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Subject: 2nd resend of Michigan bird study report

Spring 2005 progress report.do...

Once again...

Apparently the attachment didn't make it to some of you -therefore resending... ____________ Hello all,

Attached is the most recent progress report for the Michigan study of avian collisions with communication towers. This past season we had the opportunity to compare bird mortalities at towers with different lighting systems. It is important to consider that these data are from 1 season of migration. Additional seasons of data collection will strengthen the analysis and lend more confidence to the conclusions.

I hope to see many of you in the next couple of months at either the meetings of American Ornithologists' Union or at the PCIA- Wireless Infrastructure Show/Conference.

Very Sincerely,
Joelle

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Avian Collision Study for the Michigan Public Safety Communications System (MPSCS): Summary of Spring 2005 Field Season

12 August 2005

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Introduction

This report summarizes the preliminary results of the spring 2005 field season, as well as additional progress towards the study's completion. Tasks and field seasons completed prior to December 2004 were documented in previous progress reports.

Progress

Spring 2005 field season

The study design and field work were completed according to the 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 (revised version: April 27, 2004; Gehring 2004). In summary, 21 MPSCS towers, 116-146 m (380-480 ft) Above Ground Level (AGL), were randomly selected for inclusion in the full study. Additionally, I secured permission to search 3 privately-owned towers $\geq$ 305 m (>1,000 ft) AGL. One objective of this study is to assess the differences in bird mortality at towers with different lighting systems. The following night-time tower light systems were compared: towers with white strobe lights but no solid-on lights, towers with red strobe lights but no solid-on lights, towers with red, blinking, incandescent lights but no solid-on lights, towers with both red strobe lights and solid-on lights (status quo) (Fig. 1). Nine of the MPSCS towers were self-supporting (no guy wires) and the remaining 12 MPSCS towers were supported by guy wires. As described in the research proposal, each technician was assigned to a designated tower where they systematically searched for bird carcasses every morning starting at dawn for 20 days during the peak of migration for neotropical migrating birds (10 May -29 May) (Gehring 2004).

- 3 guyed towers 116-146 m (380-480 ft) AGL with white strobes at the top level and mid level; no solid-on, incandescent lights
- 3 unguyed towers 116-146 m (380-480 ft) AGL with white strobes at the top level and mid level; no solid-on, incandescent lights

- 3 guyed towers 116-146 m (380-480 ft) AGL with red strobes at the top level and mid level; no solid-on, incandescent lights
- 3 unguyed towers 116-146 m (380-480 ft) AGL with red strobes at the top level and mid level; no solid-on, incandescent lights

- 3 guyed towers 116-146 m (380-480 ft) AGL with red, blinking, incandescent lights at the top level and mid level; no solid-on, incandescent lights
- 3 unguyed towers 116-146 m (380-480 ft) AGL with red, blinking, incandescent lights at the top level and mid level; no solid-on, incandescent lights

- 3 guyed towers 116-146 m (380-480 ft) AGL with red strobes at the top level and mid level; *with* solid-on red, incandescent lights at the midpoints between the top-level and mid-level strobes and red solid-on, incandescent lights at the midpoints between the mid-level strobe and the ground (current lighting system for most MPSCS towers)

Figure 1. Four different communication tower lighting systems were installed on the Michigan Public Safety Communication System towers. The areas under these towers were simultaneously and systematically searched for bird carcasses during 20 mornings surrounding the peak of songbird migration in the spring 2005. Additional data will be collected in the fall 2005, spring 2006 and possibly the fall 2006. These data will be used to examine the relationships between bird mortality and tower lighting systems and tower support systems.

Over 20 days technicians and I found a total of 203 birds determined to be killed during the study period (Table 1). During this field season the maximum number of birds found in 1 morning at 1 tower was 16.

Table 1. The number of bird carcasses found at 24 Michigan communication towers during 20 days in the spring of 2005.

Tower support	**Height category AGL**	**Light System**	**Number of towers searched**	**Number of carcasses found**
Unguyed	116-146 m (380-480 ft)	White strobe	3	3 (mean = 1.00, SE = 1.00)
		Red strobe	3	4 (mean = 1.33, SE = 0.88)
		Red blinking incandescent	3	4 (mean = 1.33, SE = 0.67)
Guyed	116-146 m (380-480 ft)	White strobe	3	3 (mean = 1.00, SE = 0.58)
		Red strobe	3	12 (mean = 4.00, SE = 1.00)
		Red blinking incandescent	3	8 (mean = 2.67, SE = 0.33)
		Status quo (w/ non-blinking lights)	3	37 (mean = 12.3, SE = 4.84)
Guyed	≥305 m (1000 ft)	Status quo (w/ non-blinking lights)	3	132 (mean = 44.00, SE = 11.55)
Total	**All towers**		**24**	**203**

I identified each specimen to taxonomic species when possible (Table 2). The avian species identification data will be validated by Caleb Putnam (Michigan Audubon Society), an experienced ornithologist familiar with the avifauna of Michigan. Forty-seven species of birds were collected and identified to have collided with the towers during the study period. The Red-eyed Vireo (*Vireo olivaceus*) was the most common species observed this field season, with the Gray Catbird (*Dumetella carolinensis*) as the second most common species detected (Table 2). Raptors typically do not collide with communication towers (Shire et al. 2000). However, this spring a technician documented

1 Turkey Vulture (*Cathartes aura*) under a guyed MPSCS tower. However, the degree of tissue decay and scavenging prevented verification of injuries consistent with a collision. Because the bird's death occurred previous to the study period, it was not included in any analysis, Tables 1 or 2.

Table 2. Avian mortalities (by species) at 24 Michigan communication towers during 20 days in the spring of 2005.

Bird Species[a]	**Number of carcasses found**
Wild Turkey (*Meleagris gallopavo*)	2 (<1%)
Ruffed Grouse (*Bonasa umbellus*)	3 (1%)
Ring-necked Pheasant (*Phasianus colchicus*)	1 (<1%)
Mourning Dove (*Zenaida macroura*)	1 (<1%)
Hairy Woodpecker (*Picoides villosus*)	1 (<1%)
Red-eyed Vireo (*Vireo olivaceus*)	26 (13%)
Philadelphia Vireo (*Vireo philadelphicus*)	1 (<1%)
Yellow-throated Vireo (*Vireo flavifrons*)	1 (<1%)
Yellow-bellied Flycatcher (*Empidonax flaviventris*)	2 (<1%)
Blue Jay (*Cyanocitta cristata*)	3 (1%)
House Wren (*Troglodytes aedon*)	2 (<1%)
Winter Wren (*Troglodytes troglodytes*)	1 (<1%)
Marsh Wren (*Cistothorus palustris*)	1 (<1%)
American Robin (*Turdus migratorius*)	4 (2%)
Wood Thrush (*Hylocichla mustelina*)	5 (3%)
Swainson's Thrush (*Catharus ustulatus*)	3 (1%)
Veery (*Catharus fuscescens*)	6 (3%)
Gray Catbird (*Dumetella carolinensis*)	22 (11%)
Cedar Waxwing (*Bombycilla cedrorum*)	1 (<1%)
Black-and-white Warbler (*Mniotilta varia*)	1 (<1%)
Tennessee Warbler (*Vermivora peregrina*)	1 (<1%)
Hooded Warbler (*Wilsonia citrina*)	1 (<1%)
Yellow Warbler (*Dendroica petechia*)	12 (6%)
Magnolia Warbler (*Dendroica magnolia*)	2 (<1%)
Yellow-rumped Warbler (*Dendroica coronata*)	1 (<1%)
Black-throated Blue Warbler (*Dendroica caerulescens*)	1 (<1%)
Cerulean Warbler (*Dendroica cerulean*)	1 (<1%)
Black-throated Green Warbler (*Dendroica virens*)	1 (<1%)
Blackburnian Warbler (*Dendroica fusca*)	1 (<1%)
Chestnut-sided Warbler (*Dendroica pensylvanica*)	5 (3%)
Bay-breasted Warbler (*Dendroica castanea*)	1 (<1%)
Ovenbird (*Seiurus aurocapillus*)	17 (8%)

Common Yellowthroat (*Geothlypis trichas*)	15 (7%)
Canada Warbler (*Wilsonia canadensis*)	2 (<1%)
American Redstart (*Setophaga ruticilla*)	5 (3%)
Baltimore Oriole (*Icterus galbula*)	2 (<1%)
Brown-headed Cowbird (*Molothrus ater*)	2 (<1%)
Rose-breasted Grosbeak (*Pheucticus ludovicianus*)	6 (3%)
Indigo Bunting (*Passerina cyanea*)	3 (1%)
House Finch (*Carpodacus mexicanus*)	1 (<1%)
Savannah Sparrow (*Passerculus sandwichensis*)	3 (1%)
Chipping Sparrow (*Spizella passerine*)	3 (1%)
Lincoln's Sparrow (*Melospiza lincolnii*)	1 (<1%)
White-throated Sparrow (*Zonotrichia albicollis*)	1 (<1%)
White-crowned Sparrow (*Zonotrichia leucophrys*)	1 (<1%)
Swamp Sparrow (*Melospiza georgiana*)	1 (<1%)
Unknown -Rail[b]	1 (<1%)
Unknown –woodpecker[c]	1 (<1%)
Unknown -thrush size[c]	14 (7%)
Unknown –warbler/vireo size[c]	9 (4%)
Total:	**203**

[a] all names of birds follow the *AOU Check-list of North American Birds*
[b] bird lodged high in tree preventing identification of species
[c] bird carcass heavily scavenged preventing identification of species

I conducted searcher efficiency (observer detection) trials to quantify the proportion of carcasses found by technicians and the proportion left undetected. By arriving at the site before technicians and placing a known number of bird carcasses within each technician's search area, I was able to quantify the proportion of bird carcasses found or observed by field technicians (Erickson et al. 2003). Chris Mensing, United States Fish and Wildlife Service, provided Brown-headed Cowbird (*Molothrus ater*) carcasses from the Kirtland's Warbler (*Dendroica kirtlandii*) recovery project in Michigan. Before placing the cowbird carcasses under study towers, I painted 80% of the individual cowbird carcasses to include small areas of yellow, red, or blue plumage to better simulate the coloration of many neotropical migrant songbirds. To ensure the differentiation of planted bird carcasses from tower killed birds, I painted all observer detection bird carcasses with a fluorescing paint that was invisible except with the use of a black light. Any questionable carcasses or feather piles were later scanned in the lab to identify their source (i.e., tower kill or observer detection bird). The mean observer detection rate was 0.31 (SD =0.04). I used bootstrapping (5,000 iterations) to estimate the mean and standard deviation of the observer detection rate (Erickson et al. 2003, Manly 1997).

To quantify the rate of carcass scavenging and removal, technicians placed 15 unpainted cowbird carcasses near the edges of the search areas of their respective communication towers (Erickson et al. 2003). Carcasses were monitored daily for the duration of the study. Carcasses remained on the ground a mean of 8.61 days (SD = 4.88).

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. 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 specific to each tower ranging between 1.18 and 2.83 (mean =1.74, SD = 0.52).

Using the Kruskal-Wallis test, I determined that there were significant differences in the numbers of bird carcasses under communication tower types ($P = 0.015$). I used 2 methods of multiple comparisons to determine which tower types were significantly different from one another (Zar 1984). Tukey's Honestly Significant Difference (HSD), considered the more rigorous of the 2 methods, determined that more birds were found under towers $\geq$305 m AGL than at towers 116-146 m AGL. Least Significant Differences (LSD) supported the results of Tukey's HSD but also detected differences among the towers 116-146 m AGL. Specifically, LSD determined that more bird carcasses were under the MPSCS towers with the status quo lighting systems (red strobes at the top level and mid level; *with* non-blinking red, incandescent lights 1/3 and ¾ height, Fig. 1) than under both guyed and unguyed towers with white strobes. Although trends in bird mortality were present in the remaining tower types, no statistical differences were detected (Fig. 2). It is important to note that these data are still preliminary and additional field seasons of data collection will enhance statistical comparisons. Raw data were used when testing for significant differences among tower types, not data adjusted for scavenging and observer detection rates. The statistical software SPSS was used for analysis and $\alpha = 0.10$ (SPSS 2001).

Bird migration intensity data were collected on each night of the field season, via NEXt generation RADar (NEXRAD) (Diehl et al. 2003, Gauthreaux and Belser 2003). These data will be analyzed within the next several months and included in analysis when possible. It is expected that the inclusion of NEXRAD bird migration intensities as a covariate will improve the future comparisons of bird mortality among tower-type categories. The use of covariates as well as at least 2 additional field seasons will likely decrease the variance observed in these preliminary data from both privately owned and MPSCS guyed towers (Table 1).

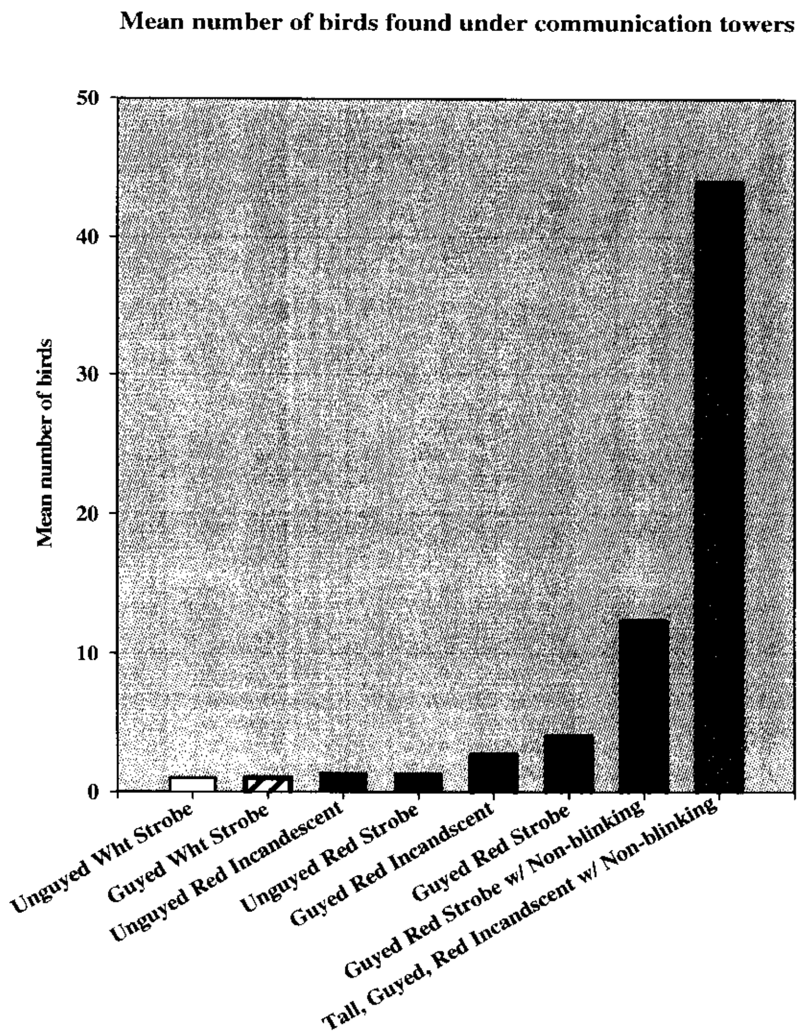

Figure 2. Bird carcass count data were compared at 8 different communication tower types during the spring of 2005 in Michigan. The bars delineated by striped patterns represent towers supported by guy wires; black outlines with no pattern represent unguyed towers. The bar with a gray striped pattern represents towers >305 m Above Ground Level (AGL), while all other towers were 116-146 m AGL. The areas under towers were simultaneously and systematically searched for bird carcasses during 20 mornings surrounding the peak of songbird migration. Additional data will be collected in the fall 2005, spring 2006 and possibly the fall 2006.

Meetings and workshops

In April 2005 I presented the results of the spring and fall 2004 field seasons and plans for future work to the Communication Tower Working Group – Research Subcommittee and later at the joint meetings of the Wilson Ornithological Society and the Association of Field Ornithologists. I also presented information to local Audubon groups and at the annual meeting of the Michigan Audubon Society (March 2005). This study received substantial interest and support from the ornithological and wildlife management communities present at the meetings. In mid-August 2005 I will be presenting at the meeting of the American Ornithologists' Union (contributed paper presentation). I have been asked to serve on a panel at the annual *PCIA-The wireless Infrastructure Association* meeting in September 2005, where the topic will be "Avian Mortality Issues: Potential Impact On Planned and Existing Wireless Infrastructures."

Current objectives

I will be continuing the process of NEXRAD data analysis. With the collaboration of radar ornithologist, Dr. Robb Diehl, the NEXRAD data will provide indices of migration intensity at communication towers included in the study. Given the time-consuming nature of examining and quantifying the large quantity of NEXRAD images collected during each field season, I will be working on this portion of the study whenever possible for the duration of the study.

I will continue to seek additional funding sources to further enhance this study. I will explore the benefits and costs of adding field seasons to the study, as well as adding privately-owned towers shorter than the current study's shortest height category, 116-146 m AGL.

I am currently recruiting and preparing for the fall 2005 field season. I am hopeful that many of the previous technicians can be retained for the fall 2005 field season. However, due to changing jobs and school schedules I will need to recruit new technicians for several of the towers.

Acknowledgments

This study could not be completed without the dedication, enthusiasm, and hard work of the technicians who conducted the early morning searches under communication towers -regardless of rainy and cold conditions. I appreciate the recruiting and advertising assistance of Michigan organizations and Internet list servers. This study is greatly enhanced by the inclusion of towers greater than ≥305 m (1000 ft) AGL. I owe a great amount of thanks to the private tower owners and engineers who by allowing us access to their sites, are taking important steps towards learning more about the issue of bird collisions with communication towers. The support of the Federal Aviation Administration (FAA) and Federal Communication Commission has allowed us to enhance this study via changing tower light systems. W. Erickson (WEST, Inc.) generously provided assistance and formats for calculating average detection probabilities considering both removal and observer detection rates. The interpretation and applicability of this study is greatly enhanced by his shared expertise. C. Mensing (United States Fish and Wildlife Service (USFWS)), and his technicians generously provided Brown-headed Cowbird carcasses. The use of NEXRAD is made possible by R. Diehl's (University of Southern Mississippi (USM)) interest and assistance. Many individuals regularly provide ideas, suggestions, and support for this project, including but not limited to: P. Kerlinger (Curry & Kerlinger, LLC), A. Manville (USFWS), C. Czarnecki (USFWS), S. Lewis (USFWS), G. Winegrad (American Bird Conservancy (ABC)), C. Schumacher (United States Forest Service (USFS)), E. Paul (Ornithological Council), B. Fisher (USFWS), J. Dingledine (USFWS), P. Lederle (Michigan Department of Natural Resources (MDNR)), R. Rustem (MDNR), M. Herbert (MDNR), T. Gehring (Central Michigan University (CMU)), and J. Janson (MDNR). I would like to express my gratitude to the USFWS, the MDNR and the NFWF for granting additional funds to improve this project. F. Moore (USM), M. Avery (United States Department of Agriculture), G. Winegrad (ABC), R. Rustem (MDNR) and an anonymous reviewer made time to provide official reviews for the NFWF grant proposal procedure. Central Michigan University and the USFS provide greatly appreciated logistical support for this research. The majority of the funding for this research is provided by the Michigan State Police. They have also allowed access to their towers and made possible the tower light system changes. A special thanks to those individuals who were involved in changing the MPSCS tower lighting systems. They frequently worked on weekends in order to complete the job. T. Shinew (MSPCS/ Michigan State Police), M. Scieszka (MSPCS/ Michigan State Police), I. Lopez (Office of the Michigan Attorney General), P. Ryan (Perkins Coie), F. Souchet (FAA), V. Vilaro (FAA), R. Matthews (FAA), K. Haggerty (FAA), F. Souchet (FAA), and M. Curry (Curry & Kerlinger, LLC) provide important logistical support for the study.

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