Windows and Vegetation: Primary Factors in Manhattan Bird Collisions

Yigal Gelb[1,*] and Nicole Delacretaz[1]

Abstract - Bird collisions in Manhattan (New York City) were studied by analyzing collision data collected from 1997 to 2008 by Project Safe Flight (PSF) participants, representing one of the largest collision monitoring efforts in the nation. Over 5400 bird collisions were recorded during this period, two-thirds of which were fatal. Collisions involved 104 bird species, primarily from the warbler, sparrow, and thrush families, and mostly during spring and fall migration. Most collisions were documented to occur during the day at the lower levels of buildings where large glass exteriors reflected abundant vegetation, or where transparent windows exposed indoor vegetation. Most collisions in Manhattan likely occurred at a smaller number of high-collision sites where strike rates of well over 100 birds per year are considerably higher than previously reported rates. We suggest here that improving our understanding of the factors involved in collisions at such sites could greatly assist in reducing bird collisions.

Introduction

Bird collisions with human-made structures have been documented extensively for over a century (Klem 1989). After habitat loss and fragmentation, collisions with such structures represent the greatest human-related threat to bird populations (Klem et al. 2004). Species involved in collisions are also listed on the US Fish and Wildlife Service's *Birds of Conservation Concern* and on the *Audubon WatchList* (Shire et al. 2000). Collisions with reflective and transparent plate glass are estimated at 100 to 1000 million birds for the continental US (Klem 1990), posing a threat to resident and migratory birds (Klem 1989, 1990; Veltri and Klem 2005). This threat is likely to increase as more natural habitat is modified through development that incorporates such glass (Klem 1990). Night collisions with structures such as communications towers also pose a threat to nocturnal migrants, especially during inclement weather (Avery et al. 1976, Gauthreaux and Belser 2003, Shire et al. 2000, Veltri and Klem 2005).

In recent years, bird-rescue organizations in Chicago (Chicago Bird Collision Monitors), Toronto (FLAP–Fatal Light Awareness Program), and New York City (NYC Audubon's Project Safe Flight) have documented thousands of collisions at human-made structures, especially during spring and fall migration. However, to date, the majority of bird-collision research consists of data gathered from rural and suburban environments. Additionally, while well-lit skyscrapers were first believed to be involved in most urban

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collisions (Ogden 1996), recent research suggests that nighttime collisions may be more limited in scope (DeCandido 2005). Other research and anecdotal information clearly documents extensive daytime collisions at low-rise buildings (Gelb and Delacretaz 2006; Michael Mesure, FLAP, Toronto, ON, Canada, pers. comm.).

Participants in Project Safe Flight (PSF) have been monitoring bird collisions in Manhattan (New York City) since 1997. This monitoring effort represents one of the largest in the nation, involving tens of program participants who dedicated what amounts to thousands of monitoring hours. By July 2008, participants in this program had recorded over 5400 collisions, which were entered into an online database available on the NYC Audubon website. In this paper, we use these data to answer important questions relating to frequency, timing, and physical context of collisions in Manhattan. Specifically, we sought to test two hypotheses: (a) that the frequency of collisions is highest along those portions of the exterior glass surface that reflect outside vegetation (reflective windows) or display indoor vegetation (transparent windows); and, consequently, (b) that most of these collisions occur during daytime hours when birds are feeding.

Methods

Since 1997, program participants have recorded a bird collision when a dead or injured bird was found at the base of a building (Dunn 1993; Klem 1989, 1990; Klem et al. 2004; O'Connell 2001). When monitoring the exterior of a building, participants walked the route slowly, looking for birds from the base of the building to the gutter on the near side of the street. Building exteriors (referred to here as "sites") were monitored once a day, usually in the morning hours during the spring (late March to early June) and fall (late August to early November) migration periods. Sites with high collision numbers (at least several collisions a day) were sometimes monitored more than once a day, while sites with low collision numbers (less than one a day) were sometimes monitored less than once a day. Daily monitoring was discontinued after collision numbers dropped substantially at the end of each migration season. Periodic monitoring of a high-collision site during non-migratory seasons indicated that strike rates remained low during these periods. Program participants were trained to follow the same monitoring procedures.

We analyzed Manhattan collision data collected from 1997–2008 to determine the top 20 species involved in collisions (Table 1) and to evaluate the role of daytime factors (vegetation and windows) and nighttime factors (building height and lighting) in causing bird collisions. We were unable to conduct a regression analysis here, as sites were not chosen randomly, and because monitoring effort and start dates differed across sites. Instead, we rank over 180 Manhattan sites to determine the top 10 sites with the highest collision numbers (Fig. 1). For these sites, as well as other sites described in this paper, we indicate total collisions recorded at the site, monitoring dates, and information relating to the factors involved in daytime and nighttime collisions. Window size and vegetation were categorized as follows: 1 = large windows opposite some vegetation; 2 = large windows opposite extensive vegetation, not adjacent to an urban park; and 3 = large windows opposite extensive vegetation, adjacent to an urban park. For the purposes of this analysis: large windows, either reflective or transparent, were 1 m x 2 m, or larger, along the building exterior; extensive vegetation signifies that 50% or more of the windows at the lower levels either reflected exterior vegetation or displayed indoor vegetation and that this vegetation was composed of at least a row of trees with interlocking canopies or dense shrubs, 5–15 m (for reflective windows) or 0–15 m (for transparent windows) from the windowed exterior; some vegetation signifies that less than 50% of the windows at lower levels reflected or displayed vegetation or that vegetation was less dense along the windows; and an urban park was an open space area one-half hectare or more in size, composed of trees and shrubs, opposite the building exterior. Building height was measured in meters. Artificial light emitted from building was categorized as follows: 1 = little to no light emissions, 2 = emissions from internal light source only, and 3 = emissions from internal light and external bright lights at the top of the building. Light intensity was gauged during random nighttime visits to the sites in question and by looking at photographs of the sites at night. In this analysis, we include the "Twin Towers" of the now destroyed World Trade Center complex, noting that monitoring was discontinued in fall 2001. We removed two sites from the top 10 list due to uncertainty relating to the precise building areas that were monitored.

Table 1. Top 20 species involved in collisions in Manhattan, 1997–July 2008. Taxonomy follows the American Ornithologists' Union 7th edition checklist (AOU 2005).

Scientific name	Common name	Number of collisions 1997–July 2008
Zonotrichia albicollis Gmelin	White-throated Sparrow	884
Geothlypis trichas L.	Common Yellowthroat	479
Junco hyemalis L.	Dark-eyed Junco	377
Seiurus aurocapillus L.	Ovenbird	330
Regulus calendula L.	Ruby-crowned Kinglet	225
Catharus guttatus Pallas	Hermit Thrush	176
Regulus satrapa Lichtenstein	Golden-crowned Kinglet	146
Scolopax minor Gmelin	American Woodcock	133
Mniotilta varia L.	Black-and-white Warbler	130
Dumetella carolinensis L.	Gray Catbird	119
Melospiza melodia Wilson	Song Sparrow	118
Dendroica striata Forster	Blackpoll Warbler	103
Melospiza georgiana Latham	Swamp Sparrow	95
Dendroica caerulescens Gmelin	Black-throated Blue Warbler	83
Parula americana L.	Northern Parula	79
Sphyrapicus varius L.	Yellow-bellied Sapsucker	75
Colaptes auratus L.	Northern Flicker	69
Dendroica magnolia Wilson	Magnolia Warbler	62
Setophaga ruticilla L.	American Redstart	56
Seiurus noveboracensis Gmelin	Northern Waterthrush	55

In addition to ongoing monitoring of sites across Manhattan, we conducted extensive monitoring during 2005 at two separate locations—a downtown location comprised of six buildings and the midtown location of the Morgan Processing and Distribution Center (Morgan Mail Building) (Fig. 2a).

Downtown study

The week-long "downtown study" from 12:00 on May 7th to 12:00 on May 14th of 2005 tested the hypothesis that most collisions occur during the day by intensively monitoring six buildings (40°42'11"N, 74°00'43"W

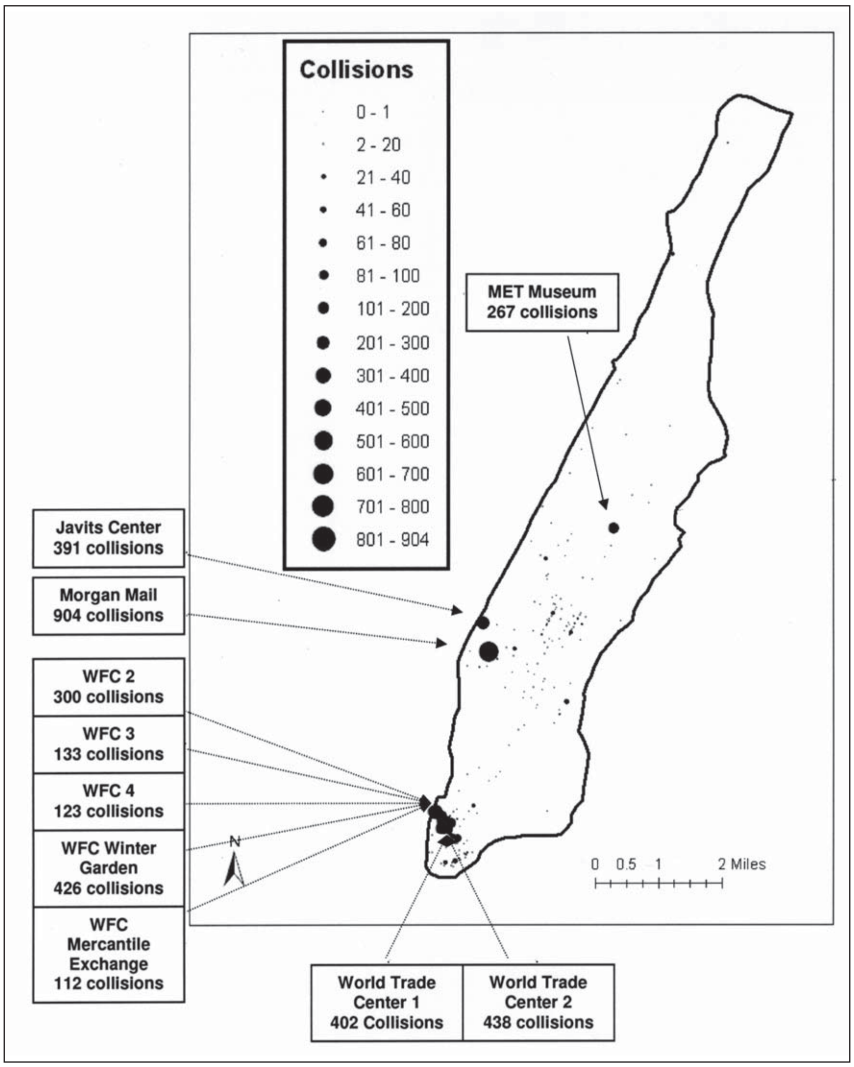

Figure 1. All collision locations across Manhattan 1997–July 2008. The building names and number of collisions are highlighted for the top ten sites with the greatest number of collisions.

at center of the route), four of which were skyscrapers that emitted artificial light during nighttime hours. All but one building included reflective exteriors with some to little vegetation nearby. All exterior walls extended vertically from the base of the buildings to the rooftops, with no setbacks or ledges that could prevent colliding birds from falling to the street level. Building exteriors were purposely chosen so that they faced the general direction of spring migration in order to maximize the potential number of collisions. Proximity to mass transit (i.e., subway stations) was also a factor in selecting study sites in order to ensure easy access for study participants.

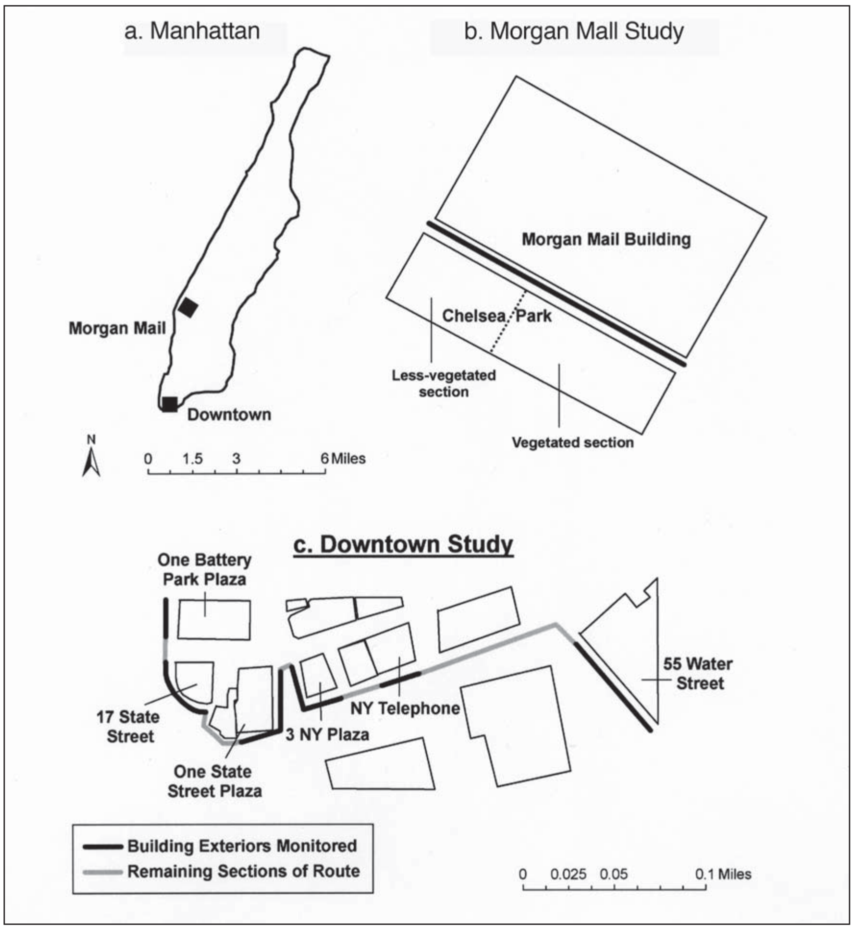

Figure 2. Study sites and sampling methodology, 2005. a) a map of Manhattan showing the location of the Downtown study and the Morgan Mail building. b) a diagramatic sketch of Morgan Mail building. The heavy black line between Chelsea park and the building represents the survey route. The northewest section of Chelsea Park was less vegetated than the southeast sector. c) a map of the Downtown Study. Heavy lines mark the survey route; light grey lines mark the route taken between building sites.

For comparison purposes, we monitored the Morgan Mail Building and the World Financial Center complex, sites not immediately in the study location, but which were already documented to be high-collision sites (defined here as sites with over 100 collisions per year).

The downtown study was conducted during the period when spring collisions generally peak (Fig. 3). In order to accurately document the time of collisions, 22 participants monitored the six building exteriors during the following time periods: 0:00–0:30, 4:00–4:30, 6:00–6:30, 8:00–8:30, 12:00–12:30, 16:00–16:30, and 20:00–20:30. The additional morning session of 6:00–6:30 was added in order to record collisions that would otherwise be hard to detect during the morning commute in this busy downtown area. The same route (590 m) was walked during each monitoring session, beginning at 1 Battery Park Plaza and ending at 55 Water Street. Participants recorded their findings on a data sheet that included the study route and a map on which to mark where birds were found. Morgan Mail and the World Financial Center, the two additional high-collision sites added for comparison purposes, were monitored only once each morning during this study. Skies were mostly clear during the week-long study. The first days had periodic overcast, beginning after midnight on the first night and lasting into the afternoon of the second day, and then beginning before midnight on the second night and dissipating by early morning; no precipitation was recorded throughout the study period. As was our experience in prior years, collisions at sites across the City clearly peaked in mid May. Given that only four collisions were recorded during this study, we were not able to analyze the data statistically.

Morgan Mail building studies

We conducted two separate studies at the Morgan Mail Building (Fig. 2b), a six-story office building where relatively high numbers of collisions have

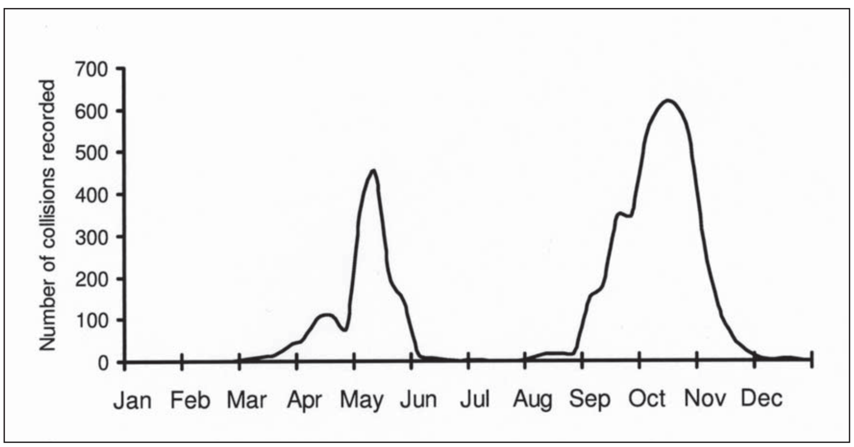

Figure 3. Weekly collision numbers, 1997–July 2008. Data points represent the cummulative number of bird collisions per week for all years during each month.

been recorded since 2002. The building is located in Manhattan between 28th and 29th Streets and between 9th and 10th Avenues (40°45'02"N, 74°00'01"W). The building's exterior was made up of windowless concrete walls for the first two stories and 440 large, reflective glass panels (each 2.3 m x 1.3 m) covering approximately 75% of the remaining four stories (the "windows" actually mask a concrete wall). All exterior walls extended vertically from the base of the building to the rooftop, with no major outcrops or ledges that could prevent colliding birds from falling to the street level. The southern perimeter of this building (247 m) faced a row of short street trees that did not reach the building windows. Across the street was a row of large street trees (mostly *Platanus x acerifolia* Muenchh [London Plane]), many of which were over 20 m tall and reached to the top of the six-story structure. Situated behind this row of trees was a 1.42-ha urban park (Chelsea Park) with more tall trees (mostly London Plane), some of which were also reflected in the building windows. The vegetation at this park was not uniformly distributed; whereas the eastern portion of the park included many large trees, the western portion of the park—amounting to slightly less than half of the entire park—was much less vegetated, partly due to the fact that most of the space was taken up by a large ball-field covered with artificial turf.

The first study, carried out during spring and fall, tested the hypothesis that the frequency of collisions is highest along those portions of the exterior glass surface that reflect outside vegetation by recording the locations of collision victims along the building's southern perimeter. As noted above, the eastern portion of the southern perimeter faced more vegetation than did the western portion. To estimate the quantity of vegetation in each of these sections, we divided the southern perimeter into approximately equal halves and counted the number of trees in each half that reached up to the fifth and sixth floors along the sidewalk opposite the building. There were 12 trees along the eastern half ("vegetated" section) and four trees along the western half ("less-vegetated" section). The positions of dead and injured birds found at the base of the building were carefully noted and assigned to one or the other of these two sections. In some instances, especially during the spring, volunteers did not record the precise locations of dead and injured birds, and those data were not included in the statistical comparison of collisions along the vegetated vs. less-vegetated sections.

The second study, referred to here as "the three-day study" (October 18 to October 20, 2005), tested whether most collisions occur during the day in areas where the exterior glass surface reflects outside vegetation. In this study, eight participants monitored the building exterior during the following time periods: 6:45–7:15, 9:00–9:30, 12:00–12:30, 15:00–15:30, and 19:00–19:30. Sunrise during this study was at approximately 7:10 and sunset was at approximately 18:10. Weather conditions during the study were generally favorable, with little to no cloud cover throughout the study period. Data were analyzed using an exact binomial test (R 2.7.2 software, R development Core Team, 2008, http://www.R-project.org).

The collision data presented here are very likely an underestimate of the true number of collisions because of our inability to continually monitor all sites. Additionally, "removal bias," i.e., the removal of dead and injured birds by predators and scavengers (Dunn 1993, Klem et al. 2004, O'Connell 2001) or by street sweepers and building maintenance staff (Klem 1990, O'Connell 2001) further reduces the true number. To correct for these sources of bias, we substantially increased the monitoring frequency at the two sites mentioned above. While not eliminating these sources of bias, the increased monitoring effort represents a considerable improvement over monitoring that is performed only once a day. It is unlikely that the downtown area included many scavengers, given the scarcity of natural habitat at the site; bird carcasses that remained intact for over a day at the base of the Morgan Mail building suggest that removal by predators was not a serious factor at this site as well. Street sweepers were more prevalent in the downtown study, and could have been a biasing factor.

We used binomial goodness-of-fit, two-tailed test (SPSS 12.0.0 for Windows, release September 2003) to evaluate experimental results. We considered test results to be statistically significant when $P < 0.05$.

Results

Downtown study

Participants recorded only four collisions during the downtown study, two of which were fatal. Birds found during the one-week study were distributed among monitoring periods as follows: 0:00–0:30, 0 birds; 4:00–4:30, 1 bird; 6:00–6:30, 1 bird; 8:00–8:30, 2 birds; 12:00–12:30, 0 birds; 16:00–16:30, 0 birds; and 20:00–20:30, 0 birds. The four collisions occurred at four different buildings and were distributed as follows: 17 State Street, 1 collision; 1 State Plaza, 1 collision; 3 New York Plaza, 1 collision; and 55 water street, 1 collision. All collision sites held large windows with some vegetation adjacent to them and were at least 77 m high. During the same period, we recorded 14 and 24 collisions at the Morgan Mail Building and the World Financial Center, respectively.

Morgan Mail studies

Of the 251 collisions recorded during the spring and fall 2005 periods at Morgan Mail, we mapped the collision locations of 144. Strike frequency differed significantly between the vegetated (105) and less-vegetated (39) halves of the southern perimeter (exact binomial test: 2-tailed, estimated proportions are respectively equal to 73% and 27%, $P < 0.0001$).

During the three-day study at Morgan Mail, participants recorded 28 collisions involving 13 different bird species, 23 of which were fatal (82%). Dead and injured birds found during this study were distributed among monitoring periods as follows: 6:45–7:15, 6 birds; 9:00–9:30, 13 birds; 12:00–12:30, 7 birds; 15:00–15:30, 2 birds; and 19:00–19:30, 0 birds (Fig. 4). We analyzed the collision by splitting them in two categories: daytime collisions (7.10 am–6.10 pm) and nighttime collisions (6.10 pm to 7.10 am). Among the 28 collisions recorded, 23 occurred during the day and 5 during the night.

The data from Morgan Mail during the three-day study demonstrate that the proportion of dead birds found during the day is significantly higher than that found during the night (exact binomial test: 2-tailed,estimated proportions are respectively equal to 82% and 18%, $P = 0.0009$; Fig. 4).

Of the total number found, 27 were found along the vegetated southern perimeter, and only one was found along the un-vegetated western perimeter.

Discussion

Our comparison of collision numbers between Morgan Mail's vegetated and less-vegetated sections supports our hypothesis that the frequency of collisions is highest along those portions of the exterior glass surface that reflect outside vegetation. The three-day study revealed a statistically significant disparity in collision rates of about five to two—very similar to the corresponding numbers of tall trees at each of these sections. Additionally, we recorded only four collisions along the less -vegetated exteriors of the six downtown buildings that were monitored intensively during the downtown study, compared with 38 collisions at the more vegetated, and less monitored, sites of Morgan Mail and World Financial Center. From 1997 to mid-2008, participants recorded more than 5400 bird collisions in Manhattan, two-thirds of which were fatal. One hundred four bird species were involved in these collisions (see Appendix 1), most of which were passerines from the warbler, sparrow, and thrush families. Most collisions involved passage-migrants during spring and fall migration (Fig. 3).

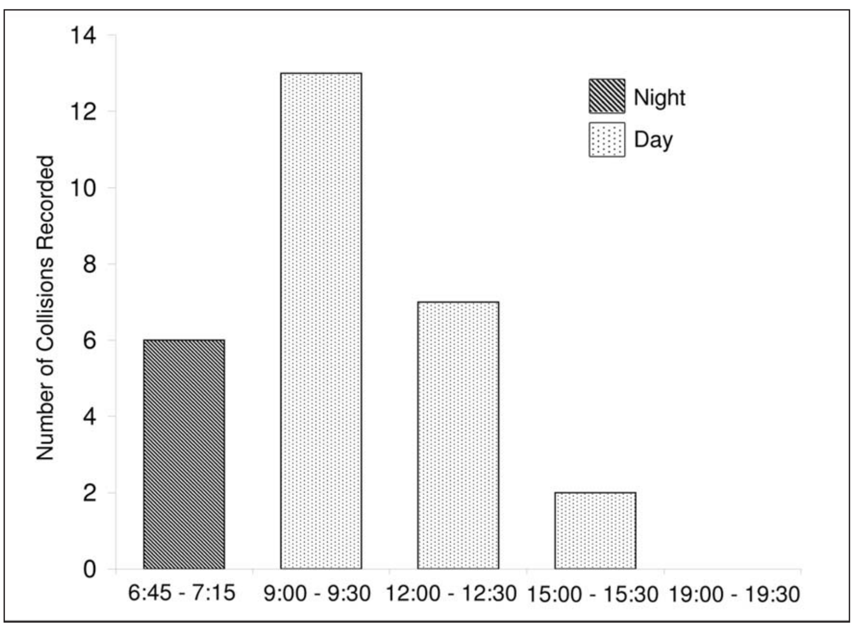

Figure 4. Time of collision at Morgan Mail–Three-day cumulative: October 18th–October 20th 2005.

Collision numbers for Manhattan's top-10 collision sites ranged from 904 to 112 (Table 2). Of the 180 sites analyzed, several of which were tall structures, about 66% registered collision numbers ranging only from 1–10 (Fig. 1). All ten sites on the top-10 list included large windows. All sites incorporated vegetation, with the Twin Towers and Winter Garden including visible indoor vegetation. Eight of the sites incorporated extensive vegetation, four of which were also opposite an urban park. Four of the sites were low-rise buildings (<40 m), three of which were mostly dark during the night. The analysis of Manhattan's top-10 collision sites lends further support to our hypothesis that both reflective and transparent windows are involved in collisions at vegetated sites by clearly documenting high collision numbers at sites with extensive vegetation opposite large windows. While more research is needed to quantify the extent of collisions across Manhattan, it is likely that the majority of collisions occur at only a handful of high-collision sites that incorporate these characteristics.

Given that most collisions seem to occur at windowed exteriors that incorporate vegetation, we find strong evidence to support our second hypothesis: that most collisions occur during daytime hours. Data gathered from the three-day study at Morgan Mail show that most collisions occurred between 6.45am and 9am, but also show that collisions occurred during daytime, as dead and injured birds were retrieved as late as 3 pm. Additionally, the single nighttime collision recorded during the spring week-long downtown study, although not representative statistically, suggests that nighttime collisions at tall urban structures may not be as pervasive as once thought especially since the nighttime monitoring during that study was intense and included four skyscrapers during the week of peak migration. This finding also supports previous research conducted in Manhattan, which documented very few nighttime collisions at the very tall and well-lit Empire State Building (DeCandido 2005).

Table 2. Top 10 collision sites in Manhattan, 1997–July 2008. N = cumulative number of collisions during the study period, W+V = window size and vegetation[A], Height = building height (m), and AL = artificial light emitted from building[B].

Location	N	W+V	Height	AL
Morgan Mail	904	3	30 (est.)	1
World Trade Center 2	438	1	415	2
World Financial Center Winter Garden	426	2	38	2
World Trade Center 1	402	2	417	3
Jacob Javits Convention Center	391	3	30 (est.)	1
World Financial Center 2	300	3	197	2
Metropolitan Museum of Art	267	3	30 (est.)	1
World Financial Center 3	133	3	225	2
World Financial Center 4	123	2	152	2
WFC - Mercantile Exchange	112	2	78	2

[A]1 = large windows, some vegetation, 2 = large windows, extensive vegetation, no park, and 3 = Large windows, extensive vegetation, near urban park.
[B]1 = little to no light, 2 = internal light only, and 3 = internal and external light.

Our analysis of Manhattan's top-10 collision sites further supports our hypothesis by showing that four of the top collision sites were low-rise buildings (<40 m), most of which were dark during the night. Additionally, the five skyscrapers on this list (>100 m) were also found to incorporate large, reflective windows opposite vegetation.

While compelling, these findings do not prove that tall, well-lit buildings do not pose a threat to nocturnal migrants passing through an urban environment. The low number of bird strikes recorded during the downtown study may simply reflect the fact that during periods with good weather and relatively clear skies, the rate of nighttime collisions at tall structures is low; a phenomenon also documented at communications towers (Avery et al. 1976, Cochran and Graber 1958). Also, the high collision numbers reported for the Twin Towers may have been partly due to the buildings' ability to attract higher numbers of birds as a result of their extreme height (almost double the height of the next tallest skyscraper on the list) and bright lights. However, participants who monitored these buildings indicated that many of the collisions at these sites were still seen to occur during the day, and it remains unclear what proportion, if any, actually occurred during the night. It is also possible that nighttime collisions may be more prevalent in other geographic locations where wind patterns and other factors may differ.

Our research finds strike rates at high-collision sites to be significantly higher than previously reported. Other studies carried out in non-urban areas estimated about 30 collisions per year per building at various high-collision sites (Dunn 1993, Klem 1990, O'Connell 2001). At Manhattan's high-collision sites, well over 100 collisions were recorded annually. Additional anecdotal evidence from similar sites in Toronto, ON, Canada and Great Neck, NY suggests that even exteriors of 40 m or less can be associated with hundreds of collisions per year (Michael Mesure, pers. comm.; and Valerie DiNatale, Project Leader, Sterling Realty, Great Neck, NY, pers. comm.; respectively). Given that such sites can be found throughout the country, the true number of annual collisions may be higher than previously estimated.

In contrast with other research, we find that most collisions occur during spring and fall migration, involving mostly passage-migrants (Appendix 1). Both Klem (1989) and Dunn (1993) focused on sites with bird feeders, a fact which could have inflated the relative proportion of collisions that occur during winter. Both our results and those reported by Ogden (1996) and O'Connell (2001) indicate that sites without feeders witness significantly more collisions during spring and fall compared with summer and winter. More research is needed to accurately estimate seasonal strike rates across North America.

The increasing usage of exterior glass together with the continuing popularity of landscaping likely presents a threat to migratory bird species. Of particular concern are buildings that incorporate the characteristics of high-collision sites—large glass exteriors opposite abundant vegetation. Our findings suggest that more research is necessary to verify and document the role of such buildings in causing bird collisions, both in urban and non-urban environments. Given that our urban and suburban centers continue to expand into rural landscapes where many migratory birds can be found during spring and fall, this knowledge would prove very valuable in guiding efforts aimed at reducing bird collisions.

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Appendix 1. Totals of the 104 Species found from 1997–July 2008.

Scientific name	Authority	Common name	Total # found
Zonotrichia albicollis	Gmelin	White-throated Sparrow	884
Geothlypis trichas	Linnaeus	Common Yellowthroat	479
Junco hyemalis	Linnaeus	Dark-eyed Junco	377
Seiurus aurocapillus	Linnaeus	Ovenbird	330
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Colaptes auratus	Linnaeus	Northern Flicker	69
Dendroica magnolia	Wilson	Magnolia Warbler	62
Setophaga ruticilla	Linnaeus	American Redstart	56
Seiurus noveboracensis	Gmelin	Northern Waterthrush	55
Certhia americana	Bonaparte	Brown Creeper	54
Dendroica coronata	Linnaeus	Yellow-rumped Warbler	54
Turdus migratorius	Linnaeus	American Robin	50
Hylocichla mustelina	Gmelin	Wood Thrush	50
Catharus ustulatus	Nuttall	Swainson's Thrush	42
Archilochus colubris	Linnaeus	Ruby-throated Hummingbird	36
Troglodytes troglodytes	Linnaeus	Winter Wren	36
Vermivora ruficapilla	Wilson	Nashville Warbler	30
Passerella iliaca	Merrem	Fox Sparrow	28
Dendroica virens	Gmelin	Black-throated Green Warbler	26
Vireo olivaceus	Linnaeus	Red-eyed Vireo	26
Dendroica palmarum	Linnaeus	Palm Warbler	25
Catharus fuscescens	Stephens	Veery	25
Zenaida macroura	Linnaeus	Mourning Dove	24
Melospiza lincolnii	Audubon	Lincoln's Sparrow	23
Passer domesticus	Linnaeus	House Sparrow	21
Poecile atricapilla	Linnaeus	Black-capped Chickadee	20
Wilsonia canadensis	Linnaeus	Canada Warbler	19
Dendroica pensylvanica	Linnaeus	Chestnut-sided Warbler	19
Dendroica pinus	Wilson	Pine Warbler	19
Sitta canadensis	Linnaeus	Red-breasted Nuthatch	19
Passerina cyanea	Linnaeus	Indigo Bunting	16
Columba livia	Gmelin	Rock Dove	16
Pipilo erythrophthalmus	Linnaeus	Eastern Towhee	15
Piranga olivacea	Gmelin	Scarlet Tanager	15

Scientific name	Authority	Common name	Total # found
Troglodytes aedon	Vieillot	House Wren	14
Oporornis philadelphia	Wilson	Mourning Warbler	14
Pheucticus ludovicianus	Linnaeus	Rose-breasted Grosbeak	14
Catharus minimus	Lafresnaye	Gray-cheeked Thrush	13
Bombycilla cedrorum	Vieillot	Cedar Waxwing	12
Vermivora peregrina	Wilson	Tennessee Warbler	12
Dendroica fusca	Muller	Blackburnian Warbler	10
Sitta carolinensis	Latham	White-breasted Nuthatch	10
Wilsonia pusilla	Wilson	Wilson's Warbler	10
Toxostoma rufum	Linnaeus	Brown Thrasher	9
Cistothorus palustris	Wilson	Marsh Wren	9
Rallus limicola	Vieillot	Virginia Rail	9
Cyanocitta cristata	Linnaeus	Blue Jay	8
Coccyzus americanus	Linnaeus	Yellow-billed cuckoo	8
Icterus galbula	Linnaeus	Baltimore Oriole	7
Oporornis agilis	Wilson	Connecticut Warbler	7
Dendroica castanea	Wilson	Bay-breasted Warbler	6
Vireo solitarius	Wilson	Blue-headed Vireo	6
Sayornis phoebe	Latham	Eastern Phoebe	6
Carpodacus mexicanus	Muller	House Finch	6
Melanerpes carolinus	Linnaeus	Red-bellied Woodpecker	6
Dendroica petechia	Linnaeus	Yellow Warbler	6
Carduelis tristis	Linnaeus	American Goldfinch	5
Spizella passerina	Bechstein	Chipping Sparrow	5
Passerculus sandwichensis	Gmelin	Savannah Sparrow	5
Helmitheros vermivorum	Gmelin	Worm-eating Warbler	5
Icteria virens	Linnaeus	Yellow-breasted Chat	5
Spizella pusilla	Wilson	Field Sparrow	4
Zonotrichia leucophrys	Gmelin	White-crowned Sparrow	4
Quiscalus quiscula	Linnaeus	Common Grackle	3
Oporornis formosus	Wilson	Kentucky Warbler	3
Falco peregrinus	Gmelin	Peregrine Falcon	3
Baeolophus bicolor	Linnaeus	Tufted Titmouse	3
Empidonax flaviventris	Baird	Yellow-bellied Flycatcher	3
Hirundo rustica	Linnaeus	Barn Swallow	2
Megaceryle alcyon	Linnaeus	Belted Kingfisher	2
Vermivora pinus	Linnaeus	Blue-winged Warbler	2
Wilsonia citrina	Boddaert	Hooded Warbler	2
Seiurus motacilla	Vieillot	Louisiana Waterthrush	2
Dendroica discolor	Vieillot	Prairie Warbler	2
Vireo flavifrons	Vieillot	Yellow-throated Vireo	2
Fulica americana	Gmelin	American Coot	1
Falco sparverius	Linnaeus	American Kestrel	1
Coccyzus erythropthalmus	Wilson	Black-billed Cuckoo	1
Molothrus ater	Boddaert	Brown-headed Cowbird	1
Dendroica tigrina	Gmelin	Cape May Warbler	1
Caprimulgus carolinensis	Gmelin	Chuck-will's-Widow	1

Scientific name	Authority	Common name	Total # found
Picoides pubescens	Linnaeus	Downy Woodpecker	1
Sialia sialis	Linnaeus	Eastern Bluebird	1
Tyrannus tyrannus	Linnaeus	Eastern Kingbird	1
Contopus virens	Linnaeus	Eastern Wood-Pewee	1
Passerina amoena	Say	Lazuli Bunting	1
Empidonax minimus	Baird	Least Flycatcher	1
Icterus spurius	Linnaeus	Orchard Oriole	1
Family Strigidae	Wagler	Owl Unidentified	1
Carpodacus purpureus	Gmelin	Purple Finch	1
Ammodramus maritimus	Wilson	Seaside Sparrow	1
Porzana carolina	Linnaeus	Sora	1
Vireo griseus	Boddaert	White-Eyed Vireo	1