

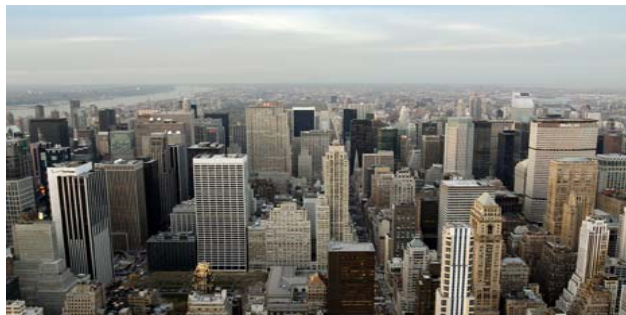
Spring 2004 Visible Night Migration of Birds at the Empire State Building, New York City, New York

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Greetings,

Attached please find our report, **Spring 2004 Visual Night Survey of Migrating Birds at the Empire State Building, New York, NY.**

The report is divided into two sections. The first is the scientific paper we have submitted for publication. The second part is Appendix A, and includes four hard to obtain articles about the night migration of birds in New York City in the late 19th and early 20th centuries.

In our study in Spring 2004, we observed over 3,000 birds migrating past the Empire State Building (ESB) at night from late April through late May. On big flight nights, it was an extraordinary experience. None of us will soon forget the views of birds racing past us like small shooting-stars over the galaxy of city lights below. On one particularly exciting night, more than 800 birds passed in a little more than three hours. We were able to see the migrants via the lights of the ESB. Though we could identify very few individuals to species, it was much fun watching these little creatures alternately flapping madly and then not. We also had Peregrine Falcons visit us on two occasions in Spring 2004...and while we did not see them hunting the migrants by the ESB lights (as we did in May 2002), we were just as happy to have them perch above us or fly about the building. These observations about Peregrine Falcons active at night are important scientific discoveries which we have written up and submitted for publication to the Journal of Raptor Research.

Unforgettable also was watching weather systems heading our way. Whether it was thunderstorms with lightning strikes approaching from New Jersey and then crossing the Hudson River to light up lower Manhattan, or fog rolling in from the Rockaways in Queens and Brooklyn, we had a bird's eye view of New York City's environment. On many nights, winds exceeded 20 mph, and such conditions made us aware of how different life is just above the city than down on the street. On a few occasions we would watch people through our binoculars walking quite happily on Fifth Avenue in their spring attire, while we shivered in our hats, mittens and coats not too far above them.

So what did we learn by doing this research? We feel comfortable in saying that the Empire State Building is not a significant hazard to spring migrating birds. Before we began this study, we had been concerned that the lights of the ESB might attract birds while they were migrating north and cause them to crash against the building. We watched many birds migrate past the ESB at night and did not see a single collision. After about May 10th, we did see a number of birds circling the ESB for up to 15 minutes. We also saw several of these birds that had been circling continue on their migration. Perhaps on foggy and/or rainy nights in spring some birds will collide with the ESB and other tall buildings in New York City. For this reason we suggest that the ESB adopt the practice of turning off its lights on foggy or rainy nights. However, our research tells us that there is good news: from about 8pm till 11:45pm during the peak of the spring migration season for small, neotropical migrants, the Empire State Building is not a hazard. Specific information can be found in our research paper included in this email. The report details our methods, discusses our results and makes recommendations to the management of the ESB and to New York City Audubon about how best to insure safe passage of night migrant birds in spring.

The second part of this report (as an Appendix to the Scientific Paper) is a collection of four articles about bird migration in New York City in the late 19th and early 20th centuries. Though we did not realize it when we began this research, the study of birds colliding with man-made structures dates back to at least 1887 in New York City. These late 19th century research efforts that began at the Statue of Liberty are also the foundation of the study of bird migration in North America, and in many ways the beginning of bird conservation in our country as well.

In 1886 the nearby Statue of Liberty was a new superstructure in the harbor. It was also one of the tallest structures in the area since the Woolworth Building and the Flatiron Building (New York's first skyscrapers) would not be built for another 25 years or so. And since electricity was also new on the scene, the Statue of Liberty functioned as a sort of a Lighthouse for the many ships leaving and entering the New York Harbor. Almost as soon as the lights were kept on overnight on Liberty's torch, birds began colliding with it (May 1887). Thankfully, the person in charge of security on the island at the time decided that the dead birds should be sent to the Department of Ornithology at the newly formed American Museum of Natural History. (Imagine if the security guard had decided it would be better to supplement his income by selling the dead birds with their exquisite feathers to the hat and dress makers of the city's millinery trade.) So the cause of science was advanced when the security chief, Colonel A. G. Tassin, decided that there was a greater good in sending the birds found dead on Liberty Island to the Museum, than in profiting from the bird deaths.

At the Dept. of Ornithology at the American Museum, the staff was intrigued with all the new bird specimens. At some point someone must have raised the question: what the heck are all these birds doing at Liberty Island at night? There is no habitat for them there... What is going on? Fortunately, the Chairman of the Ornithology Department, J.A. Allen, had in 1880 published a scientific paper about birds colliding with lighthouses at night along the Atlantic and Pacific Coasts, as well as the Gulf of Mexico. He must have had a strong suspicion, given the time of the year specimens were being sent to the Museum from Liberty Island, that the dead birds had been migrating at night. How to prove this?

Enter Jonathan Dwight. Not much is known about Mr. Dwight at this point (1887), but he would become a research associate of the Museum and earn a PhD in the coming years. And he would be a friend of Frank Chapman (more on him in a few moments) for the next two decades, since they had adjoining offices at the Museum. Somehow Mr. Dwight arrives at Liberty Island and is able to begin a study of the dead birds picked up there --- and finds that the Common Yellowthroat is the most frequently collected species.

Into the story now steps young Frank Chapman from New Jersey. (Mr. Chapman in the late 1890s would come up with the idea for the annual Christmas Bird Count that was first held in 1900, and each year subsequently. Chapman was also the founder of Bird-Lore, the magazine that would eventually become Audubon Magazine. He also shot 13 of the last 50 Carolina Parakeets for the Museum.) Chapman had worked as a banker in lower Manhattan until about 1883 when he was magically bitten by the bird watching bug. Through some great stroke of luck, the Museum was looking for volunteers to help them conduct a survey of the number and species of birds migrating through our area (spring 1884). Chapman participated and after that spring in which he ate, slept and dreamed about birds when not at his day job at the bank, he knew he wanted to be a professional ornithologist. However, that vocation was not quite

invented yet. One thing led to another and by 1887, Frank Chapman is employed at the Museum in the newly formed Department of Ornithology under Professor J. A. Allen.

By the late 1880s we have a number of disparate elements coming together: (1) birds crashing at night into the newly erected Statue of Liberty with its cluster of electric torch lights; (2) a newly formed Department of Ornithology whose Chairman had previously studied bird collisions at lighthouses throughout coastal North America; (3) a concern about the status of our native birds as a result of hunting, habitat destruction, and the very popular fashion of wearing dead birds and/or their feathers on dresses, hats, etc; and finally, (4) the scientific study of birds was an important endeavor at the newly organized American Museum and Linnaean Society of New York. So it was only natural that research in and around New York City would lead to some important discoveries.

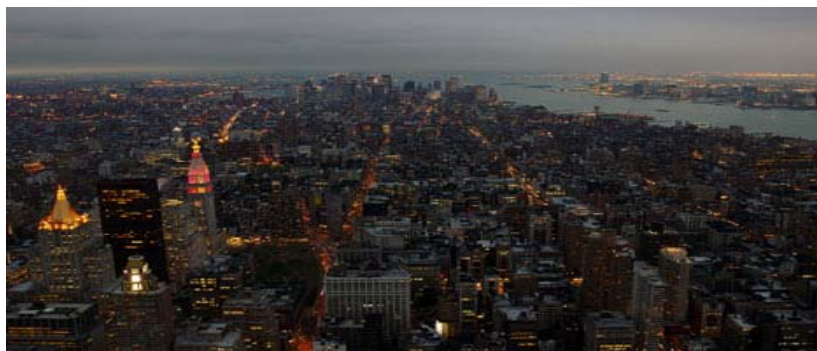
By 1887, astronomers at Princeton were being approached by ornithologists to observe the full moon at night to look for migrating birds. So it was that a Professor Young noticed birds passing across the big disk one autumn night in 1887. Soon after, Frank Chapman was assigned by the Museum from dusk until dawn to watch for night migrants near his home in New Jersey. This is the first bird study in our area to confirm what had been long suspected: that most birds migrate at night.

It was already well-known in the 19th century that when a cold wave passed (bringing northwest winds!) in late summer and autumn, a flurry of migrants also arrived in the New York City area. That observation remains correct till this day. However, if you read the Leslie's Illustrated Weekly editorial for 5 November 1887 closely, two other facts that were widely believed at that time come to light: (1) that birds frequently migrated several miles above the earth's surface; and (2) that the light of the Statue of Liberty was so bright at night that, "it can be readily seen how the intense light thrown upwards from Liberty's Statue would daze and blind the birds as they came within its rays, whose brightness makes all dark beyond them." Many scientists who now study night migration believe that most of the birds we care about (warblers, vireos, tanagers, orioles and other neotropical migrants) migrate somewhere between 1000-3000 feet - and not several miles above the earth's surface. Also, no one knows why certain kinds of birds migrating at night are attracted to lights... We will leave the resolution of that mystery to minds brighter than ours. It is believed that small birds who must flap (rather than soar) to migrate south prefer to do so at night since it is cooler to travel once the sun sets; and the structure of the atmosphere is better for night travel too since there are no bumpy thermals to disrupt active flight. The other reasons for migrating at night that William Beebe discusses in his 1954 article are still true: there are fewer predators at night, and it is then possible to feed by day in a stopover location such as Central Park.

William Beebe was born in Brooklyn and raised in New Jersey. While at Columbia University in the late 1890s, he was recruited away to become the first curator of ornithology at the New York Zoological Society (Bronx Zoo). In the 1930s he became world famous for the deepest descent in the ocean via the Bathysphere. In 1904 when Beebe spent one night at the Statue of Liberty, it was already 15 years after Jonathan Dwight, Jr. and others had done the pioneering studies there on nocturnal bird migration. Beebe's description of that night remains the most poetic one, however.

Exactly one hundred years after William Beebe spent a night in the crown and torch of the Statue of Liberty (May 1904), we were doing our study of the visible night migration of birds at the Empire State Building. From what we can determine, ours is the first study of its kind at the ESB. And in North America, it is one of only a handful of studies that have focused on how birds behave at night when approaching the lights of a tall structure. We ask that you have a look at our observations and recommendations. And we also ask that you join us this autumn for a night of watching migrants moving south over Manhattan. Email us for details.

Just as Allen, Dwight, Chapman and Beebe depended on others to help with their research at the Statue of Liberty, we too could not have done ours without the help of our friends and colleagues. We wish to thank Ms. Lydia Ruth of Helmsley-Spear, Inc. for arranging free and easy access to the Observation Deck of the Empire State Building in order to do this study. Ms. Ruth and the entire ESB staff have been delightful to work with, and are very interested in the results of this study. They have been a model of how the private sector and scientists can work together to quickly and effectively achieve shared goals. We also want to gratefully acknowledge the fine work done by Rebekah Creshkoff and her team of citizen-scientists from New York City Audubon. Project Safe Flight has been instrumental in rescuing migrant birds that have collided with buildings, and simultaneously raising awareness about migratory birds to workers and executives in Manhattan. Chad Seewagen and Eric Slayton of the Wildlife Conservation Society's New York Bird Monitoring Program kindly granted permission to photograph birds along the Bronx River during their magnificent ringing study of migrants in our area. We thank Jorge Santiago and John Delaney for bringing to our attention some of the historical information used in this report. Dr. Dan Klem, Jr. read early versions of this report and made many helpful recommendations for improvement. We wish to acknowledge the pioneering work in the field of nocturnal bird migration by Dr. Sidney Gauthreaux of Clemson University, and Dr. Paul Kerlinger of Curry & Kerlinger, LLC. Finally, we wish to thank the many birdwatchers that came up to the Observation Deck of the Empire State Building to help us count and enjoy the night migrants. Funding for this study came from Alice Barner and Patricia Essler, as well as the authors. If we have been able to discover anything in this research, it is because we stand on the shoulders of such friends and colleagues.



Looking South at Dusk from the ESB – April 2004

INTRODUCTION

In North America, reports of birds striking towers and other man-made structures date from the late 19th century (Coues 1876; Allen 1880). Since the 1950s, several studies have examined the composition and causes of large kills of night migrants at towers and buildings (see Dennis 1954; Johnston and Haines 1957; Brewer and Ellis 1958; Kemper 1996). Most nocturnal bird collisions occur on nights with inclement weather primarily in September and October, and at towers with fixed or flashing white lights. Small, nocturnally migrating songbirds such as warblers and sparrows are the ones most likely to be killed. A summary of the extensive literature on the subject is provided by Avery et al. (1980), Trapp (1998) and Kerlinger (2000).

In New York City, ornithologists first reported the deaths of nocturnal migrants from collisions with the torch of the Statue of Liberty beginning in 1887 (see Anonymous 1889; Beebe 1954). Large numbers of birds killed during migration at the Empire State Building on the night of 11 September 1948 drew media attention to the problem (Anonymous 1948; Pough 1948; Aronoff 1949). In the mid-1950s, the National Audubon Society negotiated an agreement for night lights to be turned off on the Empire State Building (ESB) during spring and autumn migration (Anonymous 1957). Since the early 1980s, New York City Audubon has worked with officers of the ESB to maintain this “night lights out” program, similar to the program established in Toronto, Canada (see Evans 1996). Beginning in autumn 2001, lights illuminating the upper floors of the ESB have remained on all night. While this situation has concerned birdwatchers, the effect(s) upon nocturnal migrants passing the ESB have not been studied. Here we report a spring 2004 count of nocturnal migrants at the ESB, and some observations about the behavior of the birds in regards to the lights of the building.

MATERIALS and METHODS

In spring 2004, from 19 April through 25 May (inclusive), a visual count of night migrating birds was made from the 86th floor Observation Deck (elevation 321 meters/1050 feet above sea level) of the Empire State Building (ESB) in New York City. At 385 m (1254 feet) above sea level, the ESB is the tallest structure in New York City, and provides an unobstructed view to the horizon in all directions. The majority of the night migrants were counted from the southwest corner of the deck since they primarily passed on the west side of the building. Birds were easily observed via the metal halide spot lights used to illuminate the upper floors of the building, combined with the fluorescent lights of the tower rising above the Observation Deck. The tower fluorescent lights were turned off at midnight, while the metal halide lights remained on all evening.

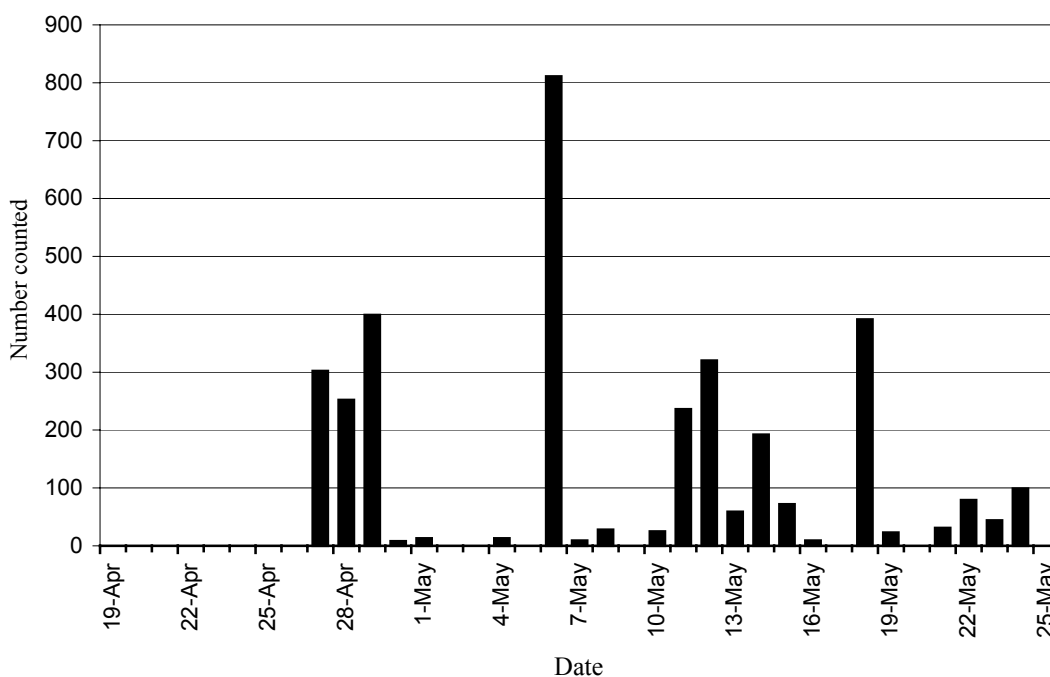
Migrating birds were counted by one observer occasionally using 8x binoculars and assisted at times by others who acted as spotters. Observations began at approximately 8pm nightly and usually ended at 11:45 pm when the Observation Deck was closed to all visitors. Weather conditions (wind speed, barometric pressure, temperature, humidity) were monitored hourly from the Observation Deck throughout the evening with a hand-held “weather station,” the Kestrel 4000 (Nielsen-Kellerman Corporation, USA). Wind direction was determined with a compass. Precise time of sunset was obtained from data posted on the web site of the local weather service.

Observers scanned primarily south for approaching migrants. An individual was considered a migrant if it passed south-to-north across an imaginary east-west line at the watch site, and continued north out of sight. On big flight nights (> 100 migrants) after 10 May, it was sometimes difficult to determine exactly the number of migrants passing the tower. We were particularly interested in birds that “circled” the tower and/or Observation Deck. In circling behavior, birds were observed approaching the ESB and then making a complete, though loose circle (oval) around the building. Sometimes the migrants would go out of sight as they dropped below eye-level or flew away (and out of the light) from the building. Because of the number of birds circling on big flight nights, on a few occasions, it was necessary to estimate the actual number of migrants.

RESULTS

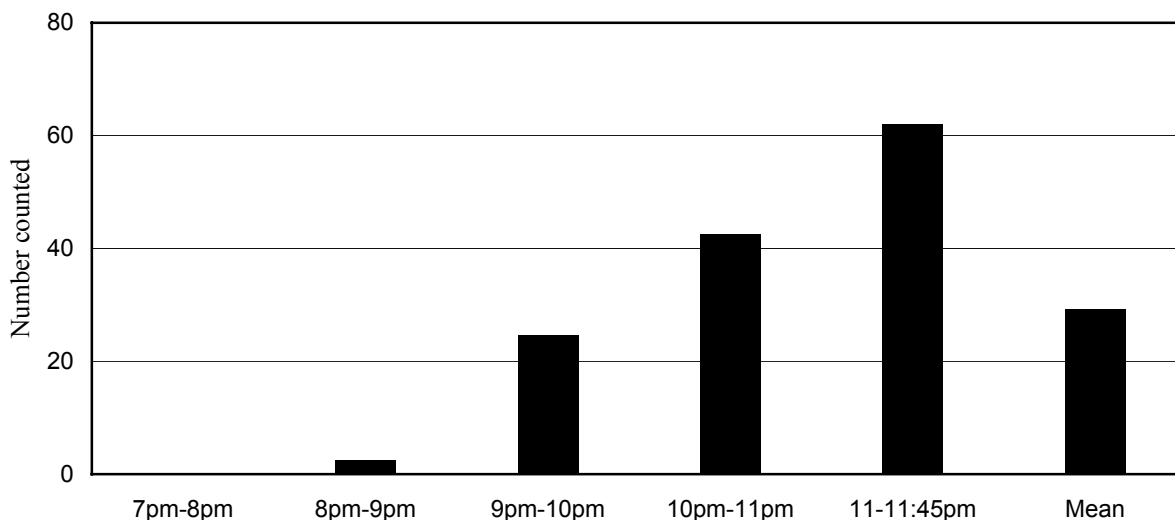
In total, we counted 3,415 migrants in 117 observation hours (Ave. = 29.2 birds/hour) on 33 evenings (Figure 1). It was possible to detect small migrants that flew within approximately 40 m of the Observation Deck and/or approximately 20 m above the top of the tower. Very few (161) migrants could be identified to species or even particular groups of birds. These were shorebirds (103), waterfowl (29), gulls (18), loons (4), as well as Black-crowned Night Heron (5) and Common Nighthawk (2). On two occasions, Peregrine Falcons landed after dark on the tower above the Observation Deck. Lone bats were observed migrating on four evenings.

Figure 1. Number of Migrants Counted from 19 April through 25 May 2004 at the Empire State Building, New York, NY.



On average, the first migrant was seen 65 minutes past sunset each evening. Our data suggest that the number of migrants passing the ESB peaked after midnight (Figure 2). Significantly more migrants were seen when winds were from the south to west, than when winds were from other directions ($\chi^2 = 923.1$; $p < 0.05$). The majority of migrants (71%) were seen when winds were >10 mph. Significantly more migrants were observed with rising rather than falling or steady barometric pressure ($\chi^2 = 406.3$; $p < 0.05$). On flight nights when more than 50 migrants were seen, significantly more migrants were counted when skies were partly cloudy ($< 80\%$ cloud cover) or clear, than when it was mostly cloudy (80-100% cloud cover) or foggy ($\chi^2 = 6.3$; $p < 0.05$). Both the highest single hour count (319) and highest evening count of migrants (811) occurred on 6 May with west to southwest winds, rising barometric pressure and mostly cloudy sky conditions. On big flight nights, it was our impression that passerines typically arrived in waves or “loose associations” of 5-15 migrants throughout the evening, and not randomly nor in tight flocks. Migrant birds used “bounding” flight (*sensu* Kerlinger 1995). Migrants seemed to fly at higher elevations when winds were light (< 12 mph) than when winds were at least 15-20 mph.

Figure 2. Average Number of Migrants Counted/hr at the Empire State Building, Spring 2004, New York, NY.



No migrants were observed striking the Observation Deck or the Tower of the ESB during this study. Occasionally till about 10 May 2004, up to 5% of the migrants on big flight nights were observed circling the tower of the ESB for 1-5 minutes before resuming migration. On one occasion, a migrant circled the tower for 25 minutes (8 May 2004). After 10 May, more migrants (up to 25% on big flight nights) circled the tower for longer time periods (≤ 15 minutes). As many as 40 were observed circling at one time on such nights. Though we could not determine how long an individual bird may have circled the ESB on these big flight nights, it seemed as though the number of birds circling would increase, and then decrease, at intervals. On several occasions we saw birds that had been circling continue north and out of sight. We could not be completely certain if others landed or struck the building below the Observation Deck. Overall, light winds (< 12 mph) and cloudy skies ($> 50\%$ cloud cover) were associated with higher numbers of migrants circling the tower. On nights with strong winds (> 20 mph),

some migrants attempted to circle the tower, but had difficulty flying back against the wind. Many of these remained aloft on the lee side of the tower before resuming migration with strong, southerly tail winds.

DISCUSSION

Studies of bird collisions at towers indicate that structures taller than 120-160 m kill many more birds than smaller ones (Kemper 1996; Kerlinger 2000). Since most small, nocturnal migrants travel with favorable tail winds primarily at altitudes between 200 to 700 m (Gauthreaux 1991; Kerlinger 1995), the Empire State Building provides a unique opportunity to study this migration and to observe the behavior of the migrants as they approach the building lights. Our results suggest that the Empire State Building, a lone, super-structure rising sharply above the surrounding buildings of mid-Manhattan, is not an important obstacle to nocturnal migrants in spring. We did not see a single bird strike either the building or the tower during this study. However, since we were not able to observe the migration after midnight, we do not know if the behavior of the migrants changed after this time due to fatigue or other unknown factors. We also do not know if the illuminated lower floors of the building proved to be hazardous to migrants throughout the night.

Migrants behaved differently in regard to the building lights early vs. late in the migration season. Before 10 May, we rarely saw migrants circling the tower or building. After this time, especially on foggy nights or when skies were 100% overcast, small birds were more likely to circle the ESB. It seemed to us that their migration was delayed by up to 15 minutes and otherwise not affected to any great degree. We were able to visually verify that some of the birds that circled were able to continue their migration. Similar observations to ours about the behavior of small birds circling illuminated towers at night have been made by Cochran and Graber (1958) and Larkin and Frase (1988).

Studies have also shown that birds collide with towers and buildings principally on foggy evenings or nights with low cloud cover, since the migrants are forced to lower elevations by inclement weather (Seets and Bohlen 1977). In Manhattan in spring, fog occurs with easterly winds that bring in cool, moist air, while most migration was observed when winds were from the south to west. Migrants such as gulls, waterfowl, shorebirds and even bats were not attracted to the lights of the ESB at any time in any weather conditions during this study.

Recommendations. (1) In the past, the management of the ESB kindly agreed to turn off building lights at midnight during spring and fall migration seasons. The current policy is to turn the lights off the upper floors when significant numbers of birds are observed circling the ESB. We suggest a policy of lights out on a limited basis to help ensure a safe flight: on foggy and rainy nights from late April through late May, and again in September and October. We also suggest that New York City Audubon provide a descriptive flyer (handout) to be distributed to Security Guards and other personnel who work on the Observation Deck of the ESB. Readily available information would make these important observers aware of what to look for on potential problem nights. In this way, observers could notify the ESB engineer in charge of lighting to turn off the lights on nights when significant numbers of birds are seen circling the tower. (2) We recommend that a co-operative study be undertaken by the New York City Audubon and representatives of the ESB to collect any dead birds from the lower floors and street level of the

building. By combining a survey of the number of birds killed (if any) with a night count of migrants, it should be possible to determine whether or not there is a correlation between the number of birds migrating on a given night, and the number of birds killed. (3) Finally, future studies should be considered from midnight to dawn in order to determine if the number and behavior of migrating birds varies significantly from those observed from 8 pm through 11:45 pm.

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Appendix A

From: The Editorial Page of Leslie's Illustrated Weekly for the week ending October 15th, 1887.

The Birds, and Liberty's Light.

The torch bearing Goddess of Bedloe's Island does not trim her hat with humming-birds, nor adorn her robes with the bright plumage of feathered creatures. She is, nevertheless, an innocent cause of death to a great many birds, of all sizes and colors, and representing numerous species, without discrimination. The fatal instrument of decoy and destruction is the vast cluster of electric lights which she holds aloft in her right hand, three hundred feet above the waters of the sea, and whose powerful rays are visible to the human eye at a distance of nearly forty miles. This is the season of migration and the number of winged wanderers of the air that dash themselves against the deceptive beacon, and fall back stunned or dead, is almost incredible. One morning recently, after the first cold wave had set the birds flying southward, the officers on the island picked up no less than 1,375 downy little dead bodies. Many of them were beautiful creatures, and the sight was pitiful. There were among them specimens of more than one hundred distinct species. The largest bird was a Canadian woodpecker measuring thirteen inches from wing to wing. The smallest was an exquisite little humming-bird, one inch long.

An examination proved that the heat of the light had blinded the unfortunate creatures. In some cases their brains were actually roasted. Comparatively few of them were dashed to death, but nearly all were fatally burned or blinded.

There will, no doubt, be more or less victims all through the season. Colonel A. G. Tassin, the commander of the military post, does not dispose of the bodies to the milliners as he might. He favors science in preference to fashion, and sends the specimens to museums. As to the occasional game-birds, their dressing is no doubt confided to that practical kitchen taxidermist, the mess-cook.

Citation:

Anonymous. 1887. The birds and Liberty's light. Leslie's Illustrated Weekly No. 1,674. Vol. 65: 134. (15 October 1887)

There was also a cover black and white illustration on that week's issue which showed many (perhaps 100) birds dead/dying in the area of the torch of the Statue of Liberty. This was the caption to that illustration: "Liberty's light a lure to death. – Thousands of birds blinded and killed by the flame in the Statue's hand. – Thirteen hundred and seventy-five perish in a single night."

From: New York Times 14 November 1888

BIRDS AND THEIR HABITS

Discussed by the Ornithologists Union. Feathered travelers killed by striking the Statue of Liberty

"..... Jonathan Dwight, Jr. read an interesting paper on 'Birds that have struck the Statue of Liberty, Bedlow's Island, New-York Harbor.' He said that on account of its lighter color more birds strike the pedestal to the Statue than the Statue itself. The Statue was erected too late in 1886 for the migratory birds, and none struck it that year. The first to strike it was May 19, 1887, and the next late in August, when the lights were said to be put out by birds. Mr. Dwight read a highly-colored newspaper account of the killing of nearly 1,500 birds on the night of Aug. 22-23, its statements exciting much merriment. He said it was utterly untrue that birds were burned or roasted, except in the case of one or two birds which had fallen near the heat. The slaughter of birds on this occasion was due to the first cold wave of the year, which started the migration. Mr. Dwight also read newspaper accounts of the slaughter of 1888, one account stating that in a single night 500 birds were killed. The first date at which birds struck the Statue was Aug. 5, when 14 were killed. A few others were killed during the month, and a considerable number in September and October. Oct. 24 was the last date at which birds were killed. The whole number killed this year was 690, which was considerably less than in 1888 or 1887. Mr. Dwight began visiting Bedlow's Island Sept. 19 this year and had studied the birds and recorded the species. He found that every cold wave in the early fall was followed by migratory birds flying against the Statue. Of the dead birds picked up this year, 60 per cent belonged to one species, the Maryland yellow throat. The remaining 40 per cent included a great variety."

"Discussion followed as to the effect of darkness in causing the destruction of birds and as to whether sparrows and hummingbirds were ever among the migrants killed."

Citation: Anonymous. 1889. Birds and their habits. New York Times Vol. 38: 4 (14 November 1889).



Common (Maryland) Yellowthroat

From: Editorial Page of Leslie's Illustrated Weekly for the week ending November 5th, 1887.

BIRDS AND LIBERTY'S STATUE

Readers of Frank Leslie's Illustrated Newspaper will remember the illustration, given in a recent issue of the destruction of birds by the electric lights of Bartholdi's Statue. In connection with this subject there is an interesting scientific fact of recent discovery. The question as to why the birds are found there at night naturally occurs to every reader. The poets tell of the feathered warblers retiring at nightfall to bush and brake, and excepting owl or bat, they are not supposed to be circulating about the sky at night like moths around a candle. Does the vivid light fascinate and draw them from the bushes where they are resting? This might be true of a lighthouse where a fertile country bordered the sea. But the Statue of Liberty is more than a mile from land. Bedloe's Island is not suited for a resting place for migrating birds in large numbers, and the roofs and tenements of New York and New Jersey, which surround the Statue, have never been known as their resorts.

The answer to this interesting enigma was given recently by Professor Allen, the Ornithologist of the American Museum of Natural History in New York. Quite a number of birds which had dashed on the lights of the Statue and perished were given Mr. Allen for the Museum. Birds, when migrating, he said, it is now accepted, fly by night, and frequently at a height of several miles above the earth's surface. This had been conjectured for some time, but it is only within two or three years that the fact was established. The circumstance was noted a short distance from New York at Princeton University, and by accident. Professor Young, the astronomer, was making a series of observations late in the night with a friend who is an ornithologist, when the latter saw objects passing between the telescope and the disk of the moon. He recognized them as birds, and became so much interested that the astronomical observations were for the time suspended. Although the birds were flying at a distance of several miles, he was able to distinguish several varieties.

During the past month, Frank M. Chapman, of the American Museum, has conducted for Mr. Allen a series of observations from Tenafly, New Jersey, to verify this fact. The result has been successful, and has contributed further information on the subject. A six-and-one-half-inch telescope was directed over the Valley of the Hudson, following the moon as she rose from the horizon. Through the small area covered by the instrument, 262 birds were counted between eight in the evening and daylight the next morning. The varieties were easily distinguished. Most of them were sparrows, but there were numbers of Carolina Rails and one duck. At first they were seen rising at an angle from the ground, but as the moon rose higher, they could be observed flying along in a line parallel to the earth. The height which many of them attained enabled them to avoid local storms, and it is believed that they flew at a great height partly for this reason, as well as to keep in view better the landmarks by which it is known birds are guided in their migrations. They follow the course of valleys, especially those running north and south, and the range of hills would be quite distinct by starlight above strata of local clouds. During severe and widespread storms it is not as though that they continue their course. Just before daybreak the birds appear to descend and feed. During the day they rest, taking up their flight again in the evening, until their destination is reached. Flying at the height they do along the Hudson Valley, it can be readily seen how the intense light thrown upwards from Liberty's Statue would daze and blind the birds as they came within its rays, whose brightness makes all dark beyond them.

Citation: Anonymous. 1887. Birds and Liberty's Statue. Leslie's Illustrated Weekly No. 1,677. Vol. 65: 179. (15 October 1887)



Fog below the Observation Deck of the ESB – May 2004

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Citation: Chapman, F.M. 1888. Observations on the nocturnal migration of birds. Auk Vol. 5 (1): 37-39. (Jan.-March 1888)

OBSERVATIONS ON THE NOCTURNAL MIGRATION OF BIRDS

Frank M. Chapman

MR. W. E. D. SCOTT'S papers on this subject (Bulletin Nuttall Ornithological Club. Vol. VI, pp. 97, 188) have not to my knowledge been followed by any of a similar character, and, the facts to be determined being of such vital interest, I feel urged to present the results of my own observations, limited though they be, as a slight contribution to the larger amount of data we must amass before arriving at any strictly accurate conclusions concerning every phase of the nocturnal journey of migrating birds.

The following notes were obtained with the assistance of my astronomical friend, Mr. John Tatlock, Jr., on the night of September 3, 1887, at Tenafly, New Jersey, about three miles west of the Hudson River, Mr. John F. Paulison most courteously having placed his observatory and 6-inch equatorial telescope at our disposal. The most important facts to be determined in observations of this nature are, of course, the height at which these flights occur, and also the number of birds which cross the field of view at any given time.

The method adopted was the same as that used by Mr. Scott, the telescope being pointed at the full moon, which served as a background, showing with wonderful distinctness the birds as they crossed, the observer calling to the recorder as each bird came into view, the latter noting the time. These observations appear in the following table, where also are given the apparent altitudes of the moon computed at ten minute intervals during the period of observation.

From the altitudes are computed the heights at which the birds in the field at that time were probably flying. The problem of determining this height exactly is not, so far as we can now judge, capable of definitive solution, for the reason that we have no means of ascertaining the distance of the bird from the observer. In this case, therefore, we are compelled to resort to an hypothesis of the probable distance at which a bird was visible, and we thus assumed that the least distance from the observer at which a bird could be seen was one mile, the greatest five miles, feeling sure that, in accepting these limits, we do not over-estimate the greater distance.

In this connection the appearance of the birds as they crossed the field is of great importance, those which passed more slowly being obviously the ones at the greater distance; and in this class are included the few possessing some marked characteristic of flight which rendered identification possible; these were as follows: at 8:34pm a Grackle, at 9:22pm a Carolina Rail, at 9:26pm two Carolina Rails, at 9:30pm a large Snipe, at 9:33 a Carolina Rail, at 10:15pm Carolina Rail, and at 10:44 a Duck.

The major portion, however, passed at what may be termed the middle distance, or, in other words, too rapidly for us to more than distinguish that they were birds. During the first half hour of observation a number of birds were seen flying upward, crossing the moon, therefore, diagonally, these evidently being birds which had arisen in our immediate neighborhood, and were seeking the proper elevation at which to continue their flight, but after that time the line of flight was parallel to the earth's surface, the general direction being south.

In the appended table the figures given in the vertical columns headed 1, 2, 3, etc., are the numbers of birds observed per minute, the time being found by adding to that of the left-hand column the desired number at the head of the column following; to the right appear the totals and altitudes.

In conclusion I desire to express my thanks to Mr. Paulison for so courteously permitting us to use his observatory, and especially to my friend Mr. Tatlock, who, in preparing its astronomical portion, deserves entire credit for whatever value this paper may possess.

TABLE SHOWING TIME AND APPROXIMATE HEIGHT AT WHICH THE BIRDS OBSERVED FLEW.

Table 1. Night Migration at Tenafly, NJ on 3 Sept. 1888											Total No. Birds	Moon's approx. alt.	Height, inf. Limit (feet)	Height, sup. Limit
Time	0	1	2	3	4	5	6	7	8	9				
8:00pm	1										1	7.0	600	3200
8:10	1										1	8.8	800	4000
8:20					1						1	10.6	1000	4900
8:30	2				1	2				1	6	12.4	1100	5700
8:40	1	2	1		1	1	2	4	7	1	20	14.2	1300	6500
8:50	1	1	1	2	4	3		2	7	3	24	16.0	1500	7300
9:00pm		1		2				2	2	3	10	17.7	1600	8000
9:10	5	1	2	2	4		3		2	2	21	19.5	1800	8800
9:20	7		6	5	4	1	7	4	5	5	44	21.2	1900	9500
9:30	4	1	5	6	6	4	3	1	2	2	34	22.8	2000	10200
9:40		2	2		1	4	2	2	1	1	15	24.5	2200	11000
9:50		1	1		1	1					4	26.1	2300	11600
10:00pm	3			1			4	3	4	1	16	27.6	2400	12200
10:10	1		1	1	1	3	1	1	2	1	12	29.2	2600	12900
10:20	3		5	1			1	1	1	1	13	30.8	2700	13500
10:30			4		1	1	3	2			11	32.1	2800	14000
10:40			1	1	1	3	1	4	2	5	18	33.6	2900	14600
10:50		2	1	1	1		2		1	3	11	34.8	3000	15100
Total No. of Birds Observed migrating in 3 hours											262			

From: Animal Kingdom – Spring 1954 Issue

MIGRATION NIGHT --- 1904

WILLIAM BEEBE

This article was originally written for the March-April 1954 issue of Animal Kingdom, the forerunner of the New York Zoological Society Magazine now called Wildlife Conservation. The article was also included in a book by Dr. Beebe, Unseen Life in New York, from Duell, Sloan and Pearce (Little, Brown), and published in ca. 1956.

To write honestly and with conviction anything about the migration of birds, one should oneself have migrated. Somehow or other we should dehumanize ourselves, feel the feel of feathers on our body and wind in wings, and finally know what it is to leave abundance and safety and daylight and yield to a compelling instinct, age-old, seeming at the time quite devoid of reason and object.

We are concerned here only with the unseen in New York — the nocturnal aspects of bird migration. Most small birds migrate at night apparently with two outstanding advantages. The first is avoidance of attacks by hawks and other enemies, and second, the use of hours when feeding is impossible. Students of migration must blame these night activities for creating a mental hazard in themselves, of utter confusion. If all birds migrated in the daytime, migration might be explained, at least in part, as a matter of eyesight. Night voyaging upsets all such theories and we must admit we have no clear-cut explanation of how birds find their way through hour after hour, and night after night of darkness, and over hundreds and thousands of miles of land and sea.

In New York City, there are three excellent methods of watching migration, and even if you do not know one bird from another, you cannot help being deeply interested by the instinct which carries these frail little beings up into dark, cold, naked space, perhaps a half-mile above the planet.

Our first method is a daylight one and hence to be dismissed in a few words. It is the observation of hosts of the birds themselves, as at dawn they glide down from their lofty levels of flight to trees and bushes on the ground. Here, in the hours of daylight, they must find time for sufficient restorative sleep and a frantic search for insects — to refuel their little stomachs for the energy needs of continued flight.

The second method is unique and requires only patience, a deck chair on a flat roof or lawn, a pair of binoculars and a full, or nearly full moon. With the said moon at a reasonable elevation the procedure is simply to rest, relaxed, with eyes focused through the glasses on the bright satellite, and await what luck and chance offer.

Perhaps already faint chirps have hinted of passing migrants, and perhaps we have let our imagination play with the results of sudden daylight illumination. The heavens would be pitted and flecked with hundreds and thousands of flying birds. This we can never hope to enjoy, but the moon cuts a narrow swath of illumination through the sky. From two hundred and forty thousand miles away, down to our very retina, the darkness of night is penetrated by a tube of light, brilliant and transparent to our vision.

Your eyes may be focused on lunar deserts and craters, when a small black dot may be seen to pass across the disk. Another follows, and somehow your eyes become focused in mid-space, and the third dot is recognized as a bird. Your neck will ache, your eyes tire, but your imagination and enthusiasm cannot flag. The very next speck may show a type of fluttering, or a looping dip which may identify the species or group. The birds in the moon will, forever afterwards take precedence over the man-in-the-moon.

The third method of watching migrants follows: many years ago (50 to be exact, in 1904) I had a memorable experience watching birds on migration, high in the air, within the limits of Greater New York. In company with Mr. Madison Grant, Secretary of the Zoological Society, I obtained permission from the city authorities to spend the night top of the Statue of Liberty. This was about mid-May, a time when the migration ought to be at its height. We caught the last boat to Bedloe's Island, and on its return trip it carried away the final sightseer, reducing the population to the Superintendent, his assistant, Mr. Grant and myself.

My first activity was rather comparable to mountain climbing. It was not the actual mounting of one hundred and sixty-eight steps from the base to the summit, but the difficulty of toting a blanket, lantern, food and binoculars up the narrow convolutions of the circular stairway. I finally had to make two trips, and unloaded in the crown of the noble goddess. As if I were planning an assault on Mount Everest, I made my base camp in the crown and my advance perch or roost in the torch.

In early evening, a downward look toward the water of the bay, three hundred feet below, showed the wake of tugs and steamers, stretching out in long, well-defined lines, intersecting one another like the strands of a gigantic, waving cobweb. The day had been clear, but as the sun sank lower, clouds collected, and soon there began the most wonderful of earthly sights — an ever familiar, ever-new sunset. The sun became obscured but I knew when it sank below the hidden horizon by the sunset guns echoing from fort to fort.

Half an hour later the whole outlook had changed. After the beacon of the statue had been turned on, a feeling of complete isolation became very real, and the distant glimmering lights of the city made the sensation more intense. One felt suspended in midair with no apparent contact with sea or land.

I climbed the vertical ladder on the narrow duckwalk around the torch itself and prepared to take a short nap before beginning my migration vigil. Hardly had I closed my eyes when a new characteristic of the copper giantess became apparent — she swayed. I was told this oscillation was through a twenty-four-inch arc, back and forth, and that it had something to do with the safety stresses of the whole structure. As long as I remained conscious, the movement was soothing, somewhat like the swinging of a hammock. When sleep closed down, the mobility changed from oscillation to acceleration, and several times I awoke and sat up terrified, certain that the massive figure was hurtling toward the ground. I have had a similar sensation three other times, in the midst of sickening waves of violent earthquakes.

The night had suddenly turned cold, a breeze arose and I changed my pallet to the wooden platform at the head of the stairway. With the rising wind the hollow statue came to life. During the day, with many people passing up and down, the echoes would be confused and not particularly noticeable. With the absence of humanity and the presence of a wind, the sounds became weird and awesome. I dropped a loose bolt which I had picked up, and the reverberations increased by echoes and distance, until, from far down, they sounded like thunder on distant mountains. The scratching of a pin was taken up and magnified until the squeakings died out in the uttermost coppery hollows. When I laughed and shouted aloud, there resulted a pandemonium of tortured devils yelling back at me. Long after all seemed quiet, a faint squeak, squeak, came softly to the ear, perhaps a mouse feeding on crumbs dropped by some sightseer.

At eleven o'clock I mounted again to the torch. The wind had quieted down, but haze was drifting up the bay and down from the sky. Every few seconds the sound of bird voices came from overhead; the peet-sweet of a sandpiper, the croaks of perhaps a Green Heron, the thin notes of warblers and the more palpable chirps of sparrows. The haze changed to fog, and now, to the chorus of bird voices, there was added the occasional, distant, sonorous bass of a foghorn. Several times birds called from below my level, and then, without warning, something hurtled past my head, struck, and fell at my feet — a warm, palpitating but dying Magnolia Warbler.

The most surprising event of the entire night was a burst of song from two birds, heard a half-hour apart. The first, I am certain, was a Red-eyed Vireo. Five of the brief, thrush-like phrases came to my ear. The first was dim in the distance, three others were hurried and close, one almost as the bird actually passed almost within sight. The fifth was half lost in a foghorn. The second song was an unmistakable four-syllabled utterance of a goldfinch. A single phrase came out of the fog, then the beginning of a second, apparently given as the bird passed, for the call rose into an indeterminate screech as it receded into the distance. I wondered at the emotion — a perfect example of displacement behavior — which prompted such an utterance under such inappropriate conditions.

As the fog increased and condensed in the warm to almost rain, birds began to pass through the periphery of illumination, then to strike intermittently, against railing and glass. I could crouch low behind what protection I could find, to avoid being hit. One warbler flew against my coat and sank down panting. They came in waves, a few scattered birds, then a mob, swift and dense as a swarm of golden bees. All appeared bright and shining as they passed. Occasionally a dozen or more would seem to come in obliquely to the general line of flight, and at slower

speed. In this case they would all keep on to the light, but put their feather brakes on in time, so that I would have five or six sparrows clinging to me unharmed, wings spread, heads back, panting.

For the period of a few hours I was permitted to share the feelings and activities of birds on migration, sensing altitude, isolation, darkness, wind, speed, and the awful confusion and dangers of light-in-fog.

At three o'clock in the morning, the fog had lifted, and there was neither sight nor sound of a bird. They had flown down somewhere to a precarious landing in the thinning fog, or had re-ascended to migration levels. I climbed again into the torch and watched for the first hint of dawn and life. The first came almost imperceptibly as a pale line of gradually brightening light; the latter was startling. A Herring Gull, all gray and white, swung swiftly toward me from the direction of the sea, shrieked when it saw my muffled figure and passed up the river. The gull presented a double surprise for at this time of the year it must have been a maverick of sorts, and should have been with its fellows on some distant breeding grounds. Prosaic tugs appeared and smoke arose from a hundred chimneys: a new day had begun over New York City.

I descended and joined Mr. Grant. He had been with me for an hour of migration watching, but after that had chosen to finish the night in a guest room at the foot of the Statue. Later on we picked up two hundred and seventy-one dead birds on the ground around the base. We were told of one tragic night when more than fourteen hundred lost their lives. Thanks to the protests of bird lovers and especially half-dazzled pilots of passing vessels, the light of the Statue was diminished and rendered indirect, so that in more recent years, there have been very few avian casualties. A visit today to the Statue of Liberty must be as memorable as ever, except that access to the torch is no longer permitted to the public.

In the intervening half-century Miss Liberty has witnessed many radical changes within her field of view. Perhaps the most spectacular are the non-migratory airplanes which roar past day and night, guided by compass, radio, radar and other direction-finding gadgets. Far overhead numberless birds are still passing, exactly as they have for thousands upon thousands of springs and autumns, guided by means which still are a mystery to us.

Citation:

Beebe, W. 1954. Migration Night – 1954. *Animal Kingdom* 57 (2): 54-57

On two walks along 14th street in Manhattan in about 1884, Frank Chapman recorded the number of bird species seen adorning the hats of women shopping on that street. Those birds he could identify ranged from small ones such as the Wilson's Warbler, to mid-sized Scissor-tailed Flycatchers and Pileated Woodpeckers, and even larger birds including Laughing Gulls. Altogether, 40 bird species were identified...



Black-and-white Warbler



Sunset – Looking West in May 2004