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.

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.

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.**

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. Belser, 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 funneling 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).**

How Many Birds Migrate Each Spring and Fall?

- **Aldrich *et al.* (1975) used 1973 Breeding Bird Survey w/ 3,325 birds/mi^2 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.**

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 1/3 N. Am. bird populations. Management challenge!

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.

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?

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.**

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.**

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.**

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 (Manville 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.

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).**

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.**

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.**

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.**

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, EEI, 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.

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.**

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.

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.

Current Tower Research

- Ongoing light attraction study by W. Evans *et al*. using ground lighting.
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- 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.

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= 6) 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.

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*.**

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).**

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.

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.**

Birds and Building Windows

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

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.**

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.**

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