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Final Research Report: Buchanan Birds

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Abstract

The human-wildlife conflict of bird-window collisions accounts for an estimated 25 million annual bird deaths in Canada. This research report sets out to find out how this statistic is reflected at the University of British Columbia (UBC), in their Faculty of Arts Buchanan buildings. Evidence of bird-window collisions including feather smears, feather piles and carcasses, were searched for 4 days a week over a period of 64 days. At least 33 bird-window collisions occurred during this time period. Carcass persistence and searcher efficiency trials were conducted to help lower study bias. This paper examines why birds collide with windows, factors that increase collision rates, report results of the study, compares last years' Buchanan study data of 49 collisions to this year's data of 33 collisions to discuss varying factors, and find the facades that have the highest collision rates so that mitigation strategies can be applied. The effect of Feather Friendly © on façade 27 was investigated and found to be effective, decreasing bird window collisions by 90-100%. The recommended treatment is Feather Friendly © for façade 13 immediately and then 25 and 10 in the future. The results of this study can be used to lower the mortality rate of birds at the Buchanan buildings and hopefully shine a light on the urgency of UBC retrofitting their buildings to be more bird-friendly in design.

Introduction

Bird-window collisions are a large source of human-wildlife conflict with an average estimate of 25 million birds in Canada being killed annually as a result (Machtans et al., 2013). For this report, human-wildlife conflict is defined as humans' or wildlife's actions having a negative impact on one another, or posing a threat to one another (Nyhus, 2016). Humans continue to pose a threat to birds by their continued and vast expansion into their habitats, with evolving architecture in cities resulting in many buildings with windows. These buildings expand into the open sky, entering and interrupting birds' paths of flight (Martin, 2011). This is not limited to skyscrapers but to any buildings with windows that pose a hazard to the birds flying into them.

Birds' sensory ecology framework is different from humans, which results in them not seeing man-made structures in the same way (Martin, 2011). Differences in their framework includes their lateral field of view being in high resolution and often their frontal vision not being in high resolution (Martin, 2011). This is likely due to how they are regularly in flight looking laterally for prey or potential food sources, conspecifics and watching out for predators (Martin, 2011). In addition, birds can hit man-made structures, not exclusively windows, due to being temporarily blind in the forward direction when in flight, by turning their heads to the side or in the downwards direction (Martin, 2011). Other factors of birds' sensory framework to be considered is how they view colour, their extended visible colour spectrum entering ultraviolet (UV), depth perception, and the potential of not being able to predict structures as obstacles in flight (Martin, 2011). Windows specifically, pose a unique threat due to their transparency and/or reflective nature (Klem, 1989). Transparent windows appear invisible to birds creating an illusion of a clear path of flight (Klem, 1989). Reflective windows create a similar illusion, but of the sky and vegetation making the window appear as part of the clear sky (Klem, 1989). Birds' behaviour suggests they cannot see windows, making all bird species potentially vulnerable to window collisions (Klem, 2014). Architecture rarely accounts for these differences in framework and perception of windows, resulting in bird-window collisions no matter the visibility conditions (Martin, 2011). The consequences of this in terms of bird mortality and welfare are vastly large, as in Canada these collisions are the leading cause of mortality (Calvert et al., 2013).

The research in this report was conducted to help gain an understanding of the severity of bird-window collisions on the Vancouver campus of the University of British Columbia (UBC) located in British Columbia, Canada. The primary objective of the study was to monitor for bird-window collisions for at least eight weeks at five buildings on the UBC campus, Buchanan Buildings A, B, C, D and E and determine the number of bird-window collisions that occur there. The secondary goals were to determine which buildings and facades were most prone to bird-window collisions, and then identify risk factors and possible mitigation strategies to lower them. Lastly, the study sought out to determine if the Feather Friendly © treatment implemented after the previous year's UBC Conservation 495 class's bird-window collision monitoring study has been effective at decreasing bird-window collisions at Buchanan A façade 27 (BUCA27). We expected to find evidence of collisions approximately three times a week, due to the large number of windows on the Buchanan buildings. Additionally, we predicted the most collisions would occur at facades with vegetation close to the window, and to find a decrease in evidence at the treated BUCA27. With these objectives, the results of the study reported in this paper hopes to invoke action for change to retrofit the Buchanan buildings to be more bird-friendly.

Materials and Methods

The study was conducted at UBC for 32 data collection days over the course of a 9-week period (64 days) from January 27th 2022 to March 31st 2022, with 8 weeks of monitoring. As surveys were stopped for reading week in February due to observers' planned absences. No bird monitoring data was collected from February 18th to 27th 2022. Before data collection began, a clean-up day was held on January 26th 2022, where all evidence of old bird-window collisions was removed. Another clean up day was held on February 27th 2022 before resuming data collection. Pairs met at the Buchanan buildings and surveyed the buildings for evidence of bird-window collisions for approximately an hour and a half to two hours, between the hours of 7am and 10am. The regular data collection days were Monday, Tuesday, Wednesday and Thursday.

To conduct this data collection a variety of materials were used. The materials included a footprint of Buchanan with labelled facades, a collision monitoring protocol, the pre-existing data which was a 2021 Buchanan bird monitoring Excel data sheet, Ziploc bags, sandwich bags, binoculars, sharpies, medical gloves, and safety vests. For recording of data collection, a shared Google sheets file and shared Google Drive folder for photos was used.

The collision monitoring protocol provided was adapted from Hager and Cosentino, 2014. Each data collection day, a pair of researchers started by recording the date by year, month and day and the weather based on the Weather Bureau Sky Condition Codes. After noting the building code and starting time the pair split up to silently observe and survey the building at the same time, by one walking clockwise and the other walking counter clockwise. This helped optimize the chance of finding evidence of bird-window collisions, as each individual would approach with a different viewing angle. The area within 2 metres of a window was thoroughly searched for evidence, including checking under and within any vegetation, along ledges, within rocks, and on windows. To search dangerous to reach ledges present at both Buchanan A façade 25 (BUCA25) and Buchanan D façade 1 (BUCD1), binoculars were used to look for evidence. The evidence being searched for were carcasses – scavenged or intact, feather smears or feather piles. For feather piles there had to be 10 or more feathers within 1 meter in a circular shape to count as evidence. Once the survey of a building was completed, the end time was noted. Each Buchanan building (A, B, C, D and E) were surveyed one at a time.

If evidence was found, either on the window or on the ground, the location along the façade, as well as the building code and façade number were recorded. The evidence was not removed until both individuals finished their observational survey of the building. Once completed, the pair would inform each other of any evidence found and return to the location it was found to collect or dispose of it. This was an important step to ensure evidence would not be double counted by the next day's surveying pair. The initials of the surveyor who had found the evidence was recorded, as well as the type of collision evidence, description of it, number of feathers if applicable and species. Pictures of the evidence were taken and then uploaded to the shared Google Drive folder, with a carcass identification number (ID). This number was created by the template of: YYYY-MM-DD building code façade species code. Unknown was written if the species could not be determined upon looking, and Krista De Groot, the community partner from Environment and Climate Change Canada would review the photo or the actual evidence in the case of found feather piles or carcasses. Feather piles or carcasses were collected using medical gloves, bagged into either Ziploc or sandwich bags depending on the size of the evidence, labelled with a carcass ID number using a sharpie and dropped off on Krista's porch to be identified. Feather smears could consist of 1 and upwards number of feathers, and after recording down the required information and taking a photo, the smears were taken off the window and disposed of.

In the shared Google sheets, the date, season, sky condition code, building name and code, façade, survey start and end time, surveyor, evidence found and type of collision was recorded every day of data collection for each façade regardless of if evidence was found. If evidence had been found, extra columns of type of collision, collision type category, ground or window, number of feathers, carcass ID, species, description and additional notes were also filled out. For the rest of this report, buildings and facades will be referenced to by their building code and façade number, for example Buchanan A façade 31 would be written as BUCA31.

Pre-existing data, from the 2021 Buchanan buildings bird monitoring group was provided. The 2021 research found evidence of 49 collisions over 31 data collection days, with the most occurring at Buchanan A, followed by building C and D. The most common type of evidence found was feather smears, and they found evidence at 12 of the 31 facades. This data was used in the analysis of this study's 2022 data to get a broader understanding of this human-wildlife conflict within the context of the Buchanan buildings.

Towards the end of the study period, a carcass persistence trial and a searcher efficiency trial were performed. The carcass persistence trial was conducted from Monday March 21st to Wednesday March 23rd 2022. A carcass persistence trial protocol was provided and followed. Three thawed bird carcasses were used, a Varied Thrush, Cedar Waxwing and Rufous Hummingbird. To identify it as part of the trial, the back toe was clipped except for the hummingbird, whose toes were too small to do so. A random number generator was used to determine both the building, façade, and placement of the carcasses. However, only one carcass could be placed at each building and it had to be placed within 2 meters from the building, as that was within the search zone for the study. Protocol required carcasses to be placed in the morning before monitoring began. Before leaving the carcass to the trial, photos were taken and labelled with a carcass ID prior to uploading to the shared folder, and a new google sheets was created to input the trials' data where date, season, building code and façade, observer, species, substrate (concrete/asphalt = c/s, grass = g, wood chips = w, etc.), visibility ranking (1 to 5, with 1 being easy to see and 5 being very difficult), carcass ID, placement of carcass time, and carcasses check times were recorded. Alongside carcass checks whether or not the carcass was still there was noted, a scavenging code (example: I for intact, g for gone without a trace etc.), and then once scavenged last present and first absent was recorded. Once placed, the carcasses were to be checked the same day around noon and 5pm, and then once a day before surveying times for the following three days unless gone before then. For this study, an additional check was performed on the placement day around 10am after surveying was completed. The purpose of this trial was to note bias of the study due to removal of carcasses due to scavengers, maintenance, or by other means. The searcher efficiency trial also had a protocol that was followed by a non-surveyor, and was performed on March 22nd and March 24th 2022. For this, a carcass was unknowingly to the surveyors placed before their data collection to see if they would find it upon first search, or later searches if the carcass persisted. The non-surveyor checked once a day to see if the carcass remained. The purpose of the searcher efficiency trials was to estimate observer bias.

Results

To address the primary objective, evidence of at least 33 bird-window collisions were found during the study period at the five Buchanan buildings. This is a 32.6% decrease from last year's data, with 16 less collision evidence found. However, due to observer bias, carcass persistence, limitations of the study and effects of weather, this number is likely very conservative. For the searcher efficiency trials, 1 out of the 2 carcasses placed were found. This is a 50% find rate, comparable to literature which suggests it is variable commonly ranging from 35% to 85% (Morrison, 2002). Based on these results, assuming we only find half of the evidence, the real number could be speculated to be closer to 66. The results of the carcass persistence trials also indicate a likely higher number of collisions (see Table 1), as the average carcass persisted for just over 24 hours. This fast average removal time indicates that evidence could be removed between data collection days or even just a couple of hours after a collision occurs.

Carcass ID	Building + Facade	Last present	First absent
2022-03-21 BUCD10 CEDW	Buchanan D, 10	8 hours	23 hours and 36 minutes
2022-03-21 BUCB17 VATH	Buchanan B, 17	0 hours	2 hours and 43 minutes
2022-03-21 BUCC12 RUHU	Buchanan C, 12	24 hours and 37 minutes	47 hours and 20 minutes

Table 1. Results of Carcass Persistence Trials. Last present is the hours since placement or last check of carcass before it is removed, whichever was most recent. First absent is the hours between placement and the check where it was noticed the carcass was gone.

Buchanan A was found to have the most evidence of bird-window collisions (see Figure 1). This is consistent with last year's data. The facades this year with the most evidence of collisions was BUCC13 with a total of seven found pieces of evidence (six feather smears and one feather pile), followed by BUCA25 and BUCD10, which both had evidence of a total of six bird-window collisions (see Figure 2). Although the order of buildings and evidence of collision was the same from 2021 to 2022, the facades with the most collisions, which will be referred to as problem facades, varied from year to year (see Figure 4). This could be due to a variety of factors such as weather which will be discussed in the Discussion section of this report. Despite the variation of facades, the most common type of evidence found was feather smears both in 2021, 84% feather smears, and in 2022, 85% feather smears (see Figure 3).

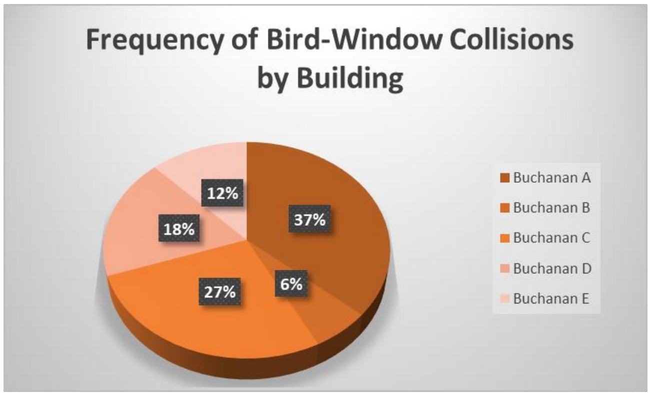

Figure 1. Frequency of bird-window collisions by building depicted by a pie chart.

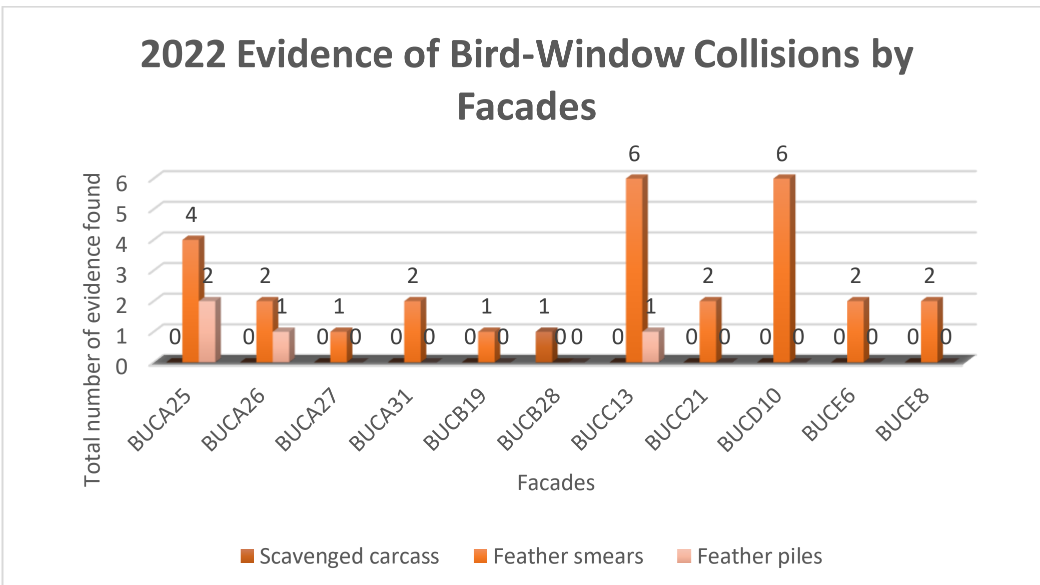

Figure 2. 2022 Evidence of bird-window collisions represented by a bar graph. X-axis depicting the façade number and the y-axis the total number of evidence found.

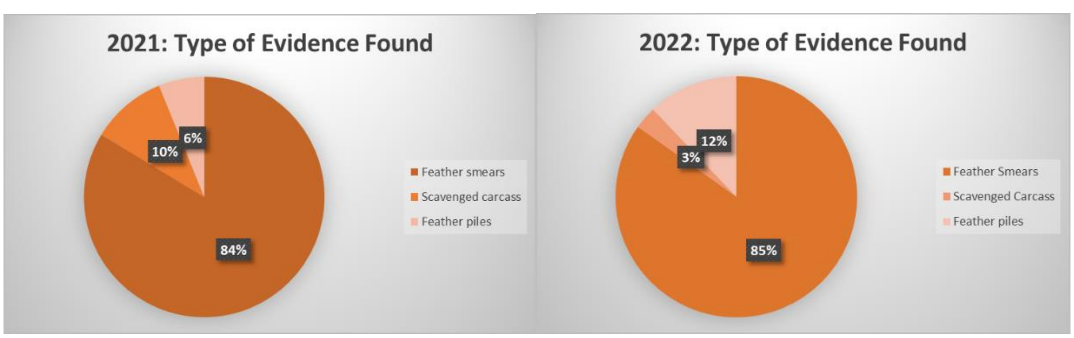

Figure 3. A side-by-side pie chart comparison of the type of evidence found in 2021 versus 2022.

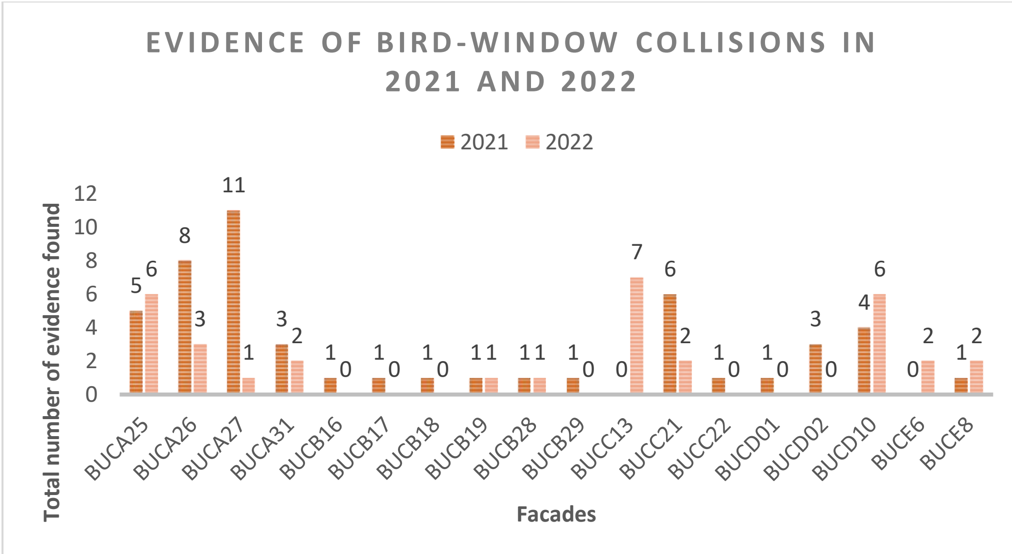

Figure 4. A comparison of evidence of bird-window collisions found in 2021 to 2022, represented with a clustered column bar graph. X-axis represent total number of evidence found and y-axis represents facades.

To address the third objective of this paper, the Feather Friendly © application on BUCA27 did cause a decrease in bird-window collisions. In 2021, evidence of eleven collisions was found (two scavenged carcasses, seven feather smears and two feather piles). This year just one feather smear was found at this façade and it was outside of the Feather Friendly treatment area, meaning zero evidence was found on the treated window. However, Figure 5, will visually show the one piece of evidence found, to account for not knowing the exact location of the found evidence at this façade last year. Regardless, this is a significant decrease of approximately 90 to 100% in bird-window collisions at the treated façade, indicating it could be a good mitigation strategy for the newly found problem facades in this study.

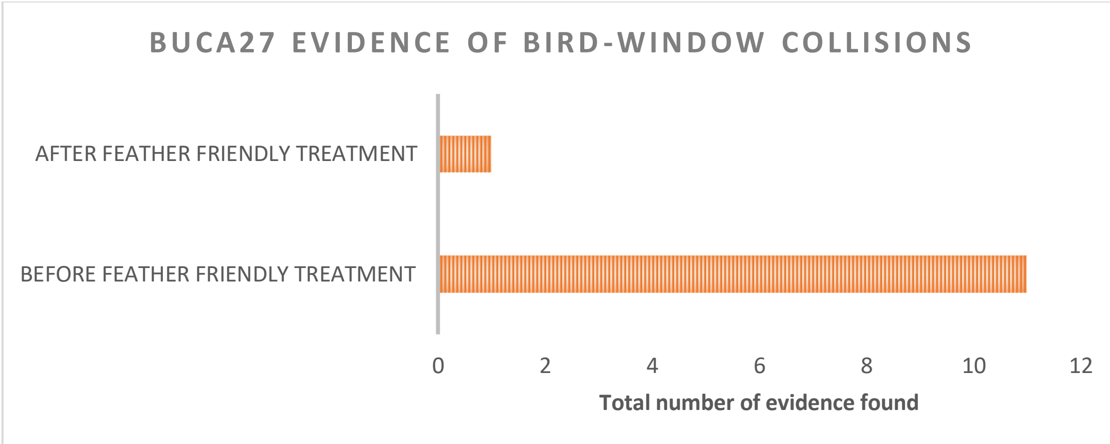

Figure 5. A chart showing the evidence of bird-window collisions in 2021 before the Feather Friendly window treatment, and in 2022 after the Feather Friendly treatment.

Discussion

The evidence of 33 bird-window collisions at the five Buchanan buildings across the study period of 64 days is within the low end of collision rates when compared to current literature of similar studies conducted at UBC. A study that monitored eight buildings on the UBC campus for carcasses, none of them being part of Buchanan, found evidence of 281 to 486 bird mortalities across five separate 45-day study periods for a total of 225 days (De Groot et al., 2021). This works out to be about 1.25 mortalities/day to 2.16 per day and about 35 to 60.75 per building. The 33 over one 64-day study period compares to be lower at approximately 0.51 per day, and 6.6 per building. It is also not confirmed mortalities like in the De Groot et. al. 2021 study, as we searched for all evidence of bird-window collisions, with unconfirmed mortality outcomes. A large factor in this is the difference in amount of data collection days in the study period and the number of buildings monitored not being factored into the comparison numbers. We monitored for 31 of the 64 study period days, while in the De Groot et al. 2021 study observers monitored for an estimated 181 days of the 225-day study period, which is about 80.4% of the period spent monitoring. We monitored for 48.4% of the study period, which is

32% lower, which would explain why the collision rate found in this study was lower than the literature available. There are also numerous additional reasons for theses differences, such as the Buchanan buildings having lower collision rate due to a perhaps lower risk factor, searcher efficiency and carcass persistence trials results and impacts of season, time or day and weather.

The results of the carcass persistence trial (Table 1) found carcasses persist on average for just over 24 hours. This suggests that the 3-day gap between data collection on Thursdays and Mondays likely results in a number of missed collision evidence. The length of carcass persistence seems to be variable by building site, with current literature trial data varying greatly in persistence times (De Groot et al. 2021, Hallingstad et al. 2018, Parkins et al., 2015). Searcher efficiency was 50%, with observers only finding 1 of the 2 placed carcasses. In another study, 37.5% of carcasses placed in the searcher efficiency trials were found, with 9 of the 24 carcasses found (Parkins et al., 2015). Our percentage would be a better estimate of observer bias if more trials were conducted. Regardless, the 50% finding rate indicates that up to half of collisions went unnoticed due to observer biases.

In this study the buildings with the most collisions were Buchanan A, C and D as shown in Figure 1. These buildings accounted for 27 of the 33 total collisions found. The facades with the most evidence found were BUCC13, BUCA25 and BUCD10 as shown in Figure 2. The common denominator between all of these facades is the presence of vegetation close to the windows. At BUCC13 there are numerous shrubs near the windows, at BUCA25 there is a small partially forested area consisting of shrubbery and trees, and at BUCD10 there are tall vegetation near the windows. The presence of vegetation is a known collision risk factor for birds (Machtans et al., 2013). Abundant vegetation, like the ones in front of this years' problem facades, can attract birds and by doing so, increase their risk of collision. This is because the abundance of birds is positively correlated with vegetation (Hager et al., 2013). Migratory birds during migration are also known to seek out vegetated areas for stopovers (Pennington et al., 2008). One study found that the majority of daytime bird-window collisions took place where there was an abundance of vegetation that reflected onto the glass or where clear glass allowed indoor vegetation to be visible (Gelb and Delacretaz, 2009).

Figure 4 indicates that the problem facades shifted from 2021 to 2022, even with BUCA27's change accounted for with the mitigation treatment. These changes show that bird-window collisions are variable. The exact reasons for the variation can only be speculated as they were not specifically tracked in this study. However, current literature suggests that it could include cleanliness of windows as dirt helps make windows more visible to birds, height or abundance of vegetation changing from year to year and differences in amount of interior light being used (Kummer et al. 2016, Parkins et al. 2015).

In addition to the change of problem facades, the overall evidence of collisions found in this study is a decrease from last years' 2021 Buchanan data. This likely due to a variety of factors, one pressing being the application of Feather Friendly treatment on BUCA27. The deterrent of Feather Friendly © symmetry and its white dots helps alert birds to the glass window, while spaced apart in a way that also creates minimal blockage to humans looking out of it (Brown et al., 2021). One study found that windows treated with this Feather Friendly © treatment had a 71% decrease in collisions (Brown et al., 2021). Another recent study monitored a retrofitted building with Feather Friendly © treatment and found it reduced the risk of collision by 95% (De Groot et al., 2022). In this paper, the research shown a 90-100% decrease on BUCA27, as the one feather smear found appeared outside of the Feather Friendly © treated area (see Figure 5). This study, and current literature suggests that Feather Friendly © markers as a treatment is an effective mitigation method at decreasing bird-window collisions.

Based on the positive impact Feather Friendly © has had both in current literature and on BUCA27, this report urges the Faculty of Arts to treat more facades at Buchanan with Feather Friendly © treatment. Despite numerous mitigation strategies being available, ranging from tempera paint to string to UV film window treatments (Klem, 2014), Feather Friendly © is recommended due to its effectiveness and it already being in place at one façade will keep the university's design/aesthetic consistent. Due to the highest collision rate being at BUCC13, we urge this façade to be treated as soon as possible. Future facades recommended for treatment include BUCD10 and BUCA25.

Limitations of this study included observer bias which was quantified with searcher efficiency trials, potential carcass removal which was quantified with carcass persistence trials, number of data collection days and length of study. All of these factors indicate the evidence found of 33 bird-window collisions is a conservative number. Searcher efficiency shines a light on human error, as members of the observation team may have not thoroughly searched the entire 2-meter length of land and vegetation from the facades every data collection day. In addition, despite having two sets of eyes each monitoring day, evidence could still be missed despite best efforts. Another limitation of this study was time. Data was collected only 4 days out of the week, allowing ample time for collisions to occur and naturally disappear either through removal from scavengers or maintenance or through varying weather conditions. For example, a carcass could be removed by a crow and a feather smear could be washed off the window by heavy rain on the weekend before the data collection resumed on Monday. Lastly, there were some missing factors of collision risks that were unnoted in the study such as cleanliness of each window or that was unavailable to the research team, such as each building's percentage of glass. High percentage of glass on a building has been found to increase the frequency of bird-window collisions, as it increases the likelihood of glass obstructing birds' paths of flights (Cusa et al., 2015). Knowledge of this structural factor would help assess the consistent results of Buchanan A, C, and D having the most collisions over the past 2 years.

Future research should include weather analysis and how it affects bird-window collision rates. For this study, evidence was found on a total of 17 days, and the weather was recorded for each day. For 10 of the 17 days the weather was clear skies to overcast, ranging from a 0 to a 2 on the Weather Bureau Sky Condition Codes. Investigating why this is could be, is important for future mitigation work. However, despite knowing that bird behaviour can be impacted by the weather (Richardson, 1990), little research currently exists discussing it in relation to bird-window collisions. Another current knowledge gap in literature is the lack of studies being conducted year-round. Currently only a small amount of available literature includes winter months. Conducting bird-window collisions year-round, preferentially with daily data collection, would set up future research to better understand more bird species within and outside of migratory seasons. Furthermore, future research should conduct adequate amounts of carcass persistence and searcher efficiency trials to minimize study biases. The use of these trials moving forward are critical to gaining a more accurate estimate of the magnitude of bird-window collisions in Canada and other parts of the world.

The research conducted in this study is important to expand on the current bird-window collision monitoring that is being performed at UBC. At a student-level, this does important work informing students of this large human-wildlife conflict. This allows for advocacy through the people that attend university at UBC, which has its own kind of power to make change. This study aimed to inform other students, as well as Buchanan staff and faculty, about this issue through printed infographics posted around the Buchanan buildings and digital signage submitted to be displayed on the Buchanan display screens.

Conclusion

This study took place to help quantify the magnitude of the human-wildlife conflict of bird-window collisions at the university campus of UBC, specifically the impact of the Buchanan buildings. Bird-window collisions occur for a variety of reasons including their visual framework, and difficulty recognizing glass as a barrier. The results of this study show that at least 33 bird-window collisions occurred at the 5 Buchanan buildings over the course of a 64-day study period. This was lower than last year's study on the same buildings, due to the Feather Friendly window treatment on BUCA27 and likely due to other risk factors being different levels. To further lower the frequency of bird-window collisions, this report urgently urges the Faculty of Arts to treat BUCC13 with Feather Friendly © markers, and to later treat BUCD10 and BUCA25. The significance of this study could invoke mitigation action on the Buchanan buildings, which would further support the initiative to retrofit buildings to be more bird-friendly, and help reduce the alarmingly high bird-window collision mortality statistic in Canada.

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