Louis Peraertz,
Spectrum and Competition Policy Division,
Wireless Telecommunications Bureau,
Federal Communications Commission,
445 12th Street, SW.,
Washington, DC 20554.

Dear Mr. Peraertz,

Please accept the following as my comments on the Notice of Inquiry comment review Avian / Communication Tower Collisions Final Report (dated September 30, 2004).

I am currently the Principal Investigator for the ongoing Michigan State Police Tower Study. Since the previously mentioned final report was written I have collected and analyzed additional data that are relevant to the issue of bird collisions with guyed vs. unguyed towers (i.e., guyless). Below I summarize those results and the related study methodology. This study will address additional variables in the future.

METHODS

In order to test for differences in bird mortality at towers with different support systems I selected towers within the height range of 116-146 m Above Ground Level (AGL). These towers functioned as part of the Michigan Public Safety Communications System (MPSCS). All of the towers had the same tower lighting systems from dusk to dawn (i.e., E-2 lighting, red strobes at the top and half-way down the tower with red, solid-on, incandescent lights 1/3 and ¾ the height of the tower; FAA 2000). Considering that the majority of tower collisions are thought to occur during migration, technicians sampled for 20 consecutive days during the peaks of spring and fall migrations. During the fall 2003 field season (15 September - 4 October) 3 guyed and 3 unguyed 116-146-m AGL towers were searched, during the spring 2004 field season (10 – 29 May) 11 guyed and 9 unguyed 116-146-m AGL towers, and during the fall 2004 field season (7-26 September) 12 guyed and 9 unguyed 116-146-m AGL towers were searched. The towers searched in 2004 were randomly selected from 150 MPSCS towers within the 116-146-m height category, after stratification for tower support system. If a randomly selected tower was within 1 mile of an extensively-lighted area (e.g., large urban area) I eliminated that tower from the sample and randomly selected another tower. This procedure prevented a situation where communication tower lights might be less visible to birds or "washed-out" due to the overwhelming lights of surrounding areas (Caldwell and Wallace 1966). Similarly, I excluded those towers associated with tower farms (additional communication tower(s) within 0.5 miles) and ridge tops to avoid additional confounding variables. Two of the towers were selected as a result of the initial motivation for this study's funding; hence, they were not randomly selected.

Carcass searches

Technicians arrived at the towers at or before dawn in an effort to prevent diurnal and crepuscular scavengers from removing carcasses. Searching the same tower every day, technicians conducted tower searches simultaneously at their designated towers.

Using flagged, straight-line transects, technicians walked at a rate of 45-60 m per min and searched for carcasses within 5 m on either side of their transects (Gehring 2004, Erickson et al. 2003). Transects covered a circular area under each tower with a radius equal to 90% the height of the tower. Bird carcasses were placed in plastic bags, and the following information was recorded: tower identification number, date, closest transect, distance from tower, azimuth to the tower, estimated number of days since death, and observer's name. Once bagged and labeled, carcasses were frozen for later identification and verification of species.

Observer detection and carcass removal trials

It is inevitable that technicians did not observe all bird carcasses under communication towers due to dense vegetation, observer fatigue, human error, and scavenging by predators. Therefore, it was necessary to quantify each technician's observer detection rate and the rate of carcass removal (Erickson et al. 2003). Observer detection trials were conducted with technicians at their designated tower 1 time during each field season. By placing 10 bird carcasses within the tower search area, I quantified the proportion of bird carcasses detected by each technician. For observer detection trials I used bird carcasses representing a range in size and colors, but predominantly Brown-headed Cowbirds (*Molothrus ater*) painted to simulate the fall plumage of migrating songbirds. Bird carcasses used for observer detection trials were also painted with an "invisible" paint that glowed fluorescent colors when viewed under a black light. When analyzing the study data, the "invisible" paint prevented any confusion between birds that had collided with the towers and birds placed in the plots for observer detection trials.

Similarly, technicians placed 10-15 Brown-headed Cowbird carcasses near their designated communication tower's search area and monitored the removal (e.g., scavenging) of carcasses daily during the study period. Using these data I calculated a scavenging or removal rate (Erickson et al. 2003). Brown-headed Cowbirds used in the removal trials were not painted, as this foreign scent might have prevented scavengers from removing carcasses. Both observer detection trial birds and removal trial birds were placed in a range of habitats characteristic of the individual tower search area.

Statistical analyses

I used the Mann-Whitney U-test to test for differences in the fall 2003 data, and the Kruskal-Wallis test combined with Tukey's Honestly Significant Difference (HSD) multiple comparison procedure to test for differences within the data from spring and fall 2004 (Zar 1984). Raw data were used when testing for significant differences among tower types, not data adjusted for scavenging and observer detection rates. I used bootstrapping (5,000 iterations) to estimate the mean and standard deviation of the observer detection rates (Erickson et al. 2003, Manly 1997). Using methods developed by W. Erickson (WEST, Inc.), I used the mean observer detection rate and the carcass removal rate specific for each individual tower to calculate adjustment multipliers by which to correct the observed number of birds per tower. This adjustment method considered the probability that carcasses not found on 1 day could be found on the following days, depending on the rate of carcass removal (W. Erickson pers. comm.). These 2 interacting variables were used to determine an average carcass detection probability and the related adjustment multiplier specific to each tower. The statistical software SPSS was used for all analysis and $\alpha = 0.05$ (SPSS 2001).

Results

Night-migrating songbirds collided most frequently with communication towers. In the fall of 2003 Red-eyed Vireos (*Vireo olivaceus*) and Magnolia Warblers (*Dendroica magnolia*) were the most common species found. Similarly, in the spring of 2004 the 2 most common bird species found were Red-eyed Vireos and Ovenbirds (*Seiurus aurocapillus*). In the fall of 2004 Blackpoll Warblers (*Dendroica striata*) and Ovenbirds were the most common tower killed birds.

The mean observer detection rate (via bootstrapping) was 0.48 (SD = 1.10) in the fall of 2003, 0.40 (SD = 0.03) in the spring of 2004, and 0.27 (SD =0.03) in the fall 2004. Carcasses placed near the tower search area for removal trials (e.g., scavenging) remained on the ground a mean of 6.10 days (SD = 2.73) in the fall of 2003, 5.66 days (SD = 2.53) in the spring of 2004, and a mean of 6.89 days (SD = 3.07) in the fall of 2004. Including both observer detection rates and carcass removal rates I estimated the adjustment multipliers specific to each tower to range between 1.76 and 2.04 (mean = 1.92, SD = 0.14) in the fall of 2003, 1.23 and 2.63 (mean = 1.68, SD = 0.37) in the spring of 2004, and 1.24 and 3.41 (mean = 2.00, SD = 0.55) in the fall of 2004.

Occasionally birds found under towers appeared to have been killed by predators (e.g., Cooper's Hawk, *Accipiter cooperii*) and plucked at the site. If the species of the dead bird was a typical prey item of an avian predator, like the Cooper's Hawk, and if the shafts of the plucked feathers had large beak impressions it was assumed that the bird was killed by a predator and the specimen was removed from further statistical analysis. I included summary statistics of data both with and without these questionable birds (Table 3). When comparing bird mortality among tower types the previously mentioned outliers were removed (i.e., 3 predator killed birds under an unguyed tower in the fall of 2004). A Mann-Whitney U-test determined that in the fall of 2003 unguyed towers 116-146 m AGL were associated with lower bird mortality than guyed towers in the same height category ($U = 0.00$, $P = 0.037$). Similarly, Kruskal-Wallis tests found significant differences among tower types in both the spring of 2004 ($\chi^2_2 = 16.839$, $P \leq 0.001$) and the fall of 2004 ($\chi^2_2 = 15.614$, $P \leq 0.001$). Tukey's Honestly Significant Difference (HSD) multiple comparison procedure determined that in the spring of 2004 tower types were statistically different from one another. More birds were found under guyed towers 116-146 m AGL than unguyed towers in the same tower height category ($P = 0.01$). Although not significant in the fall of 2004 ($P = 0.12$), more birds were found under guyed towers than unguyed towers.

Table 1. The numbers of bird carcasses found at 6 Michigan communication towers between 15 September and 4 October 2003.

Tower support	Height category AGL	Numbers of towers searched	Numbers of carcasses found
Unguyed	116-146 m	3	0 (mean = 0.0, SE = 0.0)
Guyed	116-146 m	3	22 (mean = 7.3, SE = 1.2)

Total		**6**	**22**

Table 2. The numbers of bird carcasses found at 20 Michigan communication towers between 10 May and 29 May 2004.

Tower support	Height category AGL	Numbers of towers searched	Numbers of carcasses found
Unguyed	116-146 m	9	5 (mean = 0.6, SE = 0.2)
Guyed	116-146 m	11	121 (mean = 11.0, SE = 2.6)
Total		**20**	**126**

Table 3. The numbers of bird carcasses found at 21 Michigan communication towers between 7 September and 26 September 2004.

Tower support	Height category AGL	Numbers of towers searched	Numbers of carcasses found
Unguyed	116-146 m	9	12 (mean = 1.33, SE = 0.62) 9 (mean = 1.00, SE = 0.33)[a]
Guyed	116-146 m	12	51 (mean = 4.25, SE = 0.65)
Total	**All towers**	**21**	**63** **(60)[a]**

[a] data without birds likely killed and plucked on site by raptor.

Discussion

The diversity of species that collided with communication towers in this study was consistent with other similar research (Shire et al. 2000). Specifically, the majority of carcasses were of the avian order Passeriformes (69%), but also included small representations of Anseriformes (1%), Falconiformes (<1%), Galliformes (<1%), Charadriiformes (<1%), Columbiformes (1%), Cuculiformes (<1%), Caprimulgiformes (<1%), Piciformes (<1%), and the mammalian order Chiroptera (<1%). The high proportions of Red-eyed Vireo, Ovenbird, Swainson's Thrush (*Catharus ustulatus*), and Magnolia Warbler (*Dendroica magnolia*) carcasses observed under towers may be directly related to the high relative densities of these species migrating through the region during the sample periods. It is likely that additional species collided with the study towers but were not detected due to removal of carcasses by scavengers and human error and fatigue (i.e., observer detection rate). In addition, this study was designed to encompass the peak of long-distance songbird migration; thereby, potentially missing the peak migration periods of several species. During this study, technicians did not observe any large bird kill events under communication towers. Most fatalities involved single individuals on given days.

Few other studies of avian collisions with communication towers quantified observer detection rates and carcass removal rates. However, recent research on avian and bat mortality at wind turbines provides a source of comparison. When considering birds similar in size to those which typically collide with communication towers (e.g., warblers, vireos), Johnson et al. (2002) determined that observers detected a mean of 0.29 of the carcasses and the mean length of time a carcass remained on the ground was 4.69 days. This is very similar to the observer detection and removal rates determined in this study. After additional data have been collected the observer detection rates, carcass removal rates, and resulting multiplier adjustments will be incorporated into the statistical analysis. The numbers of fatalities presented in this report do not reflect these adjustments; however, adjustments for observer detection and scavenging rates will increase the estimates of fatalities at communication towers.

The study results support and are consistent with the prediction that guyed towers are associated with higher bird mortality than unguyed towers. Kruse (1996) intensively studied the location of bird carcasses under 3 guyed communication towers during bird migration. She found a significant positive correlation between the locations of tower guy wires and the locations of bird carcasses, thus supporting the belief that birds collide with the tower guy wires as they are attracted to and flying near lit towers. Although the data from the fall of 2004 supported this trend, the lack of detected difference using multiple comparisons is likely the result of an overall lower tower kill rate at all towers 116-146 m AGL during this field season. Michigan had unusually mild temperatures during this time period, with mostly clear skies and very few foggy nights. According to the National Oceanic and Atmospheric Administration, Michigan's September 2004 was the 2nd driest month in 110 years (www.noaa.gov). Previous research suggests a positive relationship between foggy or cloud-covered nights and bird collisions with communication towers (Avery et al. 1976, Larkin 2000). Therefore, it is possible that this atypically clear Michigan fall resulted in fewer bird-tower interactions than what might have occurred during a more average fall migration season. It is important to consider that although direct bird mortality was much lower at unguyed towers, it is possible that some birds were attracted to and circled around these structures displaying behaviors similar to those observed at guyed towers (Larkin and Frase 1988, Gauthreaux 2000). The implications of this energy-consuming behavior on the survival of individual migrating birds are unknown.

Literature Cited

Avery, M., P. Springer, and J. Cassel. 1976. The effects of a tall tower on nocturnal bird migration- a portable ceilometer study. Auk 93:281-291.

Erickson, W., J. Jeffery, K. Kronner, and K. Bay. 2003. Stateline Wind Project Wildlife Monitoring Annual Report, Results for the Period July 2001 - December 2002. Technical report submitted to FPL Energy, the Oregon Office of Energy, and the Stateline Technical Advisory Committee.

Federal Aviation Administration (FAA). 2000. Obstruction Marking and Lighting. AC 70/7460-1K.

Gauthreaux, Jr., S. 2000. The behavioral responses of migrating birds to different lighting systems on tall towers. Transcripts of Proceedings of the Workshop on Avian Mortality at Communication Towers, August 11, 1999, Cornell University, Ithaca, NY.

Gehring, J. 2004. Avian Collision Study Plan for the Michigan Public Safety Communications System (MPSCS): Assessing the Role of Lighting, Height, and

Guy Wires in Avian Mortality Associated with Wireless Communications and Broadcast Towers. Research proposal.

Johnson, G, Erickson, W, M. Strickland, M. Shepherd, D. Shepherd, and S. Sarappo. 2002. Collision mortality of local and migrant birds at a large-scale wind-power development on Buffalo Ridge, Minnesota. Wildlife Society Bulletin 30:879-887.

Kruse, K. 1996. A study of the effects of transmission towers on migrating birds. M.S. thesis, University of Wisconsin, Green Bay, WI.

Larkin, R. 2000. Investigating the behavioral mechanisms of tower kills. Transcripts of the Proceedings of the workshop on Avian Mortality at Communication Towers, August 11, 1999, Cornell University, Ithaca, NY.

Larkin, R., and B. Frase. 1988. Circular paths of birds flying near a broadcasting tower in cloud. Journal of Comparative Psychology 102:90-93.

Manly, B. 1997. Randomization, bootstrap and Monte Carlo methods in biology. 2nd Edition. Chapman & Hall/CRC. New York, New York.

Shire, G., K. Brown, and G. Winegrad. 2000. Communication towers: a deadly hazard to birds. American Bird Conservancy, Washington DC.

SPSS for Windows. Rel. 11.0.1 2001. Chicago: SPSS Inc., Chicago, IL.

Zar, J. 1984. Biostatistical Analysis. Prentice Hall, Englewood Cliffs, NJ.

Thank you for your consideration of this study.

Sincerely,

Joelle Gehring, Ph.D.
Department of Biology
Central Michigan University
Mount Pleasant, MI 48859