DOI

EFFECT OF PASSERINE SIZE ON NUMBER OF LETHAL BUILDING COLLISIONS

Hanna Hauck

ABSTRACT

Nighttime migrators such as passerines utilize magnetic and visual orientation cues. These cues could be the sunset, stars and even a full moon (Åkesson and Sandberg, 1994). In buildings with lights being left on in the night can make these nocturnal passerine migrants more susceptible to collisions due to a phototactic response (Winger et al., 2019). Does passerine size impact the amount of collisions? If so, larger passerines would have less building collisions than small passerines. The data were collected in Cleveland, OH and Chicago, IL by Winger et al. and was later published on DataWorld. Data were collected in several areas of both towns, by different groups and organizations. I downloaded this dataset and combined the numbers from each city. After the data were totaled, I researched all species and recorded their average length (in), wingspan (in) and mass (oz). I multiplied these numbers together to make categories that I could group the scores into (Table 1). This aided me in making size scores from 1-10. The results from regression analyses (Figure 1 and 2) showed no significant correlation between the number of collisions and size scores with a weak negative correlation, r-squared value of 0.0438 and a p-value of 0.562. After realizing that the smaller birds may have higher collisions due to being more abundant, I divided the totals of each size scores' collisions by the number of species within that size score. This result was also insignificant with a weak positive correlation, r-squared value of 0.004 and a p-value of 0.863. The outlying size score is seven, with seven species total and four that were especially abundant: the hermit thrush, song sparrow, white-crowned sparrow and white-throated sparrow. These species are highly abundant, which could be the cause of them having over 20,000 collisions between the four species. There are many initiatives to decrease passerine mortality, such as the practice of turning off lights at night and the use of tinted windows, which appear to be reducing mortality (Erickson et al., 2005). For further studies, the species could be divided into their IUCN statuses so that species of least concerned are not directly being compared to species less abundant than them.

Keywords: Birds, behavior, size

INTRODUCTION

Passerines are "perching birds" in the order Passerifomes. Birds within this order make up over half of all bird species, representing grazers and insectivores. Passerines provide important ecosystem functions such as seed dispersal ("Passerines (U.S. National Park Service)," 2019). Many of the species under the order Passeriformes are nighttime migrators, making it difficult to study their active migratory patterns without some type of equipment. Based on some studies that utilized this equipment, nocturnal migrants tend to fly at lower altitudes than had previously been reported (Able, 1970). In a study conducted by Åkesson and Sandberg, it was reported that these nocturnal migrants often use both magnetic and visual orientation cues. Visual orientation was shown to be aided by the stars, sunset, and in certain circumstances, the full moon. It was reported that, "Under a full moon, when savannah sparrows (*Passerculus sandwichensis*) were exposed to the clear night sky without first being allowed to see the evening twilight sky, the birds oriented towards the direction of the moon, thus demonstrating a phototactic response rather than orienting in the expected migratory direction," (Åkesson and Sandberg, 1994). Keeping lights on at night can sometimes cause this phototactic response and make nocturnally migrating passerines vulnerable to collisions, even if a building is not a high rise (Winger et al., 2019). Although bird of prey species have very keen vision, passerines have faster vision as opposed to focused vision("Explore raptors page | The Peregrine Fund," n.d.; Universitet, 2016). Could larger passerines have a keener sense of vision in order to avoid lethal collisions with buildings? If this statement is true, there would be a higher number of collisions of passerines with low size scores.

METHODS

Data were collected by Winger et al and published by DataWorld for access (Winger et al., 2019; "Bird-Building Collisions - dataset by animals | data.world," n.d.). The data were collected in Chicago, IL and Cleveland, OH. In Chicago, data were collected from 1978 to 2016. The data were collected by field museum personnel that walked around the building at McCormick Place each morning during spring and fall migration to count the number of lethal collisions. In 2002, a volunteer network called the Chicago Bird Collision Monitors began to monitor collisions at other buildings in downtown Chicago. In Cleveland, data were collected in the fall of 2017 and spring of 2018. This data were monitored and recorded by Lights Out Cleveland. Once I had gained access to the data, I downloaded the reported counts from Chicago and Cleveland then combined the numbers by species. Once the data were totaled for the species I researched all species and recorded the average length (in), wingspan (in) and mass (oz) on the Cornell Lab of Ornithology website ("Cornell Lab of Ornithology—Home," n.d.). In order to assign size scores to each species, I multiplied their length, width and mass together. From there, I grouped those numbers into categories (Table 1) in order to achieve scored from 1-10.

Table 1. List of size scores and the parameters associated with each score and the number of species in each category.

Size Score	Parameters	Number of Species
1	0-9.9	10
2	10-14.9	14
3	15-19.9	18
4	20-29.9	14
5	20-39.9	5
6	40-49.9	4
7	50-74.9	7
8	75-99.9	5
9	100-249.9	10
10	250+	6

After reviewing the scores and collisions, I noticed the scores with more species could have more collisions. To account for this, I divided the total number of collisions by the number of species with that size score. In order to conduct the statistics, I ran Regression Analyses on Minitab between total collisions & size scores and total collisions divided by the number of species & size scores (*Minitab, LLC*, 2019).

RESULTS

Within the 71,217 collisions reported, there were 93 species. The total number of collisions by size score and divided by the number of species are listed in Table 2.

Table 2. Total number of collisions reported by size score. Number of species within each category are listed and the total scores were divided by the number of species within each score.

Size Score	Total Collisions	Number of Species	Total Collisions/ Species

DOI

1	7821	10	782.1
2	7543	14	538.8
3	4470	18	248.3
4	9312	14	665.1
5	6381	5	1276.2
6	6396	4	1599.0
7	20925	7	2989.3
8	5736	5	1147.2
9	2425	10	242.5
10	208	6	34.7
Total	**71217**	**93**	**---**

In the regression analysis that was run between total collisions and size scores (Figure 1), there was a weak negative correlation, with a r-squared value of 0.0438, and a p-value of 0.562, making this result not significant.

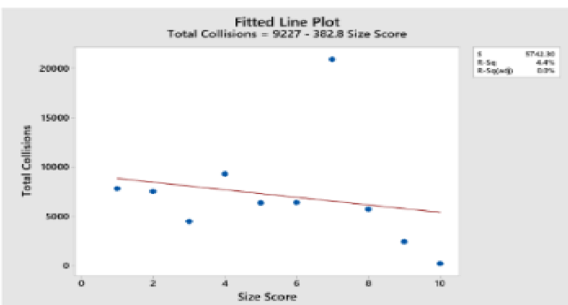

Figure 1. Regression analysis between total collisions and size scores with a r-squared value of 0.0438, and a p-value of 0.562.

The results of the analysis between total collisions divided by the number of species and size score (Figure 2) reported weak positive correlation, a r-squared value of 0.004 and a p-value of 0.863, making this result insignificant as well.

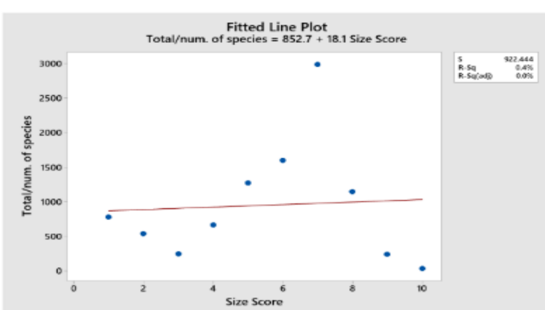

Figure 2. Regression analysis between total collisions divided by number of species and size scores with a r-squared value of 0.004 and a p-value of 0.863

There is a clear outlier in both regression analyses, which is the size score of 7, with only seven species in this group and nearly 21,000 collisions reported.

DISCUSSION

Although these results are not significant, there is a weak negative correlation between passerine size and the number of collisions. After adjusting for there being a higher abundance of small passerine species, the correlation remained weak, but became positive. The outlier in this dataset is the group with a size score of seven (Table 3). The species with the highest number of collisions in this bunch is the white-throated sparrow, who accounts for half of the collisions within this size score. The other sparrow species in this category contributed to the large number of collisions as well as the hermit thrush. These four species contribute to all but 149 of the collisions within this size score.

Table 3. Species listed within the size score of seven, which had the highest number of collisions.

Scientific Name	Common Name	Total number of collisions
Catharus guttatus	Hermit Thrush	3,756
Icteria virens	Yellow-breasted Chat	16
Icterus spurius	Orchard Oriole	6
Melospiza melodia	Song Sparrow	5,205
Piranga olivacea	Scarlet Tanager	127
Zonotrichia albicollis	White-throated Sparrow	10,712
Zonotrichia leucophrys	White-crowned Sparrow	1,103
	Total	**20,925**

These four species are listed as least concern on the IUCN Red List, all of them having their distribution cross through Chicago, IL and Cleveland, OH at least one season of the year. The hermit thrush passes through these areas during their migration periods(BirdLife International, 2016a). The song sparrow is a resident in these areas (BirdLife International, 2016b) and lastly, the white-throated and white-crowned sparrows live in these areas in the non-breeding seasons(BirdLife International, 2018, 2016c). The stark abundance of these birds throughout North America is astounding. Many people could walk out their door and these species would be some of the first species you would see. The abundance of these species, which is not listed on any of their IUCN profiles, could be the reason that the number of collisions is so high for this size score.

There are many initiatives to reduce mortality of migrating passerines. Many of these are aimed at reducing the amount of night lighting that draws many migrating passerines off course. One initiative mentioned by Erickson et al. mentions programs that "reduce night lighting at tall buildings and encourage use of tinted windows appear to be an effective measure to reduce mortality" (Erickson et al., 2005). For future studies of this nature, it may be beneficial to separate species by their IUCN classifications to compare more and less abundant species separately. In addition, more locations could be accounted for in order to incorporate more species. Lastly, if an organization was to monitor collisions of those other than passerines, there may be more of a definitive correlation due to a greater variation in bird sizes.

ACKNOWLEDGEMENTS

I would like to thank Dr. Douglas Glazier for his assistance and guidance while working on this paper and Dataworld for the access to this dataset.

LITERATURE CITED

Able, K.P., 1970. A Radar Study of the Altitude of Nocturnal Passerine Migration. Bird-Banding 41, 282–290. https://doi.org/10.2307/4511688

Åkesson, S., Sandberg, R., 1994. Migratory Orientation of Passerines at Dusk, Night and Dawn. Ethology 98, 177–191. https://doi.org/10.1111/j.1439-0310.1994.tb01069.x

Bird-Building Collisions - dataset by animals | data.world [WWW Document], n.d. URL https://data.world/animals/bird-building-collisions (accessed 4.22.20).

BirdLife International, 2018. IUCN Red List of Threatened Species: White-throated Sparrow [WWW Document]. IUCN Red List of Threatened Species. URL https://www.iucnredlist.org/en (accessed 5.5.20).

BirdLife International, 2016a. IUCN Red List of Threatened Species: Hermit Thrush [WWW Document]. IUCN Red List of Threatened Species. URL https://www.iucnredlist.org/en (accessed 5.5.20).

BirdLife International, 2016b. IUCN Red List of Threatened Species: Song Sparrow [WWW Document]. IUCN Red List of Threatened Species. URL https://www.iucnredlist.org/en (accessed 5.5.20).

BirdLife International, 2016c. Melospiza melodia (Song Sparrow) [WWW Document]. URL https://www.iucnredlist.org/species/22721058/94696727 (accessed 5.5.20).

Cornell Lab of Ornithology—Home [WWW Document], n.d. . Birds, Cornell Lab of Ornithology. URL https://www.birds.cornell.edu/home (accessed 4.22.20).

Erickson, W.P., Johnson, G.D., Jr, D.P.Y., 2005. A Summary and Comparison of Bird Mortality from Anthropogenic Causes with an Emphasis on Collisions 14.

Explore raptors page | The Peregrine Fund [WWW Document], n.d. URL https://peregrinefund.org/explore-raptors-species (accessed 4.23.20).

Minitab, LLC, 2019.

Passerines (U.S. National Park Service) [WWW Document], 2019. URL https://www.nps.gov/im/cakn/passerines.htm (accessed 4.22.20).

Universitet, U., 2016. Small birds' vision: Not so sharp but superfast [WWW Document]. ScienceDaily. URL https://www.sciencedaily.com/releases/2016/03/160318144548.htm (accessed 4.23.20).

Winger, B.M., Weeks, B.C., Farnsworth, A., Jones, A.W., Hennen, M., Willard, D.E., 2019. Nocturnal flight-calling behaviour predicts vulnerability to artificial light in migratory birds. Proc. R. Soc. B 286, 20190364. https://doi.org/10.1098/rspb.2019.0364