CELL TOWERS
Wireless Convenience?
or Environmental Hazard?

Proceedings of the "Cell Towers Forum"
State of the Science/State of the Law
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Edited by B. Blake Levitt

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Chapter 4

Avian Mortality at Communication Towers: Steps to Alleviate a Growing Problem

By: Albert M. Manville, II, Ph.D.

The issue of bird strikes at communication towers is an issue with which the U.S. Fish and Wildlife Service (FWS) is very much involved. Migratory birds are a trust responsibility for the FWS. We are responsible for the conservation and management of 836 species of migratory birds: 778 are so-called nongame species (such as the Eastern bluebird), and 58 species are legally hunted as game (such as the wood duck). All are protected under the Migratory Bird Treaty Act of 1918, as amended.

While populations of some species are doing well (some too well — e.g. snow geese, urban Canada geese, cowbirds, and cormorants), many others are not. We are seeing the continued decline of over 200 avian species. For example, there are only approximately 180 endangered whooping cranes in the wild; 77 bird species are listed as endangered; and 15 are listed as threatened under the federal Endangered Species Act (ESA). One hundred and twenty-four species are currently on the list of nongame species of management concern — meaning birds whose populations are declining, some precipitously. The next step could be the ESA — a train wreck we prefer to avoid. One species of management concern is the cerulean warbler.

For approximately one-third of the 836 species of migratory birds, we have essentially no population data. Thus, the individual factors that kill birds — including collisions with towers, wind generators, electric power lines, glass windows, oil spills, aircraft, cars, electrocutions, predators such as cats, pesticides, and other causes—are all of growing concern. The loss and/or degradation of habitat are the greatest threats to all wildlife. Of even greater concern are the cumulative and combined impacts of these mortality factors, including those impacts to bird populations.

Bird-watching is Big Business

Birds are big business in North America. More than seventy-one million adult Americans — 1 in 4 — feed, photograph, and watch birds. More than $28 billion dollars are spent pursuing these activities each year by bird enthusiasts. Bird-watching, has become America's fastest growing outdoor activity, increasing 150 percent in the past decade. More Americans reportedly go on vacations to watch birds today than to play golf.

Birds have environmental significance far beyond our visual enjoyment. Birds pollinate flowers, disperse tree seeds, and eat weed seeds. They remove insect pests that have an impact on commercial food crops and forest species, thus making possible multi-billion-dollar industries extremely dependent upon birds.

The global reduction of pollinators — including birds — raises alarm. Fully two-thirds of our flowering plants are pollinated by birds, insects, and bats, which produce a global economic benefit estimated at $117 billion per year. In short, birds are extremely important to us all.

Role of FWS

The FWS plays several roles in dealing with communication towers:

- Tower permitting and placement are coordinated through our Division of Federal Program Activities (formerly Division of Habitat Conservation) and Ecological Services field offices around the country.
- Avian management, monitoring and research are coordinated through my office — the Division of Migratory Bird Management.
- Enforcement is handled through our Division of Law Enforcement in our 7 regions and Washington, D.C. (Arlington, VA) offices.

Our offices of Federal Program Activities and Ecological Services use Federal Communications Commission regulations — specifically 47 Code of Federal Regulations (CFR) Chap. 1, Sect.1.1307 — to implement National Environmental Policy Act (NEPA) and Section 7 ESA issues.

Unfortunately, migratory birds are not specifically mentioned within this regulation, even though FWS feels towers are having a significant cumulative impact upon birds. Birds are categorically excluded from

NEPA analysis under this regulation, except where towers are proposed to be built on National Wildlife Refuges, or where threatened and endangered species, and/or their critical habitats, may be affected.

However, even under Sect. 7 of the ESA, there is no actual requirement for the tower licensee to contact us. Even when a "may affect" determination is required, there is *no consistent guidance and no standardized way* of conducting it. We've attempted to get at this through a tower site evaluation form now available publicly.

Early in 1998, the Division of Migratory Bird Management became actively involved in the tower-collision issue. A large kill of up to 10,000 Lapland longspurs, a migratory songbird, occurred on January 22, 1998, at three towers and a natural gas pumping station in western Kansas on a snowy, foggy night. The issue was almost immediately brought to our attention by the environmental community. In April 1998, I was asked to brief the Policy Council of the American Bird Conservancy on, among other things, bird mortality from tower strikes. At that time, I provided a partial — but certainly *not* complete — literature review, as well as abstracts, put together by Migratory Bird staff member John Trapp.

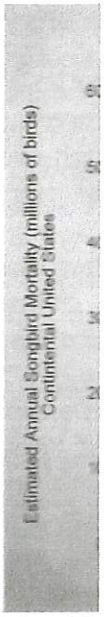
Following that meeting, informal discussions continued with representatives from the Federal Communications Commission, the FWS offices of Federal Program Activities, and the Division of Migratory Bird Management. In November 1998, representatives of the FWS's regional, field and Washington, D.C., offices met in Panama City, Florida, to discuss, "Migratory Bird Conservation and Communication Towers: Avoiding and Minimizing Conflicts." A tower risk model was developed at this meeting and the document was made available to the public.

In late December 1998, I met with representatives of the environmental dispute resolution group, RESOLVE. We discussed the need for a facilitated meeting with various stakeholders in order to review research needs and gaps; put concerns on the table; and begin a dialogue with various players interested in — and concerned about — the issue.

That meeting took place in Washington, D.C., on June 29, 1999. Forty-two stakeholders were present representing government agencies, including the Federal Communications Commission, the Federal Aviation Administration, the Federal Highway Administration, the USDA's National Wildlife Research Center, the U.S. Fish & Wildlife Service, and the Wisconsin Department of Natural Resources. The research community was also represented, including the Illinois Natural History Survey, the Buffalo Museum of Science, Geo-Marine, the State University of New

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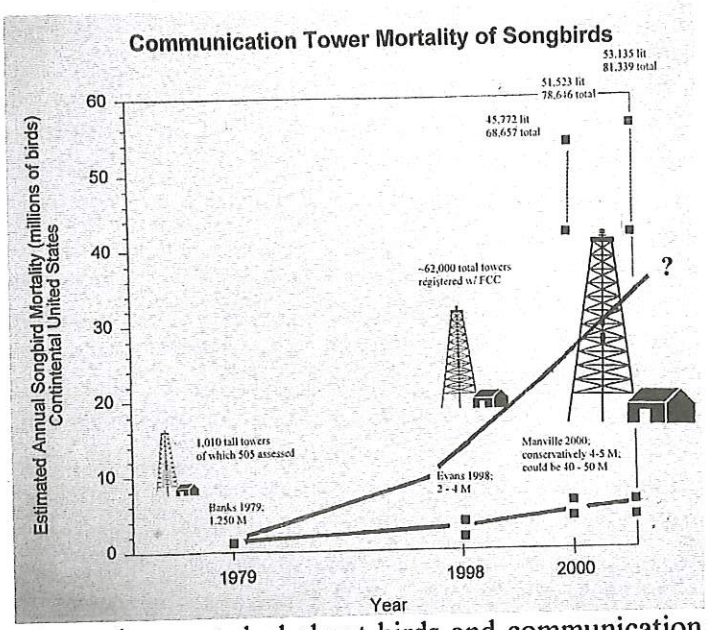
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[1] The complete tr
http://migratorybirds.

York (SUNY) at Geneseo, and Cornell and Clemson universities. Industry was also represented, including the Personal Communications Industry Association, the Cellular Telecommunications and Internet Association, Motorola, SBC Wireless, and Environmental Resources Management; as well as a broad-based representation from the environmental community.

On August 11th, 1999, the first-ever public workshop on "Avian Mortality at Communication Towers" took place at Cornell University in conjunction with the 117th meeting of the American Ornithologists Union. The workshop was co-sponsored by the FWS, the Ornithological Council, and the American Bird Conservancy.[1] I had the privilege of co-chairing and facilitating the meeting, which included presentations by seventeen speakers, as well as a discussion of research and funding needs with a focus on where the gaps were located. Future directions to fill in those gaps were discussed by a panel of twenty-three experts.

Birds and Communications Towers



We learned a great deal about birds and communication towers at this workshop. Published accounts of birds striking tall, lighted structures

[1] The complete transcripts of that meeting are available on our web site at http://migratorybirds.fws.gov/issues/towers/agenda.html.

such as lighthouses, although often anecdotal, have appeared in the literature since as far back as 1874. The earliest report of birds dying from a tower collision in the U.S. was published in 1949 after a radio-tower strike incident in Baltimore, Maryland.

The first long-term study of birds striking towers was begun by Tall Timbers Research Station in 1955, at a television station in northern Florida. Over the 25-year study, 42,384 bird carcasses representing 189 species were collected and identified from collisions with this tower, its guy wires, other birds, or the ground.

To date, the longest study of bird mortality has been conducted by physician Dr. Charles Kemper, in Eau Clair, Wisconsin. Beginning in 1957, the 38-year study has collected 121,560 bird carcasses representing 123 species. Dr. Kemper's all-time, one-night record kill occurred in 1963 when he collected and identified over 12,000 birds, not accounting for the almost certain scavenging by cats, dogs, foxes, raccoons, skunks, owls, crows, and others species then present. Similar avian fatality studies are continuing today by ornithologists Todd Engstrom, Art Clark, Bill Evans, and others.

Today the FWS conservatively estimates that four to five million birds are killed per year in the U.S. by colliding with towers, guy wires, other birds, or the ground. Mortality could range to a high end of 40-50 million. Only a cumulative impacts study will ascertain the true magnitude of this problem.

Much other information about bird strikes with communication towers, including radio, television, cellular, microwave, paging, messaging, open video, public safety, wireless data, government dispatch, and emergency broadcast, has been published since the 1970's.

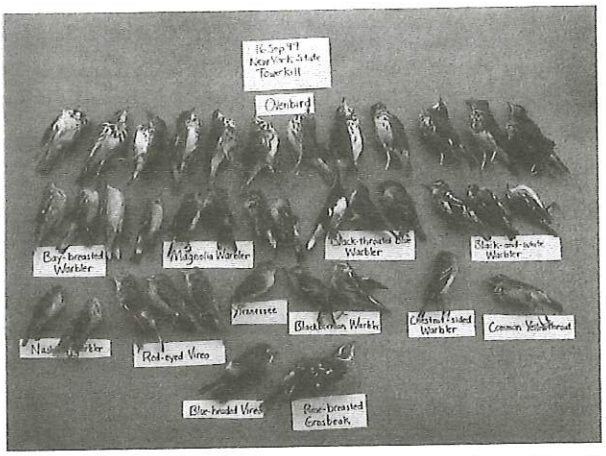
Unfortunately, most materials only review carcass counts and species variability, *not* the presumed or suspected causes of bird collisions. Research into this area is sorely lacking. Published accounts do, however, answer one question. Birds vulnerable to communication towers comprise nearly 350 species of so-called neotropical migratory songbirds — thrushes, vireos, and warblers are the species that seem to be most vulnerable. These are birds that breed in North America in the spring and summer and migrate to the southern United States, the Caribbean, or Latin America during the fall and winter. These species generally migrate at night and appear to be most susceptible to collisions with lighted towers on foggy, misty, rainy, low-cloud-ceiling nights during their migrations. Lights seem to be key.



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Bill Evans New York Study, 1999

Federal Aviation Administration (FAA) regulations currently require towers taller than 199 feet above ground level to contain pilot warning light(s). Towers within 3.8 statute miles of an airport, and towers along major highway travel corridors, must also be lighted. According to the FCC's October 2000 Antenna Structure Registry database, there were 79,000 registered towers, nearly 52,000 lighted — most exceeding 199 feet above ground level. The January 2001 database contains over 81,000 registered towers, of which more than 53,000 are lighted.

While some argue that the database understates the number of lighted towers, suggesting that upwards of 80,000 are currently lighted, we do know tower construction has increased exponentially in the past four years and continues to grow at six to eight percent per year. Six to ten thousand new towers are constructed each year.[2]

Different Aspects of Bird Mortality and Towers

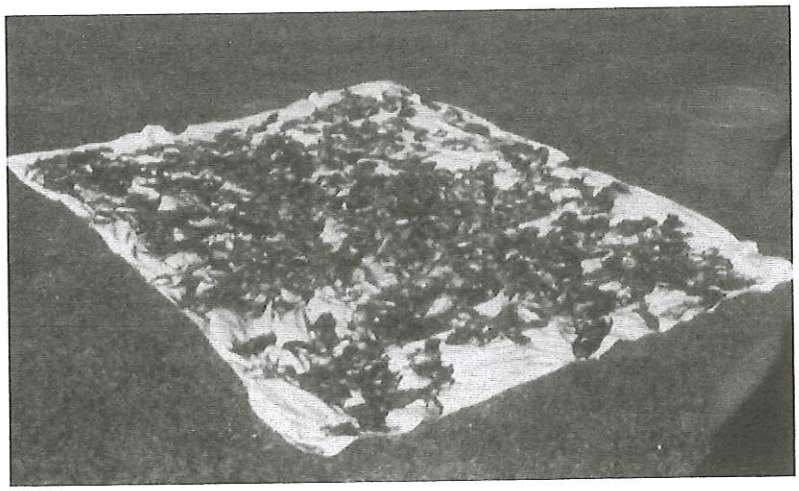
What is it specifically about the towers that seem to attract the birds? Lighting again is critical. We know, for example, that the bird's eye contains from four to six different types of cones, whereas the human eye has only three. We also know that light can affect bird behavior both visually and electromagnetically. While the retina of the bird's eye is far more sensitive to the red and ultraviolet spectra, current scientific thinking indicates that light duration — the "off" phase of lights between the blink or flash phases of light pulses — is far more critical in altering bird behavior than is color.

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[2] See the website www.towerkill.com for additional information.

In addition, solid or blinking red lights *seem* to attract birds on foggy, misty nights far more than do white strobes, which may flash once every three seconds — the currently allowable maximum "off" phase between flashes. While some preliminary research supports this premise, we will need further testing to validate this hypothesis. Simply put, the longer the off phase, the less likely the attraction. Thanks to cooperation from the FAA, I've managed to help convince that agency to allow a very controlled experiment by ornithologist Bill Evans to test this hypothesis in New York State. The FAA agreed to allow lights to be turned off for very brief periods of time under extremely strict, controlled conditions. The study will hopefully begin in 2001.

The taller the tower, the more likely it will kill birds. Guy wires and lights are critical. The more guy wires there are supporting a tower, the greater the risk for bird strikes. Lights seem to draw birds in especially during inclement nights. The birds appear to shut off their normal "nocturnal" migratory cues of star and magnetic compass orientation, and appear to switch on "diurnal" cues. Attracted to the lights, they fly around and around in a "tornado" of birds, striking the guy wires, the tower, themselves, or the ground — and frequently die.



Jenny Nehring, University of Tennessee tower study.

A Worse-case Tower Scenario

A worse-case scenario would be:

- A tower with a height greater than one-thousand feet, with multiple guy wires
- A tower with multiple solid or pulsating red lights
- Towers located in a bird migratory corridor, near or next to a wetland, with federally listed endangered or threatened bird species also present. (In fact, this real-life situation already exists.)

Unfortunately, the Telecommunications Act of 1996 only exacerbated this problem. All television stations must be digitized by 2003, adding (by some estimates) 1,000 new "mega-towers" over 1,000 feet tall. The literature strongly supports the hypothesis that the taller the tower, the more birds are likely to be killed.

The Migratory Bird Treaty Act of 1918, as amended — our "marching orders" for the Division of Migratory Bird Management — is a strict liability law. The killing of any bird is not technically allowed under the law unless permitted. The Service does not allow the "incidental taking" of migratory birds except under permit and we do not issue "incidental" or "unintentional take" permits.

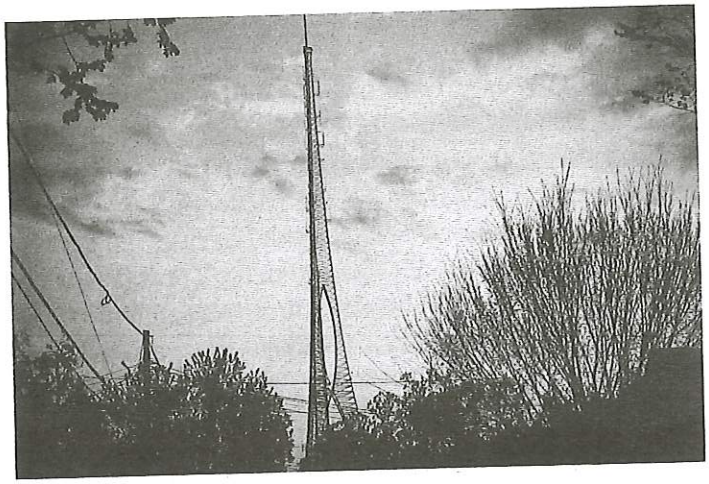
What about the impacts of electromagnetic radiation and radio waves? With the possible exception of pulsed microwave radiation such as is used in the newer digital PCS telecommunications systems, research indicates that most radiofrequency radiation has not been shown to be a problem. Possible radiation impacts to avian physiology, however, still need further research and review. The body of research on this issue is sparse.

FWS Efforts With the Bird-Strike Problem

While the FWS recognizes that research into the actual causes of bird collisions with towers is scant, some preliminary but promising findings provide insight into minimizing bird collisions with towers. A list of interim guidelines, *voluntary and nonbinding* both to the industry and to our Service personnel were approved this past September by our director.

We strongly encourage the following for companies planning to site and construct towers:

- Regardless of the type of communications being considered, we *always* recommend co-location onto an existing structure — a tower, church steeple, monopole, spire, water tower, or billboard — as the first option in siting a communications array. Depending, for example, on tower load factors, from six to ten providers may co-locate on an existing tower. Crown Castle USA has some towers with 120 clients co-located on a single tower; they average nine tenants per tower.
- If co-location is not practical, we suggest keeping towers under 200 feet, unguyed, and unlit. If at all possible, new towers should be located in existing "antenna farms" preferably in areas not used by migratory birds, or species federally or state-listed as endangered or threatened, or listed as nongame species of management concern.
- We encourage the review of local meteorological conditions, especially where there is a high incidence of fog, mist, and low ceilings during spring and fall migrations, as well as avoiding siting towers in such areas.
- If towers must be over 199 feet in height (the FAA's threshold for pilot warning lighting), we strongly suggest keeping them unguyed, using lattice or monopole structures with no supporting wires. Where permissible by FAA and local zoning regulations, only white strobe lights should be used at night. These should be up-shielded to minimize disruption to local residents. They should have the minimum number of lights, with minimum intensity and number of flashes per minute allowed by the FAA — currently twenty per minute. The use of solid red or pulsating red warning lights should be avoided at night.
- Guyed towers constructed in known raptor or waterbird concentration areas should use daytime visual markers — bird diverter devices — on guy wires to prevent collisions by these day-active species. Guidance from the electric utility industry is available for bird diverters.



Lattice construction for towers over 750'

- Towers should be constructed in a way that limits or minimizes habitat loss within the tower "footprint." If significant populations of breeding birds are known to occur within the proposed tower footprint, construction should be limited to those months when birds are not nesting — times other than spring and summer.
- If a tower is constructed or proposed for construction, FWS designated researchers should be allowed access to the site after construction is completed in order to: conduct searches for dead birds — both large (cranes, swans, and geese), and small (thrushes, warblers); to place above-ground catchment nets below towers; to position radar, Global Positioning System, infrared, thermal imagery, and acoustical monitoring equipment, as necessary, to assess and verify bird migrations and habitat use; and to assess the impact of various tower sizes, configurations, and lighting schemes.
- Lastly, we encourage the removal of towers no longer in use or when determined to be obsolete, within twelve months of cessation of use.

In addition to the voluntary tower-siting guidelines just mentioned, we also distribute a tower site evaluation form to help in our review of applications — including NEPA and Section 7 ESA issues.

Next Steps

On June 29, 1999, forty-two stakeholders attended the RESOLVE meeting. The Communication Tower Working Group (CTWG) was created — initially with 15 representatives from federal and state agencies, the research community, industry, and the conservation community. I have the privilege of chairing the CTWG for the Service. Today, the Working Group is represented by over 50 stakeholders. The task of the Working Group is simple: develop and implement a research protocol that will determine what causes bird collisions with towers, and what can be done to avoid them.

In November 1999, the first meeting of the Working Group occurred with thirty-three different representatives attending. Subcommittees were created to deal with research, funding and legal issues. The Research Subcommittee met in April 2000. The Subcommittee agreed on a protocol to conduct a nationwide study that will:

- Quantify, with statistical certainty, the cause and effects of color and duration of lighting, and the correlation between bird kills and weather.
- Determine the critical tower height and a height threshold.
- Assess and quantify the most dangerous tower situations.
- Assess radar, acoustic, and ground survey techniques that could be used to determine major migratory corridors/flyways, or routes, and stopover areas, in order to avoid tower sitings in these areas.
- Develop an effective monitoring protocol — borrowing heavily from the wind generation and power distribution industries.
- Assess cumulative impacts of towers on bird populations in North America.

In 1979, Dick Banks published a special scientific report for the FWS estimating annual bird mortality. Banks estimated *annual tower-kill mortality at nearly 1.3 million birds per year* based on 500 of the then-existing 1,010 tall towers. Today, we conservatively estimate mortality at four to five million birds per year. This could range to a high end of 40-50

million per year. Only systematic monitoring will provide us a better figure.

The Research Subcommittee finalized the framework for a nationwide study. A detailed literature review and synthesis of the bird-strike issue was also provided at this meeting. In June 2000, the full Communication Tower Working Group met, and approved the framework for the study.[3] SW Bell Wireless solicited research proposals for pilot studies to look at these problems. Several have been successfully peer-reviewed and are being submitted for possible industry funding.

The Cellular Telecommunications and Internet Association solicited a nationwide research proposal for the framework approved by the Working Group, but acknowledged that the Working Group would be competing with two other existing cell-phone health safety studies that CTIA is currently funding. The nationwide research will likely cost in excess of $15 million for a three- to- five-year study.

I have also met with a representative of White House Office of Science and Technology Policy to begin fine-tuning our nationwide research proposal — next to be reviewed by the Research Subcommittee.

Crown Castle USA is looking to provide researcher access to their tower sites. I am working with them on the access issue. Funding will need to come from the federal government as well as from industry. We're working on that and are hopeful that some seed money can be appropriated.

Meanwhile, the media and the public have shown considerable interest in this issue. We believe it to be a serious environmental problem, especially as more towers proliferate to support the infrastructure for advanced telecommunications services.

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[3] The Personal Communications Industry Association (PCIA) provided $10,000 in funding to hold the two meetings.