

Avian Migration & Human Technologies Birds Must Face: Traversing the Gauntlet of Tall Structures

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"No Bird Left Behind – Bird Interactions with Tall Structures and How to Reduce the Risk"
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Issues to Be Briefly Addressed During This Talk:

- Concepts w/ bird migration.
- Flyways, corridors, and broad front migrations.
- Status of avian populations.
- Estimates of mortality from tall structures.
- Tall structures birds must face.
- Direct, indirect, and cumulative impacts to birds from tall structures.
- Research efforts to avoid and minimize bird deaths.
- Other Service issues/activities related to wind/communication tower/power line/tall building development of interest to conference participants.
- Opportunities for coordination and alignment with our Partners.

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Introduction

- Wisconsin -- like all other states -- throes of **technology revolution**, your residents and businesses create growing energy demands and needs for improved communications.
- However, w/ growing needs and demands, old ecological adage comes into play: **"no free lunch"** when it comes to impacts human technologies have on wildlife trust resources and their habitats.
- Electric power lines (transmission and distribution), communication towers, wind energy turbines, and buildings are all **structures** that impact migratory birds, bats, and other wildlife species.

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Bird Migration

- **Air as a habitat** is new concept, including for USFWS. Goal: **do no harm**.
- Many birds **migrate great distances**: Ruby-throat hummingbird, Short-tailed Shearwater, Arctic Tern.
- **Process of migration**: poorly understood birds, barely all bats.
 - Can be episodic; Can. Geese: 0.5 M w/in 24 hours.
 - Or drawn out for months, e.g. Am. Robin, Common Loon.
 - Birds likely most vulnerable taking off/ landing.
 - Until know **height** birds fly, can't talk about risk quantitative way.

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Bird Migration, Cont. – Focusing on Songbirds

- **Process**: Migration "pathways" or "corridors" **don't generally appear exist for songbirds**, esp. contiguous U.S.
- For songbirds, best referred **"broad-front migrations"** (research by S. Gauthreaux, C. Belsler, R. Larkin, others).
- Can have **seasonal and annual variations in songbird numbers/concentration** and in **timing**, but usually **not site-specific** (except at mountain passes, e.g., Franconia Notch, White Mountains, NH, where **tunneling** can occur). Why these variations remains mystery.
- **"Flyways"** generally agency administrative designation – **ducks, geese, and swans** frequently fly well outside them.
- **Chronology**: B/w waterfowl, shorebirds, raptors, landbirds, wading birds, and marsh birds, somebody migrating all times of year (M. Shieldcastle, OH DNR).

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How Many Birds Migrate Each Spring and Fall?

- Aldrich *et al.* (1975) used 1973 Breeding Bird Survey w/ 3,325 birds/mi² estimated **9.975 billion breeding landbirds U.S.** exclusive Alaska and Hawaii. Concluded **fall population probably 2x that figure**.
- Banks (1979) used figure **10 billion breeding birds** in contiguous U.S., assuming average annual mortality **10 billion birds**.
- J. Trapp (unpubl. data) – FWS Division Migratory Bird Managemt. -- examined **1991 and 1992 Breeding Bird Census** data, extrapolated, concluded probably safe talk about minimum breeding populations order **10 B**, minimum fall populations order **20 B** in N. Am north of Mexico.

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Avian Population Status

- Status U.S. bird populations concern. 1995, FWS listed **124** "nongame species of management concern." Represents early warning system since possible next step is listing birds under Endangered Species Act – scenario we'd prefer to avoid.
- 2003, FWS published "birds of conservation concern," mandated by law. Number bird populations in trouble increased **124 to 131 species** – not good news. In addition, **77 endangered** and **15 threatened** birds included under ESA – numbers continue increase.
- Recapping, **836 species**, > **223 in trouble**. In addition, Service essentially lacks data status **173** N. Am. bird populations. Management challenge!

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Potential Impacts from Tall Structures

- **Direct effects of tall structures.**

- Bird and bat strikes.
- Electrocutions.
- Direct habitat loss/modification.
- Barrier effects.
- Increase in edge due habitat fragmentation.
- Increase nest parasitism and predation.



- **Indirect effects.**

- Reduced nesting/breeding density.
- Loss population vigor and overall density.
- Habitat and site abandonment, increased isolation b/w patches.
- Loss of refugia.
- Attraction to modified habitats.
- Effects on behavior including stress, interruption, modification.
- Disturbance, avoidance, displacement, habitat unsuitability.



- **Cumulative effects.**

- Cumulatively with all structures, overall effects from all above.



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Operative Questions

- Are human impacts affecting populations?
- What proportion of those impacts are due to tall structures?
- Is mortality additive?
- What can be done to reverse the trends?

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Estimates Avian Mortality in US – Power Lines Collisions

- **Strikes:** primarily with high-voltage transmission lines: could range **hundreds of thousands up perhaps 175 million/yr.**, based primarily extrapolations – but b/c so little of power grid is assessed, estimates not particularly meaningful (Manville 2005).
- Currently > **500,000 miles** bulk transmission line in U.S. and growing.

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Mortality Estimates – Power Line Electrocutions

- **Electrocutions:** primarily lower voltage distribution lines and infrastructure.
- **Tens of thousands to hundreds of thousands or more birds killed/yr.**, representing very rough approximations based on very limited data (Manville 2005).
- Estimated > **116 million distribution poles** in U.S. 2000 (Williams 2000) and growing.

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Mortality Estimates: Communication Towers

- Conservatively **4-5 million birds/yr.**, but could range as high as **40-50 million deaths**, only a **cumulative impacts study** providing the true magnitude of problem (Manville 2001).
- Currently some **96,000 communication towers** registered w/ Federal Communications Commission. Figure under-estimates total number towers in U.S.

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Mortality Estimates: *Wind Turbines*

- One estimate put annual level mortality ~40 K birds estimated killed (Erickson *et al.* 2001), but study design has some significant flaws and needs major update.
- FWS feels more likely **order or two in magnitude larger** (Marville 2005), w/ concerns likely undercounting small birds esp. in West. Still low wh. good news. Need try keep it that way.
- Wind industry **fastest growing electric generating industry** stateside and worldwide. U.S. has > 10,000 Megawatts (M) installed wind capacity today – and rapidly growing. WI and Midwest seeing tremendous wind development.

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Mortality Estimates: *All Buildings Short and Tall*

- Combination of apparent night lighting attraction and inability birds to see glass daytime and night could result -- based on 2 models -- annual avian mortality of **97.6 to 976 million birds** (Klem 1990) and **97 to 970 million** (O'Connell 1998).
- Based on **1-10 bird deaths/structure/yr.** (Klem 1990).

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Power Line Electrocutions -- *Background*

- Electrocutions eagles, hawks, and owls 1970s especially problematic CO and WY. Resultant research M.W. Nelson and others avoiding electrocutions resulted 1975 and 1981 publications, *Suggested Practices Raptor Protection on Power Lines*.
- 1983, **ad hoc group** stakeholders including several investor-owned utilities (IOUs), Natl. Audubon Soc., and FWS initiated dialogue address strikes and electrocutions. By 1989, group officially formalized into **Avian Power Line Interaction Committee (APLIC)**. APLIC updated *Suggested Practices* in 1996, becoming **first definitive work** raptor electrocution avoidance.

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Next Steps to Avoid Electrocutions

- 2006 update, *Suggested Practices to Avoid Bird Electrocutions at Power Lines*, in press. Designed protect **all birds**, not just raptors.
- Will include recommendations for
 - state-of-the-art **phase-to-phase and phase-to-ground wire spacing** based on mock-up bird testing,
 - **protective cutouts and surge arresters**,
 - proper location of insulation for jumper wires,
 - placements for **perch guards**, and
 - many other recommendations tested and published in **scientific journals**.

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Power Line Strikes

- Far larger numbers bird species die collisions power transmission lines than electrocuted distribution lines – including songbirds, waterfowl, herons, cranes, swans, pelicans, shorebirds, raptors, and others susceptible.
- 1994, APLIC published voluntary guidance to industry avoiding power line strikes, *Mitigating Bird Collisions with Power Lines: State of the Art in 1994*.
- APLIC currently discussing update to this document, based more recent research w/ **marker balls, bird diverters, paint, and other bird avoidance devices** – some of which shown **significant reductions** in mortality published in **scientific literature**.

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Avian Power Line Interaction Committee (APLIC)

- APLIC today grown some 20+ utility members, National Rural Electric Cooperative Association, Bonneville Power Admin., Western Area Power Admin., EPRI, EEL, and FWS.
- As tool to encourage industry use *Suggested Practices* documents, **voluntarily report bird mortality** to FWS, and **minimize power line risks** to birds, APLIC finalized **template** for an industry-specific avian protection plan (APP) released to public at FWS-APLIC ceremony April 2005.
- FWS – including this biologist – worked closely w/ electric utility industry to develop that template.

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APLIC, Cont.

- APP template and companion **Suggested Practices** documents touted as model all electric utilities and other industries to follow. FWS congratulates APLIC for being proactive its efforts reduce avian mortality.
- Message is **powerful one**: industry can and is working with the State and Federal regulatory agencies, conservation community, and public to protect wildlife trust resources. Is model for **other industries** to proactively follow.

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Communication Tower Collisions -- Background

- Collision reports **not new U.S.** Earliest known report bird-tower kill Sept. 1948, Baltimore, MD tall radio tower. Literature **replete w/ published reports** mortality last half century, including longest-term study ever completed Eau Clair, WI, Dr. C. Kemper (1957-1995). Study still holds dubious honor recording **greatest single-night bird kill** – Dr. Kemper retrieved and identified > 12,000 birds, not accounting almost certain scavenging (Manville 2005).
- **Large 3-tower one-night kill** up to 10,000 Lapland Longspurs Feb. 1998 in KS got FWS and my Division engaged w/ communication tower-bird strike challenge.
- Late 1998, Service developed and released public **tower risk model**.
- 1999, **Communication Tower Working Group** created – 14 Federal and State agencies, most communication tower trade associations, several tower companies, ornithologists, academicians, consultants, and number NGOs.

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Communication Towers – Cont.

- Privilege chairing CTWG since 1999.
- 1999 FWS co-sponsored workshop “Avian Mortality at Communication Towers,” Cornell Univ. First-ever meeting of its kind.
- Sept. 2000 Service published **voluntary communication tower guidance**, currently continuing in place, hopefully soon w/ lighting updates.
- September 2005, **Madison, WI**, 1,100-ft TV tower: 2 single-night bird kills, one least 400 birds. Problems continue happen your own backyard.

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Current Tower Research

- Ongoing light attraction study by **W. Evans et al.** using **ground lighting**.
- 2004-2005 Boulder, CO, **Clear Channel mortality study** using remote video camera. Mortality low.
- Cell tower mortality study 2004-2005 **U.S. Forest Service, Coconino NF, AZ**. Asked develop research protocol for study. Mortality low.
- **J. Johnson, Swarthmore College, Philadelphia radar-communication tower study**. Statistically greater curvilinear attraction to red incandescent lights opposed to white strobe lights. Replicates **S. Gauthreaux-C. Belser study**.

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Tower Research – Cont.

- 2003-2005: study 21 MI State Police towers, 3 tall private towers. **Dr. J. Gehring**, lead investigator. This biologist serving as co-principal investigator. 2004: no light changes at MSP towers; 2005 light changes (N=6 blinking incandescent [3 guyed, 3 unguyed]), N=6 red strobes, N=6 white strobes).
- **Preliminary results**:
 - Tall, guyed towers more impacting than short, unguyed.
 - White strobes significantly fewer fatalities.
 - Spring 2005 results b/w red strobes and red incandescents inconsistent – on way to determining red strobes as good as white strobes but **not** there yet.
- Spring 2007, 3-yr tall (N= 5) MI tower study w/ U.S. Coast Guard funding. Dr. Gehring PI for MI study.
- Cape May, NJ, “Rescue 21” USCG-funded 3-yr. tower study along coast, 450-ft.

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Wind Turbine Impacts -- Background

- Wind generation in U.S. not new. **Cape Cod, MA**, supported > 1,000 working windmills 1800s. 1930s, **VT** boasted world’s then-largest turbine likely disabled high winds due design flaws.
- 2 major issues: (1) **bird/bat strike mortality and crippling loss**; (2) **habitat fragmentation**, disturbance, behavioral disruption possibly long term impacting populations.
- Issue bird strike mortality in U.S. arose late 1980s-early 1990s **Altamont Pass Wind Resource Area, CA**. Impacts local populations Golden Eagles, Red-tailed Hawks, Am. Kestrels, Burrowing Owl, others of concern. Overall avian mortality continues today from estimated 1,760 - 4,700-some bird deaths/yr. at APWRA – currently being addressed by litigation by **Golden Gate Audubon et al.**

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Wind – Cont.

- Begin addressing challenges, **National Wind Coordinating Committee (NWCC)** created 1994 part Pres. Clinton's Global Climate Change Action Plan (Ex. Order). 1995, **Avian Subcommittee** (now called **Wildlife Workgroup**) created w/ FWS as co-founder. Manville been member since 1997.
- 1999, NWCC published **Metrics and Methods for Determining or Monitoring Potential Impacts on Birds** (peer-reviewed by this biologist for FWS).

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Wind – Recent Actions

- 2003, request Interior Secretary's Renewable Energy on Public Land's initiative, FWS published **voluntary guidance installation and operation land-based wind turbines**, 2 years public comment. Guidance intended to assist industry avoiding/minimizing wildlife impacts by:
 - evaluating potential sites,
 - properly siting and designing turbines, and
 - conducting pre- and post-construction research and monitoring to identify impacts to wildlife and their habitats.
- Service currently undergoing re-evaluation of guidance through **Federal Advisory Committee Act (FACA) process**. FACA notice **Federal Register** announcing process, calling nominations participation FACA Committee, other logistics out soon.
- 2005, Government Accountability Office (GAO) met with this biologist, others, conduct wind audit re: Service's guidance, needs, recommendations to Congress. GAO recommended that **FWS provide State and local regulatory agencies w/ information potential impacts wind power on trust resources and habitats before agency decisions are made.**

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Wind – Research Updates

- USGS biologists conducting nationwide studies utility **NEXRAD weather radars**, used in conjunction modified **marine radars**, **acoustic monitoring**, **thermal imagery**, **GIS**, other tools to better determine bird/bat stopover areas, flight migration heights and chronology, related issues. Upcoming Oct. 24-26 **radar ornithology/bat USGS-USFWS collaborative workshop**, Albuquerque, NM.
- Nov. 14-15, **NWCC Research VI meeting** – reporting out research findings since fall 2004 – take place San Antonio, TX. Open to public. First time NWCC peer-reviewed abstracts for presentation, attempted prioritize research needs.

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Birds and Building Windows

- Recapping, appear be **2 major issues** impacting birds (possibly bats):
 - (1) **attraction night building lighting** (e.g., interior, exterior vanity, celometers, spots) especially related to songbird migration and inclement weather; and
 - (2) **inability birds detect presence glass day and night.**

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Birds and Buildings – Recent Activities

- Brand new initiative for FWS. Service recently supported M. Mesure's **Fatal Light Awareness Program (FLAP)** through use our "Urban Treaty Program" (e.g., New Orleans, Chicago, Philadelphia, Houston, Portland [OR]), encouraging cities participate in "lights-out" during songbird migration.
- December 2005, Service (this biologist) became technical advisor to **Bird-Safe Glass Building Working Group**, currently chaired by NYC Audubon Society.
- Working w/ **building and glass architects**, Dr. D. Klem, R. Doeker, D. Piselli, others to develop nationwide initiative. Group currently drafted bird-safe glass **guidelines** under review. Assessing what's being done in Europe. **Huge but important initiative.**

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Conclusion

- Service continues **actively partner industry** through active roles **APLIC, CTWG, NWCC Wildlife Workgroup, Bird-safe Glass Working Group, others.**
- Reverse avian impacts I've described will take **all stakeholders working together** address challenges. Birds and bats much too important economically, culturally, and esthetically to lose them to human-caused impacts.
- They're already under assault from **natural and additive mortality, disease, global climate change, and habitat loss. We can and must reverse current population trends.**



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In Summary...

The Service favors:

conservation of wildlife in the public trust;

development of renewable energy that is bird and bat friendly;
and

use of informed decisions based on adequate environmental
assessment and sound science.



Thank you

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