed Cuckoo				1		1	12
Yellow-rumped Warbler	3	1	1	1		6	19
Yellow-throated Warbler	1					1	1
Total	**346**	**323**	**268**	**185**	**104**	**1226**	**2980**
Dead	224 (65%)	287 (89%)	263 (98%)	155 (84%)	84 (81%)		
Released	122	36	5	26	20		
Species of Greatest Cons. Need (SGCN)	**74**	**46**	**59**	**59**	**29**	**267**	**784**
Dead							664 (85%)
Released							120
Total All Buildings (all species)							**3067**
Dead							2591 (84%)
Released							476
Notes:							
1. 430 E Street, NW numbers do not include birds that have hit the Law Enforcement Museum.							
2. 700 - 800 K Street, NW, numbers include all addresses around the block bordered by K Street, NW; 7th Street, NW; I Street, NW; and 9th Street, NW. Most were found at the overpass or nearby.							
3. Total of all buildings (3,067) includes species that are not listed in this chart because they did not hit any of the 5 buildings listed. See Appendix 1 for a listing of all species found.							

Appendix 4
City Wildlife Lights Out DC
Five Building Survey by Year (2010 - 2019)

	2010*		2011		2012		2013		2014		2015		2016		2017		2018		2019		Total		
Thurgood Marshall Bldg	**36**		**23**		**31**		**39**		**48**		**32**		**41**		**29**		**34**		**33**		**346**		
Dead		15		9		22		28		26		21		26		24		25		28		**224**	**65%**
Released		21		14		9		11		22		11		15		5		9		5		**122**	**35%**
300 New Jersey Ave NW	**8**		**35**		**16**		**22**		**44**		**28**		**37**		**30**		**46**		**57**		**323**		
Dead		7		31		13		20		40		27		34		26		38		51		**287**	**89%**
Released		1		4		3		2		4		1		3		4		8		6		**36**	**11%**
430 E Street NW**	**11**		**29**		**19**		**18**		**49**		**36**		**26**		**21**		**15**		**44**		**268**		
Dead		10		29		19		18		48		36		25		20		15		43		**263**	**98%**
Released		1		0		0		0		1		0		1		1		0		1		**5**	**2%**
700-800 K Street NW	**21**		**16**		**35**		**17**		**33**		**15**		**20**		**8**		**4**		**16**		**185**		
Dead		20		13		28		15		33		11		13		8		3		15		**159**	**86%**
Released		1		3		7		2		0		4		7		0		1		1		**26**	**14%**
400-444 North Capitol St NW							**7**		**21**		**13**		**14**		**12**		**19**		**18**		**104**		
Dead								7		14		12		11		10		18		12		**84**	**81%**
Released								0		7		1		3		2		1		6		**20**	**19%**
Total from 5 Buildings	**76**		**103**		**101**		**103**		**195**		**124**		**138**		**100**		**118**		**168**		**1226**		
Dead		52		82		82		88		161		107		109		88		99		149		**1017**	**83%**
Released		24		21		19		15		34		17		29		12		19		19		**209**	**17%**
Total from all buildings:	**125**		**212**		**210**		**205**		**414**		**306**		**325**		**360**		**405**		**505**		**3067**		
Dead																						**2591**	**84%**
Released																						**476**	**16%**
*Lights Out volunteers walked only 2 days/week during this first year, 7 days/week thereafter.																							
** Not including collisions at the Law Enforcement Museum																							

Appendix 5
Graph of Bird Strikes at Five Buildings vs. All Bird Strikes (2010 - 2019)



Appendix 6
City Wildlife Lights Out DC
Walter E. Washington Convention Center Bird Strikes by Year
(2010-2019)

Convention Center Location	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	Total (2011-2019)	Total (2011-2016)	Total (2017-2019)	Average (2011-2016)	Average (2017-2019)	Percentage Reduction (2017-2019)
L Street Overpass: Calculation 1:																
L St overpass (identified location)		5	3	2	11	5	5	2	0	2	35					
L St overpass (assumed location)		5	3	3	3	4	4	0	0	0	22					
L Street overpass (total)		10	6	5	14	9	9	2	0	2	57	53	4	8.8	1.3	85%
L Street Overpass: Calculation 2:																
L St overpass (identified location)		5	3	2	11	5	5	2	0	2	35					
L St overpass (assumed location)		9	6	6	7	7	8	0	0	0	43					
L St overpass (total)		14	9	8	18	12	13	2	0	2	78	74	4	12.3	1.3	89%
Other Locations at Convention Center:																
on 9th St		1	2	3	7	9	5	5	9	13	54					
on 7th St		0	1	1	2	0	3	4	1	4	16					
on L St between overpass and 7th		0	0	0	2	0	0	0	0	4	6					
on L St beween overpass and 9th		0	3	0	0	1	0	0	0	0	4					
on corner of 9th St & L St		2	4	0	1	0	2	3	3	2	17					
on corner of 7th St & L St		0	1	1	1	0	0	0	1	1	5					
other		0	0	0	0	1	1	0	1	0	3					
Total from Convention Center:		**17**	**20**	**13**	**31**	**23**	**24**	**14**	**15**	**26**	**183**					
Notes:																

1. Data from 2010 were not included because volunteers walked only 2 days/week that year. 7 birds were found in 2010. Volunteers walked 7 days/week all other years.

2. The L Street overpass was the most hazardous part of the Convention Center prior to November, 2016, when Solyx Bird-Safety window film was installed on the overpass glass. The purpose of this spreadsheet is to determine the effectivness of the film in reducing bird strikes.

3. Two calculations are used here to determine the total number of strikes at the overpass. These two calculations are necessary because prior to 2017, volunteers did not always identify where the bird was found at the Convention Center. However, volunteers generally specified the location only when the bird was found at a location other than the overpass, since that was where most birds were found. To be conservative, however, we have performed two calculations: the first calculation is conservative and assumes that only half the birds whose location was not identified were found at the overpass. The second calculation assumes that all the birds whose location was not identified were found at the overpass, which is more likely. Either way, the reduction from film is between 85% and 89%.