

Avian Mortality at Communications Towers

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www.towerkill.com/index.html
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Presentation Number 3

Investigating the behavioral mechanisms of tower kills

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Al Manville's introduction of the third speaker, Ron Larkin.

Our next speaker is a Wildlife Ecologist at the Illinois Natural History Survey, where he has worked since 1980. His research interests center on migration, dispersal, homing and communication especially as related to the conservation of habitats and species. He was one of a number of folks who participated in our RESOLVE discussion on June 29. His topic is investigating the behavioral mechanisms of tower kills. Dr. Ronald Larkin.

Ronald Larkin

[Slide of carcasses of 21 species of songbirds killed at an east-central Illinois communications tower on the night of 10-11 October 1985, arranged on a tray]

Here is the phenomenon we are talking about today. These were birds that were picked up beneath one 1,000 ft. [308-m] communication tower after a night when there were low clouds in the fall, during nocturnal bird migration. These are mostly warblers, sparrows, and vireos--attractive small birds. Most of the birds have injuries; look closely around their eyes, on their heads and beaks, and the front edges of their wings. This indicates they had collided with something, either with the tower or when they fell down to the ground. It is sometimes hard to tell the difference. A collar there came from a domestic cat, probably one of the scavengers that Todd Engstrom talked about. One of the problems with this research is that the local small animals, especially mammals, get there before the scientists do and the scavengers pick up the carcasses and take them off. However, on a night like this with a heavy kill there just aren't enough scavengers and there are plenty of carcasses left for the biologist to find. There is also an owl feather there, indicating there are bird predators around. This is the kind of phenomenon that we are talking about today.

[slide, portrait of Richard R. Graber]

As was mentioned earlier, Dick Graber, who was formally an ornithologist at the Illinois Natural History Survey -- my organization -- has come up with a hypothesis trying to explain this. We are going to hear several hypotheses today, and I would like to emphasize--and I'm sure the other speakers will agree--that we have very little means of discriminating among these hypotheses right now. We don't know what the phenomenon is we are dealing with, really. We are groping around in the dark like the birds are. Anyway, having watched birds at towers, Dick Graber hypothesized that the birds are flying around the towers in circles, in the same way that animals are kept inside zoo exhibits without bars. Birds in such exhibits don't like to fly from a lighted area out into a darker area. Similarly, birds flying near a lighted tall structure in clouds stay in the lighted area and fly around with light all around them. Since they are in a cloud there is no visible, directed source of light, but they stay in the lighted area flying around and around.

Eventually they strike a guy wire and often it kills them. This is a plausible mechanism for the birds being killed at towers. It doesn't really explain the neurophysiological responses of the birds and doesn't explain the selection pressure that causes them not to leave a lighted area during nocturnal migration, but it's a partial behavioral explanation of the phenomenon. I would like to argue today, that until we know why these birds are killed,--until we can observe how this happens--we are going to be left with many ideas and no clear direction in which to attempt to alleviate the problem.

I would like to talk about some research that Dr. Barbara Frase and I did in the mid-1980s [Larkin, R. P. and B. A. Frase. 1988. *Circular paths of birds flying near a broadcasting tower in cloud. Journal of Comparative Psychology* 102:90-93.]. I am talking about these old data because they are some of the few data we have that actually show us something and gives a hint of what's happening during this phenomenon. [Slide of WNMU tower in daylight, with X-band tracking radar dish in foreground.] This is a 1,000-foot [308-m] communication tower, the ordinary kind that you usually listen to on your radio or watch on your television station. It is located in the Upper Peninsula of Michigan with very few lights or other human disturbances around. The object in the foreground is a tracking radar. Dr Frase and I were following the birds as they flew towards this tower. On one particular night, the tower started out at sunset on a nice, clear night and you can see the red lights on the tower. Every other light flashes, the lights in between are steady red lights, one of the standard FAA approved lighting schemes for these tall towers.

[Slide of the top of the tower in the dark, showing the top 6 red lamps, alternating 3 steady and 3 that blink slowly.] This is how it looks at night. You can see the alternating lights having just flashed. They are different colors from the steady lights. During the course of the night, the clouds descended. [Similar slide but with the top lamps obscured by low cloud, at 0255.] This is the same picture of the frame I just showed you, but the cloud is now obscuring the top of the tower. You can't see the lights, and the birds can't see the lights presumably until they are close to the tower. These are the conditions that kill birds most of the time, that cause heavy kills. We were fortunate enough to have this instrument operating on such a night during the fall. We didn't have another opportunity, another night with these conditions, and we never repeated these observations, unfortunately. So I am talking about one night worth of data here.

[Slide of a radar track of a bird engaged in normal nocturnal migration. In this and subsequent figures, the bird's path is shown in XY (map) coordinates with the bird's height shown in an inset plot.] This is a bird flying in normal migration past the tower. This was actually earlier on the same night, I believe, when the cloud was not obscuring the tower. This bird is flying at a high altitude past the tower, very straight and level. The symbol that looks like a capital "A" in the top middle of the diagram is the tower. That is the aviation signal for a tower [shaped like an upside-down capital "V"]. And a little tracking radar like symbol is pointed where the bird was at the end of its track. The inset with the box around it is the bird's altitude; you can see the altitude is 1,100 meters mostly. That is higher than the tower, which is about 300 meters, about 1,000 feet tall. This bird happens to be going in a west to east direction for reasons best known to the bird itself.

[Slide of a bird flying inside the cloud, circling the tower at time 0237.] Now here is the kind of thing that happened after the clouds descended on the tower. These observations were taken mostly after midnight on this night, and the public broadcasting station that uses this tower turns its radio transmitter off after midnight, so there were no radio signals from this tower. So we clearly can rule out one possible explanation of these data, namely that the birds might be responding to the radio-frequency emissions from the tower. But the lights are still on. The slide shows a big circle the bird has made. The circle goes counter clockwise and the altitude changed slightly during the circle as you can see. The circling happened very, very slowly.

This track is three minutes long as the bird circles the tower making a big loop. We have several more of these circling tracks and most of them are segments.

[Slide of another partially-circling bird at 0457.] Let me point out that the tracking radar is doing its best to track something about half the size of my fist at a distance of 1 km when there is a huge steel structure with tons of steel competing with the bird for the radar's tracking mechanism, so it was technically tricky trying to track little birds next to this big reflective tower. Therefore, we didn't get very many long tracks.

[Slide of bird that appears to successfully escape the tower's influence, at 0442.] Here is a bird that loops around making almost a "J" shape yet hovers there and then it heads directly south towards the second tower which is south of the radar. So this appears to be a bird that had been circling, comes to a point, breaks away, and manages to leave the tower. It did not continue circling.

[Slide of bird approaching the tower, at 0504.] Here is a bird that encounters the tower, slows down, hovers and starts making a circle. So you can see the bird in a process of starting to circle the tower here. But this is all the data we have on this particular bird. This one was very level as you can see from the inside plot. My last slide that I am going to show today shows the data in clear conditions and on other nights we had very few birds circling the tower.

[Slide of summary table from Larkin and Frase 1988 article.] These judgments were made, by the way, in a blind situation, so that the person who made the judgment that a track circled or did not circle the tower had no idea whether it was cloudy or not. So, even though it's subjective, it is scientifically rigorous and these are highly significant data although we didn't do a statistics test on them because really we only had one night's selected observations. We were trying to select birds that were flying towards the tower so we did not feel good about doing statistics. But, as you can see, the cloudy conditions were really important in causing this behavior to happen at this tower during two fall migrations in the 1980s.

I'd like to spend the rest of my talk showing other ways that might be possible to do research on this subject. Clearly, you can observe what happens at these towers if you have the right equipment, at the right place at the right time. We can study this phenomenon. I will go through some of my ideas on the subject rather quickly.

To manipulate light:

- It might be possible to wash out the bird's retinas, to use a series of flash bulbs on the towers so that when the bird approaches the tower, you wash out the retinal pigments and see whether a bird that does not have its dark adapted vision still circles the tower. You can experimentally test the hypotheses that way.
- You can ask whether tall towers in areas that are polluted by lights in cities, a lot of these towers are now in cities or suburbs, you can ask if they kill birds at the same rate as towers that are in rural areas that do not have large washes of light around them.
- You could put mirrors below the lights, so the light shines only upwards. This should cause the birds to spiral down as they circle the tower.
- You could paint the guy wires with fluorescent paint and illuminate them, making the guy wires really visible to the birds. The bird might avoid the guy wires, you might not kill as many birds that way. The guy wires are usually oiled (I understand) anyway, so people have to go up there and do something to the guy wires regardless.

To observe the birds' behavior:

- You could use radar to follow the birds, as I have shown. An ordinary old-fashioned tracking radar works. A coherent radar that can measure the birds speed would allow one to track a small moving object very close to a big stationary object much easier. So you could use a coherent radar to track a bird.
- Or you put a coherent surveillance radar, like a little Marine radar (as long as it was coherent) up on the tower and actually watch birds flying in the vicinity of the tower. This could be done even though you are on a big steel structure, because you are using the right kind of radar.
- You could take four or more microphones and localize where these calls are around a tower. Bill Evans has done this many times. You have a big steel structure there, you could hang microphones on the tower and follow birds by their calls.

To test if the birds are stressed:

- In terms of the paths of the birds on the “right” *[speaker makes quotation marks with forefingers]* night, when the birds fall to the ground, one of the old hypotheses is that the birds flying around and around and just tired or they are stressed and they fall down to the ground and they die when they hit the ground. A perfectly good idea.
- One way to do it might be to take a bomb calorimeter and measure the amount of water and the amount of fat in the bird when it hits the ground and compare that to the amount of water and the amount of fat in similar birds that are caught in mist nets that have successfully migrated the next morning and are caught in banding stations. You might be able to actually measure whether these birds are exhausted when they fall down. This is one of the common hypotheses.
- *[A little later in the meeting, during questions, another presenter pointed out that hormone levels such as adrenocorticoids could be measured.]*

To do experiments:

- Even the FAA (I think) would approve of instrumenting a tower with both flashing lights and red lights and alternating one vs. the other, say one hour worth of flashing and one hour worth of steady lights.
- You might be able to combine this with putting a Doppler radar, a very simple instrument, just below the tower shining upwards, just like a police radar, so then when the bird flew this way you would hear nothing, when the bird falls you would hear the bird dropping as the bird came down. You would hear that from the radar as the bird approached.

I'll quit with these ideas now. I just wanted to demonstrate that with a little research funding and ingenuity, it is possible to ask questions about how towers kill migrating birds and expect to get scientifically rigorous answers.

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