

THE BUILDING INDUSTRY AND BIRD CONSERVATION

INTRODUCTION

Annually, clear and reflective sheet glass as windowpanes in residential and commercial structures in urban, suburban, and rural landscapes is a passive invisible killer of billions of wild birds worldwide. This harmful attrition of common as well as species of conservation concern is unintended, unwanted, and indiscriminate. Wild birds have proven utility for humans and the global ecosystem because of their practical, recreational, and economic value. Window glass has enriched human aesthetic, cultural, physiological, and psychological well-being for at least 16 centuries. Accounts of birds killed flying into windows first appear in the scientific literature in the early 1800s, but the first comprehensive study began in the 1970s. Arguably, only recently within the last decade has meaningful progress been made to save more bird lives from windows by various building industry and avian conservation constituencies. There is reason to be optimistic and hopeful that collaboration among creative individuals dedicated to building sustainable human structures will eliminate this unintentional lethal hazard for birds. The purpose of this article is to describe the science of bird-window collisions and how to prevent them.

WHAT WE KNOW: THE FACTUAL EVIDENCE

The dead and dying victims of glass most often are hidden from view in the vegetation planted near human dwellings. Because we are not them and they cannot talk to us, we humans must rely on studies of the avian visual system and bird behavior to understand the fatal threat

that sheet glass poses to birds. Our collective knowledge reveals that clear and reflective windows of all sizes are invisible to all birds. What explains which species in what numbers are killed striking a specific window is the density of individual birds in the immediate vicinity (within 10 meters) of that invisible hazard. Window casualties are killed outright, injured and struggling to recover, or quickly taken by predators and scavengers. Birds succumb to head trauma, and a bird the size of a sparrow need only be perched **one meter from a window** to build up enough momentum to kill itself striking the glass surface. Lethal collisions are possible wherever birds and glass coexist. Unlike losses from predation, starvation, and disease that species populations compensate by replacing the less fit weak and vulnerable, sheet glass is an indiscriminate killer **taking the fittest** as well as unfit members of a species.

The annual toll exacted by windows currently is estimated at 16-42 million in Canada, 365-988 million in the United States, uncountable billions worldwide. Media reports of environmental disasters frequently highlight dramatic events such as the 1989 Exxon Valdez, or the recent 2010 Gulf of Mexico oil spills, killing thousands to hundreds of thousands of individual birds. By contrast, the first conservative estimate of birds killed at windows in the United States alone was 100 million to one billion, and if we use the lower tally as a frame of reference, the 100 million losses equates to 333 Exxon Valdez oil spills every year.

In general, birds killed flying into windows has received relatively meager publicity based on the magnitude and indiscriminate threat they pose to wild bird populations. Most often what media attention window-killed birds attract occurs during fall and spring migration periods when the dead are discovered prominently lying on sidewalks in front of glass walls in cities where most reporters live. Depending on the number of passage migrants, dramatic numbers

such as 200 a day are killed at a single building. No matter how shocking such numbers are, they are a meager few compared to the death toll occurring at millions of individual homes.

Birds are killed at all times of the day, in every season of the year, and under all weather conditions. There is no avian age, sex, or residence status immune from the fatal threat of windows. The amount of glass and associated vegetation that attract potential victims best explain the number of casualties at any one building. Of the approximately 10,000 species of birds worldwide, 1,165 (12%) have been recorded striking windows. **This specific invisible threat to bird life is adversely affecting our planet's biodiversity.** The threat has a human cause, and only humans can correct it. We must practice responsible stewardship to ensure a healthy world uniquely supporting all interdependent life.

SOLUTIONS: DESIGNING BUILDINGS TO PREVENT UNINTENDED COLLISIONS

Over the last decade, more media attention has attracted the interest of a growing public and building industry professionals such as glass manufacturers, architects, developers, and landscape designers. This increased awareness and the action it has stimulated is the result of the science explaining the glass threat to bird life and justifying its prevention. Educational programs of conservation organizations such as the American Bird Conservancy and National Audubon Society in the U.S., and the Fatal Light Awareness Program (FLAP) in Canada have informed and recommended meaningful action to protect birds from windows among individuals having an interest in birds. These collective efforts have served as a model to inspire similar interest and action among scientists, citizen scientists, and the public around the world, in Europe, Asia, Australia, Central and South America. Yet to be achieved is a critical mass of the public to drive meaningful action everywhere.

North American efforts have developed and guided an ever-increasing number of solutions to protect and save these special creatures. Bird-safe design and practices are both voluntary and mandatory. Federal, regional (Province, State), and local (municipalities) legislation in the form of treaties, laws, and ordinances exist and more are being created to make human structures safe for birds. Federally, among others, most bird species are protected from intended or unintended harm and killing by the Migratory Bird Treaty Act (MBTA) and the Endangered Species Act (ESA) in the U.S., and their equivalents the Migratory Birds Convention Act (MBCA) and the Species at Risk Act (SARA) in Canada. A current and ongoing Canadian government initiative has charged the Canadian Standards Association (CSA) with developing *Bird Friendly Building Design* (CSA A460). The result of this guiding standard is expected to influence bird-safe building practices throughout North America and elsewhere around the globe. Just one of numerous helpful practices is to treat sheet glass from grade level to the height of 16 meters. This height is to ensure mature trees will not have their attracting images reflected in windows to deceive birds attempting to reach them. Regionally, Minnesota has passed a bird-safe building law that is statewide in scope in the U.S., and the Ontario Environmental Protection Act (EPA) contains several content provisions relevant to protecting birds from windows in the province. Municipal guidelines that are both voluntary and mandatory bird-safe measures have been enacted in Calgary, Alberta, New York City, Portland, Oregon, San Francisco, California, and Toronto, Ontario. Bird-safe building design and practices to assist architects and other building professionals have been published by the American Bird Conservancy, New York Audubon Society, and City Planning departments in Calgary, Toronto, Portland, and San Francisco.

Whereas as few as ten years ago there were no bird-safe products available to architects, there are many and their number is growing today. Given that all windows are potentially lethal to birds, ideally existing sheet glass needs to be retrofitted to make it bird-safe. Remodeling and new construction need patterned sheet glass to make future buildings bird-safe. Scientific experiments inform us that bird-safe patterning must uniformly cover the glass surface. Elements making up the pattern need to be separated by 10 cm if oriented in vertical columns, and 5 cm if oriented in horizontal rows. The elements can be of any shape such as dots, lines, rectangles, and can be as small as 2 mm covering 7% of the surface offering the same protection as elements 13 mm wide covering 50% of the surface. Elements can be visible to bird and human eyes, and be applied by films for retrofitting, and by acid etching and ceramic frit for remodeling and new construction.

Effective bird-safe patterning invisible to humans but visible to birds are created using ultraviolet (UV) reflection and absorption areas. Most species of birds have the ability to see light waves having a length between 300-400 nanometers. This wavelength range is not seen by humans. Consequently, the use of UV patterning to prevent bird-window strikes is an elegant, and perhaps the best, solution because it protects birds and preserves the human of purpose windows providing an unobstructed view to the outside from a protected indoor space.

Whether retrofitting or creating new panes for remodeled or new structures, patterning applied to the outside facing glass surface, what architects refer to as Surface 1, is essential to be effective. Even clear windows will reflect the facing habitat and sky like a mirror when covering a dark interior. These reflections deceive birds, and most windows are installed such that they exhibit this mirroring effect. Surface 1 application of bird-protecting patterns is required to make reflective windows safe. Applications of patterning to other interior window surfaces are hidden

and rendered ineffective by the reflection off Surface 1. Alternatively, bird-safe patterning can be applied successfully to inner window surfaces when sheet glass is installed where a see-through effect is created, where habitat and sky are seen looking through one or more clear panes such as in linkways (corridors), atria, or railings. In these see-through conditions, the patterning on inner glass surfaces will be visible for birds and humans to see, and interpret the space that the window occupies as a barrier to be avoided. Such bird-safe patterning can completely eliminate or reduce fatal bird strikes to extremely rare events. Although challenging above grade level, also based on scientific experiments, architects have installed windows at a 20 to 40 degree angles inward from vertical. The greater the angle the more bird safe the window because potential victims hit with reduced momentum resulting in no or non-lethal injury.

CONCLUSION

The toll exacted by windows on select species and birds in general is harming their ability to survive. Half of the bird species in North American are in decline, and birds the world over are undergoing similar population depression. The threat that windows pose for birds is universal, global in scope, and is an additive rather than a compensatory mortality factor. The invisible deathtraps our windows pose to birds are one that they cannot defend or alter their nature to protect themselves. Birds have no voice and no understanding of this particular hazard and the threat it poses to them individually or collectively. We humans need to protect these innocent, defenseless, and useful marvels of Nature that play an integral role in the Earth's diverse ecosystems. We now have the knowledge and means to address these tragedies. Of all the environmental challenges threatening our planet and the life on it, such as climate change, windows are an unintended and unwanted environmental problem for birds and people **that we**

can do something about. We can solve this problem for birds, but not without the creative help of architects and other members of the building industry and those legions of individuals passionately committed to saving more bird lives from glass worldwide.

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