ANNOTATED BIBLIOGRAPHY OF BIRD KILLS AT MAN-MADE OBSTACLES: A REVIEW OF THE STATE OF THE ART AND SOLUTIONS

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You could not see a cloud, because
No cloud was in the sky.
No birds were flying overhead
There were no birds to fly.

The Walrus and the Carpenter
Lewis Carroll - 1871

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PREFACE

The following bibliography was prepared with the requirement it provide the necessary sources of information to help plan strategy in minimizing the growing problem of kills of migratory birds at man-made obstacles. A total of 471 references is presented and, in many cases, they are accompanied by short notes describing the contents. The sheer volume of the literature available precludes a detailed abstracting. Where references may be difficult to obtain, a more detailed description is given. In some cases, references are listed that do not involve kills but rather bear directly on the information needed to assess what determines where and when bird strikes occur, e.g., altitude of nocturnal migration, weather systems.

The types of obstacles in the bibliography include lighthouses, ceilometers, chimneys, cooling towers, communication towers, buildings, gantries, bridges, trains, telephone and power lines. They are located in North America and the Caribbean, Europe, Malaya and the Pacific Ocean. Six of Canada's provinces are involved, viz., British Columbia, Saskatchewan, Manitoba, Ontario, New Brunswick, Nova Scotia. Reference is made to at least 33 of the United States. About 60 ornithological journals or local natural history publications in North America and Europe were searched. Letters were sent to individuals and agencies in North America and Europe which elicited data that would otherwise have been unavailable. Nevertheless, references have probably been missed. I should be grateful if these could be brought to my attention.

The Introduction is intended to give an overall view of what is known about bird strikes and to outline some of the available techniques for minimizing them. Bird strikes against aircraft are excluded since they lie outside the terms of reference of this bibliography. In spite of the many references dealing with bird mortality by night at man-made structures, there is a dearth of information on how to prevent kills. Relatively little effort has been devoted to understanding their mechanisms. Significant progress has been made, however, at reducing or eliminating such strikes at some lighthouses in Britain and at airport ceilometers in North America. Collision accidents also occur during daylight at power lines and guy wires where these intersect regular flight paths. Electrocution of birds of prey perched on power lines can be a local problem. The varied types of kill circumstance dictate a different approach in dealing with each type. The Introduction is therefore divided into appropriate sections. Migration itself is discussed first because an understanding of it allows an appreciation of how weather, the height and location of an obstacle are factors influencing the magnitude of kills.

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INTRODUCTION

I. Migration and Related Information

Migration in North America is mainly south to north during spring. This northward movement of most migrants from South America enters North America either via the land route of Central America and Mexico or via the water route directly across the Gulf of Mexico and the U.S.A. From the southern U.S.A., migrants fly northwest, north or northeast depending upon the location of their breeding areas. Influxes to the breeding areas of central-southern U.S.A. occur during March to May and to northern U.S.A. - southern Canada during April and May, extending into June at more northerly latitudes.

Migration of some species occurs exclusively by day. Others move only by night and some migrate both by night and day. Feeding habits determine whether migration takes place during hours of daylight or darkness. Since feeding on the wing during daylight is the normal practice of swifts and swallows, they are able to feed while migrating. Waterfowl are able to feed either by day or night so their migration therefore occurs at either time: when suitable feeding locations are encountered by day, the waterfowl migrate by night or visa versa. On the other hand, several families of songbirds can forage for food in wooded areas or on the ground only by day when they rely on light to see and capture their food. Migration by day for this group would mean fasting during the night preceding the flight and on the day of the flight and again during the night following the flight. To survive without food for 36 hours is virtually impossible for these small birds which have high metabolic rates. Many species have therefore adapted to this by becoming night migrants resulting in a fasting period of only one night - the

normal period of sleep when not in migration. To make long flights possible, layers of fat are accumulated before the flight begins. The fat reserves are used as fuel en route. Nocturnal migrants include species in the families of cuckoo, woodpecker, flycatcher, Mimic Thrush, thrush, kinglet, vireo, warbler and sparrow. Migrating by both night and day are species among the waterfowl, shorebirds, blackbirds and sparrows.

Birds take advantage of moving weather systems to aid their migration. During spring, significant migration into eastern North America occurs in the warm sector of a low pressure area. The meteorological cycle associated with this is usually characterized by a high pressure, clockwise rotation, moving towards the east and being replaced by a low pressure area, counter-clockwise rotation, from the southwest. The circulation of air between the two air masses is reinforced, resulting in moist tropical air being swept northwards. Pronounced movement takes place into or through a given region during the interval between the passage of a warm front through that region and the subsequent arrival of a cold front. The cold front advancing from the west, often accompanied by rain, causes migrants to go to ground until favourable weather again permits a resumption of their flight. During these times when migrants are forced down by inclement weather, heavy kills occur at tall obstacles.

The southward movement after the breeding season is more protracted than in spring. Movement from Canada to Mexico and to the Gulf of Mexico begins in late July. This autumn flight becomes heaviest between late August and mid-October and extends into early November. As is the case in spring, certain species move only by night. However, numbers

in fall are greatly increased over those of spring by a factor up to four as a result of young of the year joining the flights.

During autumn, significant migration out of eastern North America occurs both in advance of and following the passage of a cold front. The meteorological cycle is usually composed of a low pressure area, counterclockwise rotation moving towards the east or southeast and being replaced by a high pressure cell, clockwise rotation, from the west or northwest. The circulation of air between the two air masses is reinforced resulting in northerly air being swept southwards. The cold front between these two air masses, often accompanied by rain, overtakes migrants and grounds them. In the clear southward moving air stream of the high pressure cell following the cold front, heavy migration is resumed.

Radar studies (25) have shown traffic rates of southward moving birds up to 20,000 birds per mile of front per hour immediately in advance of the cold front and exceptionally up to 200,000 birds per mile of front per hour following cold front passage. Hunt (453) notes a traffic rate of about 63,000 birds per mile of front per hour. Most of the kills during autumn at tall obstacles occur during the inclement weather associated with this type of weather system. However, not all such weather systems cause birds to move southwards. To understand why this is so it is necessary to note that a 'reservoir of physiologically primed' migrants must be built up and ready to move. When two such weather systems pass a given location within 1 or 2 days, few migrants may be available for movement on passage of the second system. It is fair to say, however, that when migrants do move in autumn, most do so in conjunction with a weather system of the type described above.

Nocturnal migrants apparently make use of several different navigational aids to find their way. These include astral cues, landscape cues, wind direction and physiographic features. Whether the earth's magnetic field is a factor is uncertain. Migration does occur under overcast skies and studies have shown that the direction of migration is then oriented almost as well as under clear skies. It is probable that the seasonal and annual variation in volume of migration that is observed under overcast skies, but without precipitation, depends upon the birds' urge to migrate. Where migration is long delayed by weather factors, the physiological state of the birds forces them to migrate before weather conditions become ideal. Bellrose (44) concluded that astral cues are advantageous but not essential for oriented migration. He further reasoned that when migrants cannot use astral cues they are forced to rely on some other navigational aids, which are either more difficult to utilize or less reliable. Experience of having already made a migratory flight should be an asset to adult birds as in the case of the Canada Goose (Branta canadensis), the adults of which lead in the Vee formations, many of which are made up of family units. Such is not the case for small birds which appear to migrate singly or in loose aggregations or groups rather than in compact and persistent flocks. There are species in which young of the year begin to migrate after all the adults have departed, e.g., one or more species of the Empidonax flycatchers.

The altitude at which birds migrate varies and seems to depend upon several factors. Cloud ceiling, winds aloft, precipitation, visibility and the time of night affect flying heights. On clear nights, migrants

are dispersed in a vertical direction. The relative proportion of small birds increases rapidly up to altitudes of 300-600 metres (1,000-2,000 feet). At higher altitudes the proportion declines. Aircraft studies (44) have shown that 48% of migrants surveyed under clear skies occurred at the 150 and 300 metre (500 and 1,000 foot) levels (above ground level-AGL), which is generally lower than those reported by radar surveillance (218). Both methods agree that few passerines migrate above 1,500 metres (5,000 feet) AGL. See also reference 451.

It is also known that shortly after taking off small birds climb quickly to their migrating altitude and maximum numbers are migrating around midnight. Shortly after midnight they begin a gradual descent and some drop out of the flight presumably on account of factors related to their energy reserves. By dawn large numbers have descended to below the 150 metre (500 foot) AGL as they prepare to terminate the night flight. This probably explains the larger numbers being killed at tall obstacles after midnight than die before midnight.

The effect of cloud on the altitude of migration depends upon the height of the cloud which can force the higher flying migrants to lower altitudes [thereby squeezing them into a narrower vertical band]. This increase in migrant density near the ground increases the probability of collision with a tall obstacle. Bellrose (44) found that 51% of the migrants surveyed under overcast skies occurred at the 150 and 300 metre (500 and 1,000 foot) AGL, compared with 48% under clear skies. Unfortunately, Bellrose did not correlate migration altitude with cloud heights on specific nights. He lumped together the results of 19 nights on which completely overcast conditions occurred. This may be misleading since the base of cloud during an overcast condition can vary between ground level and 9,000 metres (30,000 feet) AGL.

Rain or drizzle usually causes migrants to go to ground and the migration becomes temporarily arrested. Drizzle, fog and haze impair visibility and under these circumstances the migrants fly at low altitudes and resort to following topographical leading lines such as along the shores of the Great Lakes, somewhat like the behavior of diurnal migrants. This in turn gets them into difficulties at lakeshore sites where tall obstacles intersect their flight line. The situation is further compounded by bright lights, which in haze or fog serve to attract migrants. A single powerful pencil of light shining from the ground upwards into the fog serves as a corridor through the darkness into which the birds fly. Death and injury result from the birds either flying against the lighted object, or against the glass of the light itself, or by collision of birds with each other. Exhaustion also occurs after they have fluttered in the light pencils for long periods. Communication towers with navigational light, floodlit and brightly lit tall objects and buildings as well as lighthouses are among the attractants.

Nocturnal kills at man-made obstacles are composed mainly of warblers and vireos, which at many sites exceed 90% of the totals killed. Nevertheless, waterfowl, rails, shorebirds, cuckoos, flycatchers, woodpeckers, thrushes and Mimic Thrushes, tanagers, orioles and sparrows are also found. Unusual is the case of 4,200 Mourning Doves (Zenaida macroura) killed at one site along with other species rarely found in kills (421).

There are interspecific and interfamilial differences in behavior among migrants occurring at lighted obstacles. The case of the Yellow-rumped Warbler (myrtle) (Dendroica coronata) is intriguing. In eastern North America, this species is one of the most abundant seen on

the ground in trees during daylight hours through the migration period. Yet relatively few turn up in tower kills. At a tall chimney near Kingston, Ontario, [documentation is on record] hundreds of Yellow-rumped Warblers were found alive and uninjured in the vicinity of the obstacle in the dawn after a heavy kill of others in the warbler family had occurred. There are always exceptions, however, for example, at an Illinois tower (56) where there were 79 Yellow-rumped warblers among 486 casualties in one night. Perhaps more dramatic is the difference between warblers and sparrows described at the Washington Monument (295, 296). On 20 October 1935, hundreds of Field Sparrows (Spizella pusilla) were resting on benches and on other perches at the base of the monument while warblers were flying overhead and crashing into the floodlit monument. This behavioral difference, noted by others (56,281), probably explains the dearth of sparrows in most kill lists. Perhaps keener night vision is a factor.

Nocturnal bird kills are virtually certain wherever an obstacle extends into the air space where birds are flying in migration. The time of year, siting, height, lighting and cross sectional area of the obstacle and weather conditions will determine the magnitude of the kill.

II. Lighthouses

Historically in North America, coastal lighthouses were the first man-made towers to kill large numbers of migratory birds. Nocturnal kills at Canadian lighthouses and probably at American lighthouses continue to occur although their magnitude at the present time is uncertain

owing to the lack of systematic checks and surveys by the keepers now that most lights are operated automatically. Information provided to me in December 1976 by the Ministry of Transport, Marine Division, confirms that lights in all Canadian lighthouses are continuously lit, the beams being interrupted by a rotating shutter to give them characteristic signals. Flashing lights are used in buoys on the water.

The behavior of birds at the revolving beams of light is similar at sites on the Atlantic coast of Canada, along the Great Lakes and on the coasts of the United Kingdom and Europe. At the revolving beams of white light, the birds circle the tower by following in and moving up the light pencils towards the source. Many strike against the glass, roof, railings or platforms and are killed or injured. Such incidents are associated with drizzle, rain, fog or very low cloud ceiling. The birds are drawn from the darkness of the night to the intense light beams [like iron filings to a magnet].

A detailed description of this behavior is given by Brewster (57) from his experiences at the Point Lepreau Light on the Bay of Fundy, New Brunswick, during a stay of 7 weeks in the autumn of 1885. His vivid account of events on the night of September 4 is as follows:

> "Sept. 4. A clear cool day; the evening perfectly clear up to ten o'clock, when a heavy curtain of clouds rolled overhead from the northwest, and it became very dark. An hour later dense fog set in, and at midnight it began to rain, heavy showers succeeding one another at frequent intervals. Wind south; puffy, at times strong.

As soon as the sky became overcast small birds began to come about the light. Their numbers increased steadily from 10 to 11 o'clock, but during this time the majority kept at a safe distance, and only two or three struck. With the advent of fog they multiplied tenfold in the course of a few minutes. For the next hour from 50 - 100 were constantly in sight, and from one to eight to ten dashing at the lantern..... About 20% struck so forcibly as to injure themselves beyond hope of recovery, often, however, fluttering off the platform and down to the ground beneath.

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At the height of the mêlée the scene was interesting and impressive beyond almost anything that I ever witnessed. Above, the inky black sky; on all sides, dense wreaths of fog scudding swiftly past and completely enveloping the sea which moaned dismally at the base of the cliffs below; about the top of the tower, a belt of light projected some 30 yards into the mist by the powerful reflectors; and in this belt swarms of birds, circling, floating, soaring, now advancing, next retreating, but never quite able, as it seemed, to throw off the spell of the fatal lantern.

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When the wind blew strongly they circled around to leeward, breasting it in a dense throng, which drifted backward and forward,

> up and down, like a swarm of gnats dancing in the sunshine. Dozens were continually leaving this throng and skimming towards the lantern. As they approached they invariably soared upwards, and those which started on a level with the platform usually passed above the roof. Others sheered off at the last moment, and shot by with arrow-like swiftness, while more rarely one would stop abruptly and, poising a few feet from the glass, inspect the lighted space within. Often for a minute or more not a bird would strike. Then, as if seized by a panic, they would come against the glass so rapidly, and in such numbers, that the sound of their blows resembled the pattering of hail. Many struck the tin roof above the light, others the iron railing which enclosed the platform, while still others pelted me on the back, arms, and legs and one actually became hopelessly entangled in my beard. At times it fairly rained birds, and the platform wet and shining, was strewn with the dead and dying."

Seventy-seven years later, the scene is virtually unchanged in the description of behavior at the Long Point light on Lake Erie, Ontario, in the autumn of 1962 (243). The Keeper described the beams of light as being full of birds for a distance of approximately 1/4 mile and that large numbers were sheltering in the bushes and grass around the base of the light. About 2,000 were killed there that night, which was not a new phenomenon at Long Point. In 1930, Saunders (353) wrote of bird destruction there and noted that the matter was to be taken up with the authorities. Whatever transpired as a result of that has not reduced kills.

The last published reviews of kills at Canadian lighthouses based upon questionnaires to the various Keepers were in 1924 (266), 1927 (239)

and 1928 (415). Very recent documentation exists for a few sites which are visited by naturalists and students of migration. These include Gannet Rock Light (28, 29, 118) and Sable Island Light (120) in Atlantic Canada. References 28 and 29 contain reprints from the Keeper's diary. The best documented case is probably that of Long Point (33, 64, 243-246, 353, 439-443), where casualties can be heavy. Conversations which I have had with the Keepr at the Main Ducks Light in eastern Lake Ontario reveal that kills continue to occur there on foggy nights. However, regular checks or pick-ups are not carried out. The recent practice by the Canadian Ministry of Transport of withdrawing Keepers and replacing them with automated lights will make precise information on bird strikes difficult to obtain. Inevitably the status of kills at automated lights will be 'out of sight, out of mind'!

Developments in Great Britain have led to the reduction of bird losses at lighthouses there (20, 33c). Mortality at the Dungeness Light was eliminated when the original revolving white beacon was replaced with a Xenon-filled lamp that emitted a bluish light and flashed for one second in every ten. The key seemed to be the intermittent, flashing light. When the light beam is in the extinguished mode, birds which were in the light beam disperse. This behavior is in marked contrast to that at the rotating beacon. It is significant that there are similarities in bird behavior at flashing red obstruction lights on television towers in North America (15, 19, 88 - see Section IV).

Noteworthy is the difference in effect of floodlighting at lighthouses in Britain and at Long Point on Lake Erie, Canada (14, 33c). Success is claimed at five British lighthouses in using

outside floodlights to illuminate the lighthouse roof thus reducing, but not eliminating, bird strikes. Trials at Long Point resulted in greater casualty figures, which is consistent with bird behavior at chimneys, buildings and monument sites using floodlights in North America.

The technology now exists to reduce and perhaps eliminate bird kills at lighthouses. Why these strobe or flashing types have not been used in the Canadian lighthouse system is a mystery. Most likely it results from a lack of driving force to solve the kill problem in North America. The driving force in Great Britain was provided by the Royal Society for the Protection of Birds (RSPB), and this group can provide detailed information.

III. Floodlit Obstacles and Ceilometers

Floodlighting a tall obstacle has the effect of drawing nearby birds towards the light beams, especially on overcast nights. It is probable that those passing nearby enter the illuminated area which they hesitate to leave much in the same way that birds placed in a lighted room or even in a bright flashlight beam at night will not fly out into the darkness.

The magnetic effect of attraction to lights on cloudy nights is strengthened in fog, haze or drizzle when tiny drops of moisture refract the light beam and greatly increase the illuminated area. In certain conditions of haze, a tall white-coloured obstacle which is floodlit can be seen from a distance of 16-24 kilometres (10-15 miles) as a 'glowing sun'.

The behavior of the birds within such light pencils has been described and shows a few differences from bird activity in the rotating

beams of lights at lighthouses. Floodlights are stationary and birds mill about in the beams either at the end of the pencil where it falls on the object being illuminated or at the source of the light. When the surface of the obstacle being illuminated is white or concrete coloured, the effect of the light beam is to produce a dramatic contrast against the background blackness of the night. Birds flutter towards this white hole in the darkness or towards the light source itself crashing against the surface as they suddenly swoop along the light beam. Some veer away from the surface at the last moment. Exhaustion overtakes some and they fall to the ground. A study was carried out at the tall chimneys of Ontario Hydro's Nanticoke Station, Lake Erie, Ontario, and observations of flight behaviors are documented in reference 240.

Among the sites where bird kills have occurred when floodlighting was used are Washington Monument 170 metres (555' +) AGL (295-298), Perry International Peace Monument 108 metres (352') AGL (186), cooling towers (186) and chimneys (192, 423, 449). Lights have also been the catalyst in kills at ski lifts, amusement parks among others (58, 71, 190, 354, 355, 447) as well as at tall buildings (see Section V).

The use of red-coloured obstruction lights in place of floodlights on tall chimneys or other obstacles reduces the bird casualties but may not eliminate them. This is discussed in Section IV.

Red and white lights appear to be the only two colours used in lighting where mass bird kills have occurred. The red lights seem less deadly than white lights. Experiments using red filters have been carried out and found to reduce bird casualties at one site by 80% (240).

As noted there, this may be due to a reduction in light intensity rather than to the change to a red wavelength. Trials with orange and blue filters were recommended but whether they were carried out is unknown to me. Effects of intense light on bird behavior and physiology are discussed in reference 253.

The ceilometer is a floodlight used to determine elevations of cloud, especially at airports. During the 1950's many kills occurred on overcast nights when the ceilometer beam was left shining continuously for long periods. The worst one night disaster on record occurred at a fixed beam ceilometer near Macon, Georgia, where 50,000 are estimated to have died (78, 193, 195). This is the floodlight effect at its worst. The birds were dying from impact with the light source and from exhaustion.

The introduction of the rotating beam ceilometer in the early 1960's, replacing the fixed beam type, heralded the end of bird kills at these devices. A letter (362) outlining the policy switch to the rotating beam type by the United States Government is printed in reference 417. No references can be found in the literature dealing with bird kills at these new devices. This success provides grounds for optimism that kills at other types of man-made obstacles can also be reduced. Prior to the adoption of the rotating beam ceilometer, experiments were done using light filters attached to the fixed beam units (401). The visible wavelengths were filtered allowing only ultraviolet light to pass through. This also reduced mortality.

IV. Communication Towers

This category includes radio, television and microwave towers and their antennae. There are many published references to bird mortality

at radio and television towers. The absence of data from such sites means in most cases that no systematic checks have been made. Similarly there is a dearth of information from the microwave transmission towers in North America, many sites of which are normally inaccessible.

The seriousness of the problem up to 1965 is outlined in a Report of the Committee (of the American Ornithologists' Union) on Bird Protection [1965] in reference 7, which includes some limited statistics on the growth of the broadcasting service and on tower heights. In order to assess the continuing growth up to 1975, the Broadcasting Yearbook 1976 was consulted and the data from it were used to prepare Table 1, showing the number of broadcast stations, radio and television in the U.S.A. The rate of increase in the number of radio stations rose steadily until the year 1970 after which time it declined to a rate slightly less than that existing between 1955-1960. By 1 January 1975, there were 7,785 radio stations in the U.S.A. By contrast, the rate of increase of TV stations is erratic. At least 952 TV stations were operating in the U.S.A. on 1 January 1975 while in Canada 189 were operating on 1 December 1975. Many of those in Canada were rebroadcasting outlets of a parent station.

In the AM (radio) service, antenna height above ground is not usually very important in order to broadcast since the entire antenna structure acts as the antenna. This varies in height with the frequency of transmission. Some AM antennae do however exceed 300 metres (1,000 feet) in height. On the other hand, in the FM (radio) and TV service, where transmission follows line of sight, reception depends on the location of the receiver in relation to the transmitting antenna, thereby making antenna height an important factor. The antennae themselves are usually

short but are fastened on top of man-made tower structures which in turn are often located on top of high ground or buildings.

Table 2 shows numbers of TV towers in the U.S.A. as functions of height above average terrain (AAT) and above ground level (AGL). However, a similar tabulation has not been attempted for radio towers. The data of Table 2 do not provide grounds for optimism. There are 694 TV towers over 150 metres (500 feet) AGL (69% of the total). When one considers height above average terrain, the number increases to 918 TV towers over 150 metres (500 feet) AAT (91% of the total). These towers are therefore extending into the zone where large numbers of nocturnal migrants are flying. In the over 450 metre (1,500 feet) categories AAT and AGL, there are 227 towers (22.5% of the total) and 82 towers (8%), respectively. These supergiants have among their numbers a total of 26 towers which are over 1/2 kilometer (1/3 mile) AGL. Equivalent data for Canadian TV stations are not complete in the Broadcasting Yearbook, 1976, tower heights not being shown for 119 of the 189 stations listed.

Radio and TV towers normally consist of a metal superstructure, triangular in cross section, which is a lacework of struts allowing wind to pass through. The broadcasting antenna for TV transmission is frequently cross shaped in cross section. The width of side and detailed dimensions are rarely given in the kill literature. Those of the WCIA tower in Illinois are 8 feet, the width of triangular side and 9 feet, the width of the antenna side (56). Networks of guy wires connecting the towers to ground are used at various intervals along the tower. Those towers over a certain height must be lighted in the interest of safety to air navigation. This is usually done using a combination of flashing and non-flashing red lamps which are placed at intervals along

the tower superstructure. In relation to the lighting described in Sections II and III above, these red obstruction lamps on TV and radio towers can be classified as dimly lit. Nevertheless, there is now direct experimental evidence showing that even under these dimly lit conditions the red lights attract nocturnal migrants to the tower, especially in overcast conditions. The maze of guy wires and the lace-work of struts forming the tower superstructure take their toll.

Brewer and Ellis (56) described collision with the solid segments of the tower and the killing and stunning of birds by the guy wires. Some died when they fell to the ground. Cochran and Graber (88) devised simple experiments at a tower and observed confused behavior of the birds around the red lights, resembling their behavior around ceilometer beams. Birds were flying through the tower framework, circling the lighted areas and passing through the tower again. When the lights were turned off, the congestion was eliminated and within 2 minutes all birds dispersed. Within 2 minutes after relighting, either the same individuals or others returned to the lights.

Avery (15 and 19) has carried out experiments at a 366 metre (1,200 foot) AGL tower in what was the most thorough investigation published to date. He corroborated the attracting phenomenon at the red lamps observed by Cochran and Graber (88) during overcast conditions. The birds milled about the red lights by flying slowly upwind, sometimes fluttering in place, to a position near the tower where they turned to be carried rapidly downwind past or around the tower. No mention is made of birds passing through the tower. Perhaps its superstructure made this impossible. Avery suggests that most losses are likely to occur through collisions with the tower, the guy wires or with other

birds as they are blown downwind. He also explains why both fast and slowly moving birds were observed at the tower and why their flight directions on overcast nights were so diverse. The birds left the tower area either when overcast conditions lifted in the night or when the red lights were extinguished. The birds exhibited the same behavior when the tower was transmitting and when it was not transmitting. Avery's data suggest that the tower's obstruction lights were the sole factor in the congregation of birds. Even on clear nights, a few migrants were affected (15).

The common factor compounding the nocturnal kills of birds at tall obstacles is artificial light. Experiments and observations have shown this to be so at lighthouses, floodlit objects and communications towers when either white or red light is used. The elimination of kills at the Dungeness Lighthouse has been described above when intermittent flashing light was used which flashed bluish light for 1 second in every 10. Whether the length of time the light is extinguished or whether the Xenon-filled lamp producing the bluish light is more influential is uncertain. Judging from the experiments of Avery and others, the length of time the light remains extinguished is very important. These strobe or intermittent types of light appear to offer some hope that nocturnal kills can be reduced in number. However, experiments must be carried out to assess this.

Installation of a strobe lighting system during 1975-76 on the CN Tower 553 metres or (1,815 feet AGL) in Toronto, Ontario, has not prevented kills there (433) in spite of the confident predictions made about the system. In September 1976 it was necessary to darken the tower completely. There seems to be little experimental data on the reactions

of birds to light of various wavelengths, intensities and flash rates while the birds are at the communication towers. Some recent experiments using flashing and non-flashing lights have been carried out by Belton (450) on gulls, starlings and pigeons at feeding sites. These included behavioral and electrophysiological tests from which Belton concluded that the strobe lights had no clear-cut repellent effect, except when accompanied by sound. The fact that these experiments were conducted during daylight at a feeding site rules out any suggestion that similar behavior would be shown by nocturnal migrants at communication towers. His electrophysiological results did not show how bird behaviour could be modified but they do indicate the wavelengths and intensities that can be received and acted upon by gulls, starlings and pigeons. Belton includes a bibliography of colour vision, relevant electrophysiology, and anatomy and behavioral observations on the effect of light on birds.

When a taller tower is erected next to a lower one, which has been in operation for some time, the lower tower becomes more lethal than when it stood alone (391, 437, 452). This is not surprising in view of the attraction phenomenon described by Avery. The taller tower attracts greater numbers which when fluttering in the vicinity of the taller structure may strike the guy wires of the lower unit. If this is what is happening then two tall towers of equal height placed side by side should also produce the compound effect. One wonders what happens at sites where many towers are located close together. Such a site is the CBC facility near Sackville, N.B., although no references to kills there were found. This does not necessarily mean that these towers

fail to kill birds. Guy wire networks are known to kill birds during daylight hours as noted on Midway Island in the Pacific Ocean (124).

The ultimate solution to the reduction in bird kills at communication towers lies in the adoption of several strategies. The adoption of a sharing policy on the use of tall towers would reduce the hazard to all air traffic - whether that of birds or of man. Judicious selection of tower locations will also help reduce potential casualties. Lighting systems must be engineered that do not attract the migrating birds. To this end, the effects of intermittent light, its intensity and wavelength must be determined.

Table 1. Number of Broadcast Stations in the U.S.A. (as of 1 January of the year noted).

	RADIO (AM and FM)			TELEVISION		
	Commercial	Non-Comm.	Total	Commercial	Non-Comm.	Total
1950	2,819	48	2,867	97	-	97
1955	3,221	122	3,343	439	9	448
1960	4,134	162	4,296	573	44	617
1965	5,282	255	5,537	586	88	674
1970	6,503	396	6,899	690	182	872
1975	7,068	717	7,785	711	241	952

Data: From 'Broadcasting Yearbook 1976', 1735 De Sales Street NW., Washington, D.C. page A-7.

Table 2: Heights of TV Antennae in U.S.A. (status 1 December 1975).

	ABOVE AVERAGE TERRAIN						ABOVE GROUND LEVEL						
	U	≤500'	501'-1000'	1000'-1499'	1500'-1999'	≥2000'	≤500'	501'-1000'	1001'-1499'	1500'-1900'	1901'-2063'	U	Total Towers
Ala.	-	2	10	12	2	1	6	18	2	1	-	-	27
Alaska	-	9	-	1	-	-	10	-	-	-	-	-	10
Ariz.	-	-	-	1	8	5	13	-	-	-	-	1	14
Ark.	-	2	2	4	5	-	4	2	5	-	2	-	13
Calif.	1	5	8	12	20	30	60	11	-	5	-	-	76
Colo.	-	3	3	5	-	2	9	4	-	-	-	-	13
Conn.	-	1	8	-	-	-	7	1	1	-	-	-	9
Del.	-	-	1	-	-	-	-	-	1	-	-	-	1
DC	-	1	6	-	-	-	2	5	-	-	-	-	7
Fla.	-	3	25	13	1	-	2	22	16	2	-	-	42
Ga.	-	2	3	17	6	-	2	5	17	4	-	-	28
Hawaii	-	6	2	-	-	4	12	-	-	-	-	-	12
Id.	-	-	-	4	3	4	8	2	1	-	-	-	11
Ill.	-	1	16	12	-	-	1	16	11	1	-	-	29
Ind.	-	3	18	5	-	-	2	17	7	-	-	-	26
Ia.	-	1	3	9	7	3	1	5	6	3	8	-	23
Kan.	-	-	9	4	1	-	-	7	6	1	-	-	14
Ken.	-	2	14	8	1	-	3	20	-	2	-	-	25
La.	-	2	6	4	8	-	1	4	6	7	2	-	20
Me.	-	2	5	2	1	2	7	3	1	1	-	-	12
Md.	-	-	8	2	-	-	2	8	-	-	-	-	10
Mass.	-	-	6	6	1	1	5	2	7	-	-	-	14
Mich.	-	1	19	12	1	-	2	8	23	-	-	-	33
Minn.	-	2	5	13	-	-	3	7	10	-	-	-	20
Miss.	-	1	3	9	4	1	3	2	8	3	2	-	18
Mo.	-	1	3	15	2	3	1	5	13	2	3	-	24
Mon.	-	2	4	-	3	4	10	3	-	-	-	-	13
Neb.	-	1	6	13	2	1	1	6	13	2	1	-	23
Nev.	-	4	-	2	1	2	8	1	-	-	-	-	9
NH	-	2	1	4	-	-	7	-	-	-	-	-	7
NJ	-	1	6	1	-	-	3	4	1	-	-	-	8
NM	-	3	1	2	2	3	6	1	2	2	-	-	11
NY	-	6	13	19	4	-	11	20	11	-	-	-	42
NC	-	2	7	12	4	1	8	6	9	2	1	-	26
ND	-	1	3	6	1	2	1	4	6	-	2	-	13
Ohio	-	5	24	10	-	-	6	22	11	-	-	-	39
Okla.	-	1	2	5	4	-	1	3	4	3	1	-	12
Ore.	-	-	3	4	4	4	10	4	1	-	-	-	15
Pa.	-	1	21	10	4	-	8	22	6	-	-	-	36
RI	-	-	5	-	-	-	-	5	-	-	-	-	5
SC	-	1	8	5	2	3	5	8	4	1	1	-	19
SD	-	-	5	7	4	2	1	7	5	2	2	1	18
Tenn.	-	-	5	16	2	2	10	4	10	1	-	-	25
Tex.	-	10	25	21	9	1	15	17	25	9	-	-	66
Utah	-	-	-	-	-	5	5	-	-	-	-	-	5
Vt.	-	-	-	1	1	4	6	-	-	-	-	-	6
Va.	-	-	10	3	2	6	10	6	5	-	-	-	21
Wash.	-	2	10	4	1	4	12	9	-	-	-	-	21
W.Va.	-	-	6	5	1	-	3	6	3	-	-	-	12
Wisc.	-	-	9	12	3	-	-	7	14	2	1	-	24
Wy.	-	-	1	-	1	1	3	-	-	-	-	-	3
	1	92	358	332	126	101	316	339	271	56	26	2	1010

U denotes unknown

Data: Compiled from 'Broadcasting Yearbook 1976', 1735 De Sales Street NW., Washington, D.C.

V. Lighted Tall Buildings

Documented instances of bird strikes at lighted buildings in North America date back to at least the year 1888 with a kill in Wisconsin (216). The Empire State Building in New York City has long been a bird killer (63, 69, 285, 287, 320) and in recent years it has been joined by an increasing number of tall skyscrapers in many cities of North America including those in Georgia (122, 123, 405), Illinois (314), Massachusetts (119, 121, 444), Pennsylvania (213), Texas (420, 422) and Ontario (255, 433). Building kills are included in the site survey covering the locations involved in the massive bird destruction of October 1954 (195, 397).

That birds are also killed at windows and at lights of low buildings, shopping centres and apartment houses is on record from Minnesota (358), Florida (97, 222) and Tennessee (335, 447). Even picture windows in the homes of residential areas claim bird victims but because the numbers killed at any one window are not great, the occurrences are not normally on the written record. As in the case of television and radio towers, systematic checks are rarely made at most building sites so that to estimate total numbers of birds dying on account of these buildings is impossible.

Among the references, none could be found that dealt with either the mechanism of building kills or a systematic study at any site. By the very nature of the huge buildings, their downtown locations and the spectator problem, it is difficult, but not impossible to devise controlled experiments to test various hypotheses as to what factors control the kills.

More variables are involved at the tall building sites than come into play at either communication towers or at lighthouses. The shape,

colour and glazing areas of the outside of the buildings vary as does the grouping of buildings to form courtyards. The types of internal lighting vary between buildings and produce a variety of effects on different coloured walls when viewed at night from the outside. Frequently the office lights in commercial high rises remain lighted throughout the night and neither blinds nor drapes are used on the glassed areas. The following comments reflect what is known from some sites and probably are not general to all sites. The experiences of Mr. Barry MacKay (255) are relied upon in addition to my own. Where kills are caused by either the use of floodlights shining on buildings or communication towers on top of tall buildings (213), their mechanisms and solutions are covered in Sections III and IV.

Bird kills at tall buildings occur not only by night but also during daylight hours. At the Toronto-Dominion Centre, Toronto, Ontario, there are occasions when diurnal kill numbers exceed nocturnal kill totals. The numbers can be significant.

Migrating birds travelling at night are attracted to some buildings by the internal lighting system shining out through extensive areas of glass. They are killed or injured by smashing against the panes as they attempt to fly through. Many are not killed outright but flutter against the windows until exhausted or injured and then are killed when they fall to ground. The birds become confused and disoriented when faced by these extensively lighted areas of glass. Trapped within a 'courtyard' of tall buildings, something like being down inside a deep well, they cannot find their way out. By dawn, many are at ground level of the courtyard. Because birds normally gain altitude gradually as they fly

forward, much like aircraft ascend, the birds are unable to rise out of the courtyard and over the buildings. Lack of proper food supplies and ground vegetation means starvation or being killed by predators, including man.

The solution to this problem depends upon reducing the lighted areas seen from the outside during the night by means of blinds or drapes. Estinguishing lights after 2200 hrs. would be most helpful since experiments have shown migrants to begin the descent to lower altitudes shortly after midnight. To reduce the diurnal kills, it may be necessary to use opaque glazing without reflection or mirror effect. Even a grill pattern inside the glass, like a venetion blind, would help. Silhouettes of hawks placed in windows have been suggested in order to frighten birds but this seems not to be as effective as hoped.

A person can unknowingly walk into a plate glass door. When the plate of glass is interrupted by an object on its surface, our eyes focus on that object before focussing on the glass and thus preventing collision. Glass windows on construction sites are marked with cross-shaped paper or crayon to prevent accidents. In the same way birds, with their quick shift of eye focus, see initially any object placed on the surface of the glass.

Weather effects play a role at some sites insofar as the low ceiling and poor visibility forces the migrants to lower altitudes. The artificial light from windows of buildings can act in the same way as the light from floodlights. However, building kills do occur in both clear weather and in fog. The trapping phenomenon may be the factor in clear weather which gives rise to large kills at buildings which do not occur

in such numbers at other lighted obstacles in the same weather condition. There is a requirement for experiments to be done to test this. On the basis of the Toronto, Ontario, experiences, if the night flight is a heavy one, specially in fall, then a large kill at buildings is likely to occur in any weather condition. When design criteria include minimizing bird strikes, the problem will be greatly reduced.

VI. Telephone and Power Lines

Collision with or electrocution on telephone wires or power lines causes the deaths of significant numbers of birds. Collision mortality is more prevalent among larger sized birds such as herons, waterfowl and birds of prey although there are records of songbirds flying into power cables 6 metres (20 feet) above a bridge roadway in Florida (432) and into telegraph wires (92). Harrison (170) described the killing of 21 Mute Swan Cygnus olor in Great Britain which had been electrocuted when they flew into overhead cables sited about 3 metres (10 yards) above the ground. The route crossed the regular flight line between roosting and feeding areas. Blokpoel and Hatch (50) have documented a powerline disaster in Manitoba involving Snow Geese Chen c. caerulescens which were frightened by an aircraft. In their panic to take flight, some hit power lines. Stout (454) thoroughly reviewed kills at telephone and power lines as they affect waterfowl. He concluded that substantial mortality occurs and that most accidents take place in environments which are unfamiliar to the birds in the migratory period. Inclement weather is a contributing factor. Stout noted (p80) the killing of 235 Ruddy Ducks Oxyura jamaicensis in California as they crossed a spit on which power lines were present. Cornwell and Hochbaum (91) and Siegfried (363) also note waterfowl mortality at wires.

In the Middle East, White Storks Ciconia ciconia migrating south in late summer from Central Europe travel from Sinai across the Gulf of Suez on a southwesterly course and are found dead either caught on or lying beneath the telephone lines along the road running along the Gulf of Suez (Mrs. H. Quilliam, pers. comm.). Experiences in Finland are described in reference 179.

Barbed wire fences impale birds. The above references to waterfowl include this among the causes of mortality. That non-waterfowl species are sometimes involved is confirmed by references 110 and 258.

The solution to the problem of collisions lies in the judicious siting of the lines. The practice of running power and telephone lines through marshes and waterfowl breeding and feeding areas is unwise. Where collisions are known to be a problem the lines should be relocated or placed underground. Along proposed transmission routes, the siting of lines should be away from heronies and waterfowl concentration spots. A thorough environmental assessment should identify the problem areas. Local naturalist groups, Ministry of Natural Resources staff in Canada and their counterparts in the U.S.A. can usually provide lists of potentially hazardous sites.

Electrocution of large birds occurs on power lines and utility poles. Most references are to cases in North America but the phenomenon is known in Europe, e.g., in Switzerland (49). The problem was discussed at the ICBP conference in Vienna in 1975 (241). In North America, the electrocution problem is greatest in the western U.S.A., mainly Colorado, Idaho, Nevada, Utah and Wyoming. In 1972, a group of six western utilities and the Edison Electric Institute undertook a workshop to study the problems associated with raptor electrocution occurring on powerlines. They determined that grounding practices on distribution and transmission lines from

4 kv through 69 kv, certain configurations of transformer banks, fused cutouts, lightning arresters and conductor phase spacings could be a substantial cause of bird deaths. Their follow-up studies have proved that the solutions lie more with engineering expertise than with a biological approach.

Ninety per cent of all electrocution victims are Golden Eagles Aquila chrysaetos (210, 261). Egrets, herons, crows, ravens, turkeys and other birds of prey account for 10%. About 98% of the eagles electrocuted are young and just learning to fly. Apparently they lack the skill to make safe landings or take-offs from the powerline poles. Electrocution results whenever a bird provides the connection between a high voltage and a ground.

Raptors prefer elevated perches where prey species can be seen and where air currents favour flight. The preferred perch on a power pole is one where the cross arm is perpendicular to the prevailing wind and the pole overlooks a wide radius of hunting territory. The use of powerline poles as perches depends upon topography, density of raptors and the abundance of prey. In areas where natural perches are available as in rough and broken terrain, power poles are used sparingly. Where natural perches are absent as in flat broad valleys and on the prairies, power poles are frequently used. Most electrocutions in western USA occur during the wintering period when large populations of hawks and eagles are concentrated in mountain valleys, adjacent foothills and grasslands where food supplies are available.

Since the early 1970's, several references have become available in which solutions to the electrocution problem are given to assure proper

design and precaution in raptor-inhabited areas. These references contain diagrams with dimensions showing the problem and the proposed solution (36, 168, 261, 416). The material in reference 261 is an attempt to set forth the state-of-the-art as of June 1975. In reference 261, it is noted that trained eagles were used on unenergized structures of typical designs and configurations while slow motion movies were taken to determine how contact was made. This research project established safe perches, a compilation of which is given. This reference is an excellent handbook.

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Weather analysis given and comparisons made with kills at 3 Ontario sites.

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Minor kills at WHAS-TV, September and October 1965.

3. _____. 1970. A Radar Study of the Altitude of Nocturnal Passerine Migration. Bird Banding 41:282-290.

Useful information on altitudes for design engineers, biologists, etc.

4. _____. 1972. The Changing Seasons: Fall 1971 Amer. Birds 26:30.

List of North American continental migration kills in Fall 1971.

5. _____. 1973. The Changing Seasons: Fall 1972 Amer. Birds 27:22.

Summary of some kills during Fall migration 1972 in North America.

6. ADAMS, D.A. 1962. Nocturnal Migrant Mortality in the Carolinas, September 1962. Chat 26:83-88.

Composition given and weather discussed for kills at several sites involving 6042 casualities.

7. ALDRICH, J.W., R.R. GRABER, D.A. MUNRO, G.J. WALLACE, G.C. WEST and V.H. CAHALANE. 1966. Report of the committee on bird protection: Mortality At Ceilometers and Towers. Auk 83:465-467.

The seriousness of the problem is discussed and some statistics are presented. There were (1966) 50 towers over 12,000 feet in Georgia and Tennessee.

8. ALLEN, A.F. 1920. Destruction of Birds by Trains. Wilson Bull. 32:59.

Train kills by night in Iowa and South Dakota involving horned larks.

9. ALLEN, J.A. 1880. Destruction of Birds by Lighthouses. Bull. Nuttall Orn. Club 5:131-138.

A survey of kills is presented from 24 lighthouses along the Atlantic and Pacific Coasts of the USA. Weather and types of light are discussed.

10. ALLEN, J.A. 1901. R.M. Barrington's 'The Migration of Birds at Irish Light Stations' (Review) Auk 18:205-206.

Observations presented from 50 lighthouses and lightships between 1881-1897. Analysis of 2,000+ specimens is given. See Barrington, reference 37.

11. ALSOP, F.J. and G.O. WALLACE. 1969. Spring Tower Kill in Knox County (Tennessee). Migrant 40:57-58.

WTKV tower, 7/8 May 1969.

12. AMERICAN BIRDS (1947-1970 as AUDUBON FIELD NOTES)

Migration reports by season are published in this journal covering the various regions of Canada and USA. Some kills at man-made structures are reported regularly by some of the regional editors. The following list refers to such reports. Unfortunately volumes 1, 2, 4 and 7 could not be obtained for a search of kill sites. The name American Birds is used throughout this bibliography to index the publication Audubon Field Notes 1947-1970 which became American Birds 1971-.

1951, 5: 15
1952, 6: 16
1954, 8: 9
1955, 9: 6, 10, 15, 17, 18, 26, 32, 38, 318
1956, 10: 11, 15, 19, 29, 30, 325-330, 339
1957, 11: 17, 19, 21, 22, 313-316, 333, 336, 337, 338, 341
1958, 12: 4-7, 20, 22-25, 33, 57, 344, 346, 347
1959, 13: 8, 9, 11, 21-24, 37, 45, 350, 363, 372, 373, 377
1960, 14: 8, 14, 23, 26, 28, 29, 39, 44, 48, 367, 368, 380, 383, 392, 393, 403
1961, 15: 24, 28, 32, 33, 35, 36, 42, 44, 47, 55, 78, 79
1962, 16: 5, 21, 22, 24-27, 35, 47, 399, 402, 411-413
1963, 17: 22, 24, 27, 28, 29, 36, 44, 46-48, 397, 399, 400
1964, 18: 5, 9, 10, 24, 30, 34, 42, 430, 443, 455
1965, 19: 18, 22, 29, 32, 37, 44, 52, 441
1966, 20: 31, 33, 34, 38, 39, 42-45, 52, 53, 61, 63, 514
1967, 21: 23, 25, 29, 35, 36, 37, 42-44, 46, 50, 51, 498
1968, 22: 26, 30, 35, 38, 40, 41, 48, 50, 505, 519
1969, 23: 7, 8, 35, 36, 39, 40, 46, 54, 64, 66, 69, 74
1970, 24: 4, 13, 32-34, 37, 43, 55, 56, 60, 594
1971, 25: 16-23, 24, 36, 40, 43, 45, 48, 49, 54, 65, 68, 70, 722, 723, 724, 732, 733, 775

1972, 26: 30, 45, 49, 50, 53, 60, 62, 63, 65, 79, 731, 732, 736, 750, 751, 776, 777
1973, 27: 22, 29, 45, 48, 49, 55, 56, 60, 66, 69, 70, 72, 73, 745, 748, 761, 765, 795
1974, 28: 37, 43, 47, 49, 52
1975, 29: 23, 42, 44, 48, 53, 56, 58, 64, 68, 76, 77, 842
1976, 30: 57, 58, 65-67, 70, 86, 90, 708, 710

ANDRLE, R.F. See R.J. Newman.

13. ARBIB, R.S. (Jr.) 1950. Migrating Bird Mortality at Mitchell Air Force Base, Long Island. Linaean News-Letter 4:2-3.

Not seen.

14. ARTHUR, R.W. 1961. Birds Killed at Bardsey Light - 1960 Bardsey Observatory Report #8, pp.35-37.

A list of 395 birds killed is presented (Jan.-May, 136:Aug.-Dec, 259). Some comments are offered on floodlighting the unlit dome and weather vane of the lighthouse which apparently has helped reduce casualties. However, experiments were still underway.

15. AVERY, M.L. 1974. Investigations of Bird Migration and Mortality at The Omega Navigation Station, Lamoure, N.D. M.Sc. Thesis, North Dakota State University, Fargo, N.D.

The work described in this thesis is most useful. The thesis is divided into 3 parts as follows:

I - The Composition and Seasonal Variation of Bird Losses at a Tall Tower in Southeastern North Dakota.
II - The Effects of a Tall Tower on Nocturnal Bird Migration - A Portable Ceilometer Study. (See reference 19).
III - Cloud Cover and Wind as Factors in Nocturnal Bird Mortality at a Tower in Southeastern North Dakota.

16. AVERY, M.L. and T. CLEMENT. 1973. Bird Mortality at Four Towers in Eastern North Dakota - Fall 1972. Prairie Nat. 4:87-95.

List given for 561 individuals killed. Largest losses occurred on overcast nights following passage of cold fronts. Discussion of dissimilar species between sites.

17. _____ and P.F. SPRINGER. 1973. Investigation of Bird Migration and Mortality At The Omega Navigation Station, Lamoure, North Dakota. Fall 1972 and Spring 1973. Proc. 6th Bird Control Seminar, Bowling Green State University, Bowling Green, Ohio, pp.169-170.

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The behavior of birds near the tower is described. The influence of wind, flashing lights and visibility are discussed. This is a useful article.

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21. BAGG, A.M. 1957. The Changing Seasons: Spring 1957 AMER. BIRDS 11:313-316.

TV Tower Kills in Florida and North Carolina.

22. _____. 1965. The Changing Seasons: Spring 1965 AMER. BIRDS 19:441.

Kill at towers of ship at sea off New Jersey.

23. _____. 1969. The Changing Seasons: Fall 1968 AMER. BIRDS 23:7,8

Sites listed.

24. _____. 1970. The Changing Seasons: Fall 1969 AMER. BIRDS 24:4.

Sites listed.

25. _____. 1971. The Changing Seasons: Fall 1970 AMER. BIRDS 25:16-23.

Sites given along with excellent analysis of weather.

26. BAGG, A.M. and R.P. EMERY. 1960. Fall Migration - Northeastern Maritime Region. AMER. BIRDS 14: 14.

Ceilometer kill in Maine, lightship in Massachusetts and towers in Boston.

27. _____ and _____. 1960. Spring Migration - Northeastern Maritime Region. AMER. BIRDS 14:367, 368.

Ceilometer kill in Maine.

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Gannet Rock Light Kills, diary of the Keeper reprinted.

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As per reference 28.

30. BAIRD, J. 1962. The Changing Seasons: Fall 1961. AMER. BIRDS 16:5.

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32. _____ and R.P. EMERY. 1959. Fall Migration - Northeastern Maritime Region. AMER. BIRDS 13:11.

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33. BALDWIN, D.H. Mass Mortality of Nocturnal Migrants in Ontario.
a. 1962. Progress Report I The Bulletin F.O.N. #97, Sep. 1962
b. 1963. Progress Report II Ontario Nat. 1(2):7-15.
c. 1965. Final Report Ontario Nat. 3(1):3-11.

Ontario kill sites are reviewed including lighthouses, towers and buildings. The Final Report describes a new light type installed at the Dungeness Light in Kent, England, which has brought to an end (there) the destruction of night migrants.

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Electrocutions of birds of prey as they perch on power lines are discussed. Examples are given and remedies are suggested.

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Kills at TV tower in Texas.

41. _____. 1961. Fall Migration - Southern Great Plains Region. AMER. BIRDS 15:55.

Kills at TV tower in Texas.

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43. BELCHER, M., A. BINNIE and B. BINNIE. 1966. The 1965 Fall Warbler Migration at Regina. BLUEJAY 24:10-15.

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45. BENNETT, F.M. 1909. A Tragedy of Bird Migration. Bird Lore 11:110-113.

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47. BERNARD, R.F. 1966. Fall Migration - Western Great Lakes Region. AMER. BIRDS 20: 45, 52.

TV tower kills in Wisconsin.

48. BIERLY, M.L. 1973. 1971 Fall Television Tower Casualties in Nashville. Migrant 44:5-7.

Species lists given.

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Data and weather presented from kills in Sept. 1961, spring 1963 and 1964.

BRADSTREET, M.S.W. See Long Point Bird Observatory.

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TV tower kills at Eau Claire, Wisconsin.

55. _____. 1959. Spring Migration - Western Great Lakes Region. AMER. BIRDS 13:372-373.

TV tower kill at Detroit, Michigan.

56. BREWER, R. and J. ELLIS. 1958. An Analysis of Migratory Birds Killed At A TV Tower in East-Central, Illinois, Sept. 1955-May 1957. Auk 75:400-414.

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Kill noted at Bluffs Lodge, Blue Ridge Parkway, Virginia.

59. _____. 1952. Fall Migration - Appalachian Region. AMER. BIRDS 6:16.

Ceilometer kill at Knoxville, Tennessee.

60. _____. 1955. Fall Migration - Appalachian Region. AMER. BIRDS 9:26.

Kill at Tennessee airport.

61. BROWNE, M.M. and W. POST. 1972. Black Rails Hit a Television Tower at Raleigh, N.C. Wilson Bull. 84:491-492.

62. BULL, J. 1964. Birds of the New York Area. Harper and Row, New York, p.384.

63. _____. 1974. Birds of New York State. Doubleday, Natural History Press, Garden City, 655pp.

References are made to kill sites in New York State, including the Empire State Building, TV towers and communication towers. See pp. 433, 459, 460, 463, 466, 473, 475, 477, 481, 484, 492, 494, 495, 497, 507, 514, 515, 516, 521, 544, 548.

64. BURTON, D.E. and J. WOODFORD. 1960. Spring Migration - Ontario - Western New York Region. AMER. BIRDS 14:383.

Kill at Long Point Lighthouse, Lake Erie, Ontario.

BUSH, L. See V.M. Kleen.

65. BUSKIRK, W. 1967. A Preliminary Bibliography on Mortality of Nocturnal Migrants. Unpublished MS: Louisiana State University. 91pp.

A list of 177 references is given along with tabulated species lists from these references. Natural migration disasters are included. Very useful.

66. CALDWELL, L.D. and N.L. CUTHBERT. 1963. Bird Mortality at Television Towers Near Cadillac, Michigan. Jack-Pine Warbler 41:80-89.

Lists covering kills for Fall 1961 and Spring 1962.

67. CALDWELL, L.D., E.P. ODUM and S.G. MARSHALL. 1963. Comparison of fat levels in migrating birds killed at a central Michigan and a Florida Gulf Coast TV tower. Wilson Bull. 75:428-434.

68. CALDWELL, L.D. and G.J. WALLACE. 1966. Collections of Migrating Birds at Michigan Television Towers. Jack-Pine Warbler 44:117.

A listing is given from a number of sites.

69. CARLETON, G. 1965. Fall Migration - Hudson - St. Lawrence Region. AMER. BIRDS 19:18.

Empire State Building Kill of 500 in one night and lighting description are given.

70. CARPENTER, F.W. 1906. An Astronomical Determination of the Heights of Birds During Nocturnal Migration. Auk 23:210-217.

71. CARPENTER, F. and H.B. LOVELL. 1963. Bird Casualties Near Magnolia, Larue County. Kentucky Warbler 39:19-21.

Kill of 270 on 25/26 Sept. 1962 at a gas-compressor building. Lights at windows and the fog are discussed.

72. CARSON, L.B. 1954a. [Destruction of birds at a television tower at Topeka, Kansas]. Topeka Aud. News 9(1), 1-2 (Oct.).

73. _____. 1954b. [Further destruction of birds at a television tower at Topeka, Kansas]. Topeka Aud. News 9(2), 5-7 (Dec.).

Both references 72 and 73 are unsigned, unpaged and untitled by L.B. Carson, editor. The topeka kills are throughly reported by Tordoff and Mengel, reference 410.

74. CARTER, J.H. and J.F. PARNELL. 1976. TV Tower Kills in Eastern North Carolina. Chat 40:1-9.

Large kills are reviewed for autumn 1971 and 1972 in the coastal plain at WECT and WWAY towers. Guy wires and the red obstruction lights are discussed.

75. CASE, L.D., H. CRUICKSHANK, A.E. ELLIS and W.F. WHITE. 1965. Weather Causes Heavy Bird Mortality. Florida Nat. 38(1):29-30.

Kills at gantries, missile installations, radio towers and tall buildings between 6-8 Oct. 1965 are given. Over 4,700 were killed including 10 Swainson's Warblers, the third rarest warbler in the USA.

76. CHAMBERLAIN, B.R. 1954. Disaster in Migration. Chat 18:104-105.

Account is given of ceilometer and tower kills during Oct. 1954 at Charleston and Winston-Salem in the Carolinas.

77. _____. 1955. More Ceilometer Data. Chat 19:26.

Savanna, Georgia kills 7/8 Oct. 1954.

78. CHAMBERLAIN, B.R. 1955. Fall Migration - Southern Atlantic Coast Region. AMER. BIRDS 9:17, 18.

Description is given of kills throughout region and includes the 50,000 deaths at the ceilometer in Macon, Georgia. It covers Ga., S.C., and N.C.

79. _____. 1956. Fall Migration - Southern Atlantic Coast Region. AMER. BIRDS 10:15.

Area covered as in reference 78, TV towers and ceilometers.

80. _____. 1957. Fall Migration - Southern Atlantic Coast Region. AMER. BIRDS 11:17.

Kill at TV tower, Chapel Hill, N.C.

81. _____. 1957. Spring Migration - Southern Atlantic Coast Region. AMER. BIRDS 11:333, 336, 337.

Kill at TV tower, Chapel Hill, N.C.

82. CHAMBERLAIN, B.R. 1958. Fall Migration - Southern Atlantic Coast Region. AMER. BIRDS 12:20.

TV tower kills in Ga., S.C. and N.C.

83. _____. 1960. Fall Migration - Southern Atlantic Coast Region. AMER. BIRDS 14:23.

TV tower kills in Ga., and N.C.

84. _____. 1961. Fall Migration - Southern Atlantic Coast Region. AMER. BIRDS 15:24.

TV tower kills in N.C.

85. _____. 1962. Fall Migration - Southern Atlantic Coast Region. AMER. BIRDS 16:21.

TV tower kills in S.C.

86. CLARK, A.R. 1973. Avian Mortality at Three Western New York Television Towers. M.A. Thesis, State University College at Buffalo, New York, 129pp.

Between 1967-1971, 4,094 birds were retrieved. A discussion is presented of the attraction to tower lights, guy wire and superstructure impacts as well as weather effects. The correlation of kills with northerly winds and overcast conditions is given.

87. CLARKE, W.E. 1912. Studies in Bird Migration. 2 vols., Gurney and Jackson, London.

Observations are described of migration at the Eddystone Light and aboard a lightship in the North Sea.

88. COCHRAN, W.W. and R.R. GRABER. 1958. Attraction of Nocturnal Migrants by Lights on a Television Tower. Wilson Bull. 70: 378-380.

Behavior of migrants at a television tower is described. Apparently they are attracted by the lights. Some kill data is given.

89. COFFEY, B.B. 1954. Ceilometer and other indications of nocturnal migration, Memphis, October 1953. Migrant 25:11.

Small kill, 10-20, occurred on 5, 6 Oct. 1953. Weather is discussed.

90. CONNELL, C., E. ODUM and H. KALE. 1960. Fat Free Weight of Birds. Auk 77:1-9.

Specimens for this study come from television tower kills in Aiken, S.C., and Tallahassee, Fla. The towers themselves are not discussed.

91. CORNWELL, G. and H. HOCHBAUM. 1971. Collisions With Wires - A Source of Anatid Mortality. Wilson Bull. 83:305-306.

92. COUES, E. 1876. Destruction of Birds By Telegraph Wire. Amer. Nat. 10:734-736.

Diurnal collision is described of horned larks and longspurs with telegraph wires between Denver, Colorado and Cheyenne, Wyoming.

93. CRAWFORD, R.L. 1971. Predation on Birds Killed at TV Tower. Oriole 36(4):33-35.

94. _____. 1974. Bird Casualties at a Leon County, Florida TV Tower: Oct. 1966-Sept. 1973. Bulletin Tall Timbers Research Station 18:1-27.

In the stated period, 5,550 birds of 148 species were killed. Comparisons are presented. See Stoddard, references 390 and 391.

95. CUNNINGHAM, R.L. 1964a. Fall Migration - Florida Region. AMER. BIRDS 18:24.

TV tower kills in Florida.

96. _____. 1964b. Spring Migration - Florida Region. AMER. BIRDS 18:443.

TV tower kills in Florida.

97. _____. 1965. Fall Migration - Florida Region. AMER. BIRDS 19:29, 32.

Heavy kills occurred in Florida at buildings, low structures and television towers. The effects of Hurricane Hilda are discussed.

CUTLER, D.A. See F.R. Scott.

98. DANENHOUR, F.H. 1889. Birds killed by Electric Lights at Girard College, Philadelphia, Pa. Amer. Nat. 23:823-824.

A species list is given.

99. DAVIDSON, G.R., T.V. DEGEARE, T.J. SORG and R.M. CLARK. 1971. Land Disposal Sites Near Airports Reporting Bird-Aircraft Hazards. A survey for the interagency bird hazard committee. U.S. Env. Prot. Agency, Div. Tech. Operations Open-File Rep. (TSR 1.6.004/0, 33pp).

100. DAVIS, W.B. 1940. Gas Flares and Birds. Condor 42:127.

This is a one paragraph note describing 100's flying about oil field flares near Bloomington, Texas, May 1939. Few apparently died.

101. DEVITT, O.E. 1967. The Birds of Simcoe County. Sponsored by the Brereton Field Naturalists, Barrie, Ontario, 2nd edition, 192pp.

Casualties at the CKVR-TV station, Barrie, are listed. See pp. 18, 19, 180. See also references MacFayden (254), Westman (430), Wiseman and Hoskin (438), Wiseman (437) and Hoskin (452).

102. DEVLIN, J.M. and J.N. WYKOFF. 1957. Observations on Nocturnal Bird Accidents. Turtox News 35:232-233.

This magazine is devoted to what is happening in the biological and physical sciences. The article shows how mortality is associated with weather fronts.

103. DOBBEN, W.W.H. van and M.F. BRUYNS. 1939. Zug nach Alter und Geschlecht an niederlandischen Leuchtturme. Ardea 28:61-79.

Analysis is given of the age-sex of birds killed at lighthouses of Holland. Records show that in autumn, adults of several species migrate before immatures while in spring the age difference is evident only in Starlings. (See also Auk 57:271 (1940)).

104. DUNBAR, R.J. 1954. Bird Mortality During Night Migration, October 1954. Migrant 25:63-64.

Kills at Oak Ridge, Tennessee, See Tanner: reference 397.

105. DUTCHER, W. 1883. Bird Notes from Long Island, New York. Auk 1:174-179.

106. DUTCHER, W. 1888. Bird Notes from Long Island, New York. Auk 5:169-183.

References 105 and 106 refer to kills at the Fire Island Light. Some contemporary British references are quoted on migration but these were not seen.

107. EASTERLA, D.A. 1973. The Rock Wren in Missouri. Wilson Bull. 85: 479-580.

Kill at radio tower in Missouri.

108. _____, G. JACKSON, K. MARTINSON and D. SNYDER. 1961. Large Bird Kills at TV Towers. Bluebird 28:9.

Kill at KOMU-TV tower in Columbia, Missouri on 24 Sept. 1960 (658 dead).

109. EATON, S.W. 1967. Recent Tower Kills in Upstate New York. Kingbird 17(3):142-146.

Kills were monitored at 6 communications towers. Another 10 towers are known to cause kills with an additional 40 towers probably killing birds.

110. EDEBURN, R.M. 1973. Great Horned Owl Impaled on Barbed Wire. Wilson Bull. 85:478.

See also McCarthy, reference 258.

111. EDSCORN, J.B. 1974. Fall Migration - Florida Region. AMER. BIRDS 28:43.

112. _____. 1975. Fall Migration - Florida Region. AMER. BIRDS 29:44.

113. _____. 1976. Fall Migration - Florida Region. AMER. BIRDS 30:57-58.

References 111-113 refer to kill sites at television towers in Florida.

114. ELDER, W.H. and J. HANSEN. 1967. Bird Mortality at KOMU-TV Tower, Columbia, Missouri, Fall 1965 and 1966. Bluebird 34: 3-6.

Species list, age and sex analysis and weather conditions are given referring to kills on 22 Sept. 1965, 27 Sept. 1965 and 19-20 Sept. 1966. Respective numbers killed were 205, 28 and 618.

EMERY, R. See J. BAIRD; A.M. BAGG; A. MORGAN.

115. ENGLISH, A.O. 1961. Destruction of Birds in Migration. Raven 32: 66-67.

Ceilometer kill of 92 at Roanoke, Virginia airport, 3 Oct. 1960.

116. FEEHAN, J. 1963. Destruction of Bird Life in Minnesota - Sept. 1963. 2) Birds killed at the Ostrander TV Tower. Flicker 35:111-112.

See R.B. Janssen, reference 191.

117. FERREN, R.L. 1959. Mortality at the Dow Air Base Ceilometer. Maine Field-Naturalist 15:113-114.

Kills of 45 on 30-31 Aug. 1957 and 32 on 30 Sept.-1 Oct. 1957 occurred during rain, fog and low ceiling conditions.

118. FINCH, D.W. 1970. Fall Migration - Northeastern Maritime Region. AMER. BIRDS 24:13.

Kills at the Gannet Rock, New Brunswick.

119. _____. 1971. Fall Migration - Northeastern Maritime Region. AMER. BIRDS 25:24.

Kill at Boston's Prudential Building, Massachusetts.

120. _____. 1973. Fall Migration - Northeastern Maritime Region. AMER. BIRDS 27:29.

Kills at Sable Island Lighthouse, Nova Scotia.

121. _____. 1973. Spring Migration - Northeastern Maritime Region. AMER. BIRDS 27:748.

Kill at Boston's Prudential Building, Massachusetts.

122. FINK, L.C. 1970. Birds in Downtown Atlanta - 1969. Oriole 35: 1-9.

Kills at tall lighted buildings.

123. _____ and T.W. FRENCH. 1971. Birds in Downtown Atlanta - Fall 1970. Oriole 35:13-20.

124. FISHER, H.I. 1966. Midway's Deadly Antennae. Audubon Mag. 68(4):220-223.

Collisions of birds with guy wires of the communications towers are described.

125. FOBES, C.B. 1956. Bird Destruction at Ceilometer Light Beam. Maine Field-Naturalist 12:93-95.

Kill of 60 on 15-16 Sept. 1956 at Portland airport is documented. Weather conditions preceding the flight are described.

126. GANIER, A.F. et al. 1935. Nocturnal Migration in Stormy Weather. Migrant 6:77-80.

127. GANIER, A.F. 1954a. Bird Casualties at Smyrna Airport. Migrant 25:11

128. _____. 1954b. Bird Mortality During Night Migration. October 1954. Migrant 25:61-62.

Kills at Shelbyville, Tennessee. See J.T. Tanner, reference 397.

129. _____. 1962. Bird Casualties at a Nashville Television Tower. Migrant 33:58-60.

Presented are a list, bird behavior, weather comments and a description of the tower.

130. _____. 1963. A Kentucky Bird-Fall in 1962. Migrant 34:34-35.

A listing is given for this building kill.

131. _____. 1966. Some Facts Learned from Nocturnal Migration. Migrant 37:27-34.

The title is self-explanatory.

132 GASTMAN, E.A. 1886. Thousands of birds killed at electric light towers in Decatur, Illinois. Amer. Nat. 20:981.

Kill of 28-29 Sept. 1886.

133. GAUTHREAUX, S.A. 1972. The Changing Seasons: Spring 1972. AMER. BIRDS 26:731, 732, 736.

An overview is presented of the migration kills reported in spring 1972.

134. _____. 1973. The Changing Seasons: Spring 1973. AMER. BIRDS 27:745.

As per reference 133 but for spring 1973.

135. GEORGE, W. 1963. Columbia Tower Fatalities. Bluebird 30:5.

A list is given of the 941 birds killed on 20-21 Sept. 1963 at a Columbia, Missouri (KOMU) TV tower.

GOELDIN, P. See M.F. BIJLEVELD.

136. GOLLOP, M.A. 1965. Bird Migration Collision Casualties at Saskatoon. Blue Jay 23:15-17.

Casualties are listed for 1961-1964 covering 9 radio and television towers which occurred during inclement weather and at 29 power lines which occurred during clear weather.

137. GOODPASTURE, K.A. 1963. Age, Sex and Wing Length of Tower Casualties: Fall Migration, 1962. Bird Banding 34:191-199.

Studies were carried out using specimens from kills at two TV towers in Nashville, Tennessee.

138. _____. 1963. Age and Sex Determinations of Tower Casualties, Nashville, 1963. Migrant 34:67-70.

139. _____. 1974a. Fall 1972 TV Tower Casualties in Nashville. Migrant 45:29-31.

140. _____. 1974b. Fall 1973 TV Tower Casualties in Nashville. Migrant 45:57-59.

141. GOODPASTURE, K.A. 1975a. Nashville Television Tower Casualties, 1974. Migrant 46:49-51.

142. _____. 1975b. Nashville Television Tower Casualties, 1975. Migrant 47:8-10.

143. GOODWIN, C.E. 1971. Fall Migration - Ontario - Western New York Region. AMER. BIRDS 25:49.

Kills at TV towers and buildings in Ontario.

144. _____. 1973a. Fall Migration - Ontario - Western New York Region. AMER. BIRDS 27:49, 55.

Kills are noted at chimneys in Ontario.

145. _____. 1973b. Spring Migration - Ontario - Western New York Region. AMER. BIRDS 27:765.

Kills are reported at chimneys and a lighthouse in Ontario.

146. _____. 1974. Fall Migration - Ontario - Western New York Region. AMER. BIRDS 28:47.

Kills are reported at chimneys in Ontario.

147. _____. 1975. Fall Migration - Ontario - Western New York Region. AMER. BIRDS 29:48.

Kills are reported at TV towers and chimneys in Ontario.

148. GRABER, R.R. 1962. Fall Migration - Middle western Prairie Region. AMER. BIRDS 16:35.

A TV tower kill is reported in Illinois.

149. _____. 1968. Nocturnal Migration in Illinois - Different Points of View. Wilson Bull. 80:36-71.

The mechanics of migration and tracking migration are described. This article may be of use to design staff.

150. _____ and W.W. COCHRAN. 1959. An Audio Technique for the Study of Nocturnal Migration of Birds. Wilson Bull. 71:220-236.

151. GRABER and W.W. COCHRAN. 1960. Evaluation of an Aural Record of Nocturnal Migration. Wilson Bull. 72:253-273.

References 150 and 151 deal with the methods of studying nocturnal migration.

152. GREEN, J.C. 1963. Destruction of Bird Life in Minnesota - Sept. 1963. 3) Notes on Kills at Duluth on Sept. 18/19. Flicker 35: 112-113.

See R.B. Janssen, reference 191.

153. _____. 1964. Fall Migration - Western Great Lakes Region. AMER. BIRDS 18:34.

Kills are reported at ceilometer and TV towers in Minnesota and Wisconsin (30,000+).

154. _____ and J.P. PERKINS. Some Notes on the Fall 1974 Migration of Vireos and Warblers. Loon 36:127-129.

A kill is described on board steamer on Great Lakes, 7-8 Sept. 1964.

155. GREGORY, H. 1975. Unusual Fall Tower Kill. Bluebird 42:9-10.

Kills (98+) on 14-15 Oct. 1975 at 4 radio-television towers in Kansas City - Lawrence Area, Missouri, are reported. Late date, absence of guy wires, high cloud ceiling and large numbers of mourning doves make it unusual.

156. GRIFFIN, W.W. 1956. Unexpected Birds Killed at Atlanta Area Ceilometers. Oriole 21:21-22.

Kill of 556 on 26-27 Sept. 1955 is reported.

157. GRISCOM, L. 1955. The Changing Seasons: Fall 1954. AMER. BIRDS 9:6.

Overview is presented of kills reported during migration.

158. GUNN, W.W.H. 1956. Spring Migration - Ontario Western New York Region. AMER. BIRDS 10:330.

Kill at a grain elevator at Collingwood, Ontario.

159. HALL, G.A. 1965. Fall Migration - Appalachian Region. AMER. BIRDS 19:37.

Kills at TV towers in Tennessee.

160. _____. 1966. Fall Migration - Appalachian Region. AMER. BIRDS 20:42-44.

TV tower kills in Tennessee and West Virginia.

161. _____. 1967. Fall Migration - Appalachian Region. AMER. BIRDS 21:35, 36.

TV tower kills in West Virginia.

162. _____. 1968. Fall Migration - Appalachian Region. AMER. BIRDS 22:38, 40.

TV tower kills in West Virginia.

163. _____. 1972. Fall Migration - Appalachian Region. AMER. BIRDS 26:63, 65.

Kills at chimneys and windows in Ohio and Virginia.

164. _____. 1973. Fall Migration - Appalachian Region. AMER. BIRDS 27:60.

TV tower kills in Tennessee.

165. _____. 1974. Fall Migration - Appalachian Region. AMER. BIRDS 28:52.

Kills at chimneys and buildings in Ohio and Virginia.

166. _____. 1975. Fall Migration - Appalachian Region. AMER. BIRDS 29:58.

TV tower kills in Ohio and Tennessee.

167. _____. 1976. Fall Migration - Appalachian Region. AMER. BIRDS 30:67, 70.

TV tower kills in Ohio.

168. HANNUM, G., W. ANDERSON and M. NELSON. 1974. Power Lines and Birds of Prey. Paper presented at the Northwest Electric Light and Power Association Conference, Yakima, Washington, April 1974, 20pp.

Power line design and configurations are given to reduce the raptor electrocution problem.

169. HANSEN, L. 1954. Birds Killed at Lights in Denmark 1886-1939. Vidensk. Medd. dansk. naturh. Foren. 116:269-368.

Not seen.

170. HARRISON, J. 1963. Heavy Mortality of Mute Swans from Electrocution. Wildfowl Trust Annual Report 14:164-165.

A kill of 21 on 25 April 1962 at Romney Marsh, Kent, England where three line cable at a height of 10 yards from ground crossed the regular flight line.

171. HATCH, D.R.M. 1966. Fall Migration - Northern Great Plains Region. AMER. BIRDS 20:63.

TV tower kills in Manitoba.

172. _____. 1967. Fall Migration - Northern Great Plains Region. AMER. BIRDS 21:50.

TV tower kills in Saskatchewan.

173. _____. 1969. Fall Migration - Northern Great Plains Region. AMER. BIRDS 23:74.

TV tower kills in Manitoba.

174. HERNDON, L.R. 1954. Bird Mortality During Night Migration. October 1954. Migrant 25:65-67.

Kills at TV tower in Johnson City, Tennessee. See Tanner, reference 397.

175. _____. 1957. Johnson City, Tennessee, TV Tower Casualties. Migrant 28:56-57.

Kill on 29 Sept. 1957.

176. HERNDON, L.R. 1962. A Texas Bird-Fall. Migrant 33:60-61.

Ceilometer kill at Dal Rio, Texas.

177. HEYE, P. 1963. Tower Fatalities. Bluebird 30:7.

A list is presented of the kill at KFVS-TV tower in Cape Girardeau County, Missouri, during Autumn 1962.

178. HICKEY, M.B. 1960. Migrants at Airport Ceilometers. Passenger Pigeon 22:23-26.

A kill list and bird behavior at the lights are described in the Madison, Wisconsin area (May 1952 and October 1959).

179. HILTUNEN, E. 1953. On Electric and Telephone Wire Accidents in Birds. Suomen Riista 8:70-76.

Experiences in Finland are described. (Text is in Finnish).

HOSKIN, J. See reference 452.

180. HOUSTON, C.S. 1972. Fall Migration - Northern Great Plains Region. AMER. BIRDS 26:79.

TV tower kill in Saskatchewan.

181. _____. 1972. Spring Migration - Northern Great Plains Region. AMER. BIRDS 26:776-777.

Communication tower kills in North Dakota.

182. _____ and M.I. HOUSTON. 1975. Fall Migration - Northern Great Plains Region. AMER. BIRDS 29:76.

Kill at TV Tower in Saskatchewan.

183. HOWELL, J.C. 1955. A Comparison of Ceilometer Mortality at Knoxville and Nashville, Tennessee in 1951 and 1954. Migrant 26:53-57.

184. _____, A.R. LASKEY and J.T. TANNER. 1954. Bird Mortality at Airport Ceilometers. Wilson Bull. 66:207-215.

An extensive review of the subject is given including bird behavior, types of injuries and their causes and the effects of weather.

185. HOWELL, J.C. and J.T. TANNER. 1951. An Accident to Migrating Birds at the Knoxville Airport. Migrant 22:61-62.

Kill of 1,044 birds is noted on 7-8 Oct. 1951.

HUNT, F.R. See reference 453.

HUSSELL, D.J.T. See Long Point Bird Observatory.

186. JACKSON, W.B., E.J. RYBAK and S.H. VESSEY. 1974. Vertical Barriers to Bird Migration. Published as Conference on the Biological Aspects of the Bird/Aircraft Collision Problem 5-7 Feb. 1974, Clemson University, Clemson, South Carolina. pp.279-287. Editor S.A. Gauthreaux.

Observations are described and kills are listed at the cooling tower of the atomic power station at Port Clinton, Ohio, on Lake Erie. Lighting techniques are given. See also Rybak, reference 352.

187. JAMES, D. 1966. Fall Migration - Central Southern Region. AMER. BIRDS 20:61.

TV tower kills in Tennessee and Louisiana.

188. _____. 1968. Fall Migration - Central Southern Region. AMER. BIRDS 22:50.

TV tower kills in Tennessee and Oklahoma.

189. _____ and H.H. SHUGART. 1967. Fall Migration - Central Southern Region. AMER. BIRDS 21:46.

TV tower kill in Tennessee.

190. JAMES, P. 1956. Destruction of Warblers on Padre Island, Texas, in May 1951. Wilson Bull. 68:224-227.

Kills at lights, wires and poles following a severe storm were estimated in excess of 10,000 individuals. A list is given.

191. JANSSEN, R.B. 1963. Destruction of Bird Life in Minnesota - Sept. 1963. 1) Birds Killed at the Lewisville TV Tower 5) Television Towers in Minnesota. Flicker 35:110-111 and 113-114.

Series of 5 articles on kills in Flicker 35:110-114 by Janssen, Feehan, Green, Peterson and Janssen.

192. JOHANSEN, K. 1975. Review and Analysis of Bird Impingement and Stack Illumination at Ontario Hydro Generating Stations. Ontario Hydro Report 75073, 42pp.

A detailed comparison is made between the Nanticoke Station on Lake Erie and the Lennox Station near Kingston on Lake Ontario. Correlations of kills with weather, lighting on the chimneys and general site illumination are carried out. Only a brief reference is made to three other stations where kills are on record but where systematic checks have apparently not been made.

193. JOHNSTON, D.W. 1955. Mass Mortality in Georgia, October 1954. Oriole 20:17-26.

A survey is given of several sites where kills occurred between 6-8 Oct. 1954. An estimated 79,000 died at television towers and ceilometers during inclement weather.

194. _____. 1957. Bird Mortality in Georgia, 1957. Oriole 22: 33-39.

Massive kills are reported from several sites on 4-5 October 1957. Over 4,000 birds were reported killed.

195. _____ and T.P. HAINES. 1957. Analysis of Mass Bird Mortality in October 1954. Auk 74:447-458.

This reports on kills at 25 sites from New York to the South Atlantic states. Ceilometers, TV and radio towers, tall buildings and a brightly lit parking area are involved. Reference is made to a total fall of at least 106,804 plus 9,495 of 88 species.

196. KALE, H.W., M.H. HUNDLEY and J.A. TUCKER. 1969. Tower-killed Specimens and Observations of Migrant Birds from Grand Bahama Island. Wilson Bull. 81:258-263.

A listing is given of 200 killed at a TV tower and of 400 dying at the USAF tracking tower during inclement weather.

197. KALE, H.W. 1971. Spring Migration - Florida Region. AMER. BIRDS 25:723-733.

Kills at towers, Cape Kennedy and a crane on site at a nuclear power station in Florida.

198. KALE, H.W. 1972. Spring Migration - Florida Region. AMER. BIRDS 26:751.

199. _____. 1973. Spring Migration - Florida Region. AMER. BIRDS 27:761.

200. _____. 1975. Spring Migration - Florida Region. AMER. BIRDS 29:842.

201. _____. 1976. Spring Migration - Florida Region. AMER. BIRDS 30:831.

References 198 to 201 refer to kills at TV towers and at the Kennedy Space Centre in Florida.

202. KEMPER, C.A. 1958a. Bird Destruction at a TV Tower. Aud. Mag. 60:270.

Kill at Eau Claire, Wisconsin.

203. _____. 1958b. Destruction at the TV Tower. Passenger Pigeon 20:3-9.

Over 20,000 were killed at the WEAU-TV tower at Eau Claire, Wisconsin in Aug.-Sept. 1957.

204. _____. 1959. More TV Tower Destruction. Passenger Pigeon 21:135-142.

The status of kills up to 1959 at the Eau Claire tower is described and the mechanics of kill are discussed. Brief reference is made to the WEAU-TV tower in other issues of Passenger Pigeon as follows: 1965, 27:121; 1966, 28:114; 1967, 29:83 and 1969, 31:285.

205. _____. 1964. A Tower for TV - 30,000 Dead Birds. Audubon Mag. 66:86-90.

206. _____, D.G. RAVELING and D. WARNER. 1966. A Comparison of the Species Composition of Two TV Tower-Killed Samples from the Same Night of Migration. Wilson Bull. 78:26-30.

Kills from Eau Claire, Wisconsin and Westport, Minnesota sites are compared as to species make-up. Striking differences are apparent from the kill of 9-10 Sept. 1962.

207. KEMPER, C.A., S.D. ROBBINS and A.C. EPPLE. 1964. The Ornithological Flood of September 18-20, 1963. Passenger Pigeon 26:159-172.

Mortality at TV towers in Wisconsin and Minnesota, together with a discussion of weather and migration, is given. Lists are presented for three sites.

208. KIBBE, D.P. 1975. Fall Migration - Western New York and Northwestern Pennsylvania Region. AMER. BIRDS 29:53, 56.

209. _____. 1976. Fall Migration - Western New York and Northwestern Pennsylvania Region. AMER. BIRDS 30:65-66.

References 208 and 209 refer to kills at TV towers in New York State.

210. KINGERY, H.E. 1971. Spring Migration - Great Basin - Rocky Mountain Region. AMER. BIRDS 25:775.

Electrocution of eagles in Colorado and Wyoming.

211. KLEEN, V.M. 1975. Fall Migration - Middlewestern Prairie Region. AMER. BIRDS 29:64.

TV tower kills in Illinois and Iowa.

212. _____ and L. BUSH. 1973. Fall Migration - Middlewestern Prairie Region. AMER. BIRDS 27:66, 69, 70.

TV tower kill in Illinois.

213. KRAMER, Q. 1948. Bird Tragedy in a Fog. Cassinia 37:21-22.

Presented are a short description of and a list from a kill at a TV tower atop a building in Philadelphia, Pa., on 10-11 Sept. 1948.

214. KRAUSE, H. 1960. Fall Migration - Northern Great Plains Region. AMER. BIRDS 14:48.

TV tower kill in Saskatchewan. See Lahrman, reference 219.

215. KUHRING, M.S. 1963. Equipment Used in Canada for Dispersing Birds. National Research Council of Canada Associate Committee on Aircraft Engine Bird Strikes, 6pp.

216. KUMLIEN, L. 1888. Observations on Bird Migration at Milwaukee. Auk 5:325-328.

Building kills are reported.

217. LABAND, K.A. 1951. An Accident to Birds at the Ceilometer near Smyrna. Migrant 22:63.

Kill of 1,000 is described which occurred on 7 October 1951 in Tennessee.

218. LACK, D. 1960. The Height of Bird Migration. Brit. Birds 53:5-10.

This may be useful to design personnel.

219. LAHRMAN, F.W. 1959. TV Tower Casualty List. Blue Jay 17:142-143.

Kills at Moose Jaw, Saskatchewan, 22 Sept. 1959.

220. _____. 1962. Fall Migration TV Tower Kills, 1962. Blue Jay 20:152.

Kills at Caron, Moose Jaw and Regina, Saskatchewan.

221. _____. 1965. Regina and Lumsden TV Tower Bird Mortalities 1964. Blue Jay 23:18-19.

LANCASTER, D.A. See R.J. Newman.

222. LANGRIDGE, H.P. 1960. [Birds killed (200+, 156) at windows of shopping centres during May 1960 in Palm Beach, Florida]. Florida Nat. 33:226.

Not seen, see Velie reference 417.

223. LASKEY, A.R. 1951. Another Disaster to Migrating Birds at the Nashville Airport. Migrant 22:57-60.

224. LASKEY, A.R. 1954. Bird Mortality During Night Migration, October 1954, Nashville and Smyrna. Migrant 25:59-61. (See Tanner, reference 397).

225. _____. 1956a. Bird Casualties at Smyrna and Nashville Ceilometers. Migrant 27:9-10.

226. _____. 1956b. Television Towers and Nocturnal Bird Migration. Migrant 27:66-67.

227. _____. 1957. Nashville Television Tower Casualties 1957. Migrant 28:54-56.

228. _____. 1960. Bird Migration Casualties and Weather Conditions, Autumns 1958-59-60. Migrant 31:61-64.

229. _____. 1962. Migration Data from Television Tower Casualties at Nashville. Migrant 33:7-8.

230. _____. 1963a. Casualties at WSM-TV Tower in Autumn, 1962. Migrant 34:15.

231. _____. 1963b. Mortality of Night Migrants at Nashville TV Towers 1963. Migrant 34:65-66.

232. _____. 1964. Data from the Nashville TV Tower Casualties. Migrant 35:95-96.

233. _____. 1965. Autumn 1965 TV Tower Casualties at Nashville. Migrant 36:80-81.

234. _____. 1966. TV Tower Casualties at Nashville Spring and Fall 1966. Migrant 37:61-62.

235. _____. 1968. TV Tower Casualties at Nashville Autumn 1967. Migrant 39:25-26.

236. _____. 1969a. Television Tower Casualties at Nashville in Autumn 1968. Migrant 40:25-27.

237. LASKEY, A.R. 1969b. Autumn 1969 TV Tower Casualties at Nashville. Migrant 40:79-80.

238. _____. 1971. TV Tower Casualties at Nashville: Spring and Autumn 1970. Migrant 42:15-16.

In references 223 to 238, Mrs. Laskey provides kill lists, weather data and a general discussion of kills in the Nashville, Tennessee area. Sites include ceilometers and television towers WSM, WSIX, WLAC.

239. LEWIS, H.F. 1927. Destruction of Birds by Lighthouses in the Provinces of Ontario and Quebec. Canadian Field-Naturalist 41:55-58 and 75-77.

Reports are presented covering 68 sites which are responses to a questionnaire sent to lighthouse keepers. See also Munro; Tufts - references 266 and 415.

240. LGL LIMITED. 1972. An Examination of the Bird Impact Problem at the Nanticoke Plant of the Ontario Hydro Electric System, Phase II: Autumn 1972. Consultant's Report, December.

241. LINDBERG, P. and V. OLSSON. 1976. World Conference on the Predator Birds. Var Fagelvarld 35:168-170. [In Swedish].

Reference is made to the problem of eagle destruction on power lines. (Vienna 1975 conference).

242. LISTER, R. 1965. Fall Migration - Northern Great Plains Region. AMER. BIRDS 19:52.

Kills at TV towers in Saskatchewan.

243. LONG POINT BIRD OBSERVATORY. 1965. [References to lighthouse kills at Long Point Lighthouse]. Ontario Bird-Banding 1:5-8, by D.J.T. HUSSELL, et al.

244. _____. 1966. [References to lighthouse kills at Long Point Lighthouse]. Ontario Bird-Banding 2:5-7 by D.J.T. HUSSELL et al.

245. _____. 1969. Nocturnal Migration. Ten Year Report 1960-69, pp.19-23, M.S.W. BRADSTREET and P.S. WOODFORD.

246. LONG POINT BIRD OBSERVATORY. 1973. Lighthouse Project 1973. Annual Report, p.20, D.J.T. HUSSELL.

References 242 to 245 contain information on bird kills at the lighthouse. See also Saunders, reference 353.

247. LORD, W.G. 1951. Bird Fatalities at Bluffs Lodge on the Blue Ridge Parkway, Wilkes County, N.C. Chat. 15:15-16.

A kill of 200+ is reported at floodlights on the foggy night 17 Sept. 1950.

248. LOVELL, H.B. 1952. Catastrophe to Birds at a Louisville Airport. Kentucky Warbler 28:5-6.

A small kill occurred on 7 October 1951 at the ceilometer.

LOWERY, G.H. See R.J. Newman.

LUNN, J. See J. Woodford.

249. LUPIENT, M. 1961. Fall Migration - Western Great Lakes Region. AMER. BIRDS 15:42.

Kills are reported from TV towers in Wisconsin. The greatest number (12,000) were killed at Eau Claire.

250. _____. 1962a. Fall Migration - Western Great Lakes Region. AMER. BIRDS 16:35.

More kills are reported from Eau Claire, TV tower (38,000).

251. _____. 1962b. Spring Migration - Western Great Lakes Region. AMER. BIRDS 16:411-413.

TV tower kill is reported at Chippewa Falls, Wisconsin. A natural disaster is also reported from the lakeshore at Duluth where many birds were washed up.

252. _____. 1963. Fall Migration - Western Great Lakes Region. AMER. BIRDS 17:36.

Ceilometer kill of 48 occurred at Duluth, Minnesota.

253. LUSTICK, S.I. 1973. The effects of intense light on bird behavior and physiology. Proc. 6th Bird Control Seminar, Bowling Green State University, Bowling Green, Ohio. Editors Cones and Jackson.

This reference may be of use to design personnel.

254. MACFAYDEN, C. 1970. TV Tower Bird Kills. Blue Heron 15(2).

Kills are reported at CKVR-TV Tower at Barrie, Ontario.

255. MACKAY, Barry Kent. 1976. Personal communication.

Mr. MacKay has gathered large quantities of data on bird kills in Toronto during spring and autumn at (i) the CFTO-TV tower 1960-1974; (ii) Toronto-Dominion Centre and Commerce Court Area 1972-76; (iii) CN Tower 1976 - . He can be contacted at either his home 35 Thorncliffe Park Drive, Toronto, Ontario, Apt. 1208, M4H 1J3 (January 1977) or through the Royal Ontario Museum, Department of Ornithology, Toronto.

See also P. Whelan, reference 433.

256. MANUWAL, D.D. 1963. TV Transmitter Kills in South Bend, Indiana, Fall 1962. Ind. Audubon Quar. 41:49-53.

Lists are presented for Fall 1961 and Spring and Fall 1962.

257. MAYFIELD, H. 1967. Shed Few Tears. Audubon 69:61-65.

The author gives a personal opinion on the effects of kills on bird population.

258. McCARTHY, T. 1973. Ocular Impalement of a Great Horned Owl. Wilson Bull. 85:477.

See also Edeburn, reference 110.

259. MERRIAM, C.H. 1885. Preliminary Report of the Committee on Bird Migration. Auk 2:53-65.

A reference is made to kills.

260. MERITT, J.K. 1960. An Albany Airport Ceilometer Disaster in 1956. Kingbird 10:170-171.

Kill of 313 on 15 Sept. 1956.

253. LUSTICK, S.I. 1973. The effects of intense light on bird behavior and physiology. Proc. 6th Bird Control Seminar, Bowling Green State University, Bowling Green, Ohio. Editors Cones and Jackson.

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254. MACFAYDEN, C. 1970. TV Tower Bird Kills. Blue Heron 15(2).

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A reference is made to kills.

260. MERITT, J.K. 1960. An Albany Airport Ceilometer Disaster in 1956. Kingbird 10:170-171.

Kill of 313 on 15 Sept. 1956.

261. MILLER, D., E.L. BOEKER, R.S. THORSELL and R.R. OLENDORFF. 1975. Suggested Practises for Raptor Protection on Power Lines, Edison Electric Institute, 21pp.

Progress in the field up to 1975 is summarized. Designs are proposed along with detailed diagrams which reduce electrocution of raptors. This 'handbook' is a must for Hydro Companies. It is distributed by Raptor Research Foundation, Inc., c/o Department of Zoology, Brigham Young University, Provo, Utah, 84601.

262. MILLER, G.S. 1897. Winge on Birds at the Danish Lighthouses. Auk 14:415.

This is a review article on the annual Danish publication of Ornis (Vols. I-VI) in which petrels are noted on the kill list of two lightships. Winge is the name of a person.

263. MORGAN, A. and R.P. EMERY. 1955. Spring Migration - Northeastern Maritime Region. AMER. BIRDS 9:318.

Kill at Cape Sable Light, Nova Scotia.

264. MUMFORD, R.E. 1960. Fall Migration - Middlewestern Prairie Region. AMER. BIRDS 14:39.

Kills at TV towers in Illinois and Indiana.

265. _____. 1961. Fall Migration - Middlewestern Prairie Region. AMER. BIRDS 15:44.

Kills at TV towers and a ceilometer in Iowa and Indiana.

266. MUNRO, J.A. 1924. A Preliminary Report on the Destruction of Birds at Lighthouses on the Coast of British Columbia. Canadian Field-Naturalist 38:141-145 and 171-175.

Responses to a questionnaire, which was sent out to lighthouse keepers, are tabulated. Forty-three stations reported with heaviest kills on dark, rainy nights in autumn. See also Tufts; Lewis - references 239 and 415.

267. NERO, R.W. 1962. Fall Migration - Northern Great Plains Region. AMER. BIRDS 16:47.

TV tower kills in Saskatchewan. See reference 268.

268. NERO, R.W. 1961. Regina TV Tower Bird Mortalities - 1961. Blue Jay 19:160-164.

269. _____. 1962. Regina TV Tower Mortality, May 11-12, 1962. Blue Jay 20:151-152.

Kill lists are given together with an account of the inclement weather and low cloud ceiling.

270. _____. 1963. Fall Migration - Northern Great Plains Region. AMER. BIRDS 17:44.

TV tower kill in Manitoba.

271. NEWMAN, R.J. 1955. Fall Migration - Central Southern Region. AMER. BIRDS 9:32.

Ceilometer kills in Alabama and Tennessee.

272. _____. 1956. Fall Migration - Central Southern Region. AMER. BIRDS 10:29, 30.

Ceilometer kills in Alabama and Tennessee.

273. _____. 1956. Spring Migration - Central Southern Region. AMER. BIRDS 10:339.

TV tower kill in Louisiana.

274. _____. 1958a. The Changing Seasons: Fall Migration 1957. AMER. BIRDS 12:4-7.

Comprehensive overview is given of kills from a number of sites in Tennessee, Massachusetts, New York, Louisiana and Georgia.

275. _____. 1958b. Fall Migration - Central Southern Region. AMER. BIRDS 12:36.

Kills reported from Tennessee, Florida, Louisiana and Mississippi.

276. NEWMAN, R.J. 1959. The Changing Seasons: Fall Migration 1958. AMER. BIRDS 13:8-9.

An overview is given of kills from Massachusetts, Tennessee and Florida which occurred at buildings and towers.

277. _____. 1959. Fall Migration - Central Southern Region. AMER. BIRDS 13:37.

Kill at TV towers in Tennessee.

278. _____. 1960. Fall Migration - Central Southern Region. AMER. BIRDS 14:44.

Kill at TV towers in Tennessee.

279. _____. 1960. Spring Migration - Central Southern Region. AMER. BIRDS 14:392-393.

A kill of 1,100+ is reported at an oil refinery in Louisiana. The birds were burned as they flew about tall flaming stacks.

280. _____. 1961. Fall Migration - Central Southern Region. AMER. BIRDS 15:47.

TV tower kills in Tennessee and Louisiana.

281. _____ and R.F. ANDRLE. 1961. The Changing Seasons: Fall Migration 1960. AMER. BIRDS 15:78-79.

Continental overview is given of the kills and their relation to hurricane Donna. (20,000+ casualties).

282. _____ and D.A. LANCASTER. 1960. The Changing Seasons: Fall Migration 1959. AMER. BIRDS 14:8.

A continental overview is presented involving about 3,000+ birds killed with 98% occurring on overcast nights and with cold or stationary front present within 24 hours.

283. _____ and G.H. LOWERY. 1959. The Changing Seasons: Spring Migration 1959. AMER. BIRDS 13:350.

A continental overview of kills is given.

284. NEWMAN, R.J. and S.L. WARTER. 1959. Fall Migration - Central Southern Region. AMER. BIRDS 13:377.

TV tower kill in Louisiana.

285. NICHOLS, C.K. 1954. Fall Migration - Hudson - St. Lawrence Region. AMER. BIRDS 8:9.

286. _____. 1955. Fall Migration - Hudson - St. Lawrence Region. AMER. BIRDS 9:10.

287. _____. 1956. Fall Migration - Hudson - St. Lawrence Region. AMER. BIRDS 10:11.

References 285 to 287 note kills at the Empire State Building in New York City and at an airport (ref. 286).

288. NISBET, I.C.T. 1968. Weights of Birds Caught at Night at a Malayan Radio Tower (Migrants). Ibis 110:352-354.

An account is given of migrating birds being attracted to lights and killed on dark misty nights.

289. _____. 1970. Autumn Migration of Blackpoll Warbler Bird-Banding 41:207-240.

An excellent 'special bibliography' is contained in this reference. Some 184 sources of published and unpublished data are quoted.

290. _____, W.H. DRURY and J. BAIRD. 1963. Weight Loss During Migration. Parts I and II. Bird-Banding 34:107-159.

Some specimens for this study came from tower kills. The paper does not deal with the mechanism of migrating birds killing themselves against towers.

291. NOLAN, V. and R.E. MUMFORD. 1965. An Analysis of Prairie Warblers Killed in Florida During Nocturnal Migration. Condor 67:322-327.

A total of 448 specimens for this study came from one television tower, the birds being killed between 1957 and 1963.

292. NOOE, S.H. 1956. Charlotte Ceilometer Kill. Chat 20:20-21.

A list is presented of a kill (113 birds) on 25 Sept. 1955 in overcast, foggy conditions in Charlotte, N.C.

293. NORWOOD, J.R. 1960. TV Tower Casualties at a Charlotte Station. Chat. 24:103-104.

A total of 390 died at WSOC-TV tower on three nights between October 1 to 9. A list and weather conditions are given.

294. OGDEN, J. 1960. Observations at a TV Tower During a Bird-Fall. Migrant 31:65-67.

An interesting description is given of the kill process at WSM in Nashville, Tenn. (321 died).

295. OVERING, R. 1936. The 1935 Fall Migration at the Washington Monument. Wilson Bull. 48:222-224.

296. _____. 1937. The 1936 Fall Migration at the Washington Monument. Wilson Bull. 49:118-119.

297. _____. 1938. The 1937 Fall Migration at the Washington Monument. Wilson Bull. 50:146.

298. _____. 1938. High Mortality at the Washington Monument. Auk 55:679.

References 295 to 298 contain interesting information. Kill lists, weather and the effects of extinguishing floodlights are presented. Kill numbers increased dramatically when the floodlights were used. It is also interesting that the behavior of fringillidae was different from that of parulidae. Sparrows were seen perching around the base while at the same time warblers were crashing into the concrete structure. See Newman and Andrle, reference 281 on this same point.

299. PACKARD, C.M. 1958. Bird Mortality During a Migration Maine Field-Naturalist 14:83-85.

A list is given of 198 birds killed at the Portland airport ceilometer on 16 Sept. 1958 during rain and fog.

300. PARMALEE, P. and B. PARMALEE. 1959. Mortality of Birds at a Television Tower in Central Illinois. Ill. Aud. Bull. 111:1-4.

An account is given of a kill of 1,000-1,500 on 16-17 Sept. 1958 at a tower in Springfield, Illinois, during drizzle and fog.

301. _____ and M.D. THOMPSON. 1963. A Second Kill of Birds at a Television Tower in Central Illinois. Ill. Aud. Bull. 128:13-15.

302. PARNELL, J.F. 1970. Fall Migration - Southern Atlantic Coast Region. AMER. BIRDS 24:32.

TV tower kill in North Carolina.

303. PAULSON, D.R. and H.M. STEVENSON. 1962. Spring Migration - Florida Region. AMER. BIRDS 16:399, 402.

TV tower kill in Florida.

304. PETERSON, A.W. 1963. Destruction of Bird Life in Minnesota - Sept. 1963. 4). Birds killed at Park Rapids. Flicker 35:113.

See R.B. Janssen, reference 191.

305. PETERSON, P.C. 1963. Fall Migration - Middlewestern Prairie Region. AMER. BIRDS 17:36.

TV tower kill in Kentucky.

306. _____. 1964a. Fall Migration - Middlewestern Prairie Region. AMER. BIRDS 18:42.

TV tower kills in Iowa and Missouri.

307. _____. 1964b. Spring Migration - Middlewestern Prairie Region. AMER. BIRDS 18:455.

TV tower kill in Missouri.

308. _____. 1965. Fall Migration - Middlewestern Prairie Region. AMER. BIRDS 19:44.

TV tower kill in Ohio.

309. PETERSON, P.C. 1966a. Fall Migration - Middlewestern Prairie Region. AMER. BIRDS 20:53.

TV tower kills in Ohio and Indiana.

310. _____. 1966b. Spring Migration - Middlewestern Prairie Region. AMER. BIRDS 20:514.

TV tower kills in Ohio.

311. _____. 1967. Fall Migration - Middlewestern Prairie Region. AMER. BIRDS 21:44.

TV tower kills in Kentucky, Missouri and Ohio.

312. _____. 1968. Fall Migration - Middlewestern Prairie Region. AMER. BIRDS 22:48.

TV tower kills in Indiana and Ohio.

313. _____. 1969. Fall Migration - Middlewestern Prairie Region. AMER. BIRDS 23:64.

TV tower kill in Ohio.

314. _____. 1970. Fall Migration - Middlewestern Prairie Region. AMER. BIRDS 24:55.

Building kill in Chicago, Illinois.

315. _____. 1971. Fall Migration - Middlewestern Prairie Region. AMER. BIRDS 25:65.

TV tower kill in Illinois.

316. _____ and B.P. GLASS. 1946. Notes on Bird Mortality During Nocturnal Thunderstorms near College Station, Texas, Condor 48:96.

A list is given of the birds found dead. Geese and pelicans collided with power lines.

317. PIERCE, M.E. 1969. Tall Television Tower and Bird Migration. South Dakota Bird Notes 21:4-5.

Not seen.

318. POST, W. 1963. Tower Casualties at Aiken, S.C. Chat. 27:23.

Kill is described with a list of species at the WJBF-TV tower on 6-7 Sept. 1962. (400 died).

319. POST, W. and M.M. BROWNE. 1971. Seaside Sparrow Hits a TV Tower Near Raleigh, N.C. Wilson Bull. 83:102-103.

320. POUGH, R.H. 1948. Out of the Night Sky. Audubon May 50:354-355.

Mass mortality is described from collisions with Empire State Building in New York City.

321. PURRINGTON, R.K. 1969. Fall Migration - Central Southern Region. AMER. BIRDS 23:66, 69.

TV tower kills in Tennessee.

322. _____. 1970. Fall Migration - Central Southern Region. AMER. BIRDS 24:56, 60.

TV tower kills in Alabama and Louisiana.

323. _____. 1971. Fall Migration - Central Southern Region. AMER. BIRDS 25:68, 70.

TV tower kills in Tennessee.

324. _____. 1973. Fall Migration - Central Southern Region. AMER. BIRDS 27:72-73.

TV tower kills in Tennessee.

325. _____. 1975. Fall Migration - Central Southern Region. AMER. BIRDS 29:68.

TV tower kills in Tennessee.

326. _____. 1976. Fall Migration - Central Southern Region. AMER. BIRDS 30:86.

TV tower kills in Tennessee.

327. RAVELING, D.G. 1965. Geographic Variation and Measurement of Tennessee Warblers Killed at a TV Tower. Bird-Banding 36: 89-101.

328. _____ and D.W. WARNER. 1965. Plumages, Moult and Morphometry of Tennessee Warblers. Bird-Banding 36:169-179.

References 327 and 328 make use of data from specimens killed at the Eau Claire, Wisconsin TV tower. About 800 Tennessee warblers were killed there in autumn 1961 and 1962.

329. REITZ, R. 1954. Birds Meet With Disaster at the Brunswick Naval Air Station. Bull. Maine Aud. Soc. 10:61-62.

330. _____. 1956. Birds Meet With Disaster at the Brunswick Naval Air Station. Auk 73:150.

References 329 and 330 report the same kill of 500-1,000 birds on 8-9 Sept. 1954. They smashed into steel doors of hangars.

331. RINTOUL, L.J. and E.V. BAXTER. 1914. Notes on Passerine Birds Found Migrating in Moult. Scot. Nat. 35:245-252.

Kills reported at Scottish lighthouses.

332. ROBBINS, S.D. 1967. Fall Migration - Western Great Lakes Region. AMER. BIRDS 21:36, 42, 43.

TV tower kill in Wisconsin.

333. _____. 1968. Fall Migration - Western Great Lakes Region. AMER. BIRDS 22:41.

TV tower kills in Wisconsin and Michigan.

334. _____. 1969. Fall Migration - Western Great Lakes Region. AMER. BIRDS 23:54.

TV tower kills in Wisconsin.

335. ROBERTSON, W.B. 1968. Spring Migration - Florida Region. AMER. BIRDS 22:519.

TV tower kill in Florida.

336. ROBERTSON, W.B. 1969. Fall Migration - Florida Region. AMER. BIRDS 23:35, 36, 39-40.

TV tower kills in Florida.

337. _____. 1970. Fall Migration - Florida Region. AMER. BIRDS 24:33-34, 37.

TV tower kills in Florida and a lighthouse kill in Cuba.

338. _____. 1971. Fall Migration - Florida Region. AMER. BIRDS 25:45, 48-49.

339. _____. 1972. Fall Migration - Florida Region. AMER. BIRDS 26:50, 53.

340. _____ and J.C. OGDEN. 1968. Fall Migration - Florida Region. AMER. BIRDS 22:26, 30.

341. _____ and D.R. PAULSON. 1961. Fall Migration - Florida Region. AMER. BIRDS 15:28, 32-33.

342. _____ and H.M. STEVENSON. 1957. Spring Migration - Florida Region. AMER. BIRDS 11:337-338, 341.

References 338 to 342 note kills at TV towers in Florida.

343. ROSCHE, R.C. 1966. Fall Migration - Ontario - Western New York Region. AMER. BIRDS 20:38-39.

344. _____. 1967. Fall Migration - Ontario - Western New York Region. AMER. BIRDS 21:29.

345. _____. 1968. Fall Migration - Ontario - Western New York Region. AMER. BIRDS 22:35.

346. _____. 1969. Fall Migration - Ontario - Western New York Region. AMER. BIRDS 23:46.

347. _____. 1970. Fall Migration - Ontario - Western New York Region. AMER. BIRDS 24:43.

348. ROSCHE, R.C. 1971. Fall Migration - Ontario - Western New York Region. AMER. BIRDS 25:54.

349. _____. 1972. Fall Migration - Ontario - Western New York Region. AMER. BIRDS 26:60, 62.

350. _____. 1973. Fall Migration - Ontario - Western New York Region. AMER. BIRDS 27:56.

351. _____. 1974. Fall Migration - Ontario - Western New York Region. AMER. BIRDS 28:49.

References 343 to 351 list kill sites, mostly TV towers, in western New York state and in northwest Pennsylvania. Reference 351 notes building kills as well as TV towers.

352. RYBAK, E.J., W.B. JACKSON and S.H. VESSEY. 1973. Impact of Cooling Towers on Bird Migration, Proc. 6th Bird Control Seminar, pp.187-194. Bowling Green State University, Bowling Green, Ohio. Editors: Cones and Jackson.

This reference is an additional analysis of the work described by Jackson in reference 186 at the Nuclear Power Station near Port Clinton, Ohio, where a massive natural draft cooling tower is in operation (495' high x 410' wide at base).

353. SAUNDERS, W.E. 1930. The destruction of Birds at Long Point Lighthouse, Ontario, on Four Nights in 1929. Auk 47:507-511.

A list is presented. See also Long Point Bird Observatory references 243 to 246.

354. SAVAGE, T. 1963. Bird Mortality Near Gatlinburg, Sept. 21-22, 1963. Migrant 34:56-57.

A kill of 144 birds is listed from collison with ski lift machinery and cables.

355. _____. 1965. Casualties at Ski Resort, Gatlinburg, 25-26 Sept. 1965. Migrant 36:81-82.

Kills are noted at lighted buildings with a discussion of weather.

356. SAWYER, P.J. 1961. Bird Mortality at the WENH-TV Tower in Deerfield, New Hampshire. New Hampshire Aud. Quar. 14:46-49.

357. _____. 1961. Report on the Cause of Mortality and the Morphometry of 70 Ruby-Crowed Kinglets Killed at the WENH-TV Tower in Deerfield, N.H. Bird-Banding 32:162-168.

A kill on 13-14 Oct. 1959 is described in references 356 and 357. Details of weather are provided.

358. SCHOTZKO, J. 1962. Interrupted Migration. Flicker 34:61.

Kills occurred at store windows on 12 Sept. 1961 in Paynesville (400) and Redwood (200+), Minnesota.

359. SCOTT, F.R. and D.A. CUTLER. 1965. Fall Migration - Middle Atlantic Coast Region. AMER. BIRDS 19:22.

TV tower kills in Maryland and ceilometer kill in Virginia.

360. _____. 1971. Fall Migration - Middle Atlantic Coast Region. AMER. BIRDS 25:36.

TV tower kill in Maryland and a bridge superstructure kill in Virginia.

361. SHARP, B. 1971. Heavy Mortality of Migrating Birds at Madison's TV Towers. Passenger Pigeon 33:203-204.

A list is given of kills (493) from four towers during inclement weather on 24 Sept. 1968.

362. SHOWALTER, A.K. 1963. [Change over to rotating-beam ceilometers]. Flicker 35:80.

An interesting letter from the U.S. Weather Bureau, Washington is reprinted here. The policy on ceilometers is set out. See Velie, reference 417.

SHUGART, H.H. See D. James, reference 189.

363. SIEGFRIED, W.R. 1972. Ruddy Ducks Colliding with Wires. Wilson Bull. 84:486-487.

Two paragraphs are devoted to these kills which occurred at dusk.

364. SMALL, A. 1958. Fall Migration - Southern Pacific Coast Region. AMER. BIRDS 12:57.

The following quote belongs to Small ..."as contrasted with the eastern portion of the continent, 'collision' recoveries from lighted towers, power lines, airport ceilometers, etc. are virtually unknown and/or unreported in this Region". [R.D. Weir note: See Squires and Hanson, reference 370].

365. SMITH, L.B. 1966. Bird Mortality at Radio and TV Towers near Winnipeg, September 1965. Blue Jay 24:172-176.

Kill lists and weather data are presented covering various towers.

366. SPINNEY, H.L. 1902. Seguin Light Station, Maine. J. Maine Ornith. Soc. 4:43-45.

Kill of 400 on 5 Oct. 1900.

367. _____. 1903. Extracts From the Journal of Capt. Herbert L. Spinney, First Keeper Seguin Island Light, Maine. J. Maine Ornith. Soc. 5:52-58.

Various kills are noted.

368. SPOFFORD, W.R. 1949. The Accident to Migrating Birds at the Nashville Airport. Migrant 20:9-12.

369. _____. 1949. Mortality of Birds at the Ceilometer of the Nashville Airport. Wilson Bull. 61:86-90.

The kill of 9-10 Sept. 1948 is referred to in references 368 and 369. Weather is discussed. (300+) died.

370. SQUIRES, Walter Albion and H.E. HANSON. 1918. The Destruction of Birds at the Lighthouses on the Coast of California. Condor 20:6-10.

Responses to questionnaires are noted from lighthouses of which 11 reported kills.

371. SQUIRES, W. Austin. 1976. The birds of New Brunswick Monograph Series 7, New Brunswick Museum, Saint John, N.B., 2nd edition.

References are made to kills at coastal lighthouses on the Bay of Fundy as follows: pp. 8, 66, 137, 138, 146, 158, 159, 161, 162, 164, 166, 168, 170, 171.

372. STEVENSON, H.M. 1956a. Fall Migration - Florida Region. AMER. BIRDS 10:19.

373. _____. 1956b. Spring Migration - Florida Region. AMER. BIRDS 10:325-329.

374. _____. 1957. Fall Migration - Florida Region. AMER. BIRDS 11:19-22.

375. _____. 1958a. Fall Migration - Florida Region. AMER. BIRDS 12:22-25.

376. _____. 1958b. Spring Migration - Florida Region. AMER. BIRDS 12:344-347.

377. _____. 1959a. Fall Migration - Florida Region. AMER. BIRDS 13:21-24.

378. _____. 1959b. Spring Migration - Florida Region. AMER. BIRDS 13:363.

379. _____. 1960a. Fall Migration - Florida Region. AMER. BIRDS 14:26-29.

380. _____. 1960b. Spring Migration - Florida Region. AMER. BIRDS 14:380.

381. _____. 1962. Fall Migration - Florida Region. AMER. BIRDS 16:22-25.

382. _____. 1963a. Fall Migration - Florida Region. AMER. BIRDS 17:24, 27.

383. _____. 1963b. Spring Migration - Florida Region. AMER. BIRDS 17:397-399.

384. _____. 1966. Fall Migration - Florida Region. AMER. BIRDS 20:31-34.

385. STEVENSON, H.M. 1967a. Fall Migration - Florida Region. AMER. BIRDS 21:23, 25.

386. _____. 1967b. Spring Migration - Florida Region. AMER. BIRDS 21:498.

387. _____. 1973. Fall Migration - Florida Region. AMER. BIRDS 27:45, 48.

388. _____. 1976. Spring Migration - Florida Region. AMER. BIRDS 30:708, 710.

See also Robertson, reference 342 and Paulson, reference 303. References 372 to 388 note kills at various television towers in Florida, especially in Leon County and at Jacksonville.

389. STEWART, P.A. 1973. Electrocution of Birds by an Electric Fence. Wilson Bull. 85:476-477.

390. STODDARD, H.L. 1962. Bird Casualties at a Leon County, Florida, TV Tower, 1955-1961. Bull. Tall Timbers Res. Sta. 1:1-94.

391. _____ and R.A. Norris. 1967. Bird Casualties at a Leon County, Florida, TV Tower - An Eleven Year Study, Bull. Tall Timbers Res. Sta. 8:1-104.

See also Crawford, reference 94. These references 94, 390, 391, are excellent reference sources dealing with tower casualties. They are published by Tall Timbers Research Station, Tallahassee, Florida.

392. STONE, W. 1906. Some Light on Night Migration. Auk 23:249-252.

A kill is reported in which birds fell into the great fire in Philadelphia during March 1906.

STOUT, I.J. See reference 454.

393. STREET, T.E. 1954. The Ceilometer Hazard. Chat. 18:56-57.

A small kill and associated weather conditions are described at the Greensboro, N.C., airport on 7 Sept. 1953.

394. STRNAD, F.V. 1962. Birds Killed at the KROC-TV Tower, Ostrander, Minnesota. Flicker 34:7-9.

Five separate kills are noted during autumn of 1961. Heavy kills occurred during inclement weather at the guy wires and tower.

395. _____. 1975. More Bird Kills at KROC-TV Tower, Ostrander, Minnesota. Flicker 47:16-21.

Summary lists are given covering the period up to 1974.

396. SWENK, M.H. 1922. An Unusual Mortality Among Migrating Lapland Longspurs in Northwestern Nebraska. Wilson Bull. 34:118-119.

Many longspurs were killed at night by flying into lighted objects, after being grounded by heavy snowstorms in February 1922.

397. TANNER, J.T. et al. 1954. Bird Mortality During Night Migration, October 1954. Migrant 25:57-68.

Large kills are reported from 27 localities in the eastern and southeastern states of the U.S.A. Ceilometers, TV and radio towers, brightly lit parking areas and tall buildings are included in the list. The following authors contributed: Laskey, Ganier, Dunbar, West, Luskey, Herndon.

398. TAYLOR, W.K. 1972. Analysis of Ovenbirds Killed in Central Florida. Bird-Banding 43:15-19.

Specimens were from WDBO-TV tower, Orange County, Florida, where 714 were killed between 1969-1971.

399. _____. 1973. Black-throated Blue and Cape May Warblers Killed in Central Florida. Bird-Banding 44:258-266.

Specimens were from WDBO-TV tower. See reference 400.

400. _____ and B.H. ANDERSON. Nocturnal Migrants Killed at a Central Florida TV Tower: Autumns 1969-1971.

The WDBO-TV tower is described. There is a reference to lighting and weather.

401. TERRES, J.K. 1956. Death in the Night. Audubon Mag. 58:18-20.

Ceilometer kills are discussed and experiments using light filters are described. The filters reduced mortality.

TESSEN, D. See Kemper.

402. TEULINGS, R.P. 1971a. Fall Migration - Southern Atlantic Coast Region. AMER. BIRDS 25:40, 43.

TV tower kills in North Carolina and tall building kills in Georgia.

403. _____. 1971b. Spring Migration - Southern Atlantic Coast Region. AMER. BIRDS 25:722.

Building kill in Georgia.

404. _____. 1972a. Fall Migration - Southern Atlantic Coast Region. AMER. BIRDS 26:45, 49.

TV tower kills in North Carolina.

405. _____. 1972b. Spring Migration - Southern Atlantic Coast Region. AMER. BIRDS 26:750.

Kills at a skyscraper building in Georgia.

406. _____. 1974. Fall Migration - Southern Atlantic Coast Region. AMER. BIRDS 28:37.

TV tower kill in North Carolina.

407. _____. 1975. Fall Migration - Southern Atlantic Coast Region. AMER. BIRDS 29:42.

TV tower kill in North Carolina.

408. THOMAS, H.A. 1954. Some Experiments with Supersonic Sound and Birds at Liverpool Cathedral [England]. Merseyside Nat. Assoc. Bird Report, pp.26-28.

Pigeons were scared from roosts using ultrasonic sound and did not return, at least for some time, when the radiation was removed. Trials were conducted at frequencies of 15,000 cps. (2 watts) and 18,000 cps. (1 watt).

409. TOMKINS, I.R. 1963. Fall Migration - Southern Atlantic Coast Region. AMER. BIRDS 17:22.

TV tower kills in South Carolina.

410. TORDOFF, H.B. and R.M. MENGEL. 1956. Studies of Birds Killed in Nocturnal Migration. Univ. of Kansas, Mus. Nat. Hist. 10:1-44.

This is an informative reference on kills. It is based upon work done on WIBW-TV tower near Topeka, Kansas, and presents as well a detailed study on the specimens themselves.

411. TREMBLY, C.C. 1889. Northern Phalarope. Oologist 6:236.

A northern phalarope is said to have been one of a group of similar birds found dead below an electric light tower in Utica, New York.

412. TRIMM, H.W. 1957. Birds and the Cylcometer. New York State Conserv. p. 36, Dec.-Jan. 1956-57.

About 200 were killed at the Albany, N.Y., airport on 17 Sept. 1956 during inclement weather. A list is presented. See also Meritt, reference 260.

413. _____. 1957. Birds and the Cyclometer. Bulletin Aud. Soc. Rhode Island 18:37-38.

This is a reprint of reference 412.

414. TROTT, J. 1957. TV Tower Fatalities at Chapel Hill, N.C. Chat. 21: 28.

About 2,500 were killed in late September and a few more died in early October at this site. A species list is given and the types of injuries sustained are described. Chapel Hill is one of the highest hills in the area.

415. TUFTS, R.W. 1928. A Report Concerning Destruction of Bird Life at Lighthouses on the Atlantic Coast (of Canada). Canadian Field-Naturalist 42:167-172.

The status of kills from 45 stations is reported. See also Lewis; Munro - references 239 and 266.

416. UNITED STATES DEPARTMENT OF AGRICULTURE. 1972. Powerline Contacts by Eagles and Other Large Birds. Rural Electrification. Administration Bulletin 61-10, 6 pp.

The problem of electrocution and the behavior of large birds of prey are reviewed. Remedial measures are outlined with 10 figures showing structures to minimize deaths.

417. VELIE, E.D. 1963. Report of a Survey of Bird Casualties at Television Towers, Ceilometers and Other Obstructions. Flicker 35:79-84.

A tabulation is presented in which site, kill dates, obstruction and weather are listed. The size of the kills and the sources of reference are given. The data covers the period up to 1961.

VESSEY, S.H. see Jackson; Rybak. References 186 and 352.

418. WADE, D.E. 1952. Mortality of Migrating Birds at Mount Washington, New Hampshire. Wilson Bull. 64:242.

Several migrants were found dead in snow banks at the summit, presumably having been caught in an April storm.

419. WALKER, A.T. 1964. Major Fatty Acids in Migratory Bird Fat. Physiological Zoology 37:57-64.

The birds used in this study were from TV tower kills in Northern Florida.

WARTER, S.L. see Newman, reference 284.

420. WEBSTER, F.S. 1960. Spring Migration - South Texas Region. AMER. BIRDS 14:403.

Building kill in amusement park on Padre Island, Texas.

421. _____. 1963. Fall Migration - South Texas Region. AMER. BIRDS 17:47, 48.

Ceilometer kill at Del Rio, Texas. The composition is unusual.

422. _____. 1973. Spring Migration - South Texas Region. AMER. BIRDS 27:795.

State Capitol Building kill.

423. WEIR, R.D. 1972. Autumn Migration Kills at the Lennox Generating Station. Blue Bill 19:49-51.

424. _____. 1973. Bird Kills at the Lennox Plant of the Ontario Hydro-Electric System, Spring 1973. Blue Bill 20:23-24.

425. _____. 1973. Bird Kills at the Lennox Generating Plant. Autumn 1973. Blue Bill 20:55-57.

426. _____. 1974. Bird Kills at the Lennox Generating Plant. Spring and Autumn 1974. Blue Bill 21:61-62.

427. _____. 1975. Bird Kills at the Lennox Generating Plant. Spring and Autumn 1975. Blue Bill 22:47-48.

428. _____. 1976. Bird Kills at the Lennox Generating Plant. Spring and Autumn 1976. Blue Bill 23:41-43.

In references 423 to 428, accounts of the kills at the 653' chimneys at the fossil-fired station are given. Species lists, weather and density of night flights at nearby locations are presented. Dramatic reductions in the numbers killed occurred when floodlighting was extinguished. Normal practise at the site is now to turn out floodlights on the stacks throughout the spring and autumn migration period. Experiments are underway to determine the effectiveness of extinguishing lights on only those nights when predicted weather conditions are such that kills are likely to occur.

429. WEST, A.H. 1954. Bird Mortality During Night Migration, October 1954. Migrant 25:62-63.

Kills at Chattanooga, Tennessee. See Tanner, reference 397.

430. WESTMAN, F. 1960. [Barrie TV Tower Kill (936) on 23-27 September 1960]. The Bulletin F.O.N. #90:4-5. See reference 101.

431. WESTON, F.M. 1965. A Survey of the Birdlife of Northwestern Florida. Bull. Tall Timbers Res. Sta. 5.

Migrants are killed by the Pensacola Bay Bridge. See reference 432.

432. WESTON, F.M. 1966. Bird Casualties on the Pensacola Bay Bridge (1938-1949). Florida Nat. 39:53-55.

An account is given of strikes against three power cables located 20' above the roadway. About 740 casualties are noted in the article, occurring mainly between September and November.

433. WHELAN, P. 1976. The Bird Killers. Ontario Nat. 16:14-16.

This contains a review of known sites in Toronto. Forty buildings have been identified as notable bird killers along with at least two TV towers, including the 1815' CN Tower.

434. WILLIAMS, F.C. 1967. Fall Migration - Southern Great Plains Region. AMER. BIRDS 21:51.

TV tower kill in Texas.

435. _____. 1975. Fall Migration - Southern Great Plains Region. AMER. BIRDS 29:77.

TV tower kill in Oklahoma. See also the note there of birds in the landing light beams at the airport.

436. _____. 1976. Fall Migration - Southern Great Plains Region. AMER. BIRDS 30:90.

TV tower kill in Texas.

437. WISEMAN, J. 1975. 1975 TV Tower Kills - Barrie (Ontario). Blue Heron 19:5.

This is a short note only.

438. _____ and J. HOSKIN. 1974. Part One: Supplement to O.E. Devitt's Birds of Simcoe County. Casualties at the CKVR-TV Tower. Blue Heron 19:17-18.

A list is given from this tower at Barrie. See reference 101.

439. WOODFORD, J. 1963a. Fall Migration - Ontario - Western New York Region. AMER. BIRDS 17:28-29.

TV tower kills in Ontario and New York plus kills at Long Point Lighthouse in Ontario.

440. WOODFORD, J. 1963b. Spring Migration - Ontario - Western New York Region. AMER. BIRDS 17:400.

Long Point Lighthouse kill in Ontario plus storm kill over Georgian Bay.

441. _____. 1964. Fall Migration - Ontario - Western New York Region. AMER. BIRDS 18:30.

Long Point Lighthouse kill in Ontario.

442. _____ and D.E. BURTON. 1961. Fall Migration - Ontario - Western New York Region. AMER. BIRDS 15:35-36.

TV tower and lighthouse kills in Ontario. See also Burton, reference 64.

443. _____ and J. LUNN. 1962. Fall Migration - Ontario - Western New York Region. AMER. BIRDS 16:25-27.

TV tower and lighthouse kills in Ontario.

WOODFORD, P.S. See Long Point Bird Observatory, reference 245.

444. WOODRUFF, R.E. 1968. Spring Migration - Northeastern Maritime Region. AMER. BIRDS 22:505.

Kill at building in Boston, Massachusetts.

445. WOOLFENDON, G.E. 1970. Spring Migration - Florida Region. AMER. BIRDS 24:594.

TV tower kill in Florida.

446. WRAY, D.L. 1960. Parasitic Jaeger at Raleigh TV Tower. Chat:24: 97-98.

447. ZANI, R. 1967. Recurrence of Casualties at Gatlinburg Ski Resort. Eastern Bird Banding Association News 30:243-244.

A kill is described of 400 + 100 birds at 2 sites on 10 Oct. 1967. The birds struck lights, poles and buildings in fog and rain. A list is given which includes a remarkable total of 80 yellow-billed Cuckoos. A reference is also made to kills at that site in Oct. 1965 of 1915 birds. See also Savage, references 354 and 355.

448. ZIEGLER, A. 1952. Three Birds Dead Near an Airport Ceilometer in Illinois. Migrant 23:75.

A one paragraph entry gives a list and the weather.

449. ZIMMERMAN, D.A. 1975. The Changing Seasons: Fall Migration 1974. AMER. BIRDS 29:23.

A new 600' chimney in New Mexico is noted.

ADDITIONAL REFERENCES

450. BELTON, P. 1976. Effects of Interrupted Light on Birds. National Research Council of Canada Field Note 73:12pp.

451. BLOKPOEL, H. 1971. A Preliminary Study on Height and Density of Nocturnal Fall Migration, Canadian Wildlife Service Report Series 14:95-104.

452. HOSKIN, J. 1975. Casualties at the CKVR-TV Tower, Barrie. Nature Canada 4:39-40.

453. HUNT, F.R. 1975. Automatic Radar Equipment to Determine Bird Strike Probability Part I. Night-Time Passerine Migration. National Research Council of Canada Field Note 69:24pp.

454. STOUT, I.J. 1967. The Nature and Pattern of Non-Hunting Mortality in North American Waterfowl, unpublished M.S. thesis, Virginia Polytech. Inst., 331pp.

UNVERIFIED REFERENCES

455. ARANOFF. Linnaen Newsletter 3(1).

456. BAILY. Abstr. Proc. Delaware Valley Orn. Club 3:15. [This group also published Cassinia].

457. BARTOLO, W. 1975. Bull. Aud. Soc. of W. Pa. (Nov.). [2 TV tower kills, Youngstown, Ohio].

458. _____. 1976. Redstart (Oct.) [TV tower kills, Brooks Bird Club].

459. BASSETT. Bird-Lore 26:427.

460. COOKE. U.S. Dept. Agric. Bull. 18.

461. CORNWELL, W.B. 1966. Conserv. Catalyst 2(4):15-18. Needless Duck Deaths.

462. DEANE, R. 1888. Forest and Stream 31:385. [Destruction in Migration].

463. ELLIOTT. 1954. Kingbird 4:118.

464. HOSFORD, H.V. 1962. Nat. Hist. Soc. of Manitoba, Ornithology Section. Newsletter 1:5 (mimeo).

465. HOWARD. 1963. Chemung Valley Aud. Soc. Newsletter (March).

466. MACDONALD. Oshawa Nat. Club. Bull 8:5.

467. NOBLE, G. Forest and Stream 24 or 25:305. [Destructive Electric Light Tower].

468. NORRIS. Contr. Charleston Museum 14.

469. PETERSON. Audubon Bull. 122:14.

470. STERLING, E. 1888. Forest and Stream 334:389. [Killed in Migration].

471. WARREN. Birds of Pennsylvania p.400.