**Detection on Causes of Bird-Window Collisions and Effective Mitigation Efforts**

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**ABSTRACT**

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| Bird window collisions are one of the leading causes of Bird deaths throughout the world. Millions and billions of birds die annually due to window collisions. Sadly, this number in reality would be even higher due to the lack of awareness among the common people and predation of the affected bird individuals. As the rise of modern development takes place at a rapid rate, the cases of bird window collisions may also rise. The main objective of this review is to evaluate the causes of bird window collisions and mitigation efforts and to understand how much new research has been done on the topic of bird window collision in India. A study period of 2018 to 2024 was selected for this review as no data is available for these years further, detailed literature searches were done on Google Scholar with keywords like “Bird window collisions”, “Bird Window Strikes”, “Window strikes”. Factors playing a major role are the use of reflective windows (also known as 1-way windows locally) and the construction of tall skyscrapers in the path of affected birds which are mostly migratory. Bird window collisions tend to occur more frequently in the migration season of migratory birds. Considering the rising cases of bird window collisions several organizations have made guidelines in construction of bird friendly buildings. Rapid development taking place in developing countries would also mean an increase in the use of reflective glass and hence, cases of bird window collision may rise in such countries. Hence, our study would be important in a way to achieve precautions related to bird window collisions in further developing countries. |

*Keywords: Bird-Window collision, Avian collision, Bird conservation, Bird death, Bird mortality*

**1. INTRODUCTION**

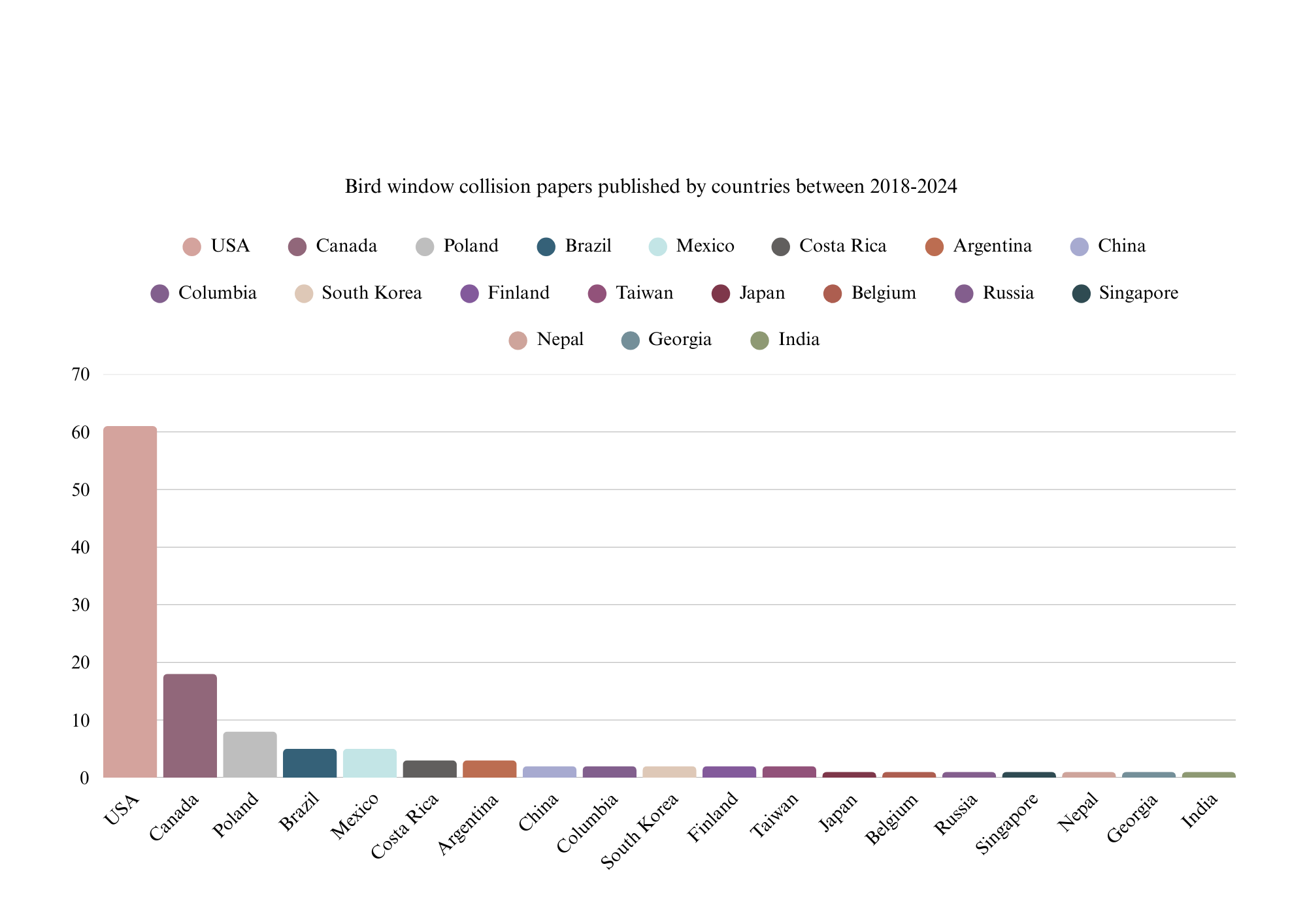
Bird window collisions or window strikes are a rising problem in urban or rural areas as development in these areas is happening at a rapid rate (McDonald 2008). Window strikes are among the top three causes of deaths of birds by humans (Loss, Marra and Will, 2015). It seems that the problem of bird-glass collisions became even more important during recent decades, due to three independent processes connected with rural and urban development. First, built-up areas expand at the expense of agricultural and forested land and new buildings are increasingly often located close to natural areas – in the countryside or in the city outskirts. The broad landscape characteristics (i.e., at a scale exceeding single bird territory) may also contribute to bird-glass collision patterns as some landscapes are used by birds more often, e.g., as breeding grounds (protected areas) or migration routes (river valleys) (DeLuca et al., 2021). The main cause of bird window collisions is the reflective windows which are being used on a large scale in modern architecture (Klem 2014). Millions and billions of birds die throughout the year although these numbers are just a mere assumption a lack of knowledge and various factors like predation (Klem 1990), disposing the carcass without reporting makes it difficult to know actual numbers. Though these reflective windows make any architecture look fascinating, wonderful and marvelous, it comes with a great drawback of bird window collision, birds think that these glass reflections are nothing but sky or the birds may even think that the glass is not just present and end up colliding with the window pane (Klem 2014). Nocturnally migrating birds are extremely difficult to monitor because direct visual observation of birds flying under cover of darkness and at high speed and altitude is often impossible. Acoustic monitoring can help identify species composition of migratory birds aloft but is severely constrained by species' behaviour and factors influencing detection (Lin et al., 2019). The main objective of this paper is to evaluate the causes of bird window collisions and mitigation efforts and to understand how much new research has been done on the topic of bird window collision in India.

**2. MATERIALS AND METHODS**

A study period of 2018 to 2024 was selected for this review as no data is available for these years further, detailed literature search from 2018 - 2024 was done on google scholar with keywords like “Bird window collisions”, “Bird Window Strikes”, “Window strikes”. Further, each and every research paper was studied for the region of their study. All relevant papers were then reviewed and papers having less relevance were not considered. Further, all these papers were then represented in a graph and in tabular form, which compared the number of papers published to the region from which the papers were published. A further detailed literature study was done to evaluate the causes of bird window collisions and also current mitigation efforts towards it.

**3. RESULTS AND DISCUSSION**

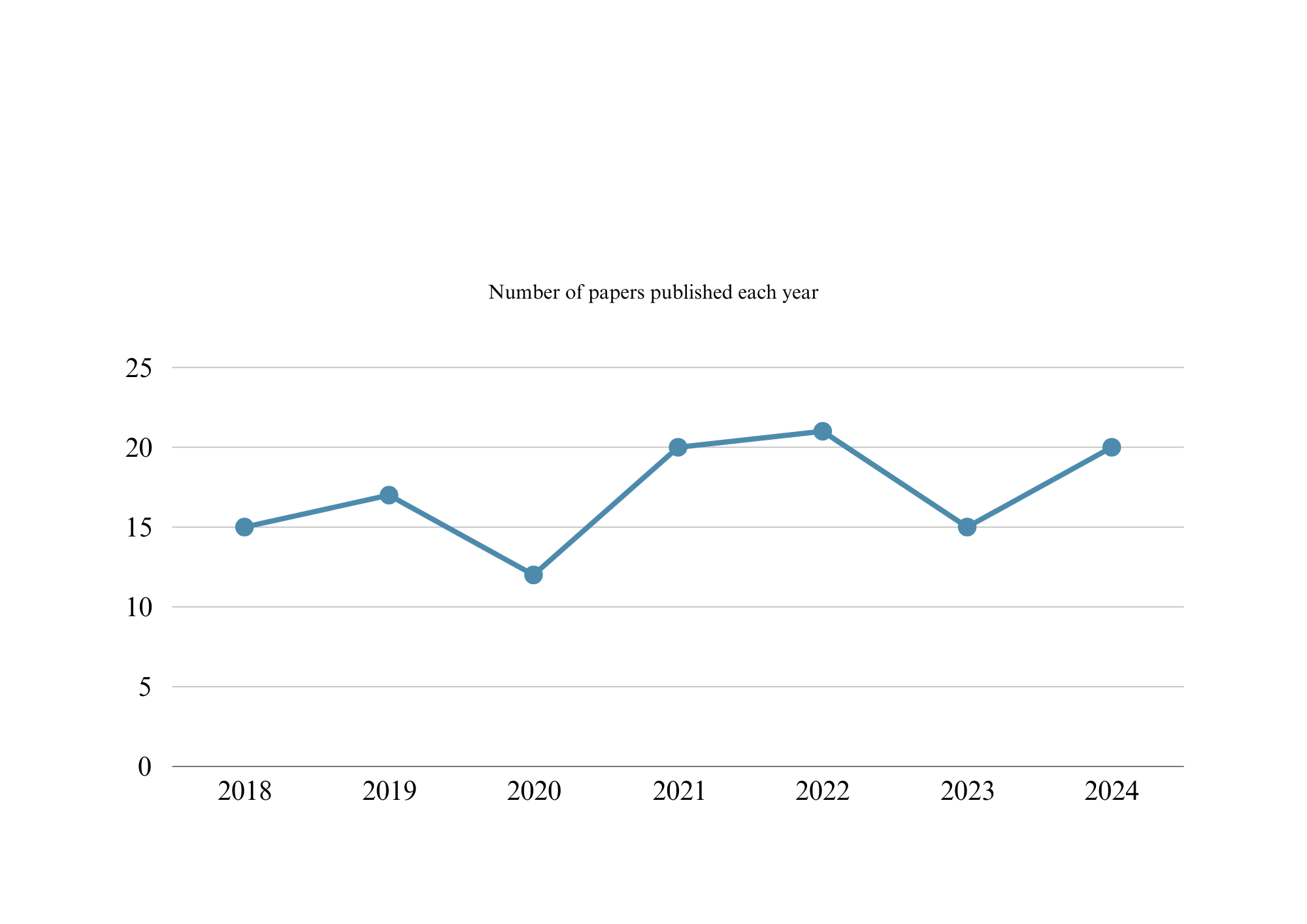
After detailed analysis, a total of 120 papers relevant to bird window collisions were found (cited in reference). Most papers were found from the US (61) and Canada (18). Further papers were from Poland (8), Brazil (5), Mexico (5), Costa Rica (3), Argentina (3), China (2), Columbia (2), South Korea (2), Finland (2), Taiwan (2), Japan (1), Belgium (1), Russia (1), Singapore (1), Nepal (1), Georgia (1), India (1). In case of paper from India, google scholar database did not show any paper published from India hence a separate web search was made with the keywords “Bird window collision research paper in India” and only 1 research paper was found.

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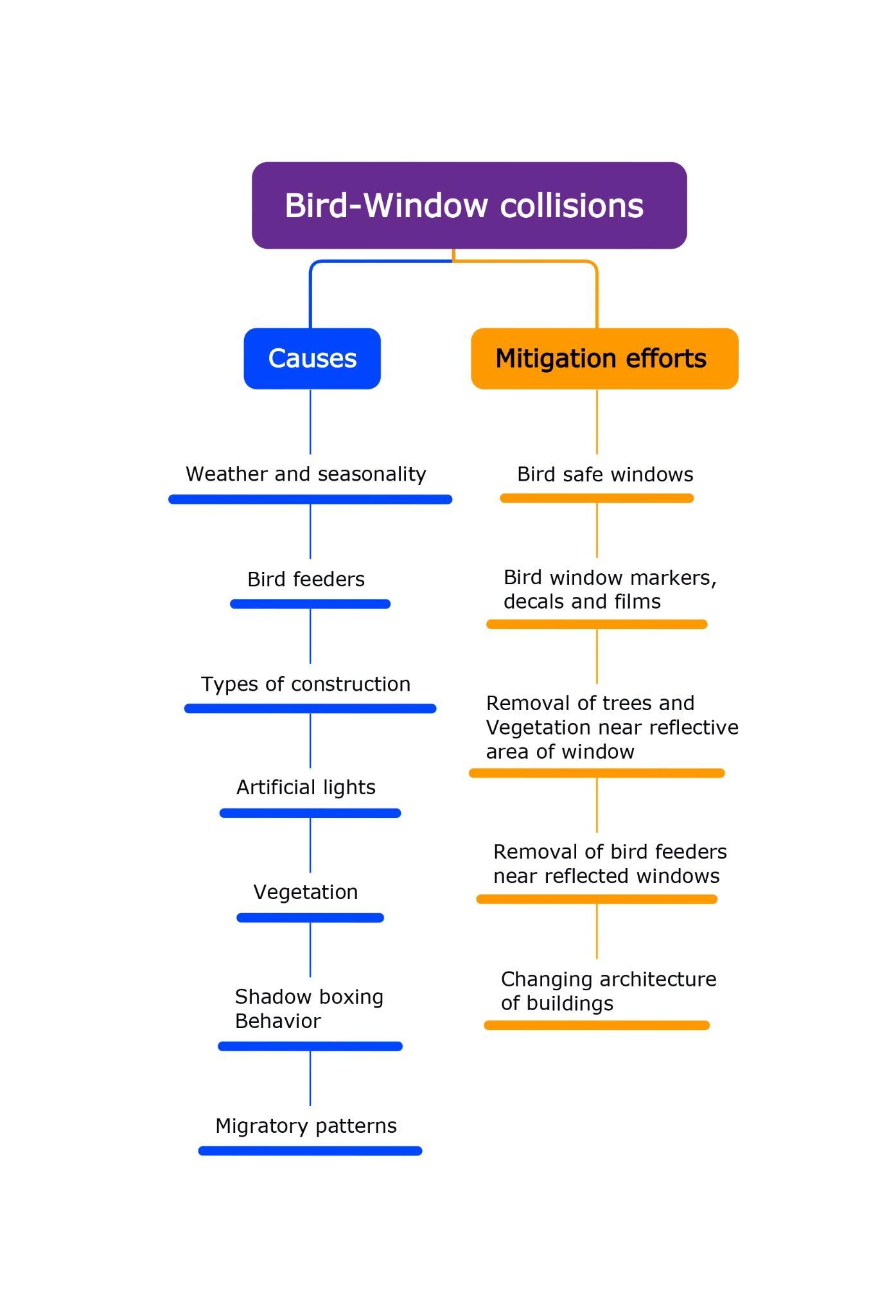
**Figure No. 1. Graph showing total number of papers published by each country between 2018-2024**

**Table No. 1. Table showing in detail the number of papers published by each country in each of the following year (2018-2024)**

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| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Countries** | **2018** | **2019** | **2020** | **2021** | **2022** | **2023** | **2024** | **Total** |
| **Usa** | 11 | 10 | 8 | 10 | 10 | 5 | 7 | 61 |
| **Canada** | 1 | 1 | 2 | 2 | 6 | 2 | 4 | 18 |
| **Poland** | 1 | 0 | 1 | 1 | 3 | 2 | 0 | 8 |
| **Brazil** | 0 | 1 | 1 | 1 | 0 | 0 | 2 | 5 |
| **Mexico** | 0 | 2 | 0 | 2 | 0 | 1 | 0 | 5 |
| **China** | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 2 |
| **Argentina** | 0 | 1 | 0 | 2 | 0 | 0 | 0 | 3 |
| **Columbia** | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 2 |
| **South Korea** | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 2 |
| **Finland** | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 2 |
| **Taiwan** | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 2 |
| **Japan** | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 |
| **Belgium** | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 |
| **Russia** | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 |
| **Singapore** | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 |
| **Nepal** | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 |
| **Costa Rica** | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 3 |
| **Georgia** | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 |
| **India** | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 1 |
| **Total** | 15 | 17 | 12 | 20 | 21 | 15 | 20 | 120 |



**Figure No. 2. Graph showing total number of papers published each year (2018-2024) globally**

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**Figure No. 3. Overall causes and mitigation efforts regarding bird-window collision**

**3.1 Causes of Bird Window Collision**

*3.1.1. Weather and seasonality:*

Bird window collisions occur all time of the year (Klem 1989, Bayne et al. 2012, Ocampo-Peñuela et al. 2016), although vast majority of them occur in the migratory seasons ( Kara M et al. 2023) Studies have shown that bird window collisions tend to be higher during migratory periods ( Bracey et al. 2016 ) Further due to weather there could be errors in migration decisions, flight and navigation which could increase chances of bird window collisions ( Kara M et al. 2023 ) and unpleasant weather could lead to error in the birds ability to detect and respond to obstacles (Marques et al. 2014) Weather conditions like precipitation, cloud cover or extreme weather conditions tend to influence time and magnitude of migration of birds ( Van doren et al. 2017) Further it has been seen that unpleasant weather may also lead to birds flying down to lower altitudes having more artificial light increasing their chances of collisions (Cochran & Graber, 1958, Van Doren et al. 2021) In relation to time , more collisions occur during day time (Klem 1989, Borden et al. 2010) . While in terms of migration most collisions occurred during sunrise and noon (Mckinney 2002, Sumrada et al. 2015, Aymí et al. 2017) while in terms of breeding season most collisions occur between late morning and early afternoon (Hager & Craig 2014). and studies conducted showed collisions were highest in the morning, although their frequency varied throughout testing sites (Hager & Craig 2014, Parkins et al. 2015, Kahle et al. 2016)

*3.1.2. Bird Feeders:*

The increase in popularity of wild-bird feeding has led to worry about bird window collisions , as in the past few decades homeowners have become progressively motivated to connect to the natural world as part of their daily lives (Fuller et al. 2008, Jones and Reynolds 2008, Robb et al.2008, Goddard et al. 2013).Use of bird feeders and their placement on the windows has been an interest of study among researchers.( Kummer and Bayne 2015). The use of bird feeders has been known to consistently increase in the number of birds–window collisions. (Klem et al. 2004, Bayne et al. 2012, Kummer and Bayne 2015, Kummer et al. 2016). Birds of prey may also lead to collisions while chasing their prey. (Glue 1971, Newton et al. 1999). It is also observed that the presence of bird feeders increases the number of collisions in all seasons except spring. (Kummer et al. 2016). A study conducted showed that Collisions were not random, collision and mortality rates was higher in rural residences with bird feeders, which decreased to rural residences without feeders, urban residences with feeders, urban residences without feeders, and apartments. (Bayne et al. 2012).

*3.1.3. Types of construction:*

Construction features of buildings such as, building height, adjacent vegetation, facade shape, and proportion covered by windows are most likely to influence the collision risk for birds already present near buildings. (Riding et al 2020). Birds residing in urban settings face numerous anthropogenic threats to survival, including mortality from bird-window collisions (Drewitt and Langston 2008). The rapid increase in the production of glass panes in urban designs, particularly after World War II, has increased the risk of bird collision. (Klem 1989). The glass having larger surface area makes it more difficult for birds to perceive the glass. (Parkins et al. 2015). Hence larger facade with high proportion of glass provides greater area for collisions relative to smaller facades with the same proportion of glass. (Riding et al 2020). Glass panes that reflect surrounding vegetation have increased the collision risk by three times. (Kummer et al. 2016). Many species of birds while landing for rest or to forage, may collide with reflective buildings (Klem 1989). Some studies suggest that resident species may become habituated to the glass panes and may suffer fewer collisions (Parkins et al. 2015), although there is no evidence that birds actually learn to avoid these obstacles (Sabo et al. 2016).

*3.1.4. Artificial lights:*

The artificial light emitted from windows can disorient birds and can lead to collisions. (Evans Ogden, 2002, Keyes and Sexton 2014, Parkins et al. 2015). Hence artificial light is often a major cause of bird building collision (Sirena et al. 2020) of which most collision victims are nocturnal migraines. (Arnold and Zink, 2011, Loss et al. 2014, Nichols et al. 2018). At smaller scale, on nights with low clouds or visibility birds can get attracted towards artificial light emitted from a building (Avery et al. 1976, Kerlinger et al. 2010, Rebke et al. 2019). The large number of birds affected by buildings are songbirds because they migrate at night, fly at low altitude, have a tendency to be trapped and this disoriented by artificial light, increasing their susceptibility to collision (Ogden & Lesley 1996). Bird collision on window during daytime can occur due to daylight on the external surface and artificial light on the internal surface (Swaddle et al. 2020). Due to urban expansion, growth and increasing artificial light, Bird-window collisions are increasing and becoming a threat to migratory birds. (Cabrera-Cruz et al. 2018, Horton et al. 2019, Kyba et al. 2017, Seto et al. 2012).

*3.1.5. Vegetation:*

Buildings having nearby green areas may cause high collision rate and are threat to migratory birds, even in urban areas (Borden et al. 2010). Surrounding vegetation reflected on glass planes causes more collision than those that do not (Kummer et al. 2016). As vegetated areas attract nearby birds (Klem 1989, Klem et al. 2004) and this vegetated area is reflected in window of nearby building affecting collision rate (Klem, 2009, Hager et al. 2008). More the number of trees in an area, higher is the collision rate on the window (Lopez et al 2024). When vegetation is near the glass window, the collision rate increases (Gleb and Delacretaz 2006) and it makes it difficult for birds to differentiate between environment and reflected image (Gleb and Delacretaz 2009, Sameuls et al 2022). Number of collisions can also be affected due to greenery and bird feeders near buildings (Cusa et al. 2015, Kummer et al. 2016, Brown et al. 2019). Some birds are known to fly quickly through dense vegetation and hence are known to become collision victims because even if they detect the glass, they can't prevent them from stopping due to high speed (Chin 2016).

*3.1.6. Shadow boxing behaviour:*

Birds are known to be intolerant of seeing their own reflection on a reflected surface within its territory (Verea 2018). The bird may tend to mistake its own reflection as its competitor (Epstein and Koerner 1986) There is a close relationship between shadow boxing behaviour and breeding season hence shadow boxing occurs mostly during breeding season (Verea 2018). As birds are territorial during breeding season, they tend to drive away and attack the reflection of their own which they assume as a competitor (Temby 2003, Mayntz 2018). The degree of aggression of attacks and duration of attacks are unique for different species and also for individual birds (Mayntz 2018) And shadow boxing behaviour is found more to occur mostly in males but females are also occasionally involved (Robertson1935, Sutton 1947). Shadow boxing behaviour disappears after breeding season (Mayntz 2018) A study conducted has showed that shadow boxing may increase chance of Bird window collisions (Rebekh et al., 2025).

*3.1.7. Migratory Patterns:*

Bird window collisions tend to occur more frequently in the migration season of migratory birds (Elmore et al., 2021). Man made structures responsible for migratory bird window strikes are diverse ranging from high rise glass buildings to urban and rural homes (Gauthreaux and Belser 2003, Machtans 2013). Lots of birds migrate at night and factors like outdoor lighting, interior lights from inside the building may disorient migrating birds (Mclaren et al., 2018) and these birds may be attracted to the lights particularly during unpleasant weather (Verheijen 1958, 1985). Various studies have shown that migratory birds are at higher risk of bird window collision (Borden et al., 2010, Arnold and Zink 2011, Kahle et al. 2016, Sabo et al., 2016)

**3.2. Current Mitigation efforts**

*3.2.1. Bird safe windows:*

These are windows which are specifically designed and constructed in such a way which would help the birds to perceive the window, they are of various types and have different efficiencies. like fritted windows which have patterns fused inside glass which and have success in birds avoiding the window 89% of the time (Klem 2009). Other include UV-treated glass which is based on the fact that birds perceive UV light, one of the examples would be ORNILUX®ultraviolet which as per studies reduce bird window collision by 66-71% (De Groot et al 2022)

*3.2.2. Bird window markers and decals and films:*

These include various decals or stickers or films which are applied to the external surface or the internal surface of the window with the idea that the bids would perceive the windows due to the stickers. Examples are decals of birds of prey, bird friendly artwork, circular stickers, patterns created using tapes, bird friendly films and also UV stickers and UV tapes. All of these have different ways and rules of application and tend to have different efficiencies. A study conducted found that bird friendly artwork was found to reduce bird window collisions by 96-100% (Crews and Christie 2022). Another study conducted also found that birds avoided windows by 40-47% if Haverkamp or Bird Shades film if they are applied on the external surface of the window (Swaddle et al 2022). Various studies also show good effectiveness of Feather Friendly® markers with decline in bird window collision by 53-75% (Winton, Ocampo-Peñuela & Cagle, 2018, Riggs et al 2023). Bird of prey decals also decrease bird window collisions although their effectiveness is not much (Brisque et al 2017) experiments have shown effective mitigation with stripes and dots applied on external window surfaces (Klem, 2009).

*3.3.3. Removal of trees and vegetation near reflective area of window:*

Presence of vegetation or trees have been found to increase bird window collisions. The proximity of vegetation near glass panes may lead to high collision rates and are a threat migratory birds and even in urban areas (Borden et al. 2010). hence trees or vegetation can be removed from near the window surface, although this may be species specific as some species of birds would tend to be more attracted to vegetation. A study conducted on collisions of cedar waxwings showed Fruiting pear tree proximity and mirrored windows increased risks of bird window collisions (Barbara et al 2020).

*3.4.4. Removal of bird feeders near reflected windows:*

Bird feeders have been found to consistently lead to increase in the number of bird–window collisions (Klem et al. 2004, Bayne et al. 2012, Kummer and Bayne 2015, Kummer et al. 2016 ) Bird feeders, when close to glass windows have a possibility to increase bird window collision (Klem 1990).houses with bird feeders consistently report more bird-window collisions that those without, regardless of how collision data have been collected (Klem et al. 2004, Bayne et al. 2012; ). A Study conducted showed that the presence of bird feeders may attract more birds towards windows and may increase the chance of collision, however this is dependent on various factors like seasonality and the species of birds hence removal of bird feeders alone may not decrease bird window collisions and other related factors too should be considered (Kummer and Bayne 2015)

*3.4.5. Changing architecture of Buildings:*

Considering the rising cases of bird window collisions several organizations have made guidelines in construction of bird friendly buildings (U.S. Fish and Wildlife Service 2016, American Bird Conservancy 2019, Fatal Light Awareness Program [FLAP] Canada 2019). Facades on a building cause a lot of bird window collisions as they have a large surface area of glass Therefore, hence efforts should be made to avoid the use of such facades ( Riding et al 2020 ) Artificial lights are also found to be significant in causing bird window collisions , hence buildings can considering placement of lights in such a manner that they reduce light pollution Leadership in Energy and Environmental Design (LEED) is a standard of building designs that are followed In US and Canada have been found to reduce bird window collision to some extent (Wood, J. S. 2014).

**4. CONCLUSION**

Hence our detailed analysis reveals the various causes and mitigation efforts. Our study reveals how the developed nations like US and Canada lead in their published studies regarding bird window collisions, this can be due to the fact the such nations have had been under rapid development which would have led to increased number of bird window collisions. For countries like India and Nepal or other countries, the reason for less studies are more likely to be related to less awareness among common people and researchers or it may be genuine that there are really no cases. Rapid development taking place in developing countries would also mean an increase in use of reflective glass and hence cases of bird window collision may rise in such countries. Further current mitigation efforts are known to reduce bird window collisions although most of these mitigation efforts are not cost effective and underdeveloped countries might not be able to apply these in their cases hence there is a detailed study required to find a cost-effective solution for bird window collisions. A similar and wonderful kind of study was also done by Basilio et al 2020 where they also listed out number of studies done and factors causing bird window collision although our study tries to go in more detail and also tries to mention more of the factors that lead to bird window collision, mentioning mitigation efforts and also raising awareness for developing countries which would see a rise in rapid development. Hence our study would be important in a way to achieve precautions related to bird window collisions in further developing countries. Our study also raises the need to have more studies related to this topic of bird window collisions as there is a high chance that most people are not aware of this issue and even if they find such cases they may ignore it. Our study also calls rescue teams and all wildlife educators to make their best as to raising awareness regarding bird window collisions and also provide valuable data to researchers using simple databases.

**5. LIMITATIONS**

Although we have gone through research paper databases manually looking for each and every paper, there can be a chance that some papers may not have been visible in the databases as they may not have been published in top journals or because of other not known causes.

**DISCLAIMER (ARTIFICIAL INTELLIGENCE):**

Author(s) hereby declares that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc.) and text-to-image generators have been used during the writing or editing of this manuscript.

**REFERENCES**

A. Farnsworth, K.G. Horton, P.P. Marra, (2024). To mitigate bird collisions, enforce the Migratory Bird Treaty Act, Proc. Natl. Acad. Sci. U.S.A.121 (9) e2320411121,<https://doi.org/10.1073/pnas.2320411121>

Anderson, Abigail. (2018). Modeling Bird-Window Collisions in Core Urban Environments. Retrieved from the University Digital Conservancy, https://hdl.handle.net/11299/218668.

Arnold TW, Zink RM (2011) Collision Mortality Has No Discernible Effect on Population Trends of North American Birds. PLOS ONE 6(9): e24708. <https://doi.org/10.1371/journal.pone.0024708>

Avery, M., Springer, P. F., & Cassel, J. F. (1976). The Effects of a Tall Tower on Nocturnal Bird Migration: A Portable Ceilometer Study. The Auk, 93(2), 281–291. <http://www.jstor.org/stable/4085044>

Aymí, Raül & González, Yolanda & López, Txiqui & Gordo, Oscar. (2017). Bird-window collisions in a city on the Iberian Mediterranean coast during autumn migration. Revista Catalana d'Ornitologia. 33. <http://hdl.handle.net/10261/161063>

B.M. Van Doren, D.E. Willard, M. Hennen, K.G. Horton, E.F. Stuber, D. Sheldon, A.H. Sivakumar, J. Wang, A. Farnsworth, & B.M. Winger (2021)., Drivers of fatal bird collisions in an urban center, Proc. Natl. Acad. Sci. U.S.A. 118 (24) e2101666118, <https://doi.org/10.1073/pnas.2101666118>

B.M. Van Doren, K.G. Horton, A.M. Dokter, H. Klinck, S.B. Elbin, & A. Farnsworth (2017)., High-intensity urban light installation dramatically alters nocturnal bird migration, Proc. Natl. Acad. Sci. U.S.A. 114 (42), 11175-11180, <https://doi.org/10.1073/pnas.1708574114>

Baasch, D. M., A. M. Hegg, J. F. Dwyer, A. J. Caven, W. E. Taddicken, C. A. Worley, A. H. Medaries, C. G. Wagner, P. G. Dunbar, and N. D. Mittman. (2022). Mitigating avian collisions with power lines through illumination with ultraviolet light. Avian Conservation and Ecology 17(2):9.<https://doi.org/10.5751/ACE-02217-170209>

Bajagain, S., Joshi, A. B., & Pradhan, A (2024). Urbanization and Avian Collisions: Baseline Study on Bird-Building Strikes in Nepal. VOLUME 31 ISSUE 4 <http://www.researchgate.net/publication/382826068_Urbanization_and_Avian_Collisions_Baseline_Study_on_Bird-Building_Strikes_in_Nepal>

Basilio, L. G., Moreno, D. J., & Piratelli, A. J. (2020). Main causes of bird-window collisions: a review. Anais Da Academia Brasileira De Ciências, 92(1), e20180745. <https://doi.org/10.1590/0001-3765202020180745>

Bayne Erin M., Scobie Corey A., Rawson-Clark Michael (2012) Factors influencing the annual risk of bird–window collisions at residential structures in Alberta, Canada. Wildlife Research 39, 583-592. <https://doi.org/10.1071/WR11179>

Berger, K., Hagemeyer, N., & Schubert, S. (2018). Factors Affecting Migratory Bird-Window Collisions: The Role of Canopy Cover and Scavenger Bias.<https://digitalcommons.odu.edu/undergradsymposium/2018/biology/4/>

Biagi, N. (2018). Breeding season bird mortality from window collisions: Comparing species-specific abundance with mortality rates. Minnesota Undergraduate Research & Academic Journal, 1(1).<https://pubs.lib.umn.edu/index.php/muraj/article/view/1332>

Borden, W. & Lockhart, Owen & Jones, Andrew & Lyons, Mark. (2010). Seasonal, Taxonomic, and Local Habitat Components of Bird-window Collisions on an Urban University Campus in Cleveland, OH. Ohio Journal of Science. 110. 44-52. <https://kb.osu.edu/bitstreams/5d0c1c6b-047e-5bf1-a4e5-9f4418d0a0e5/download>

Bracey, Annie & Etterson, Matthew & Niemi, Gerald & Green, Richard. (2016). Variation in bird-window collision mortality and scavenging rates within an urban landscape. The Wilson Journal of Ornithology. 128. 355-367. 10.1676/wils-128-02-355-367.1. <https://doi.org/10.1676/wils-128-02-355-367.1>

Brisque, Thaís & Campos-Silva, Lucas Andrei & Piratelli, Augusto. (2017). Relationship between bird-of-prey decals and bird-window collisions on a Brazilian university campus. Zoologia (Curitiba Impresso). 34. 10.3897/zoologia.34.e13729. <https://doi.org/10.3897/zoologia.34.e13729>

Brown, B. B., Kusakabe, E., Antonopoulos, A., Siddoway, S., & Thompson, L. (2019). Winter bird-window collisions: mitigation success, risk factors, and implementation challenges. PeerJ, 7, e7620.<https://doi.org/10.7717/peerj.7620>

Brown BB, Hunter L, Santos S. (2020). Bird-window collisions: different fall and winter risk and protective factors. PeerJ 8:e9401 <https://doi.org/10.7717/peerj.9401>

Brown BB, Santos S, Ocampo-Peñuela N. (2021). Bird-window collisions: Mitigation efficacy and risk factors across two years. PeerJ 9: e11867 <https://doi.org/10.7717/peerj.11867>

Byron, S. (2024). Crash course conservation: Evaluating the effectiveness of Feather Friendly® markers and bird-safe murals in reducing bird-window collisions.<https://dx.doi.org/10.14288/1.0444884>

Cabrera-Cruz, S.A., Smolinsky, J.A. & Buler, J.J (2018). Light pollution is greatest within migration passage areas for nocturnally-migrating birds around the world. Sci Rep 8, 3261. <https://doi.org/10.1038/s41598-018-21577-6>

Chen, K., Kross, S. M., Parkins, K., Seewagen, C., Farnsworth, A., & Van Doren, B. M. (2024). Heavy migration traffic and bad weather are a dangerous combination: Bird collisions in New York City. Journal of Applied Ecology, 61, 784–796. <https://doi.org/10.1111/1365-2664.14590>

Chin, S. (2016). Investigating the effects of urban features on bird window collisions.

Christopher C. M. Kyba et al. (2017), Artificially lit surface of Earth at night increasing in radiance and extent.Sci. Adv.3, e1701528.DOI:10.1126/sciadv.1701528

Cochran, W. W., & Graber, R. R. (1958). Attraction of Nocturnal Migrants by Lights on a Television Tower. The Wilson Bulletin, 70(4), 378–380. <http://www.jstor.org/stable/4158703>

Colling, O. M., Guglielmo, C. G., Bonner, S. J., & Morbey, Y. E. (2022). Migratory songbirds and urban window collision mortality: vulnerability depends on species, diel timing of migration, and age class. Avian Conservation & Ecology, 17(1).<https://doi.org/10.5751/ACE-02107-170122>

Colling, Olivia M., "Differential Vulnerability to Window Collision Mortality Among Migratory Songbird Species" (2019). Electronic Thesis and Dissertation Repository. 6410. <https://ir.lib.uwo.ca/etd/6410>

Coolidge, M., Helzer, D., & Ujcic-Ashcroft, J. (2021). A Successful Monitoring and Mitigation Project to Address Bird Window Collisions at the City of Portland’s Columbia Building, 2015-2019.<https://pdxscholar.library.pdx.edu/uerc/2021/Presentations/15/>

Corey S Riding, Timothy J O’Connell, Scott R Loss (2020), Building façade-level correlates of bird–window collisions in a small urban area, The Condor, Volume 122, Issue 1, 3 February 2020, duz065, <https://doi.org/10.1093/condor/duz065>

Crews, C. (2022). Reducing bird-window collisions at a botanical garden: The effect of bird-friendly artwork and dirty windows [R]. doi:<http://dx.doi.org/10.14288/1.0421555>

Cusa, M., Jackson, D.A. & Mesure, M. (2015). Window collisions by migratory bird species: urban geographical patterns and habitat associations. Urban Ecosyst 18, 1427–1446. <https://doi.org/10.1007/s11252-015-0459-3>

Daniel Klem, David C. Keck, Karl L. Marty, Amy J. Miller Ball, Elizabeth E. Niciu, And Corry T. Platt "Effects Of Window Angling (1 March 2004), Feeder Placement, And Scavengers on Avian Mortality at Plate Glass," The Wilson Bulletin 116(1), 69-73. [https://doi.org/10.1676/0043-5643(2004)116[0069:EOWAFP]2.0.CO;2](https://doi.org/10.1676/0043-5643(2004)116%5B0069:EOWAFP%5D2.0.CO;2)

Danyang Shi, Shu-Yueh Liao, Lei Zhu, Binbin V. Li. Review on bird-building collisions and the case study of a systematic survey in China[J]. Biodiv Sci, 2022, 30(3): 21321. DOI:10.17520/biods.2021321

De Groot KL, Wilson AG, McKibbin R, Hudson SA, Dohms KM, Norris AR, Huang AC, Whitehorne IBJ, Fort KT, Roy C, Bourque J, Wilson S. (2022). Bird protection treatments reduce bird-window collision risk at low-rise buildings within a Pacific coastal protected area. PeerJ 10: e13142 <https://doi.org/10.7717/peerj.13142>

Del Carmen Gómez-Moreno, V., González-Gaona, O. J., & Niño-Maldonado, S. (2019). Colisión de aves en México: la urbanización de un problema creciente y una barrera del vuelo. In XXXII Congreso de la Asociación Latinoamericana de Sociología. Association Latinoamericana de Sociología. <https://www.aacademica.org/000-030/1505>

Drewitt, A.L. and Langston, R.H.W. (2008), Collision Effects of Wind-power Generators and Other Obstacles on Birds. Annals of the New York Academy of Sciences, 1134: 233-266. <https://doi.org/10.1196/annals.1439.015>

Dwyer, J.F., Hindmarch, S., Kratz, G.E. (2018). Raptor Mortality in Urban Landscapes. In: Boal, C.W., Dykstra, C.R. (eds) Urban Raptors. Island Press, Washington, DC. <https://doi.org/10.5822/978-1-61091-841-1_14>

Elmore JA, Riding CS, Horton KG, O'Connell TJ, Farnsworth A, Loss SR (2021). Predicting bird-window collisions with weather radar. J Appl Ecol. 2021; 58: 1593–1601. <https://doi.org/10.1111/1365-2664.13832>

Emerson, L. C. (2021). Bird-Window Collisions and Reflection as a Daytime Risk Factor. The College of William and Mary.<https://doi.org/10.21220/zcd1-ne05>

Emerson, Lauren C.; Thady, Robin G.; Robertson, Bruce A.; and Swaddle, John P (2022)., Do lighting conditions influence bird-window collisions? Avian Conservation and Ecology, 17.<https://doi.org/10.5751/ACE-02167-170203>

Epstein R and J Koerner. (1986) The self-concept and other daemons. Pp. 27–53 in J Suls and A Greenwald (eds). Psychological Perspectives on the Self (Volume 3). Lawrence Erlbaum, Hillsdale,USAhttps://[drrobertepstein.com/downloads/Epstein-Reflections\_on\_Thinking\_in\_Animals-Cognition\_Language\_and\_Consciousness-1987.pdf](http://drrobertepstein.com/downloads/Epstein-Reflections_on_Thinking_in_Animals-Cognition_Language_and_Consciousness-1987.pdf)

Evans Ogden, L. J. (1996). Collision course: the hazards of lighted structures and windows to migrating birds. Fatal Light Awareness Program (FLAP), 3.<https://digitalcommons.unl.edu/flap/3/>

Evans ogden, Lesley. (2002). Summary Report on the Bird Friendly Building Program: Effect of Light Reduction on Collision of Migratory Birds.<https://digitalcommons.unl.edu/flap/5/>

Ewa Zyśk-Gorczyńska, Hanna Sztwiertnia, Małgorzata Pietkiewicz, Aleksandra Kolanek, Katarzyna Bojarska, Michał Żmihorski (2021),Local bird densities and habitats are poor predictors of bird collision with glass bus shelters, Landscape and Urban Planning,Volume217,2022,104285,ISSN 0169-2046,<https://doi.org/10.1016/j.landurbplan.2021.104285>.

Ewa Zyśk-Gorczyńska, Katarzyna Bojarska, Michał Żmihorski (2021) "Nonrandom Bird-Glass Collision Pattern: Fewer Strikes Near Glass Edge," Acta Ornithologica, 56(1), 133-137, (20 August 2021)<https://doi.org/10.3161/00016454AO2021.56.1.012>

Ewa Zyśk-Gorczyńska, Piotr Skórka, Michał Żmihorski (2020),Graffiti saves birds: A year-round pattern of bird collisions with glass bus shelters, Landscape and Urban Planning, Volume 193,2020,103680,ISSN 0169-2046, <https://doi.org/10.1016/j.landurbplan.2019.103680>.

Fischer, S. E., & Islam, K. (2020, January). Identifying Bird-Window Collisions on a University Campus during Spring and Fall Migration. In Proceedings of the Indiana Academy of Science (Vol.129,No.1,pp.47-55).<https://www.researchgate.net/publication/350960000_Identifying_bird-window_collisions_on_a_university_campus_during_spring_and_fall_migration>

Front Ecol Environ (2019); 17(4): 209–214, doi:10.1002/fee.2029

Fuller, Richard A., and others, 'Interactions between People and Birds in Urban Landscapes', in Christopher A. Lepczyk, and Paige S. Warren (eds) (2012), Urban Bird Ecology and Conservation (Oakland, CA, 2012; online edn, California Scholarship Online, 23 May 2013), <https://doi.org/10.1525/california/9780520273092.003.0016>,

Gabrielle Adad Fornazari, André Saldanha, Rogerio Ribas Lange, Tilde Froes, Daniel Klem Jr, Bret A. Moore, Fabiano Montiani-Ferreira (30 September 2021)"Window Collisions by Birds in Brazil: Epidemiologic Factors and Radiographic and Necropsy Assessments," Journal of Avian Medicine and Surgery, 35(3), 313-324, <https://doi.org/10.1647/20-00009>

Galanek, J. (2023). Bird-Strike Risk Factors and Prevention in Atlanta (Master's thesis). <https://etd.library.emory.edu/concern/etds/cf95jc69v?locale=en>

Gelb, Y., & Delacretaz, N. (2006). Avian window strike mortality at an urban office building. The Kingbird, 56(3), 190-198.<https://www.nybirds.org/Publications/KB56no3_WindowStrike.pdf>

Glue, D. E. (1971). Ringing Recovery Circumstances of Small Birds of Prey. Bird Study, 18(3), 137–146. <https://doi.org/10.1080/00063657109476307>

Gómez-Martínez, M.A., Klem, D., Rojas-Soto, O. et al. (2019). Window strikes: bird collisions in a Neotropical green city. Urban Ecosyst 22, 699–708 <https://doi.org/10.1007/s11252-019-00858-6>

Gómez-Moreno, V. D. C., González-Gaona, O. J., Niño-Maldonado, S., & Lucio-Martínez, M. E. (2023). Bird mortality caused by collision in Ciudad Victoria, Tamaulipas, Mexico. Huitzil, 24(1).<https://doi.org/10.28947/hrmo.2023.24.1.697>.

Hager SB, Craig ME (2014). Bird-window collisions in the summer breeding season. PeerJ 2:e460 <https://doi.org/10.7717/peerj.460>

Hardy, E. (2022, April 13). Longitudinal Bird strike monitoring: UBC Buchanan Building [R]. doi:<http://dx.doi.org/10.14288/1.0421569>

Heckman, A. (2019). Assessing Factors that Influence Avian Window Collisions on the Loyola MarymountUniversityCampus. <https://digitalcommons.lmu.edu/honors-research-and-exhibition/2019/section-03/3/>

Heister, C. (2021). Geospatial and Temporal Drivers of kererū (Hemiphaga novaeseelandiae) Bird-Window Collisions in Dunedin, New Zealand. University of Otago. <https://hdl.handle.net/10523/12188>

Hong Yang et al. (2021), Bird-friendly buildings for China’s cities. Science374, 268-268.DOI:10.1126/science. abm3221

Hsieh, C. H., Hsu, G. C., & Wang, L. M. (2024). Can social media serve as a potential citizen science source for bird-window collision (BWC) data? A study using a decadal data set in Taiwan. bioRxiv, 2024-03.<https://doi.org/10.1101/2024.03.29.587372>

Hudecki, J., & Finegan, E. (2018). Songbird collision injuries during migration season. Journal ofWildlifeRehabilitation,38(2),7-11.<https://www.researchgate.net/publication/330847892_Songbird_collision_injuries_during_migration_season>

John Kricher; Solid Air: Invisible Killer (2022): Saving Billions of Birds from Windows. The Wilson Journal of Ornithology; 134 (3): 569–571. doi: <https://doi.org/10.1676/22-00069>

Jones, D.N. and James Reynolds, S. (2008), Feeding birds in our towns and cities: a global research opportunity. Journal of Avian Biology, 39: 265-271. <https://doi.org/10.1111/j.0908-8857.2008.04271.x>

Justine A. Kummer, Erin M. Bayne, Craig S. Machtans (2016), Use of citizen science to identify factors affecting bird–window collision risk at houses, The Condor, Volume 118, Issue 3, 1 August 2016, Pages 624–639, <https://doi.org/10.1650/CONDOR-16-26.1>

K.C. Seto, B. Güneralp, & L.R. Hutyra (2012), Global forecasts of urban expansion to 2030 and direct impacts on biodiversity and carbon pools, Proc. Natl. Acad. Sci. U.S.A. 109 (40) 16083-16088, <https://doi.org/10.1073/pnas.1211658109>

Kahle LQ, Flannery ME, Dumbacher JP (2016) Bird-Window Collisions at a West-Coast Urban Park Museum: Analyses of Bird Biology and Window Attributes from Golden Gate Park, San Francisco. PLOS ONE 11(1): e0144600. <https://doi.org/10.1371/journal.pone.0144600>

Kaitlyn L. Parkins, Susan B. Elbin, Elle Barnes (1 March 2015) "Light, Glass, and Bird—Building Collisions in an Urban Park," Northeastern Naturalist, 22(1), 84-94, <https://www.jstor.org/stable/26453706>

Karen E. Powers, D. McKenzie Clore, Georgia M. Davidson, and Ryley C. Harris, (3 January 2022). "A Bird's-Eye View: Novel Use of Drone Images to Quantify Differences in Altitudinal Reflections in Bird-window Collision Studies," The American Midland Naturalist 187(1), 51-61 <https://doi.org/10.1674/0003-0031-187.1.51>

Kerlinger, P., Gehring, J. L., Erickson, W. P., Curry, R., Jain, A., & Guarnaccia, J. (2010). Night Migrant Fatalities and Obstruction Lighting at Wind Turbines in North America. The Wilson Journal of Ornithology, 122(4), 744–754. <https://doi.org/10.1676/06-075.1>

Keyes, T., & Sexton, L.E. (2016). Characteristics Of Bird Strikes at Atlanta ’ S Commercial Buildings During Late Summer and Fall Migration, 2005. <https://www.semanticscholar.org/paper/CHARACTERISTICS-OF-BIRD-STRIKES-AT-ATLANTA-%E2%80%99-S-LATE-Keyes-Sexton/41576d3bf96e62fa1a678f14149a60fec65a161f>

Kim, CM., Kim, JH. & Yoo, SH (2023). Economic benefits of preventing bird collisions in South Korea: findings from a choice experiment survey. Environ Sci Pollut Res 30, 2945–2957. <https://doi.org/10.1007/s11356-022-22343-y>

Klem, Jr, Daniel. (1989). Bird-window collisions. Wilson Bulletin. 101. https://sora.unm.edu/sites/default/files/journals/wilson/v101n04/p0606-p0620.pdf

Klem, Jr, Daniel. (1990). Collisions between birds and windows: Mortality and prevention. J. Field Ornith.. 61. <https://www.jstor.org/stable/4513512>

Klem, Jr, Daniel. (2009). Preventing Bird–Window Collisions. The Wilson Journal of Ornithology.121.314-321.10.1676/08-118.1. <https://www.researchgate.net/publication/232662651_Preventing_Bird-Window_Collisions>

Klem Jr, D., Saenger, P. G., & Brogle, B. P. (2024). Evidence, consequences, and angle of strike of bird–window collisions. The Wilson Journal of Ornithology, 136(1), 113-119.10.1676/23-00045

Klem Jr., D. (2014). Landscape, Legal, and Biodiversity Threats that Windows Pose to Birds: A Review of an Important Conservation Issue. Land, 3(1), 351-361. <https://doi.org/10.3390/land3010351>

Kornreich A, Partridge D, Youngblood M, Parkins K (2024) Rehabilitation outcomes of bird-building collision victims in the Northeastern United States. PLoS ONE 19(8): e0306362. <https://doi.org/10.1371/journal.pone.0306362>

Kummer, J. A., and E. M. Bayne. (2015). Bird feeders and their effects on bird-window collisions at residential houses. Avian Conservation and Ecology 10(2):6. <http://dx.doi.org/10.5751/ACE-00787-100206>

Labedz, T. E. (2020). WINDOW STRIKE BIRD MORTALITY ON THE UNIVERSITY OF NEBRASKA–LINCOLNCITYCAMPUS.<https://digitalcommons.unl.edu/cgi/viewcontent.cgi?article=2476&context=nebbirdrev>

Lancaster, S. L., Salen, R., Olsen-Hodges, E. H., Simon, S. R., & Powers, K. E. (2022). Techniques and trends in aging carcasses of bird-window collisions in the New River Valley. Banisteria,56,18-24.<http://virginianaturalhistorysociety.com/wp-content/uploads/sites/28/2023/07/Banisteria_56_Lancaster_et_al_Trends_aging_birds.pdf>

Lao, S. (2019). Investigating the effects of weather, artificial lighting, and polarized light on bird-building collisions in the downtown area of a major US city.<https://openresearch.okstate.edu/bitstreams/a4201853-ab13-4081-9039-8669d76e661a/download>

Lee, S. J., Matos, F. N., Gonzaga, C. R. R., de Medeiros, M. A., Leandro, S. D. F. S., Teixeira, R. H. F., ... & Piratelli, A. J. (2024). Post mortem analysis of birds that collided with glass panes reveals multiple injuries and fractures. Ornithology Research, 32(4), 399-403. DOI:10.1007/s43388-024-00201-4

Lessin, L. M. (2022). Factors related to bird collisions with buildings along the coast of Lake Erie. [Master's thesis, Ohio State University]. Ohio LINK Electronic Theses and Dissertations Center. <http://rave.ohiolink.edu/etdc/view?acc_num=osu1641474194012681>

Leung, K. (2022, April 13). Invisible to visible: A field study investigating dirty windows and bird-friendly artwork as mitigation strategies against bird-window collisions [R]. doi:<http://dx.doi.org/10.14288/1.0421588>

Li, H., Li, G., Hokao, R., Powell, B., & Salah, M. (2023, April 27). Designing Window Sensors to Advance Bird- Friendly and Energy Saving Building Design Strategies on UBC Vancouver Campus [R]. doi:<https://dx.doi.org/10.14288/1.0435808>

Little, R. (2024, April 12). Monitoring the Frequency and Severity of Bird Collisions: An Analysis of Factors Influencing the UBC Chan Centre and Wall Institute [R]. doi: <http://dx.doi.org/10.14288/1.0444916>

Lopes, A. C., Rocha, G. O. C., de Oliveira Passos, M. F., Barçante, L., & de Azevedo, C. S. (2024). The Influence of Building Surroundings and Glass Cover in Bird Collisions. Birds, 5(4), 703-711. <https://doi.org/10.3390/birds5040048>

Lopes, A. C. (2019). Colisões de aves com o vidro na Universidade Federal de Ouro Preto-UFOP: é possível evitar?.<https://www.monografias.ufop.br/handle/35400000/2471>

Loss, S. R. et al. (2023). Citizen science to address the global issue of bird–window collisions. – Front. Ecol. Environ. 21: 418–427. <https://doi.org/10.1002/fee.2614>

Loss, Scott & Will, Tom & Marra, Peter. (2015). Direct Mortality of Birds from Anthropogenic Causes. Annual Review of Ecology Evolution and Systematics. 46. 10.1146/annurev-ecolsys-112414-054133. <https://doi.org/10.1146/annurev-ecolsys-112414-054133>

Loss SR, Lao S, Eckles JW, Anderson AW, Blair RB, et al. (2019) Factors influencing bird-building collisions in the downtown area of a major North American city. PLOS ONE 14(11): e0224164. <https://doi.org/10.1371/journal.pone.0224164>

Maaike A Hiemstra, Erin K Dlabola, and Erin L O'Brien (19 February 2020). "FACTORS INFLUENCING BIRD-WINDOW COLLISIONS IN VICTORIA, BRITISH COLUMBIA," Northwestern Naturalist 101(1), 27-33, (<https://doi.org/10.1898/1051-1733-101.1.27>

Machtans, Craig. (2013). A First Estimate for Canada of the Number of Birds Killed by Colliding with Building Windows. Avian Conservation and Ecology. 8. 6. 10.5751/ACE-00568-080206. <http://dx.doi.org/10.5751/ACE-00568-080206>

Maren Rebke, Volker Dierschke, Christiane N. Weiner, Ralf Aumüller, Katrin Hill, Reinhold Hill(2019),Attraction of nocturnally migrating birds to artificial light: The influence of colour, intensity and blinking mode under different cloud cover conditions Volume, May 2019, Pages 220-227.<https://doi.org/10.1016/j.biocon.2019.02.029>

Mark A. Goddard, Andrew J. Dougill, Tim G. Benton, 2010 Feb;25(2):90-8. doi: 10.1016/j.tree.2009.07.016. Epub 2009 Sep 14. DOI: 10.1016/j.tree.2009.07.016

Marques, Ana & Batalha, Helena & Rodrigues, Sandra & Costa, Hugo & Ramos Pereira, Maria João & Fonseca, Carlos & Mascarenhas, Miguel & Bernardino, Joana. (2014). Understanding bird collisions at wind farms: An updated review on the causes and possible mitigation strategies. Biological Conservation. 179. 40–52. 10.1016/j.biocon.2014.08.017. <https://doi.org/10.1016/j.biocon.2014.08.017>

Martin, B. (2021). Weather Patterns and Seasonal Effects on Bird-Window Collisions at USU's C&SSBuilding,BrighamCity,Utah <https://digitalcommons.usu.edu/researchweek/ResearchWeek2021/All2021/109/>

Martin, H. (2021). Analyzing Fatal Bird-Window Collision Mitigation Occurring at the Classroom and Student Services Building, Brigham City, UT.<https://digitalcommons.usu.edu/researchweek/ResearchWeek2021/All2021/110/>

Martin, Hunter (2020), "Bird-Window Collision MItigation at USU's C&SS Building, Brigham City, Utah". Fall Student Research Symposium 2020. 47.<https://digitalcommons.usu.edu/fsrs2020/47>

Mayntz M. (2018). Stop birds attacking windows. Documento en línea. URL: http://www.the spruce. com/stop-birds-attacking-windows 386 449. Visited: June 2018https://[flap.org/stop-birds-from-attacking-windows/](http://flap.org/stop-birds-from-attacking-windows/)

McDonald, R.I. (2008), Global urbanization: can ecologists identify a sustainable way forward?. Frontiers in Ecology and the Environment, 6: 99-104. <https://doi.org/10.1890/070038>

McGregor, C., Ewing, C., Perez, E. L., & Barnard-Chumik, H. (2020, April 9). Bird-Friendly Art: A Social-Ecological Evaluation of the Prevention of Bird Collisions with Campus Windows [R]. doi:<http://dx.doi.org/10.14288/1.0394849>

McLain, Antarius D.(2019), "Bird Window Strikes on a College Campus: Mortality Estimates and Possible Mitigation" . Electronic Theses and Dissertations. 1975.<https://digitalcommons.georgiasouthern.edu/cgi/viewcontent.cgi?article=3111&context=etd>

McLaren, J.D., Buler, J.J., Schreckengost, T., Smolinsky, J.A., Boone, M., Emiel van Loon, E., Dawson, D.K. and Walters, E.L. (2018), Artificial light at night confounds broad-scale habitat use by migrating birds. Ecol Lett, 21: 356-364. <https://doi.org/10.1111/ele.12902>

Menacho-Odio, R. M. (2018). Colisión de aves con ventanas: problema, prevención, mitigaciónytendencias,de,investigación.,Zeledonia,22(1).<https://www.zeledonia.com/uploads/7/0/1/0/70104897/zel22-1-june-2018-0059-0076.pdf>

Menacho-Odio, R. M. (2018). Local perceptions, attitudes, beliefs, and practices toward bird-window collisions in Monteverde, Costa Rica. UNED Research Journal, 10. <https://revistas.uned.ac.cr/index.php/cuadernos/article/download/2038/2323/5505>

Menacho-Odio, Rose Marie, Garro-Cruz, Martha, & Arévalo, J. Edgardo. (2019). Ecology, endemism, and conservation status of birds that collide with glass windows in Monteverde, Costa Rica. Revista de Biología Tropical, 67(2), 326-345. <https://dx.doi.org/10.15517/rbt.v67i2supl.37255>

Michael L. McKinney (2002), Urbanization, Biodiversity, and Conservation: The impacts of urbanization on native species are poorly studied, but educating a highly urbanized human population about these impacts can greatly improve species conservation in all ecosystems, BioScience, Volume 52, Issue 10, , Pages 883–890, [https://doi.org/10.1641/0006-3568(2002)052[0883:UBAC]2.0.CO;2](https://doi.org/10.1641/0006-3568(2002)052%5B0883:UBAC%5D2.0.CO;2)

Michał Żmihorski, Dorota Kotowska, Ewa Zyśk-Gorczyńska (2022),Using citizen science to identify environmental correlates of bird-window collisions in Poland, Science of The Total Environment,Volume811,2022,152358,ISSN0048-9697,<https://doi.org/10.1016/j.scitotenv.2021.152358>.

Mitrus, C., Zbyryt, A (2018). . Reducing avian mortality from noise barrier collisions along an urban roadway. Urban Ecosyst 21, 351–356 https://doi.org/10.1007/s11252-017-0717-7

Monge-Nájera, J., & Llosa, Z. B. (2018). A new, cheap method to reduce bird mortality from window collisions. UNED Research Journal, 10.<https://www.researchgate.net/publication/323622534_A_new_cheap_method_to_reduce_bird_mortality_from_window_collisions>

Mouchet, S., Wauters, R., Haye, E., Lucas, S., & Deparis, O. (2023). Bioinspired coating for bird-safe glazing optimised for avian and human vision. In International Conference on Metamaterials, Photonic Crystals and Plasmonics (pp. 1118). (International Conference on Metamaterials, Photonic Crystals and Plasmonics). <https://metaconferences.org/META23/files/meta23_proceedings.pdf>

Mouton, J. A. (2022). Collisions on Campus: Species-specific susceptibility of resident and migrant birds to window strikes at Louisiana State University.<https://repository.lsu.edu/cgi/viewcontent.cgi?article=2052&context=honors_etd>

Mr. Jugmohan Singh, Mr. K J V Ramana Rao (2022): A Trend to Be Reduced: “Mortality of Birds by Collisions with Buildings in Urban Areas” GSJ: Volume 10, Issue 12, December 2022, Online: ISSN 2320-9186 www.globalscientificjournal.com

Myhill, M., 2021. Bird-friendly Design Guideline Introduction When does the Bird-friendly Design Guideline apply? City of Guelph, Ontario. Canada. Retrieved f on 09 Jan 2025. COI: 20.500.12592/bdn59c.<https://coilink.org/20.500.12592/bdn59c>

Nana Ushine, Aki Tanaka, Tatsuo Sato, Masaki Nonagase, Shin-ichi HayamabioRxiv (2021).05.25.445584; doi: <https://doi.org/10.1101/2021.05.25.445584>

Newton, I., Wyllie, I. and Dale, L. (1999), Trends in the numbers and mortality patterns of sparrowhawks (Accipiter nisus) and kestrels (Falco tinnunculus) in Britain, as revealed by carcass analyses. Journal of Zoology, 248: 139-147. <https://doi.org/10.1111/j.1469-7998.1999.tb01190.x>

Nichols, K. S. (2018). Birds & buildings: Bird-window collisions in the urban landscape (Doctoraldissertation,UniversityofMinnesota).<https://conservancy.umn.edu/items/366a31e8-242a-4aea-8715-48532a9b04a8>

Nichols KS, Homayoun T, Eckles J, Blair RB (2018) Bird-building collision risk: An assessment of the collision risk of birds with buildings by phylogeny and behavior using two citizen-science datasets. PLOS ONE 13(8): e0201558. <https://doi.org/10.1371/journal.pone.0201558>

Ocampo-Peñuela N, Winton RS, Wu CJ, Zambello E, Wittig TW, Cagle NL. (2016). Patterns of bird-window collisions inform mitigation on a university campus. PeerJ 4:e1652 <https://doi.org/10.7717/peerj.1652>

Oglęcki, P., & Żabicka, J. M. (2023). Mortality of birds as a result of collisions with glazing on the example of building structures in Warsaw. Zeszyty Naukowe SGSP/Szkoła Główna Służby Pożarniczej, (85).<https://zeszytynaukowe-sgsp.pl/article/01.3001.0016.3278/en>

Paniagua-Ugarte, C. Y., Powers, K. E., & Sheehy, R. R. (2019). Using DNA Barcoding to Identify Carcasses from Bird-window Collisions at Radford University. Banisteria, (53). <https://virginianaturalhistorysociety.com/wp-content/uploads/sites/28/2022/11/Banisteria53_Paniagua_Ugarte_etal_Digitizing.pdf>

Paula, M. C., Sebastián, H. S., & Jaime, G. C. (2023). Bird window collisions in a university campus of Medellín (Colombia): signs of a silent death. Revista Facultad Nacional de Agronomía Medellín, 76.

Petrycki, S. (2024). Building Design and Bird Fatalities: a Synthesis of Bird-window Collision Studies on North American University Campuses [Undergraduate thesis, Kent State University]. Ohio LINK Electronic Theses and Dissertations Center. <http://rave.ohiolink.edu/etdc/view?acc_num=ksuhonors1714841080958501>

Rebekah Netzley, Hannah C Partridge, Sara A Gagné (2024), Shadow-boxing: Major gaps to knock out in bird–window interaction research, Ornithological Applications, duae054, <https://doi.org/10.1093/ornithapp/duae054>

Rebolo, Natalia; Zamora Nasca, Lucía Belén; Lambertucci, Sergio Agustin (2021); Cat and dog predation on birds: the importance of indirect predation after bird-window collisions; Elsevier; Perspectives in Ecology and Conservation; 19; 3; 7-2021; 293-299https://[bicyt.conicet.gov.ar/fichas/production/11976253](http://bicyt.conicet.gov.ar/fichas/produccion/11976253)

Rebolo-Ifrán, N., Di Virgilio, A., & Lambertucci, S. A. (2019). Drivers of bird-window collisions in southern South America: a two-scale assessment applying citizen science. Scientific reports, 9(1), 18148.<https://doi.org/10.1038/s41598-019-54351-3>

Ribeiro, B.C., Piratelli, A.J(2020). Circular-shaped decals prevent bird-window collisions. Ornitol. Res. 28, 69–73. <https://doi.org/10.1007/s43388-020-00007-0>

Riding, C. S., O’Connell, T. J., & Loss, S. R. (2020). Building façade-level correlates of bird–window collisions in a small urban area. The Condor, 122(1), duz065.<https://academic.oup.com/condor/article/122/1/duz065/5690596>

Riding, C.S., O’Connell, T.J. & Loss, S.R(2021). Multi-scale temporal variation in bird-window collisions in the central United States. Sci Rep 11, 11062 <https://doi.org/10.1038/s41598-021-89875-0>

Riding, C. S. (2019). Factors affecting bird-window collisions in a small urban area: Stillwater, Oklahoma (Doctoral dissertation, Oklahoma State University).<https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0224164>

Riding, C.S. and Loss, S.R. (2018), Factors influencing experimental estimation of scavenger removal and observer detection in bird–window collision surveys. Ecol Appl, 28: 2119-2129. <https://doi.org/10.1002/eap.1800>

Riggs, G.J., Barton, C.M., Riding, C.S. et al (2023). Field-testing effectiveness of window markers in reducing bird-window collisions. Urban Ecosystem 26, 713–723 <https://doi.org/10.1007/s11252-022-01304-w>

Riggs, G. J. (2021). Bird-Window Collisions: Field Testing a Potential Solution and Evaluating Stakeholder Perceptions (Master's thesis, Oklahoma State University).<https://hdl.handle.net/20.500.14446/333646>

Riggs GJ, Joshi O, Loss SR (2022) Stakeholder perceptions of bird-window collisions. PLOS ONE 17(2): e0263447. <https://doi.org/10.1371/journal.pone.0263447>

Robb, G.N., McDonald, R.A., Chamberlain, D.E. and Bearhop, S. (2008), Food for thought: supplementary feeding as a driver of ecological change in avian populations. Frontiers in Ecology and the Environment, 6: 476-484. <https://doi.org/10.1890/060152>

Robertson, J. M. (1935). Bush-tits Shadow-boxing"". Condor, 37(5), 14.<https://digitalcommons.usf.edu/condor/vol37/iss5/14>

Sabo, Ann & Hagemeyer, Natasha & Lahey, Ally & Walters, Eric. (2016). Local avian density influences risk of mortality from window strikes. PeerJ. 4. e2170. 10.7717/peerj.2170. <https://doi.org/10.7717/peerj.2170>

Sagers Lauritsen, R., Landon, L., Brinnlie, K., & Schmid, H. H. (2018). Patterns of Bird Window Strikes on USU Campus and Physical Features that Increase Risk for Collision.

Samuels B, Fenton B, Fernández-Juricic E, MacDougall-Shackleton SA. (2022). Opening the black box of bird-window collisions: passive video recordings in a residential backyard. PeerJ 10: e14604 <https://doi.org/10.7717/peerj.14604>

Schneider, R. M., Barton, C. M., Zirkle, K. W., Greene, C. F., & Newman, K. B. (2018). Year-round monitoring reveals prevalence of fatal bird-window collisions at the Virginia Tech Corporate Research Center. PeerJ, 6, e4562.<https://doi.org/10.7717/peerj.4562>

Scott, K. M., Danko, A., Plant, P., & Dakin, R. (2023). What causes bird-building collision risk? Seasonal dynamics and weather drivers. Ecology and Evolution, 13, e9974. <https://doi.org/10.1002/ece3.9974>

Scott R. Loss, Tom Will, Sara S. Loss, Peter P. Marra (2014), Bird–building collisions in the United States: Estimates of annual mortality and species vulnerability, The Condor, Volume 116, Issue 1, 1 February 2014, Pages 8–23, <https://doi.org/10.1650/CONDOR-13-090.1>

Seo H-M, Kim Y-J, Lee E-J, Lee S-G, Lee W-S, Choi C-Y (2023). Another emerging threat to birds: avian mortality estimates from roadside transparent noise barrier collisions in South Korea. Bird Conservation International. 2023;33: e50. 10.1017/s0959270922000454https://[colab.ws/articles/10.1017%2Fs0959270922000454](http://colab.ws/articles/10.1017%2Fs0959270922000454)

Sheng, Gan & Ingabo, Simeon & Chan, Ying-Chieh. (2024). Evaluating the impact of bird collisions prevention glazing pattern design on window views. Building and Environment. 259. 111657. 10.1016/j.buildenv.2024.111657. <https://doi.org/10.1016/j.buildenv.2024.111657>

Sheppard, C. D. (2019). Evaluating the relative effectiveness of patterns on glass as deterrents of bird collisions with glass. Global Ecology and Conservation, 20(3), e00795. <https://www.researchgate.net/publication/335974538_Evaluating_the_relative_effectiveness_of_patterns_on_glass_as_deterrents_of_bird_collisions_with_glass>

Sidney A. Gauthreaux, Carroll G. Belser,(2003). Radar Ornithology and Biological Conservation, The Auk, Volume 120, Issue 2, 1 April 2003, Pages 266–277, <https://doi.org/10.1093/auk/120.2.266>

Simmons, D. B. (2021). A survey of bird-building collisions and building characteristics at the university of New Mexico. nmos bulletin, 49(2), S1.<https://www.nmbirds.org/wp-content/uploads/2016/12/Simmons_A_Survey_of_Bird-Building_Collisions_and_Building_Characteristics_at_UNM_Suppl_NMOS_Bulletin_492.pdf>

Sirena Lao, Abigail W Anderson, Robert B Blair, Joanna W Eckles, Reed J Turner, Scott R Loss (2023), Bird–building collisions increase with weather conditions that favor nocturnal migration and with inclement and changing weather, Ornithological Applications, Volume 125, Issue 1, 3 February 2023, duac045, <https://doi.org/10.1093/ornithapp/duac045>

Sirena Lao, Bruce A. Robertson, Abigail W. Anderson, Robert B. Blair, Joanna W. Eckles, Reed J. Turner, Scott R. Loss (2020),The influence of artificial light at night and polarized light on bird-building collisions, Biological Conservation, Volume 241,2020,108358,ISSN 0006-3207,<https://doi.org/10.1016/j.biocon.2019.108358>

.

Smith, S. (2019). Survey of Bird/Window Collisions at Utah State University-Brigham City.<https://digitalcommons.usu.edu/roch/115/>

Stapleton, K. (2024). Bird-Window Collisions at the Chan Centre for Performing Arts and the Wall Institute for Advanced Studies Balcony: First Year of Monitoring [R]. doi:<http://dx.doi.org/10.14288/1.0444930>

Stephen B. Hager, Heidi Trudell, Kelly J. McKay, Stephanie M. Crandall, Lance Mayer (1 September 2008)"Bird density and mortality at windows," The Wilson Journal of Ornithology, 120(3),550-564,<https://default.sfplanning.org/publications_reports/bird_safe_bldgs/HageretalBirdWindowMortWJO2008.pdf>

Sumrada, T. (2015). Trki ptic v stekleno procelje poslovne stavbe v Ljubljani (osrednja Slovenija) jeseni 2012/Bird collisions with glass façade of a commercial building in Ljubljana (central Slovenia) in autumn 2012. Acrocephalus, 36(164-165), 69.<https://doi.org/10.1515/acro-2015-0005>

Swaddle JP, Brewster B, Schuyler M, Su A. (2023). Window films increase avoidance of collisions by birds but only when applied to external compared with internal surfaces of windows. Peer J 11: e14676 <https://doi.org/10.7717/peerj.14676>

Swaddle JP, Emerson LC, Thady RG, Boycott TJ. (2020). Ultraviolet-reflective film applied to windows reduces the likelihood of collisions for two species of songbird. PeerJ 8:e9926 <https://doi.org/10.7717/peerj.9926>

Tan, D. J. X., Freymueller, N. A., Teo, K. M., Symes, W. S., Lum, S. K. Y., & Rheindt, F. E. (2024). Disentangling the biotic and abiotic drivers of bird–building collisions in a tropical Asian city with ecological niche modeling. Conservation Biology, 38, e14255. <https://doi.org/10.1111/cobi.14255>

Temby I. (2003). Flora and Fauna Notes: Problems Caused by Birds Attacking Windows. Department of Sustainability and Environment, Victoria, Australiahttp://[www.wildcare.org.au/Documents/Problems\_caused\_by\_birds\_attacking\_windows.pdf](http://www.wildcare.org.au/Documents/Problems_caused_by_birds_attacking_windows.pdf)

Tews, A. (2022). LEED Certified Buildings and Bird-Friendly Window Design. UF Journal of Undergraduate Research, 24.<https://doi.org/10.32473/ufjur.24.130839>

Thady, R. G. (2021). Evaluating The Use of Acoustic Warning Signals to Reduce Avian Collision Risk (Master's thesis, The College of William and Mary).<https://doi.org/10.21220/xs38-4147>

Thady RG, Emerson LC, Swaddle JP. (2022). Evaluating acoustic signals to reduce avian collision risk. Peer J 10: e13313 <https://doi.org/10.7717/peerj.13313>

Thaker, M. (2021). Assessing and addressing bird-window collisions on the Queen's University main campus (Master's thesis, Queen's University (Canada)).

Trudell, H., & Elliott, A (2018). 3.5. 3 Bird Strikes at Windows in Eastern Washtenaw County, MI: A Preliminary Assessment. Urban Bird Summit: Status, Trends, and Risks to Species that Call the Corridor Home, 63.<https://web2.uwindsor.ca/softs/reports/SOFTS_2018_Report.pdf>

Uribe-Morfín P, Gómez-Martínez MA, Moreles-Abonce L, Olvera-Arteaga A, Shimada-Beltrán H, MacGregor-Fors I (2021). The invisible enemy: Understanding bird-window strikes through citizen science in a focal city. Ecological Research. 2021; 36: 430–439. <https://doi.org/10.1111/1440-1703.12210>

Verea, C (2018). Some Venezuelan wild bird species that box against their own reflections. Rev. Bras. Ornitol. 26, 192–195. https://doi.org/10.1007/BF03544428

Verheijen, F.J. (1960). The Mechanisms of the Trapping Effect of Artificial Light Sources Upon Animals. Archives Néerlandaises de Zoologie, 13(1), 1-107. <https://doi.org/10.1163/036551660X00017>

Verheijen FJ (1985). Photo pollution: artificial light optic spatial control systems fail to cope with. Incidents, causation, remedies. Experimental Biology. 1985 ;44(1):1-18. PMID: 3896840. <https://pubmed.ncbi.nlm.nih.gov/3896840/>

Villon, E. (2024). How dangerous is glass? Understanding collisions and bird mortality in Finland.Environment,121,126-134.<https://helda-test-22.hulib.helsinki.fi/items/6070b587-d9dd-45f3-99c8-062d3ed8cb63/full>

Wazny, N. (2024, April 12). Bird-Window Collision Risks and Mitigation Strategies at Buchanan: The University of British Columbia [R]. doi: <http://dx.doi.org/10.14288/1.0444936>

Why garden for wildlife? Social and ecological drivers, motivations and barriers for biodiversity management in residential landscapes, Ecological Economics, Volume 86,2013, Pages 258-273, ISSN 0921-8009, <https://doi.org/10.1016/j.ecolecon.2012.07.016>.

Winton, Robert & Cagle, Nicki. (2018). Geo-referencing bird-window collisions for targeted mitigation. PeerJ. 6. e4215. 10.7717/peerj.4215. <https://doi.org/10.7717/peerj.4215>

Wood, J. S. (2014). Birds, Buildings and LEED Mitigation Design at the University of Calgary Campus (Master's thesis, University of Calgary, Calgary, Canada). Retrieved from https://prism.ucalgary.ca. doi:10.11575/PRISM/25141

Yatsuda, S. (2024, April 12). Investigating Bird-Building Collisions at the University of British Columbia’s Vancouver Campus [R]. doi:<http://dx.doi.org/10.14288/1.0444938>

Zammuto, I. B. R. M., & Franks, E. C. (1979). A Journal Of Ornithological Investigation.Bird-Banding,50(3),201-209.[Https://Ornithologyexchange.Org/Resources/Journals/Database/Ornithological-Journals/Bird-Banding-R15/](https://ornithologyexchange.org/resources/journals/database/ornithological-journals/bird-banding-r15/)

Zulian, V., A. R. Norris, K. L. Cockle, A. N. Porter, L. G. Do, And K. L. De Groot. (2023). Seasonal Variation in Drivers of Bird-Window Collisions on The West Coast Of British Columbia, Canada. Avian Conservation and Ecology 18(2):15.[Https://Doi.Org/10.5751/Ace-02482-180215](https://doi.org/10.5751/ACE-02482-180215)

Zyśk-Gorczyńska, E., & Żmihorski, M. (2022). Ultraviolet Film Reduces Bird–Glass Collision Risk. Ornis Fennica, 99(2–3), 95–103. [Https://Doi.Org/10.51812/Of.115995](https://doi.org/10.51812/of.115995)

Zyśk-Gorczyńska, E., & Żmihorski, M. (2023). Ultraviolette Folie verringert das Risiko von Zusammenstößen Zwischen Vögeln und Glas.<https://www.zobodat.at/pdf/Vogelwarte_61_2023_0123-0130.pdf>

Беляев, Д. А., & Коробов, Д. В. (2023). Массовая гибель птиц от столкновения с оконными стеклами зданий в г. Уссурийске в 2023 году. Амурский зоологический журнал, 15(4), 923-938.<https://orcid.org/0000-0001-7356-434X>.

DeLuca, W. V., Meehan, T., Seavy, N., Jones, A., Pitt, J., Deppe, J. L., & Wilsey, C. B. (2021). The Colorado River Delta and California’s Central Valley are critical regions for many migrating North American landbirds. The Condor: Ornithological Applications, 123(1).

Lin, T. Y., Winner, K., Bernstein, G., Mittal, A., Dokter, A. M., Horton, K. G., Nilsson, C., Van Doren, B. M., Farnsworth, A., La Sorte, F. A., Maji, S., & Sheldon, D. (2019). MistNet: Measuring historical bird migration in the US using archived weather radar data and convolutional neural networks. Methods in Ecology and Evolution, 10, 1908–1922