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Student Research Report

# APBI 495: Final Research Report

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**Abstract**

Bird-window collisions are the second leading cause of bird fatalities in the United States, accounting for billions of deaths each year. This study aimed to determine how many bird-window collisions occurred at the University of British Columbia's Buchanan complex, using a modified methodology created by Hager and Cosentino ( 2014). We collected data and surveyed for eight weeks and found evidence of at least thirty-three bird-window collisions. The buildings that accounted for the most collisions were Buchanan A, C and D, specifically facades twenty-five, thirteen, and ten. Contributing factors that make these facades the most problematic include the presence of vegetation. We also found that our results this year were similar to last year. However, there were critical differences in collision types and which facades accounted for collisions. Future management solutions would include applying the feather-friendly decal to Buchanan C, facade thirteen, as it was responsible for the most significant number of collisions.

**Introduction**

In light of the rapid rate of urbanization and the development of human-centric buildings, there is a growing concern regarding the associated human-wildlife conflict. Human-wildlife conflict can be defined in various ways; however, the most basic definition is the direct or indirect conflict between humans and wild animals ( Lute et al., 2016). In the context of this paper, human-wildlife conflict is defined as the rate and frequency of collisions of birds with human-built infrastructure and the fatalities associated. Focusing on this conflict is significant because bird-window collisions are detrimental to the total bird population as it accounts for 364 to 988 million deaths in the United States a year ( Loss et al., 2014). With this number of fatalities per year, there is an estimated 11 to 31% decline in the bird population ( Nichols et al., 2018). Conserving current and future bird populations is crucial for maintaining population numbers; however, birds also have a significant ecological role like seed dispersal ( Tabur & Ayvaz, 2010). When they consume fruits, like berries, once they dispose of the seeds, their fecal matter and location of dispersal provide excellent conditions for the seed to thrive ( Tabur & Ayvaz, 2010). They also act as pollinators in some geographical locations, and the combination of their responsibilities dramatically contributes to the overall ecosystem ( Tabur & Ayvaz, 2010).

To determine acceptable methods to reduce bird collisions, it is vital to understand why they happen in the first place. Birds are susceptible to bird-window collisions for a variety of reasons, including both environmental and physiological reasons. In terms of environmental causes, firstly, the extent of glass a building is composed of is a significant contributor ( Elmore et al., 2020). Glass is a contributing factor to collisions because, during daylight hours, the glass acts as a mirror and reflects the surrounding landscape in front of it ( Elmore et al., 2020). This deceives birds as they cannot perceive the window as a solid barrier; instead, they believe they are flying toward an open landscape ( Elmore et al., 2020). It has also been found that buildings with darker interiors pose a greater risk of collisions because the darkness exacerbates the reflection the window emits ( Klem, 2015). Building type also poses a significant risk of bird-window collisions ( Loss et al., 2014). Larger buildings, including high-rises or office buildings, contribute more to bird fatalities than smaller buildings ( Loss et al., 2014). This is potentially because it is a larger object, making it more likely to be hit than smaller buildings ( Loss et al., 2014). Another contributing factor to bird-window collisions includes the amount or presence of vegetation near windows ( Parkins, Elbin & Barnes, 2015). The increased greenery provides a haven for birds, especially in urban settings, as it provides them cover, however, once they leave these areas, they are more likely to collide with windows due to the general proximity

( Parkins, Elbin & Barnes, 2015). Birds who are more adapted to rural areas and travel into more urban areas may be more susceptible to collisions because they more commonly seek refuge in this vegetation and are not adapted to the presence of large buildings ( De Groot et al., 2021). Another factor includes the access to food. Bird feeders can contribute to up to 39% of bird fatalities in residential areas as these feeders attract birds to the site (Machtans, Wedeles & Bayne, 2013). The placement of these bird feeders also poses an issue because many individuals will place them outside of their windows to view the feeding process; however, this causes a great deal of harm as it increases the likelihood of bird-window collisions ( Machtans, Wedeles & Bayne, 2013). Physiological factors that contribute to collisions include the fact that birds' visual systems vary significantly from humans ( Martine, 2011). Birds can see in a greater colour spectrum than humans, which means that they may be prone to more distractions, as they can focus on more stimuli than a human can ( Martin, 2011). Additionally, the resolution of the bird's eye lies more laterally than forward, and to see in front of them, they primarily rely on their peripheral vision, and even though the majority of a bird's resolution is focused laterally, it is significantly lower compared to a human ( Martin, 2011). Therefore, generally, a bird's visual system is reduced, making them more susceptible to collisions ( Martin, 2011). A bird's vision also tends to be more focused downwards to focus the attention on foraging or predator avoidance which can make them more likely to collide with windows, as they are not necessarily paying attention to what is in front of them ( Martin, 2011). Other physiological factors relate to a bird's life history ( Elmore et al., 2020). Migratory birds are considered high-risk species to collisions because they travel far distances, encounter various building types, and are more likely to fly when fatigued ( Loss et al., 2014). This can make them less aware of their surroundings, increasing their chances of collisions ( Loss et al., 2014). Those that migrate during the night have an increased risk because the artificial light emitted from buildings can change the natural behaviours, disorienting or distracting the birds from their natural flight path ( Elmore et al., 2021). However, despite migratory birds' increased susceptibility, all birds are prone to bird collisions ( Klem, 2015).

This project aims to determine how many bird collisions occurred at the University of British Columbia's Buchanan buildings. More specifically, we aimed to determine which facade was prone to the most collisions and whether the Feather Friendly application on BUCA27 has effectively decreased bird-window collisions? For each of these questions, we developed an associated hypothesis. In terms of our first research question, we hypothesized that there would be around three to five bird collisions at the Buchanan buildings per week. This is based on the fact that about 10,000 bird collisions occur at the University of British Columbia each year (Ryan, 2019), and it was a general estimate our group had decided on. Next, regarding which facade would be prone to the most collisions, we hypothesized that facades with the most vegetation and window coverage would account for the most collisions due to the associated risks of those two factors. Finally, we hypothesized that the facade treated with Feather Friendly application would account for very few or no collisions.

**Materials and methods**

We followed the methodology created by Hager and Cosentino (2014) for this project, modified by Krista De Groot. First, we started by deciding on a schedule appropriate for our group members to collect data at the Buchanan buildings. Initially, our group consisted of three members, and after the second week, another member joined, so our schedule initially was only to collect three times a week. After joining our fourth group member, we decided to monitor four days a week, Monday through Thursday, in pairs for two hours from around 8:00 am to 10:30

am. We were also given a set of materials to use for our data collection, which included safety vests, ziplock bags to collect evidence, a pen to label the evidence, binoculars, gloves, and sanitation materials. When we first arrived at Buchanan, we noted down the weather, following the Weather Bureau Sky Condition Codes, an eight-point scale rating the weather from clear to snowing. After we recorded the weather, we began our data collection. For this process, we started at the first building, Buchanan A, and worked our way to the last, Buchanan E, following the observer protocol. This protocol entailed that the pair of observers would start at a specific location at the building, for example, at the entrance of Buchanan A, note the start time, and each partner would walk in the opposite direction, clockwise or counter-clockwise, around the building and meet back at the starting spot. This method optimized the likelihood of evidence being found because it allowed two observers to approach the same facades from different angles. While walking around the building, each observer would carefully look for evidence of bird collisions such as feather smears, feather piles, or scavenged or whole carcasses. Observations for these types of evidence were conducted within two meters of each facade. Feather smears were any number of feathers directly attached to a window on a first-story window. This excluded feathers attached to webs or looked as though they were not from a collision. Feather piles are defined as at least ten feathers within a one-meter circle within two meters of the facade. An intact or scavenged carcass was any whole or dismembered part of a bird that had died from a window collison. We used binoculars to look for evidence for any facade that was not easily accessible by foot, including part of Buchana A facade 25 and Buchanan D facade 1. After each observer reached the starting position, we would discuss whether any evidence was found, and at this time, the survey end time would be recorded. If any evidence were found during the first walk around the building, it would be left until the whole building was surveyed. Any evidence found both partners would go back to the specific area and take a photograph, and a general description of its whereabouts on the facade was noted and the building and facade. Next, if the evidence required collection, like feather piles or intact or scavenged carcasses, we would take the gloves and bags we were provided and pick up any evidence, place it into the bag and label it appropriately. Feather smears were not required to be collected. Instead, they were removed after they were recorded and photographed to avoid doubling counting evidence. Collected evidence would then be brought to Krista De Groot's home to be identified, and the data we collected would be entered into a shared google drive. In this drive, we uploaded photos of the discovered collisions, and there is a data sheet where we noted all of the evidence found. If no evidence was found, we still entered this into the datasheet. This datasheet noted down the data, weather condition, start time, end time, building, facade, and whether or not evidence was found. This process was conducted for eight weeks, starting on January 27, 2022, and ending on March 31, 2022. We also conducted a carcass persistence trial from March 21, 2022, to March 23, 2022. During this trial, we collected three different species of birds from Krista De Groot, which were properly prepped. The back toe of each carcass was clipped to identify it as part of our trial easily. We then randomly placed them throughout the Buchanan complex. This randomization was done through a number generator. We first started by generating which building the bird would be placed at; numbers one through five correspond to each Buchanan building, A to E, respectively. Then we chose the facade and the location on the facade in the same manner. After each carcass was placed, we took photos of their location and noted a general description of their placements. This description included the substrate the carcass was placed on, how covered it was by shrubbery and the general visibility of the carcass. For our trials, we randomized the location of three separate carcasses, and their placements ended up being at Buchanan D, facade 10, Buchanan C facade 12 and Buchanan B facade 17.On the first day, we checked their status three times, at 10:00 am, just before noon, and 5:00 pm. The days after, we checked on them in the morning before surveying the buildings. We noted their presence or absence in a shared datasheet, and once all of the carcasses were gone, we calculated the last and first absent times. Searcher efficiency trials were also conducted, and these trials were meant to test how thoroughly we were at searching the facades. They were placed without our knowledge and conducted similar to the carcass persistence trials. Carcasses were obtained from Krista De Groot and were randomly placed using a number generator. Each building and facade had an associated number, and that was how the carcass placement was chosen. Once they were placed, they were checked on three times throughout the day, at around 7:00 am, 1:00 pm and 5:00 pm, and their presence or absence was noted in a google sheet, as well as which pair of observers were monitoring that day. They were placed and checked on by our teaching assistant, Natalie until they were gone or found. This could be by an observer or if they had been taken by anyone or anything else. The details of this trial were not shared with the group until after it was conducted.After our data collection was completed, we were given access to last year's data to compare our findings. This data was given in a data sheet similar to ours. We used this information to compare differences and similarities and conclude what the differences in data meant. This data was important because it also provided information regarding how effective the feather-friendly application was on facade 27. This application was implemented last year, based on last year's group's recommendation. This bird-friendly application consists of evenly spaced dots applied to a face to reduce bird collisions.

**Results**

The results of our study indicated that over thirty-two data collection days, we found evidence of at least thirty-three bird-window collisions. Furthermore, by analyzing the data imputed into our shared google sheet, we found that of the five buildings in the Buchanan complex, Buchanan A, C, and D accounted for the most collisions, with twelve, nine and six collisions, respectively ( Figure 1).

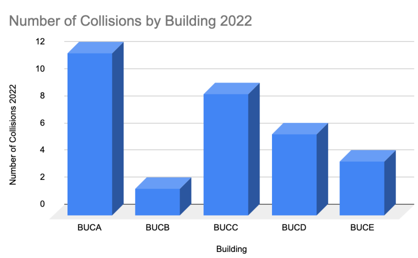


Figure 1. Number of bird collisions that occurred by building 2022. This figure shows how many collisions occurred at specific Buchanan buildings. Based on this figure, it is clear that Buchanan A had evidence of the most, followed by Buchanan C then D.

These three buildings alone accounted for 81% of the total collisions found during our surveying period, twenty-seven out of thirty-three collisions. In terms of each building, there was diversity in the evidence found at each building. At Buchanan A, we found nine feather smears and three feather piles. At Buchanan B, we found one feather smear and one scavenged carcass. At Buchanan C, we found eight feather smears and one feather pile. At Buchanan D, we found six feather smears. Finally, at Buchanan E, we found four feather smears. Focusing on each building, we discovered that particular facades were most prone to bird collisions, as evidence of bird collisions was only found over twelve different facades. At Buchanan A, all facades, twenty-five, twenty-six, twenty-seven and thirty-one, accounted for multiple bird collisions. At Buchanan B, facades nineteen and twenty-eight had evidence of one collision. At Buchanan C, facades thirteen and twenty-one saw collisions, and most of the evidence was found at facade thirteen. At Buchanan D, facade ten had evidence of collisions, and finally, at Buchanan E, facades five, six and eight had evidence of collisions ( Figure 2).

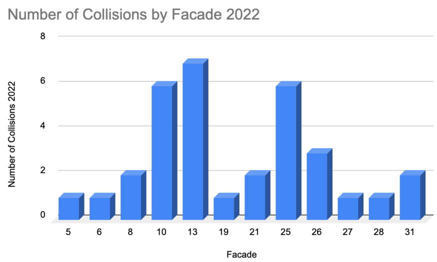


Figure 2. How many collisions occurred at what facade at Buchanan 2022.This figure shows the number of collisions that occurred at each specific facade in the Buchanan complex. Facades that had no evidence were exempt from this figure and it is clear that facade thirteen accounted for the most collisions followed by facade ten and twenty-five.

Generally, the most commonly found evidence at all buildings were feather smears, as it accounted for twenty-eight occurrences of the total thirty-three, 84% of all collisions. Following feather smears, feather piles were the second most common, with four occurrences, and the last being scavenged or intact carcasses which were found once during the entire surveying period ( Figure 3).

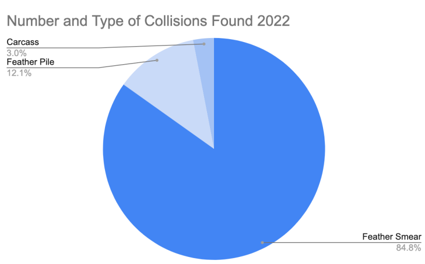


Figure 3. The most common type of collisions found at Buchanan 2022. This figure shows the distribution of types of collisions we found during our data collection. The most common evidence found was feather smears, followed by feather piles and carcasses.

We also conducted carcass persistence trials during our data collection, where we measured how long it would take for a carcass to be removed from a particular area. This removal did not necessarily have to be from scavengers; however, it could have been due to people, or other animals who took the carcass is less important than how quickly it was taken. After these trials, we found that the carcass at Buchanan D, facade ten remained for twenty-three and a half hours, and this is approximate because it was last checked at 5:00 pm and then was found to be gone at 9:41 am the next day. Therefore, the first absent time was twenty-three and a half hours, as it was placed at 10:05 am and found gone the next day at 9:41 am. This methodology was used for all carcasses to calculate the first absence time. The carcass at Buchanan C, facade twelve, lasted the longest of the three, remaining for forty-seven and a half hours. Finally, the carcass placed at Buchanan B stayed for the least amount of time, with the first absence time being less than three hours. The evidence was removed almost immediately.

While we surveyed the Buchanan buildings and collected data physically, we also had access to last year's data and compared it to ours. Again, it was found that there were multiple similarities in both years, as the buildings that accounted for the most collisions were Buchanan A, C, and D, with Buchanan A having the most collisions and Buchanan E having the least ( figure 4).

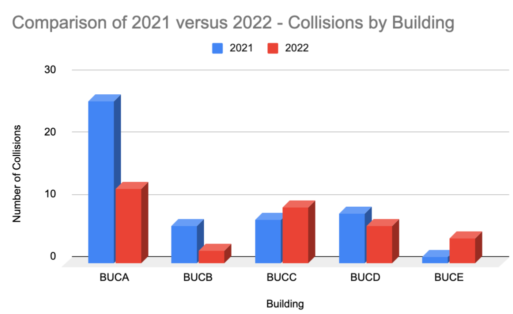


Figure 4. A comparison of 2021 data versus 2022 data - collisions by buildings. This figure shows the comparison between the two data collection years, 2021 and 2022. This figure is specifically comparing collisions between buildings at Buhanan.

There were also similarities in which facades accounted for the most collisions in both years. It was found that facades twenty-five and ten saw similar amounts of collisions and were facades with a high number of collisions ( Figure 5).

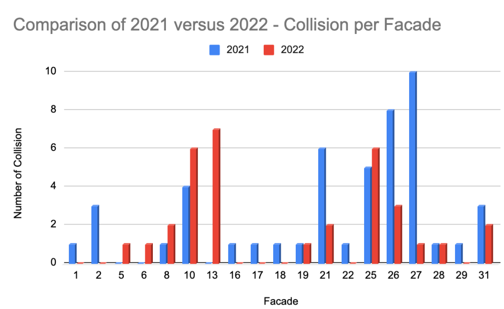


Figure 5. A comparison of 2021 data versus 2022 data - collisions by facades. This figure shows the comparison of evidence found at each facade during each data collection year, 2021 and 2022.

In both data sets, it was also found that feather smears were the most commonly found evidence, 85% and 84%, respectively ( Figure 6). Despite these similarities, there were also quite a few differences noted. The first is that when we conducted our data collection, we found 32% fewer collisions than last year. This year we discovered evidence of at least 33 collisions, while there was evidence of at least 49 collisions last year. There were also differences in which facades evidence was found at. For example, in the data collected this year, evidence was found over twelve facades, whereas last year, evidence was found in over sixteen ( Figure 5). This year we found evidence of collisions at facades five, six, ten, thirteen, nineteen, twenty-one, twenty-five, twenty-six, twenty-seven, twenty-eight, and thirty-one. Last year, they saw collisions at facades one, two, ten, sixteen, seventeen, eighteen, nineteen, twenty-one, twenty-two, twenty-five, twenty-six, twenty-seven, twenty-eight, twenty-nine and thirty-one. Another difference was that while both data years saw feather smears as the most commonly found evidence, there were differences in the number of feather piles and carcasses found ( Figure 6). This year we found more feather piles, four compared to three. However, last year they found more carcasses, five compared to one.

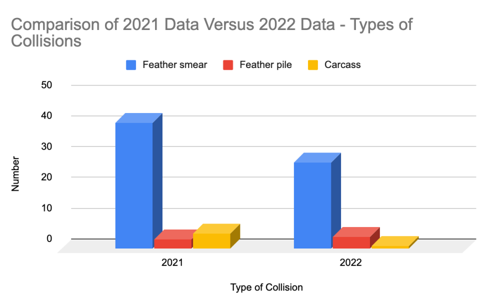


Figure 6. A comparison of 2021 data versus 2022 data - collision type.

Finally, another difference was that they identified a problem facade, facade twenty-seven, and advocated for the application of a feather-friendly decal last year. They saw ten total collisions at this facade, whereas this year, this facade only accounted for one collision ( Figure 7).

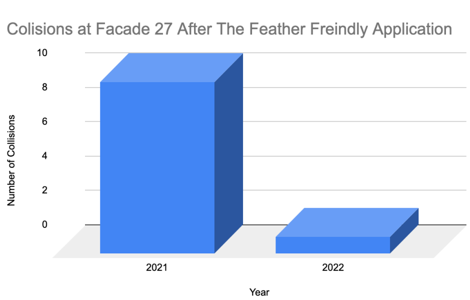


Figure 7. A comparison of collisions at facade 27 with and without the application of Feather friendly dots. This figure specifically shows the effects of how the Feather Friendly application has affected bird collisions at a specific facade, face twenty-seven.

**Discussion**

Throughout this project, our primary goal was to determine how many bird-window collisions occurred at the Buchanan complex, precisely what facades were most prone to those collisions, and whether applying a feather-friendly decal worked at reducing bird collisions? During our eight-week surveying period, it was found that the buildings that were most prone to collisions were Buchanan A, C and D, specifically facades twenty-five, thirteen, and ten, respectively. A potential cause for why these facades were most prone to collisions is that they were surrounded by some form of vegetation, whether that be partial forests, shrubbery or smaller plants. Vegetation contributes to bird-window collisions because it provides a place of refuge or rests for birds, increasing the density of birds in an area; however, once they leave these areas, they are more prone to collisions ( Parkings, Elbin & Barns, 2015). When vegetation lies too close to windows, the reflection of the foliage through the window deceives the birds into believing that they are flying towards more cover, causing a collision ( Parkings, Elbin & Barnes, 2015). Similar results to our study were found by Gelb and Delacretaz ( 2009), as they studied the influence of vegetation on bird collisions. They discovered that low-lying buildings that reflected the surrounding vegetation caused the most collisions ( Gelb & Delacretaz, 2009). This is similar to what Parkings, Elbin and Barnes ( 2015) found. They also noted that the highest collision in their study occurred at the buildings surrounded by the greatest amount of vegetation ( Parkings, Elbin & Barnes, 2009). We found that facade thirteen was especially prone to collisions as it accounted for seven collisions, the most seen at a single facade. The presence of vegetation and the Buchanan buildings are low, and medium-rise buildings increase the likelihood of collisions. Low and medium-rise buildings are a cause for concern in terms of bird collisions because they were found to account for 44 and 56% of collisions, respectively

(Ocampo-Peñuela et al., 2016). Another potential cause for these collisions includes the variability in weather. During our study, in most collisions, ten of the seventeen days where evidence was found, the weather varied from clear to overcast. While bird collisions can happen during any weather condition (Klem, 2015), how specific weather conditions influence bird collisions is not entirely clear. Studies have been done on how extreme weather conditions, like snowstorms affect bird collisions ( Loss et al., 2020). Other studies have studied the use of weather radar in predicting bird collisions at airports ( Nilsson et al., 2021); however, there has been no direct study of what weather condition influences bird-window collisions. It has been said that weather patterns that reduce visibility are more likely to contribute to bird collisions because it forces birds to fly at lower altitudes, increasing their likelihood of coming into contact with a building ("Threats to Birds: Collisions | U.S. Fish & Wildlife Service", 2022). However, seldom research has been done to clarify this.

When comparing the results of our study to last years, while similarities were abundant, there were also vast differences. Firstly, there was a 32% reduction in collisions found this year compared to last, 49 versus 33. This could be due to various reasons, including general searcher efficiency, changes in bird populations around the Buchanan complex, or the presence of scavengers and maintenance staff. Searcher efficiency would be the most likely cause of this because when searcher efficiency trials were conducted, our group could only find one of the two carcasses placed. The carcasses placed at Buchanan A were very visible; however, the carcass placed at Buchanan C was less visible, and this was the missing carcass. Another critical difference in the number of collisions found would be the application of the feather-friendly decal on Buchanan A, facade twenty-seven. Last year, this facade accounted for ten total collisions, whereas it only accounted for one this year. However, this one collision did not happen directly onto the decal; it was at the corner of facades twenty-six and twenty-seven. The identification of a problem facade and implementation of an effective window treatment successfully reduced bird-window collisions.

When we concluded our carcass persistence trials, it was found that the carcasses rarely remained past the forty-eight-hour mark, indicating that there may be a variety of factors that will influence the presence of a carcass in the area. One of the main reasons so few of the carcasses lasted past twenty-four hours was that two of the three carcasses placed were very visible to any individual in their proximity. The carcass at Buchanan B was placed in the bushes right in front of facade seventeen, and while the carcass was still technically placed undercover, the bushes did not have a lot of foliage, and it was clear to see. The carcass set at Buchanan D, facade ten, was placed behind some shrubbery; however, it was not covered. This may be a possible reason why the carcasses were taken so quickly. Another reason for their swift departure would include that Buchanan has many scavengers, like crows, present. They continually monitor the Buchanan building due to the heavy foot traffic, which means an accumulation of garbage that they can sort through. They are very active in the area, and despite placing the carcasses without their noticing, it is not surprising they were found so quickly.

There were a variety of limitations present throughout our study. The first is that we were only able to collect data four times a week. At the beginning of our research, we decided to collect data Monday through Thursday. However, collecting data four days a week may not be sufficient to gather adequate data. It is entirely possible that collisions may have occurred on the days we were not monitoring, Friday through Sunday. The evidence of those collisions remaining by the next monitoring day is also quite slim due to various reasons, including removal from weather conditions, scavengers, or maintenance staff. In terms of the presence of carcasses, it is highly likely that if a bird strike occurred on a day that we had not monitored, scavengers are likely to take it away almost immediately. During our study, we conducted a carcass persistence trial, and it was found that, on average, the carcasses remained for under or about twenty-four hours. One of the carcasses was removed as soon as three hours. Therefore, if collisions were to occur on days where monitoring was not happening, it is very likely that we would not find that evidence due to the swiftness of scavengers. The presence of these scavengers is expected not to be a coincidence either, as scavengers, like crows, are prevalent around the Buchanan buildings. This could be because there is a significant presence of students in the area, and garbage can accumulate very quickly, so this is an easily accessible food source. Additionally, in Buchanan A, a cafe is another food source for these animals. Additionally, at the beginning of our study, we only had three group members, so we could only collect data three times a week, rather than the recommended four. An initial reduction in collection days increases the likelihood that we may have missed evidence. Another limitation of this study is that it was only conducted over eight weeks. If data was collected over a more extended period, spanning different seasons and weather patterns, a better understanding could be acquired of how those factors affect collisions. It would also provide insight into the bird population around Buchanan and how it is being affected by these collisions. Finally, a limitation of this project included human error. While the methodology we used was pioneered to reduce the likelihood of missing evidence, there is still the possibility of mistakes despite thoroughly looking at each facade. There are various reasons why missing evidence may have occurred, including a searcher's fatigue, eyesight or other distractions. Data collection occurred in the morning; however, there were still many students and faculty members walking around Buchanan, and initially, data collection posed an uncomfortable task. However, after a habituation period, this became more normalized, but in the beginning, to avoid awkward stares, data collection may have been done more quickly or less thoroughly. Many collisions were likely missed due to these reasons. This is supported by the fact that when a searcher efficiency trial was held, our group could only locate one of the two carcasses placed without our knowledge. The one found was in a more prominent location, so it was subjectively easier to find; however, the second was located in a less visible location which all four members of our group missed.

Future research areas should include how specific weather conditions affect bird-window collisions at low to medium-rise buildings. Other research areas should include whether or not feather-friendly applications affect a bird's flight path in areas such as Buchanan and whether this influences whether a bird is more likely to collide with windows that are not treated. Finally, when conducting bird-window collision studies, it would be beneficial to gather data every day to see how much data is being missed and how other factors such as seasonality, weather, or the presence of humans have on bird collisions.

**Future Management Strategies**

To reduce the number of collisions at the Buchanan complex, practical management strategies should be implemented for the buildings and facades that accounted for the most collisions. Our studies demonstrated that Buchanan C, facade thirteen, should be treated immediately, as it accounted for the most collisions, and facades twenty-five and ten should be treated next. There are various appropriate methods to apply to these buildings, including using ceramic fruits, UV marks or reflective films ( Klem, 2009). It was found that windows that were involved or built into windows effectively prevented window collisions as they were able to disrupt the clear reflectiveness of the windows ( Klem, 2009). This allowed birds to recognize the glass window as a barrier rather than an open landscape they could fly through ( Klem, 2009). Another possible alternative includes UV-absorbing films ( Klem, 2009). A bird's visual system differs from a human's; more specifically, they can see into the ultraviolet range ( Martin, 2011). When using a UV reflective film and applied in a particular pattern, it was able to disrupt the reflectiveness of the window to make it more identifiable to the bird ( Klem, 2009). These films worked in the same way as the ceramic frits; however, the UV film's advantage is that it is unidentifiable to humans, so the glass windows hold the same aesthetics while reducing bird collisions ( Klem, 2009). A specific brand of UV reflective film was created by Birdshades ( Swaddle et al., 2020). This film can be applied to windows and increase the surface reflection on the windows ( Swaddle et al., 2020). While this specific film can be used and was found to be effective in some species of birds, it was found that it was not the most effective method at reducing bird collisions ( Swaddle et al., 2020). What it was effective at, however, was reducing the speed at which birds collided with the windows ( Swaddle et al., 2020). When the bird approached the window with the applied treatment, while it was not seen right away for a collision to be avoided, it was seen with enough time for the bird to reduce its flight speed, so when it did collide with the window, the likelihood of death was reduced ( Swaddle et al., 2020). A minor injury would only result ( Swaddle et al., 2020). Another effective and cost-efficient method would be to use feather-friendly markers. This solution is cost-effective and was found to reduce collisions by up to 95% due to its ability to break up the reflection of windows ( De Groot et al., 2021). This is the most practical solution. It has already demonstrated that it is an effective method as it has been applied to Buchanan A, facade twenty-seven and has already reduced collision by 90% within a year.

**Conclusion**

Reducing bird-window collisions at the Buchanan complex is essential for conserving the total bird species; however, this also has a more significant toll on their environment as they play a crucial role in seed dispersal and pollination ( Tabur & Ayvaz, 2010). To find solutions to reduce these collisions, it is vital to understand why they happen. Many factors can influence bird collisions like vegetation, feeders, the presence of windows, and building type ( Parking, Elbin & Barnes, 2015; Machtans, Wedeles & Bayne, 2013; Elmore et al., 2020; Loss et al., 2014). There are also physiological reasons why birds are prone to collisions, including the differences in visual organization and perception ( Martin, 2011). Based on the results of our study, the Buchanan complex at the University of British Columbia contributes significantly to bird-window collisions, accounting for at least thirty-three collisions over an eight-week surveying period. While this was a 32% reduction from the previous year, multiple problem facades were identified, including facade thirteen on Buchanan C, and they should be treated immediately to reduce collisions. A highly suggested treatment option would include a feather-friendly decal that has already proven to reduce bird collisions at Buchanan A, facade twenty-seven. Understanding and applying the knowledge to reduce bird-window collisions is essential at the University of British Columbia's campus, but it is also crucial for buildings and complexes across the globe. Bird-window collisions account for billions of bird fatalities yearly ( Klem, 2015). To conserve this ecologically significant population, there needs to be a tremendous effort from individuals to advocate for bird-friendly management solutions and continue future research to save bird populations

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