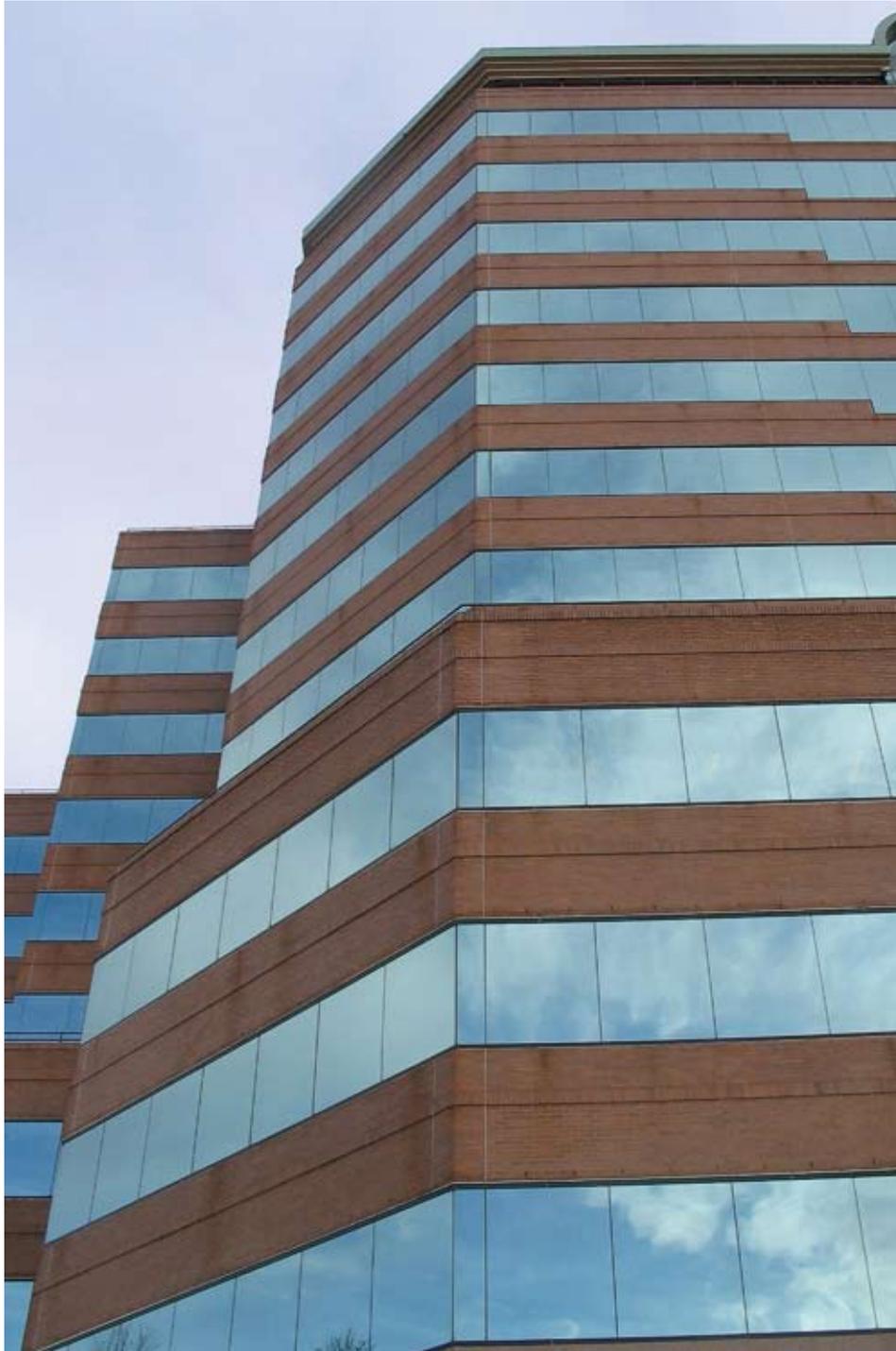


WINDOWS: AN UNINTENDED FATAL HAZARD FOR BIRDS

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Large glass surfaces such as office buildings kill millions of birds every year.

With the exception of habitat destruction, a vast amount of evidence, primarily collected over the past 35 years, indicates that clear and reflective sheet glass causes the unintended deaths of more birds worldwide than any other human-related avian mortality factor. This article provides an overview of the harmful relationship between wild birds and the glass they encounter in human-altered environments, whether urban, suburban, or rural.

What Do We Know?

Without question, glass in the form of windows has enriched and contributed to the aesthetic, cultural, economic, physiological and psychological well-being of humans for at least 16 centuries. Equally without question, birds act as if clear and reflective glass is invisible to them, and they are killed in the billions worldwide flying into panes as small as those in garage doors and as large as those making up entire walls of multi-story buildings. Every bird that dies striking glass is an unintended regrettable event that stimulates guilt and anxiety among aware and caring humans, and especially among the conservation minded. Elimination of glass from human structures has never been advocated as a realistic solution to an ever-growing hazard for birds. A universally accepted means of preventing these unwanted kills must retain the current properties of glass for humans, and, at the same time, inform flying birds that the space occupied by glass is to

be avoided. The long-term solution is likely to be new glass products, but mitigating or eliminating kills at existing panes will be a necessary challenge to save countless bird lives, among them rare, threatened, and endangered species.

The lethal effect of bird-glass collisions differs from breeding territorial individuals that repeatedly attack their mirrored image as if it were a rival. Although annoying to some, these types of strikes are harmless to attackers, even though they may appear bloody and disheveled from their relentless encounters.

Alternatively, the deceived casualties that attempt to reach habitat seen through or reflected in windows are most often hidden from view in vegetation surrounding human dwellings. They are either killed outright, injured and struggling to recover, or quickly taken by predators and scavengers, and this best explains why many homeowners are unaware of the birds dying around them. When death occurs it is from head trauma, similar to what humans experience after head injury where the brain becomes herniated from swelling, resulting in the breaking of the blood-brain barrier; x-rays of more than 500 avian window-kills reveal no evidence that birds die of a “broken neck” although this particular cause is most often assumed.

Glass Strikes Kill More Birds Than Any Other Human-Related Mortality Factor

Using 1970s Census data, approximately 100 million to 1 billion birds were estimated to be killed annually by striking windows in the US alone based on the assumption that 1 to 10 birds are killed at one building each year. An independent study throughout North America at homes where winter bird feed-



Migrant warblers such as this Northern Parula commonly strike windows.

ing was monitored supported and judged the 100 million figure to be reasonable. Given what we currently know about the glass threat to birds, common sense suggests that even the upper figure of a 1 billion US death toll is highly conservative. A now frequently used frame-of-reference for this attrition is that if the ultra-conservative lower 100 million US annual kill figure is accepted then you would need 333 Exxon Valdez oil spills each year to match the carnage. It is especially ironic that the 100,000 to 300,000 marine birds estimated to have been killed by the 1989 Exxon Valdez oil spill in Alaska is still often cited by various media sources as a prime example of a world-class environmental disaster while the far greater yearly toll exacted by common everyday window glass largely goes unnoticed, even ignored.

Comparable annual US avian mortality from other human-related sources include: 120 million from hunting, 60 million from vehicular collisions, 10,000 to 40,000 at wind power turbines, and as many as a billion by domestic cats. Even considering the billion bird deaths

attributable to cats, this figure is expected to be far less than the annual kill at glass, reasoning that cats are active predators that most often capture vulnerable prey, while sheet glass is an indiscriminate killer that takes the strong as well as the weak and is astronomically more abundant than cats in the environment. The toll will only increase as more and more human structures are modestly or lavishly covered with glass and placed on avian breeding and non-breeding grounds and across migratory routes as gauntlets of invisible killers.

Annual US bird populations are estimated to be 20 billion in the fall when the young of the year enter the population, and annual glass kills are estimated to be 0.5 to 5 percent of this figure. With one rather dramatic exception, no specific evidence currently accounts for the decline in any species population being directly attributable to glass.

In Connecticut 16 of 21 species classified as endangered have been documented as window kills.

The Exxon Valdez oil spill is cited as a prime example of a world-class environmental disaster, killing 100,000-300,000 marine birds, yet it was a small fraction of birds killed each year by glass strikes.

The exception is the globally endangered Swift Parrot of Australia where 1.5 percent of the entire population of 1,000 breeding pairs are annually killed striking windows. Surveys of bird strikes reveal that approximately 25% (225 species) of North American and 6 percent (556 species) of the world's birds have been documented colliding with windows. In Connecticut, all but the Upland Sandpiper, Northern Harrier, Bald Eagle, King Rail, and Roseate Tern, 16 of 21 species, that are classified as Endangered have been documented as window-kills. Of those classified as Threatened are the Short-eared Owl, American Kestrel, and Purple Martin, 3 of 9 species, are known to be glass victims.

Among those listed as Special Concern, the Northern Saw-whet Owl, Whip-poor-will, Alder Flycatcher, Brown Thrasher, Northern Parula, Saltmarsh Sharp-tailed Sparrow, Savannah Sparrow, Ipswich Sparrow (Savannah Sparrow subspecies), and Eastern Meadowlark, 9 of 20 species, are known window casualties.

Birds Strike Glass Wherever the Two Occur

Worldwide, the bird species not recorded as window-kills are those that typically do not occur near human dwellings. The sex, age, or resident status of a bird in any locale has little influence on their vulnerability to windows. There is no season or time of day, and almost no weather conditions during which birds elude glass. Transparent or reflective panes of various colors appear equally lethal. Strikes occur at sheet glass of various sizes, heights and orientation in urban, suburban, and rural environments, but birds are more vulnerable to large (> 2 m² = 7 ft²) panes, near ground level

Plastic film used on some vehicles and in Southern states to reduce interior heat and glare are effective at preventing bird strikes without significantly reducing the visibility from inside.

and at heights above 3 m (10 ft) in suburban and rural areas. Strikes are more frequent during winter when birds are attracted to feeders in larger numbers than at any other time of the year, including the spring and fall migratory periods when glass casualties typically attract the most human attention because they are often more visible in urban areas on sidewalks or around workplaces. Strikes are known wherever birds and glass mutually occur, and the best predictor of strike rate at any site is the density of birds in the vicinity.

To what extent the glass hazard accounts for attrition in abundant or declining species populations is as yet unknown and in need of detailed study, but, given the nature of this type of threat, the attrition at glass potentially can affect every species and total bird numbers overall. Glass is an indiscriminate killer that takes the fittest as well as the unfit from populations. Because glass is a universally indiscriminate killer, the attrition it claims is an additive rather than a compensatory avian population mortality factor; meaning, the toll exacted is a separate and independent loss in addition to what disease, starvation, weather, the rigors of migration, and other mortality factors take annually.

What Can Be Done?

Legislation in the form of the Migratory Bird Treaty Act (MBTA) of 1918, as amended, and the Endangered Species Act (ESA) of 1973

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Glass strikes are more frequent during the winter when birds such as this Northern Cardinal are attracted to feeders near houses.



Some glass surfaces have killed hundreds of birds in a single day, including Black-throated Blue Warblers.

have been used to protect the unintended killing of birds by pesticides and power lines, but its use to protect birds from glass is currently seen as impractical. While no reasonable person would advocate prosecuting homeowners for birds killed at their windows, we should expect responsible government agencies charged with enforcement of this legislation to address those sites where hundreds of birds are killed by glass, at some places, in a single day. At such killing-places, the toll is substantial, foreseeable, and avoidable, and birds in general merit protection at such locations under the purview of the MBTA and ESA to be consistently enforced, no matter what the source of unintended mortality. Minimally, regulations are recommended to require warning labels be attached to sheet glass to alert building industry professionals that this product is a proven lethal hazard for federally protected birds.

Monitoring, care and protection programs focusing on window casualties during the fall and spring migratory periods in the North American cities of Chicago, New York, and Toronto are sophisticated and extensive, especially in attempting to describe and mitigate the effects of lighting to attract large numbers of birds, typically under unfavorable weather conditions, to the vicinity of the glass hazard. Conservation-minded leaders in Philadelphia (PA) are currently plan-

ning a similar program for that city, and given the universal nature of the threat, the only reason any other metropolitan area does not have a similar commitment is because they also lack dedicated individuals committed to the cause of saving bird lives from this particular human-associated threat. Certainly, more programs to save birds from glass will be created worldwide as more effective education informs the general public of the universal nature, scale, and consequences of the threat. As a promising start, on 31 January 2006, an historic event occurred in Toronto, Ontario where the government adopted formal guidelines to prevent bird collisions with buildings, making it the first city in the world to

The major cities of New York, Chicago and Toronto have led the way with extensive and sophisticated mitigation programs.

implement a migratory bird protection policy associated with the lethal effects of glass on birds in the environment.

Research and Development of New Glass Products is Necessary

The long-term solution to preventing all bird kills at glass is expected to be a new sheet glass product to be used in the construction of manmade structures, one in which humans continue to enjoy all the attractive and functional qualities of windows while birds are able to recognize clear and reflective panes as barriers to be avoided. Such a product and the specific attributes it will possess is not currently available, but under discussion and study by principals of the building industry and conservation community. Great hope is placed in the ability of birds to see ultraviolet (UV-A wavelengths)

The popular falcon decals, unless placed to cover most of the surface (two to four inches apart) are not very effective at preventing bird strikes.

signals that humans do not, and incorporate such signals into glass in a way that birds will be alerted to danger. Surely, if possible, this would be an elegant solution, but whether birds can use UV-A signals for this purpose is still questionable but under intense study.

If no universal solution is as yet available, there are a number of ways to mitigate or eliminate bird strikes at homes and commercial buildings. Commercial window screens designed specifically for this purpose are available (see www.birdscreen.com for more

Bird feeders within three feet of windows caused no collision fatalities in a documented study, however, numerous collisions were recorded with a feeder placed 33 feet away.

information), but other physical barriers, such as awnings, garden netting or insect screening can work equally well. Decals of any shape and size will reduce or eliminate bird strikes when applied to uniformly cover the glass surface. The more decals the fewer strike deaths; include enough decals to uniformly cover the entire window such that they are separated by 5-10 cm (2-4 in) distance and you eliminate strikes altogether. At see-through sites such as glass-lined corridors or the corners of rooms where panes join, decals can be applied to the inside surface and still be visible to

birds on the outside; alternatively, decals must be applied and contrast with the outside surface of reflective panes to be visible to birds. The popular falcon silhouette and more recently spider web designs and UV reflecting maple leaves are no more effective than any other shape. Mylar strips, curtains of beads or bamboo sections, or colored feathers on monofilament line are all effective if applied in an amount that uniformly covers the glass surface, and spaced 10 cm (4 in) apart when oriented vertically, and 5 cm (2 in) apart when oriented horizontally. The difference in vertical and horizontal spacing is perhaps best explained by birds being more apt to give wider clearance flying around vertical tree trunks than over and under more closely spaced horizontal branches.

Bird feeders are known to markedly increase the number of birds in the vicinity of glass. A simple way to protect birds from collid-

Connecticut Audubon Society will be reviewing the windows in its six centers based on Klem's research to reduce bird strikes.

ing with windows is to move bird feeders to within 1 m (about 3 ft) of the glass surface. Birds come and go from feeders, but only rarely do they pass by with enough speed to injure themselves at a nearby pane. Field experiments documented no collision fatalities when feeders were placed within 1 m (about 3 ft) of a window, and an incremental increase in collision fatalities to a level of 70% at a window with a feeder placed 10 m (33 ft) away. As easy a solution as feeder placement is, it can save countless bird lives, certainly in the millions, at homes and at high-image sites such as the visitor centers of local, state (provincial), and federal parks, refuges, and nature centers. Other

experiments document how constructing human structures with windows angled 20 and 40 degrees from the vertical will significantly reduce strike fatalities compared to the conventional vertical orientation. Such angling, however, is likely to be structurally impractical above the ground level; nevertheless, a group of New England architects believe these results are of value and have promise for addressing bird kills in their designs of new construction.

Advertising film used on buses or the rear windows of pickup trucks are also effective and drawing serious attention as a bird-glass collision pre-

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White-breasted Nuthatches are common feeder birds that often strike windows.



Commercial buildings with extensive glass facing the environment are deadly to migrating birds.

vention measure. The film permits a clear unobstructed view with, only a modest reduction in light, from the inside of a room or vehicle while presenting a dramatic visible pattern on the outside that birds will avoid (see www.flap.org for information about CollidEscape). Building managers at a vast corporation campus with extensive glass corridors in St. Louis (MO) and even for an entire glass-covered building in San Diego (CA) are contemplating using this film to address bird kills at their respective sites.

The loss of birdlife from striking glass at our beautiful and not-so-beautiful homes, commercial buildings, as well as all other human structures with glass facing the environment is tragic, inexcusable, and must be stopped. Especially

vexing are the window-kills at prestigious avian research centers and field stations that are both aesthetically attractive and lavishly covered with glass, and where the mission of those working therein is avian conservation.

The unintentional killing of life is a moral and ethical issue demanding serious attention wherever it occurs, for the toll of birds exacted by glass is a scale far above any other human-associated avian mortality factor. So-called "green buildings" are not truly "green" if they unintentionally kill even one bird (most kill many) when victims fly into their clear or reflective low-E (energy) glass, no matter how many other environmentally responsible features have been incorporated into the structure. Every aware

citizen is invited to educate others and act to help save the birds of Connecticut and the world from this foreseeable and preventable lethal hazard, including those having any level of passion for birdlife to those in government, the building industry (architects, developers, landscape designers), and conservationists whose dedicated hard work is devoted to the aesthetic appearance and protection of the environment for all life: bird, human, and all others upon which we depend on this special planet (see www.birdsandbuildings.org for more information).

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