Title
Examining bird collisions around Northwestern University's Evanston campus

Abstract
Using collision data from Chicago Bird Collision Monitors, I was able to use Python, along with Pandas and Plotly to determine which bird species on campus have the highest number of collisions, along with other data analysis.

Introduction
According to Northwestern ASG's (Associated Student Government) petition, over 700 bird collisions occur on Northwestern University's campus every year (see figure below). This high collision rate can likely be attributed to the fact that Northwestern is situated on very ecologically and biologically diverse lakefront land. Over 200 species of birds, many of which are endangered or threatened, pass by the lakefront during migration[1,2]. My goal for this project was to investigate the collision data to examine what birds are involved in collisions, which buildings have the most collisions, determine what mitigation strategies could be taken by Northwestern to reduce collisions, and the success of mitigation strategies Northwestern has already taken.

Petition to Make Mudd Library Bird Safe

Every year, over 700 birds are killed or injured by flying into buildings at Northwestern as they migrate in the fall and spring. This is because birds do not understand windows; when they see a reflection of a lake, trees, or sky, they believe they can safely continue flying. This problem has a simple solution: putting patterned film, which does not impede a human's ability to see through windows, on the glass. Patterned films have already had great success at reducing bird deaths at Searle and East Kellogg.

One of the most problematic locations for birds today is the northeastern and eastern segments of Mudd library. Mudd alone accounts for over 14% of bird deaths and injuries on campus each year. Applying patterned window film to this portion of the building would dramatically reduce these collisions.

The ASG Sustainability Committee has been working to get Northwestern to fund this project and, while we have been making great progress, we need student support to convince administrators that bird safety on campus ought to be prioritized. **Please sign this petition to express your support for implementing more campus bird safety measures.**

In addition, if you would like to help more with this initiative, please contact the ASG Sustainability Committee at **asg-sustainability@u.northwestern.edu** and, if you see a dead or injured bird, please fill out **this form** to report it to community bird collision monitors.

Figure 1: ASG Bird Collision petition Google Form

Framework/ Methodology
I was provided an Excel dataset by Chicago Bird Collision Monitors, which included bird strike data from 2017 to 2021. Parameters tracked in the data set included date/time of collision, species name, building of collision, status of bird (injured or dead), and direction. There were entries where time and direction were omitted, so I opted to focus exclusively on the species

and building columns. I used Pandas to import the Excel file into a dataframe, and used the get and value_counts methods to get the number of collisions by building and species, respectively. Then, I exported the species, building, and time series data to separate CSV files for data analysis.

Analysis Results

After creating the CSV files for data analysis, I created a Jupyter notebook file where the data visualization would be created. I used Pandas again to import the CSV files into dataframes along with another library, Plotly, for the bar graphs. For the graphs where there are only five elements(figures 1 and 3, respectively), I used Pandas' head method to retrieve the top five buildings and species from their respective dataframes.

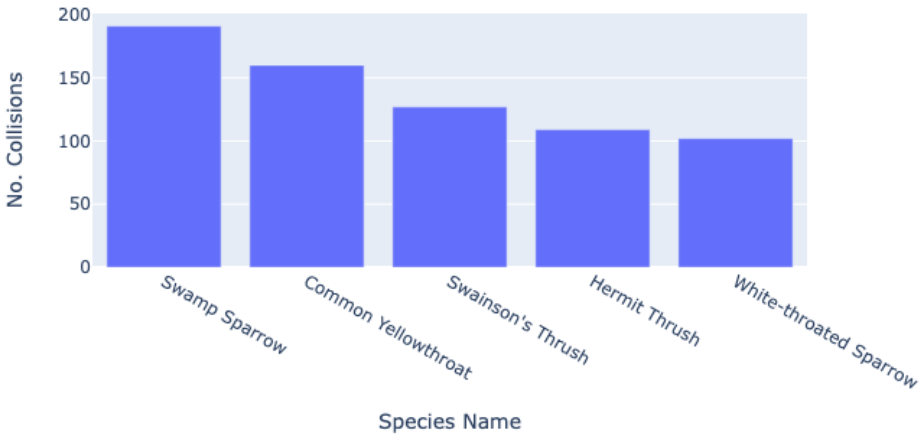

Figure 2: Top Five Species By Collision Counts bar chart

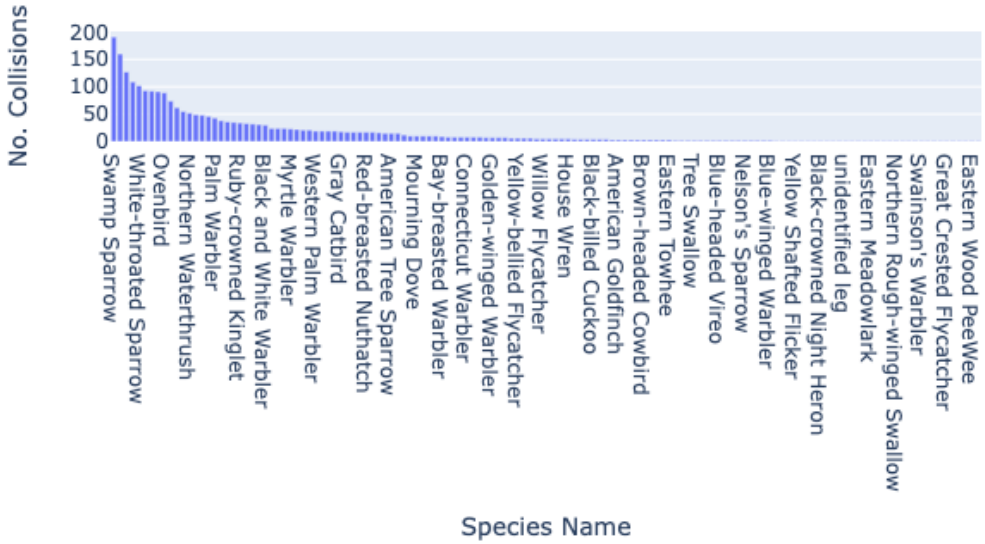

Figure 3: All Species - number of collisions bar chart

Figure 2 indicates the top 5 bird species with the highest number of building collisions: Swamp Sparrow, Common Yellowthroat, Swainson's Thrush, Hermit Thrush, and White-throated Sparrow. All of these species share a common link: their diets consist mainly of insects, and they are all migratory birds[5-9]. According to a study cited in an Audubon article, these factors put these species at a higher risk of colliding with buildings, due to the high speeds they fly at to pursue their prey and disorientation from nighttime lights during migration. The article noted that researchers flagged species such as the Common Yellowthroat as having high collision rates prior to starting the study[10].

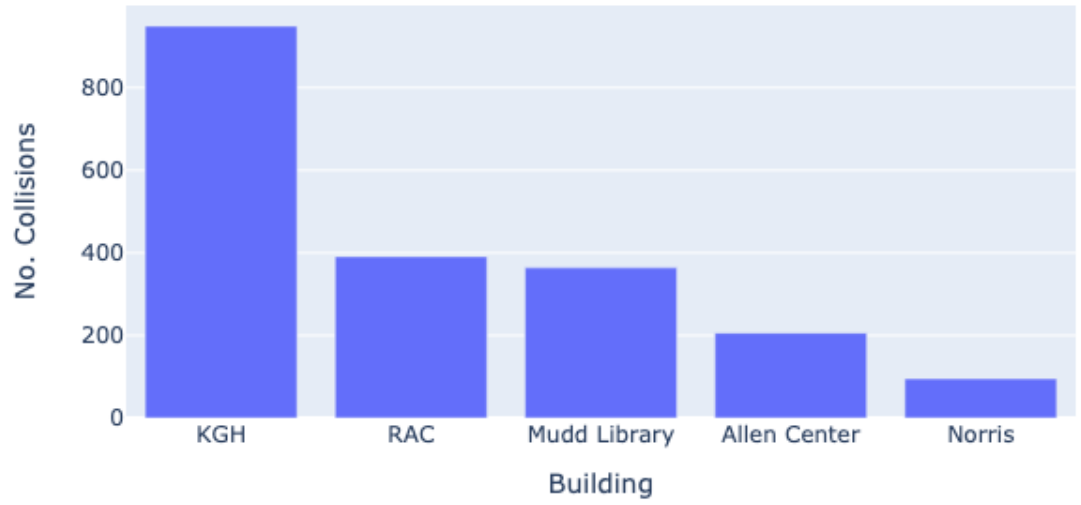

Figure 4: Top Five Buildings By Collision Counts bar chart

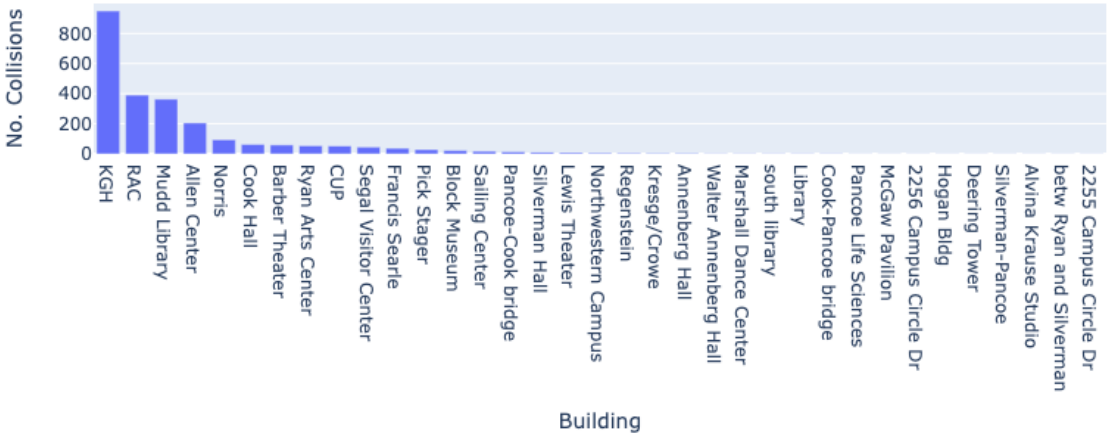

Figure 5: All Buildings - number of collisions bar chart

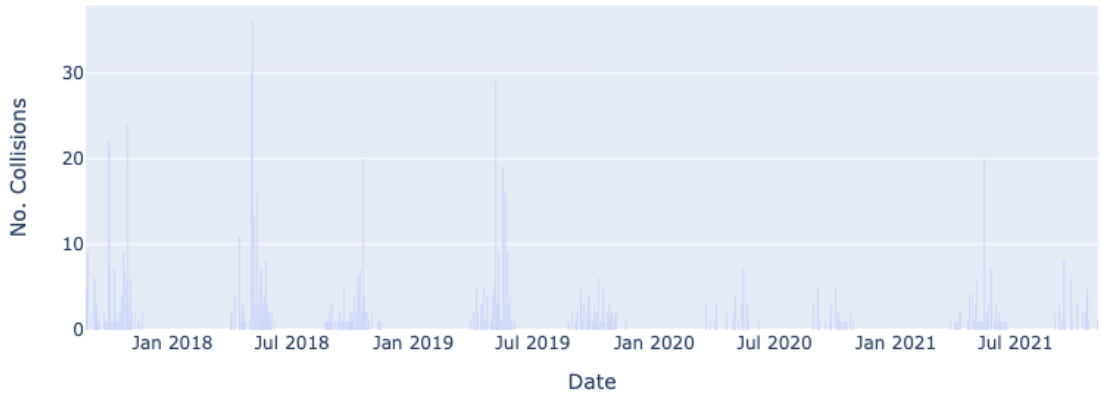

Figure 6: Kellogg Global Hub (KGH) collision counts bar chart over time, 2017-2021

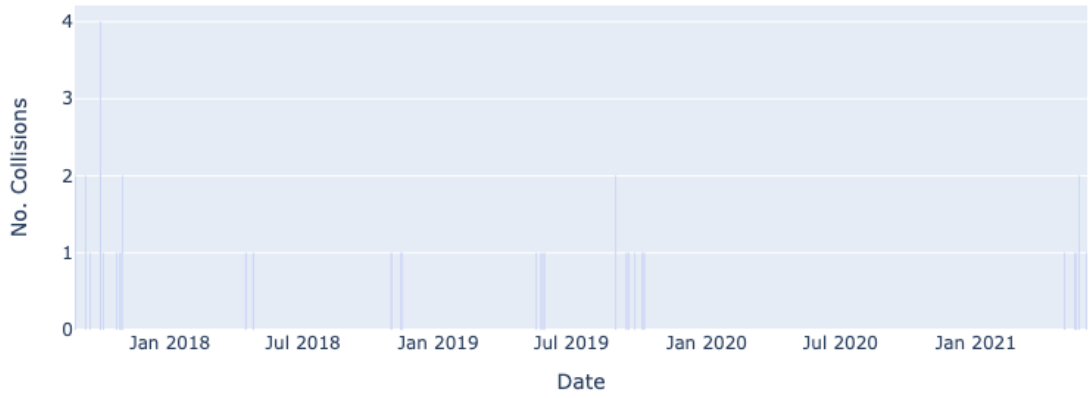

Figure 7: Francis Searle collision counts bar chart over time, 2017-2021

Figure 4 shows that of all the buildings on campus, Kellogg Global Hub (abbreviated KGH in the chart) has the most collisions, with over 800 logged. KGH significantly outpaces the other buildings in the Top 5 No. of Collisions, making it an outlier. This can likely be attributed to two reasons: KGH is a multi-story, mostly-glass building, and it is one of the closest buildings to the lakefront as seen on the map below. Buildings as small as 4 stories can cause collisions. Additionally, glass can reflect sky or natural landscapes, which can confuse birds into thinking they can fly through a window[3].

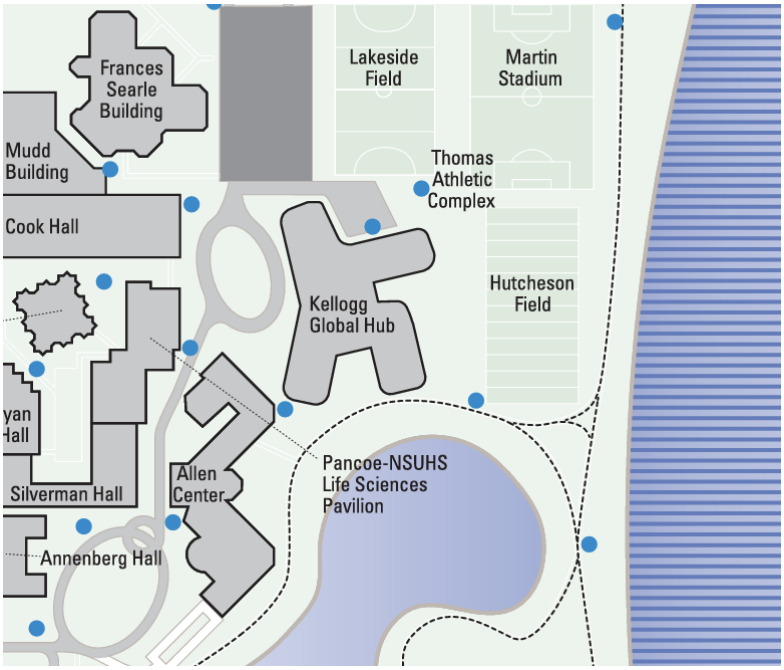

Figure 8: Kellogg Global Hub's location on campus map[4] relative to lakefront.

Conclusion and Future Work

The data makes it clear that of all buildings on campus, Kellogg poses the biggest threat to migratory birds. This is not a new concern for KGH or Northwestern; The Daily Northwestern has reported on this topic several times since 2016[11-14]. In fact, one of the articles dating back to 2018 noted that KGH had tested the performance window inserts on a small portion of the building[12], and a more recent article from 2022 confirms that the retrofits were applied long-term[14]. Figure 6 shows a decrease in collisions at KGH after 2018, highlighting the efficacy of the retrofits. Frances Searle, a building with collisions logged in the data set, was retrofitted with special patterned glass to help reduce collisions according to the Daily[14], and figure 7 supports this. The petition mentioned in the Introduction suggests that Mudd Library would be a good next contender to be retrofitted with patterned glass. This would be a good move to take, as, like Kellogg, Mudd Library is another multistory building composed mostly of glass and close to the lakefront (see figure 8). Despite the action taken, this speaks to the larger issue of construction that does not keep bird migration in mind, especially given Northwestern's (and Evanston's) presence in migration pathways. The City of Evanston recently passed an ordinance requiring new buildings to implement anti-collision measures[13], which will hopefully have a positive impact on reducing bird collisions. A good continuation of this research would be to examine the collision rates of buildings constructed before and after the ordinance passed. Another interesting area of research would be mitigation strategies. So far, only patterned glass mitigation has been explored at Northwestern, but several other types exist such as netting[15] and colored lights[16]. Bird collisions are also an increasingly prevalent problem for aircraft[16], so further mitigation strategy research will not only benefit cities, but airports as well.

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