Bird-Window Collisions at the Chan Centre For Performing Arts and the Wall Institute for Advanced Studies Balcony: First Year of Monitoring

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Abstract

Window bird strikes pose a significant treat to bird populations as one of the most common causes of avian mortality (Scott et al. 2023). This study investigates the severity and frequency of bird strikes at two buildings at the UBC Vancouver Campus, the Chan Centre for Performing Arts and the balcony at the Wall Institute for Advanced Studies, where bird collision prevention measures have not been implemented. Research in this topic explores the factors that contribute to bird collisions such as visual capabilities of birds, properties of glass, weather conditions, and the presence of nearby vegetation. Through field observations conducted for an 8 week period in the winter and spring (February and March 2024), evidences of collisions such as feather smears, feather piles, and carcases were recorded at these study sites. Findings indicated a higher incidence of bird collisions at the Chan Centre, particularly at Façade 5 with 14 evidences observed, compared to the Wall Institute with 6 evidences observed in total. However, limitations included quick carcass disappearance and monitoring scheduling suggesting the true extent of collisions were underestimated. Factors that could have influenced bird collision frequency at these sites include the nearby vegetation, size of windows, and weather, which impacts reflectivity on windows and alters glass surface. Continued monitoring throughout the year are recommended to assess these factors at the study sites. Management implications include the implementation of preventative bird-collision strategies such as Feather Friendly markers and UV-treated glass, tailored to building design and purpose. As well, the continued involvement of students in this project and creation of educational initiatives is suggested to increase awareness of this human-

wildlife conflict issue and promote further enforcement of mitigation measures. By addressing these factors and contributions to bird window strikes, future efforts should improve sustainability and more effectively reduce bird mortalities at UBC.

Introduction

Window bird strikes are one of the most common causes of bird mortalities, particularly for migrating species (Scott et al. 2023). In Canada, window collisions result in the death of millions of birds per year (Machtans et al 2013). Building collisions are the second highest cause of mortality in birds followed by predation by cats (Loss et al., 2015). Collisions can cause injury, which can lead to later death, such as by predation, or immediate death on impact (Rebolo-Ifrán et al. 2021). Birds face risk of colliding with windows due to a combination of factors related to their visual capabilities and properties of glass (Martin, 2011; Zyśk-Gorczyńska et al., 2022). Their vision and lateral eye position puts them at risk of flying into windows because they are unable to see what is directly in front of them (Martin, 2011) and fail to discern glass as a physical obstacle (Zyśk-Gorczyńska et al., 2022). As well the fast speeds at which they fly restricts their visibility and flying slow can be energetically costly or even impossible (Martin, 2011). Since glass is transparent and reflections occur, birds do not perceive the windows as barriers very well the same way humans do, they may perceive continuous vegetation or sky (Scott et al. 2023; Zulian et al., 2023; Zyśk-Gorczyńska et al, 2022).

All birds can be affected, but species less adapted the urban environment are more vulnerable (De Groot et al., 2021). Particularly in Vancouver and especially at UBC, the

Varied Thrush (*Ixoreus naevius*) has been found to be more likely to fly into windows compared to other common birds such as chickadees (*Poecile atricapillus*), American robins (*Turdus migratorius*), or spotted towhees (*Pipilo maculatus*) which are also found to collide with windows at UBC (De Groot et al., 2021). Other species that have been found to be prone are White-throated sparrows (Zonotrichia albicollis), Dark-eyed juncos (*Junco hyemalis*), and Swainson's thrushes (*Catharus ustulatus*) (Zyśk-Gorczyńska & Żmihorski, 2022). During fall migration there are particularly high mortality due to window strikes in migrating species as they are flying for extended periods of time and flying traffic is increased (Scott et al. 2023). However collision mortality is also significant in the winter and spring (De Groot et al., 2021). During the winter in Vancouver, bird populations increase as local species mix with short distance latitudinal and altitudinal migrants (Boyle & Martin, 2015). As well, migratory stopovers and foraging behaviours play a role in collision rates (Kummer et al., 2016). The presence of nearby vegetation can attract birds, providing them with shelter and food, thereby increasing the overall bird abundance in the area (Parkins et al., 2015; Kummer et al., 2016). This increase in abundance of birds raises the likelihood of collisions to occur (Parkins et al., 2015).

Another factor that influences bird flight, affects migration patters, navigation, and the visibility of glass surfaces is weather (Scott et al., 2023). Unfavorable weather conditions that hinder bird flight, such as strong winds, precipitation, or low temperatures can trigger flight and disrupt birds' senses, depleting their energy reserves (Scott et al., 2023). Adverse weather can lead to increased stress which can lead them to be more prone to making mistakes, further exacerbating their vulnerability to collisions (Scott et al., 2023).

As well, adverse weather conditions may compel birds to fly at lower altitudes to avoid unfavorable weather conditions, thereby increasing the risk of collisions with buildings (Scott et al., 2023). Changes in weather conditions can affect the appearance of glass, potentially confusing birds as the misinterpret reflections of vegetation or sky such as on clear days (Scott et al., 2023; Zulian et al., 2023). We should take into account the consideration of birds when approaching window building design in the addition of visual cues to allow birds to perceive glass as a barrier and avoid it (De Groot et al., 2021). De Groot et al. (2021) described a perception of the general public against implementing window surface treatments due to the view from within the buildings being interrupted. The human wildlife conflict arises when human and bird objectives do no align such as when buildings are designed solely on human preference without incorporating bird collision prevention measures.

The purpose of this study is to investigate the severity and frequency of bird strikes at the Chan centre for Performing Arts and the Wall Institute for Advanced Studies, where bird collision prevention measures have not been implemented and as the first year these sites were studied for bird window collisions. The primary hypothesis is that the Chan Centre experiences higher frequency of bird collisions compared to the Wall institute, particularly at Façade 5 (CCPA5). Through observations and analysis of data, this paper discusses limitations of this study, future monitoring to gain more understanding of the extent of bird collisions at these study sites, and proposes possible management strategies to reduce these incidents.

Materials and Methods

Our field work was conducted on the University of British Columbia Endowment Lands, Vancouver, British Columbia, Canada, at two campus buildings, the Chan Centre for Performing Arts (CCPA) and the balcony at the Peter Wall Institute for Advanced Studies (WALL). Each site was visited three times a week, typically on Mondays, Thursdays, and Fridays around 10am from February 5th 2024 – March 29th 2024. Our collision monitoring protocol was adapted from Hager and Cosentino, 2014. Prior to monitoring, the study sites were cleaned on February 4th for any evidence of bird collisions. Data such as time, location, weather, façade, type evidence of collisions, and notes were recorded using the Epicollect5 app which was translated to a Microsoft Excel sheet. A pair of surveyors walked simultaneously around the facades in opposite directions and returned together to compare notes and record evidence found. Evidence included feather smears, feather piles, intact carcasses, and scavenged carcasses. After evidence was found, the spots were cleaned if possible or removed to avoid recounting in subsequent surveys. Feather smears were identified as small feathers stuck to the glass or imprint of wings visible on the glass. Feather piles were over 10 feathers within a 1m diameter area. Intact carcases were full body deceased birds, while scavenged carcasses were missing body parts. Carcases and feather piles were placed in a plastic back and stored within a freezer to be later identified, with the label of the day found, building code (CCPA or Wall Institute), and façade number. Materials and equipment used included maps of building facades (See Appendix, Figure 6), gloves for handing evidence, plastic bags for collecting feathers or carcases, sharpie marker to label the collected evidence, alcohol spray to clean surfaces,

safety vests for visibility of surveyors, binoculars to see evidence on high windowpanes, and cell phones for recording data on the Epicollect5 app.

Midway and towards the end of the study period, a carcass persistence trial and searcher efficiency trail were performed. The carcass persistence trail involved placing a carcass with a clipped hallux (back toe) at a specific location known to the surveyors and checked at ~12:00 and 17:00 same day the carcass was placed, the following day, and during regular survey times until the carcass is removed without a trace. A picture of the carcass and its location was shared with the rest of the group, so all members knew where to look for the carcass. This trial is to test for how long a carcass would persist at the site before being removed such as by humans or by scavengers. Searcher efficiency trial involved placing a carcass with a clipped hallux, similarly to the carcass persistence trial, however at a location unknown to the surveyors. Carcasses were placed in the morning prior to collision monitoring that day by a non-surveyor. Surveyors conducted the monitoring as usually, unknowingly participating in the trial to estimate surveyor bias in finding evidence.

Results

Chan Centre for Performing Arts

At the Chan Centre, an estimated 24 collisions occurred as was the number of evidences found (Figure 1), 16 feather smears, 9 feather piles, and 1 carcass identified as a Varied Thrush. The most evidence of collisions were found at façade 5, with 14 evidences (11 feather smears, and 4 feather piles, 1 carcass) followed by Façade 4 with 5 evidence (2

feather smears and 3 feather piles), and Façade 1 with 3 evidence (2 feather smears and 1 feather pile). 60 percent of the collisions evidence found were feather smears, 36 percent feather piles, and 4 percent carcass (Figure 2). Of these 24 collision evidences found, 16 evidences were found on cloudy or overcast days (Figure 3). The next common weather condition was clear days or with low cloud cover, with 5 evidence of collisions found. 2 evidences were found on rainy days and 1 evidence was found on a partly cloudy day.

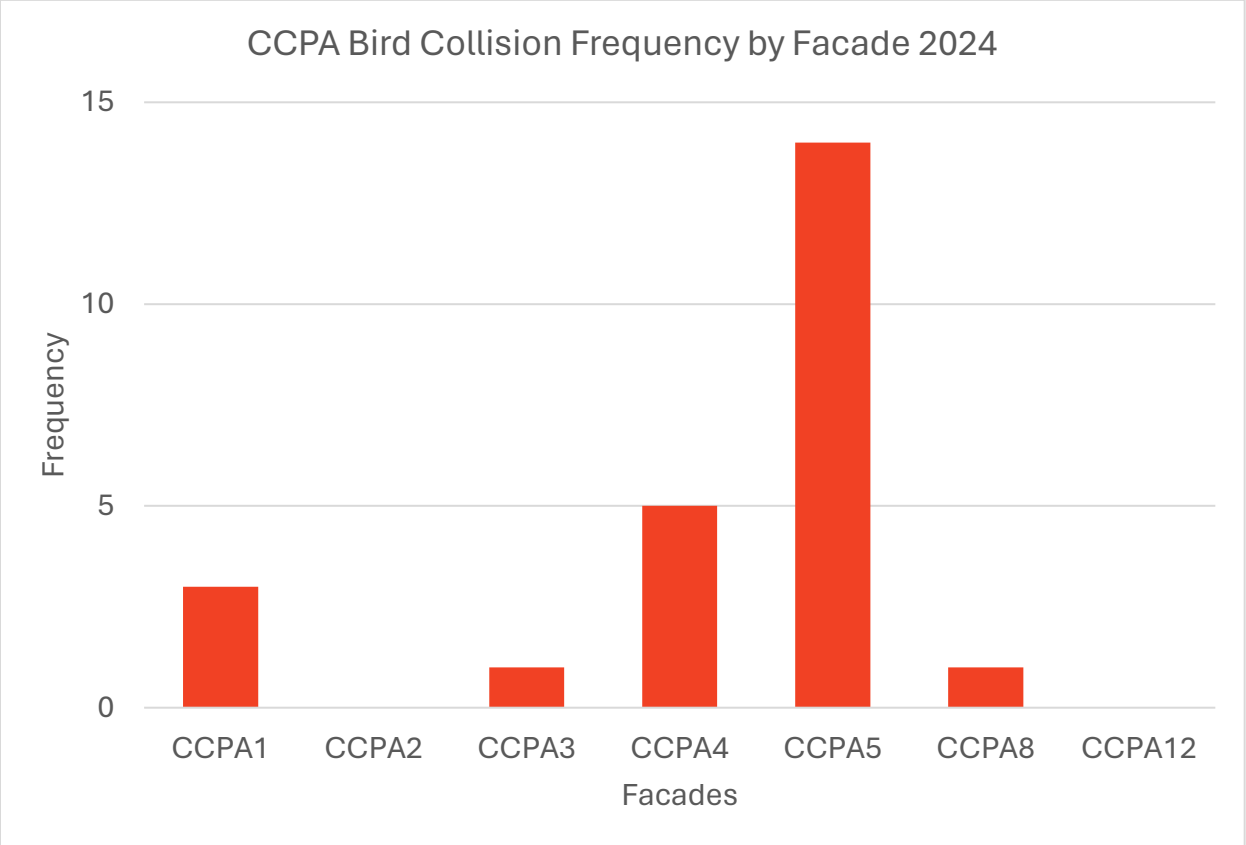

Figure 1. Bird collision frequency by facade at the Chan Centre for Performing Arts (CCPA) at UBC Vancouver during February and March 2024. Total = 24 evidences found.

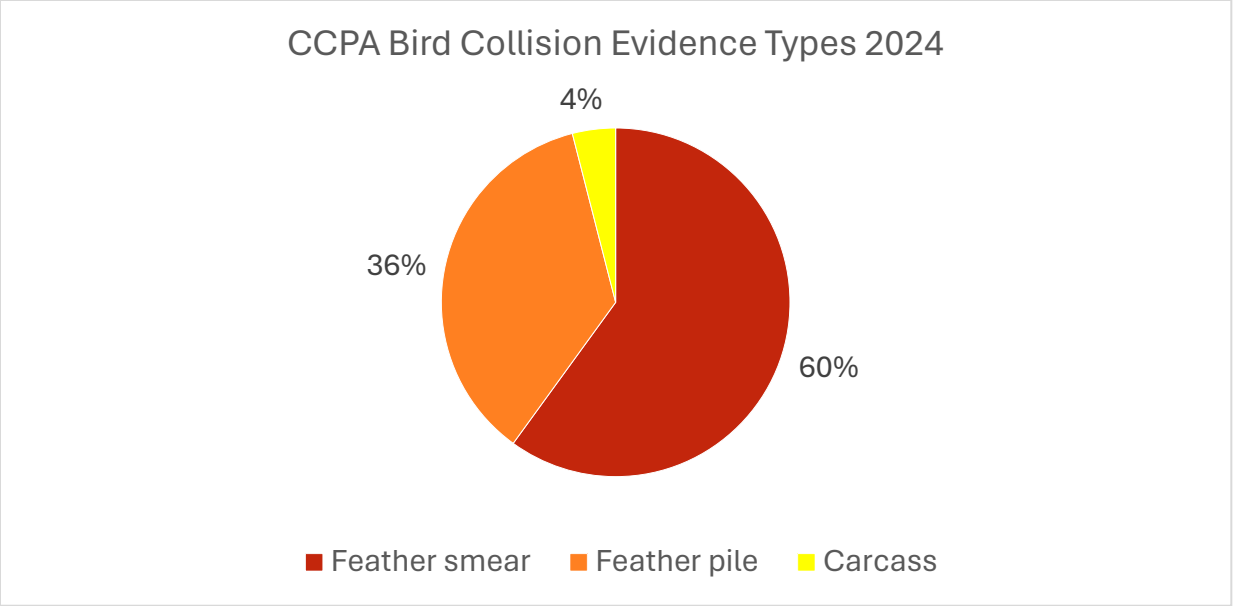

Figure 2. Percentage of bird collision evidence types at the Chan Centre for Performing Arts (CCPA) at UBC Vancouver during February and March 2024. 15 feather smears, 9 feather piles, and 1 Varied Thrush carcass.

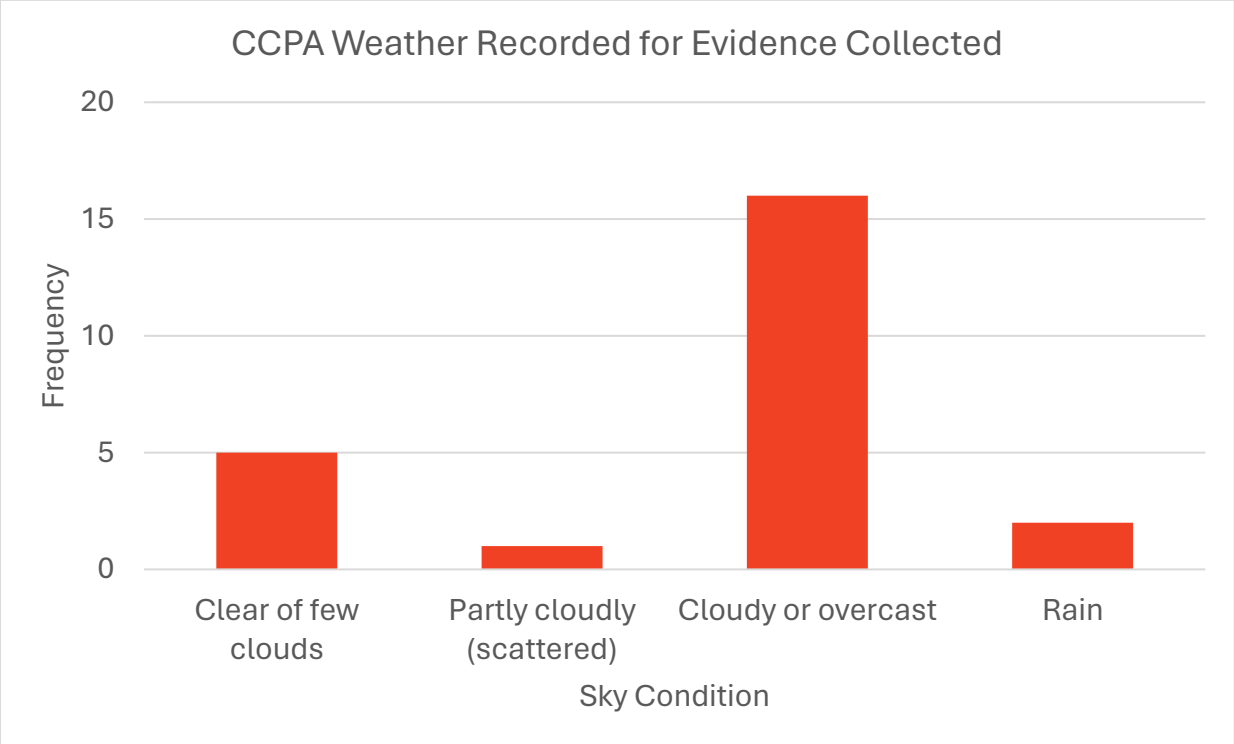

Figure 3. Weather condition recorded at the time the evidence of bird collisions were collected at the Chan Centre for Performing Arts (CCPA) at UBC Vancouver and the frequency of collisions with each sky condition during February and March 2024.

Wall Institute for Advanced Studies

The CCAP had more evidence of collisions found compared to the WALL which had 6 evidences of collisions, all feather smears, and all found on Façade 3 (Figure 3). 100 percent of the evidence found were feather smears. In terms of weather, 4 feather smears were found on clear days, or low cloud cover, and 2 feather smears were found on cloudy or overcast days (Figure 4). No evidence was found on partly cloudy or rainy days at the wall institute balcony glass railing.

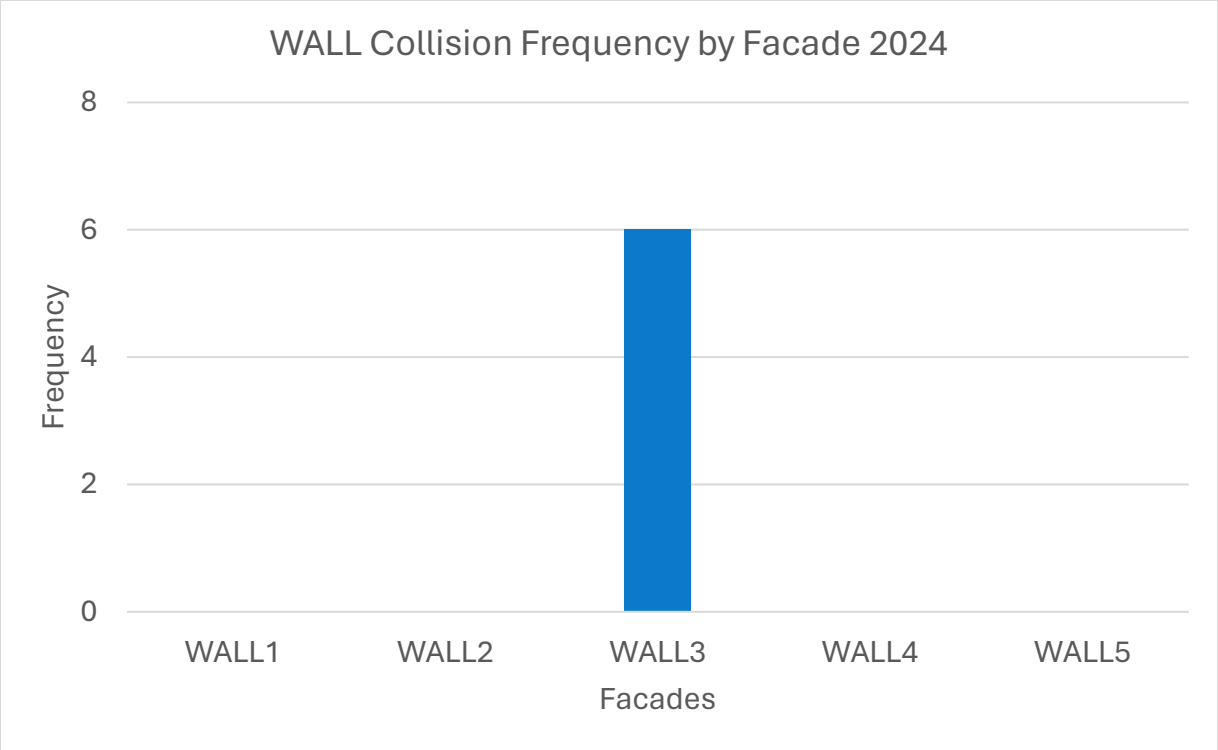

Figure 4. Bird collision frequency by facade at the Wall Institute for Advanced Studies (WALL) at UBC Vancouver during February and March 2024. Total 6 feather smears found.

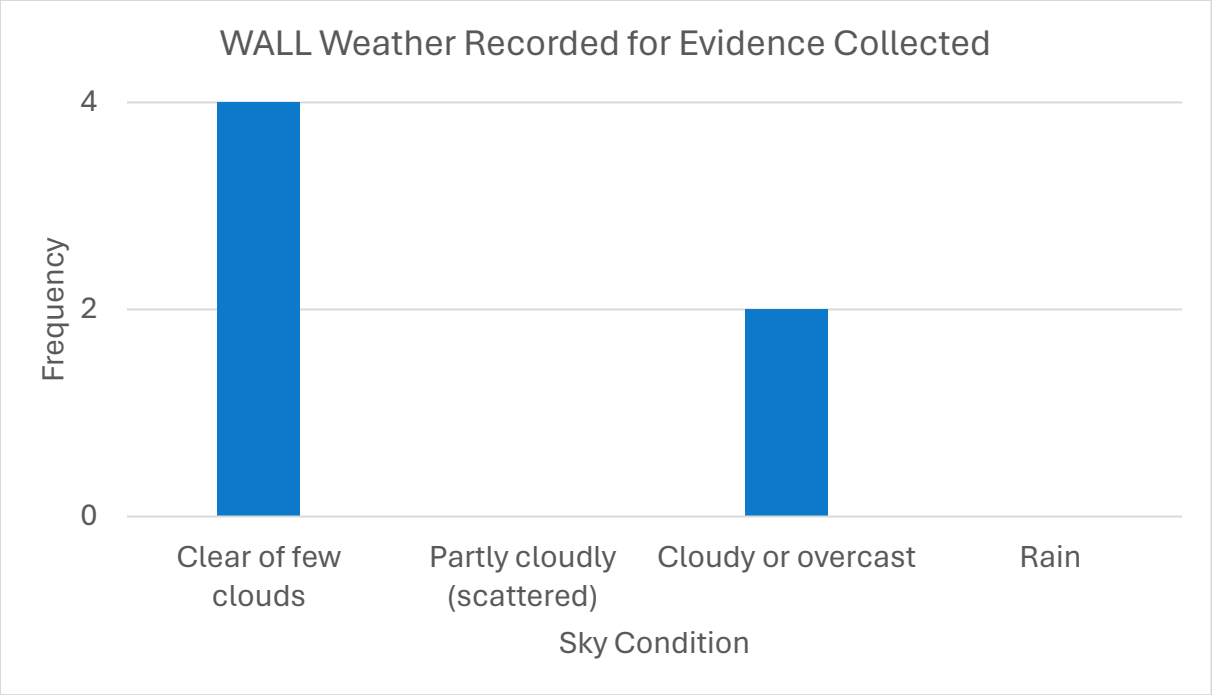

Figure 5. Weather condition recorded at the time the evidence of bird collisions were collected at the Wall Institute for Advanced Studies (WALL) at UBC Vancouver and the frequency of collisions with each sky condition during February and March 2024.

Carcass persistence trial at the Wall Institute resulted in one of the fastest carcass removals across UBC bird strike monitoring buildings as it was removed 2 hours after being placed. At the Chan Centre, the carcass was still intact 36 hours after being placed and was not found after 53 hours. No carcass were found by the surveyors during the searcher efficiency trial in this study.

Table 1. Bird carcass persistence trail at the Chan Centre for Performing Arts (CCPA) and the Wall Institute for Advanced Studies (WALL) at UBC Vancouver during February and March 2024. Date and time of carcass placed and the following days and time the carcass was observed before it was removed. *Unsure if the carcass was scavenged or removed by humans.

Date & Time	03/14/24 ~10:00	03/14/24 ~12:00	03/14/24 ~17:00	03/15/24 ~12:00	03/15/24 ~17:00	03/16/24 ~17:00
CCPA	Placed	Intact	Intact	Intact	Intact	Removed*
WALL	Placed	Removed*	-	-	-	-

Discussion

As the most common bird strike evidence at the Chan Centre and exclusively at the Wall institute, feather smears serve as indicators of collisions without necessarily indicating mortality. However, most collisions do result in eventual bird mortality (Machtans et al 2013). In contrast, feather piles and carcasses, though less frequently recorded than feather smears, do signify a higher likelihood of mortality, as they indicate actual death of a bird. The presence of carcases or feather piles provide insight into the consequences of bird-collisions at these surveyed locations. Our findings suggest that a minimum of 10 bird fatalities occurred due to window collisions at the Chan Centre over the course of 8 weeks. Extrapolating this data to a yearly timeframe, an estimate of 520 bird mortalities could occur attributable to strikes with Chan Centre windows. However further monitoring is required to get a more accurate estimate as there are seasonal variations in collision rates (Scott et al., 2023; Zulian et al., 2023). The discovery of the Varied Thrush carcass aligns with existing literature indicating that this species is particularly susceptible to colliding with class (De Groot et al., 2021).

Evidence of bird collisions were more prevalent at the Chan Centre compared to the Wall Institute, suggesting a higher frequency of incidents, specifically at Façade 5. This observed difference in collision rates may be attributed to the varying environmental factors and architectural features. Facades 5 of the Chan Centre and Façade 3 of the Wall Institute appear to be more susceptible to bird collisions, potentially due to their proximity to vegetation compared to the other facades. The vegetation could have attracted birds to these locations and the vegetation surrounding the facades was visually reflected into the

window, further deceiving birds and which lead window strikes to occur (Parkins et al., 2015). The number of stories reflecting vegetation has been identified as a factor that impacts collision risk (Zulian et al., 2023). Given that vegetation near Façade 5 of the Chan Centre and Façade 3 of the Wall Institute vegetation matches or exceeds the height of the window, it is possible that this alignment to vegetation contributes to their increased susceptibility to collisions compared to other windows. Since the presence of vegetation surrounding building facades may play a role in exacerbating collision risks, this warrants further research into the specific characteristics of vegetation, such as density or type, in relation to bird-window collisions.

These particular facades (CCPA5 and WALL3) hold the longest, continuous stretches of glass compared to the other facades windows. Research suggests that the size of the glass surface on buildings may play a role in bird mortality resulting from collisions (Zulian et al., 2023). Larger areas of glass not only provide more surface area for potential collisions but also create more visual obstacles for birds to navigate around (Klem, 2014). This increased expanse of glass may increase the likelihood or chance of collisions to occur (Klem, 2014) and could be why these facades were where the most collisions occurred.

Scott et al. (2023) predicted that cloudy or overcast and rainy days, when sunlight is diffused, lowers glass reflectivity and droplets on the glass alter the appearance of the glass. They expect that collisions will be higher on clear days and no rain clouds and rain (Scott et al., 2023). For the Wall Institute and Chan centre this partially correlates with Scott et al. (2023) predictions as most evidence were found on clear days with minimal

cloud cover. No evidence was found on rainy days at the Wall Institute, which could potentially be attributed to the significant alteration of glass surface by rainwater. The presence of water droplets adhering to the glass not only made the collision evidence more challenging to detect but also may enhance the visibility of the glass to birds, enabling them to avoid collision more effectively. However, evidence were also found on cloudy or overcast days at the Wall Institute, similarly to the Chan Centre where most evidence of collisions were found on cloudy days. This suggests that factors other than sky condition contribute to bird collision occurrences. Additionally, the architectural design of Façade 5, with angled windowpanes, prevented rainwater from altering the glass surface, possibly explaining why collisions occurred on rainy days. Further research at these sites should consider the impact of weather on the reflectivity and appearance of the glass in relation to collision frequency and severity.

While the evidence suggests higher incidence of collisions at the Chan Centre in comparison to the Wall institute, it is important to acknowledge the limitations of this study in fully capturing severity and frequency of bird-window collisions. A significant limitation is searcher efficiency, which is estimated to be around 57% chance of a carcass being found by a surveyor if a carcass persists (De Groot et al., 2021). The lack of carcass found with clipped hallux used in the searcher efficiency trial suggests that there may also be inefficiencies in surveyors ability to find carcases, although this is likely due to the rapid removal of carcasses from the study sites, as indicated by the carcass persistence trial. The removal of evidence implies that many collisions might have occurred but went unrecorded, underestimating the true extent of this issue. Specifically the monitoring

schedule, conducted three times a week, once per day, resulted in missed observations of potential bird carcasses. It is possible that collisions occurred between monitoring days or times when monitoring was not conducted. Our results from the carcass persistence trial indicated that the carcass persisted for around 2.20 days after the carcase was placed. This aligns with the findings from De Groot et al. (2021) with a winter median carcass persistence of 2.23 days.

Recommendations

Since availability of surveyors limited the ability to consistently monitor the study sites, a possible change to the monitoring schedule for future studies could include monitoring on more days to capture more possible evidences before they disappear. Continuing this project and involving UBC students in creating educational materials for raising awareness and engaging other students, staff, and campus visitors, can improve window and glass management to address this human wildlife conflict. Recommendations proposed for building managers of the Chan Centre and Wall Institute are to employ known solutions for preventing bird-window strikes. Studied strategies that are used across the UBC campus include Feather Friendly adhesive markers, decals, and UV-treated glass (De Groot et al., 2022). Feather friendly markers demonstrate a substantial decrease in collision risk at a 95% reduction. UV treated glass offers a transparent view for human viewing but are visible to birds (De Groot et al., 2022). However, the effectiveness of UV window treatments are still being contested and varies among different bird species (De

Groot et al., 2022; Zyśk-Gorczyńska & Żmihorski, 2022). Building managers should look into what preventative measures can cater best for the building design and purpose.

Conclusion

Collisions with windows pose a significant threat to birds when preventative measures are not taken and requires mitigation and adaption to window design to prevent this human-wildlife conflict from occurring. This study aimed to investigate the severity and frequency of bird collisions at the Chan Centre for Performing Arts and Wall Institute for Advanced Studies, where bird prevention measures have not been incorporated in building design. Our findings suggest higher frequency of collisions at the Chan Centre, particularly at Façade 5, compared to the Wall Institute, however the fast removal of carcass indicate that the more collisions could have occurred but were not observed. Further monitoring at these sites are suggested to assess seasonal variations, the impact of vegetation, and the influence of weather on the reflectivity window alteration. Limitations of this study such as carcass persistence, searcher efficiency, and monitoring schedule are acknowledged and modification to future bird collision studies is recommended. The involvement of UBC students in creating educational materials can help spread awareness on this human-wildlife conflict issue and lead to further enforcement of preventative strategies. If efforts are taken to reduce bird-window strikes, bird mortalities can be greatly reduced moving forward.

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Appendix

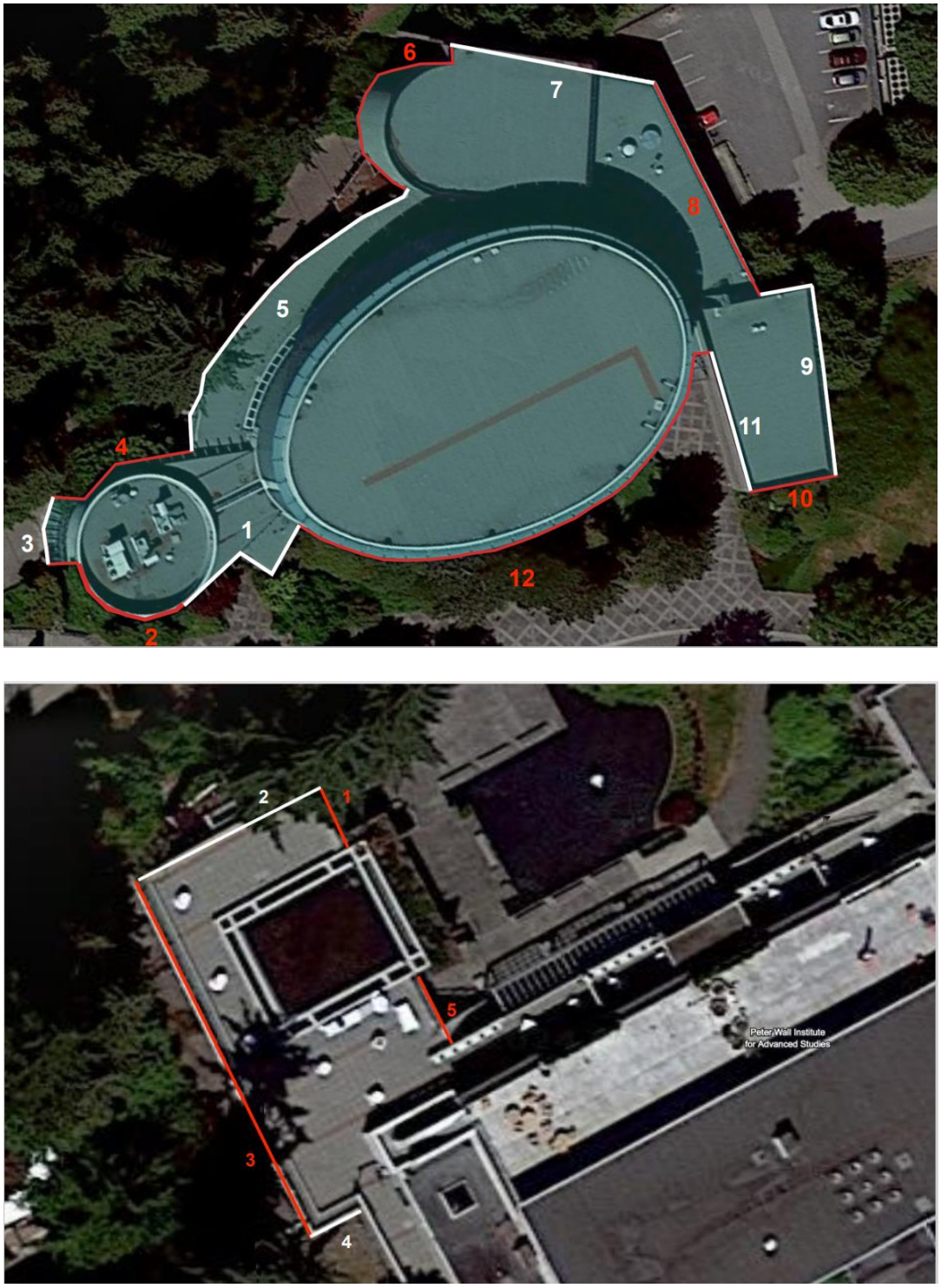

Figure 6. Facade map of the Chan Centre for Performing Arts at UBC Vancouver campus with each façade numbered (A). Facade map of the Wall Institute for Advanced Studies balcony at UBC Vancouver campus with each façade numbered (B).