Anthropogenic-related Bird Mortality Focusing on Steps to Address Human-caused Problems – a White Paper for the Anthropogenic Panel, 5th International Partners in Flight Conference, August 27, 2013, Snowbird, Utah

Albert M. Manville, II, Ph.D., Senior Wildlife Biologist, Division of Migratory Bird Management (DMBM), U.S. Fish and Wildlife Service, 4401 N. Fairfax Dr.–MBSP 4107
Arlington, VA 22203; 703/358-1963; albert_manville@fws.gov

Abstract:

This paper briefly reviews some of the significant human-related causes of bird mortality in the U.S., with a focus on empowering stakeholders including industry and other affected parties regarding steps each can take to avoid, minimize and mitigate direct and indirect impacts from projects on migratory birds. It also briefly reviews efforts at conducting effective and efficient impact analysis. The issues in this white paper pertain to the problems being presented and discussed by panelists at the 5th International Partners in Flights Anthropogenic Panel on August 27, 2013. The white paper reviews some of the validated conservation measures for avoiding and minimizing the "take" (i.e., injury or death) of migratory birds caused primarily by humans and human development. It also references some of the various "tools" currently available to minimize impacts to bird habitats and reduce the consequences of indirect effects, and discusses several ongoing partnerships with industry stakeholder groups. Included is a very short summary of the statutory and trust responsibilities of the U.S. Fish and Wildlife Service (hereafter, Service or FWS) and the ways the Agency works with the respective industries and other stakeholders to empower action and achieve "due diligence" in better addressing impacts to birds.

Introduction:

Currently, 1,027 species of migratory birds (50 C.F.R. 10.13) are afforded protection under the Migratory Bird Treaty Act (MBTA, 16. U.S.C. 703 *et seq.*) and its implementing regulations. While MBTA is a key statute used for protecting and managing migratory birds, there are several other laws, policies and implementing regulations that pertain to bird protection and the Service's trust responsibilities. These include the Bald and Golden Eagle Protection Act (BGEPA, 16 U.S.C. 668-668d), the Endangered Species Act (ESA, 7 U.S.C. 136, 16 U.S.C. 1531 *et seq.*), the National Environmental Policy Act (NEPA, 42 U.S.C. 4321 *et seq.*), Executive Order 13186 (the 2001 Migratory Bird Executive Order – which, in addition to BGEPA and ESA, also addresses bird habitat protection), the Fish and Wildlife Coordination Act (FWCA, 16 U.S.C. 661-667e), and the Fish and Wildlife Conservation Act (Nongame Act, 16 U.S.C. 2901-2912). The Service's tribal trust responsibilities associated with migratory birds are, in part, based on reserved right doctrines, Executive Orders, judicial mandates, specific treaties between the Federal government and the Native American governments, and statutes such as the American Indian Religious Freedom Act (AIRFA, 42 U.S.C. 1996) and the National Historic Preservation Act of 1966, as amended (NHPA, 16 U.S.C. 470 *et seq.*). Migratory birds, and the impacts on them, must therefore be examined from a number of statutory, regulatory and legal perspectives.

The overall objective and systematic goal of the Service is to maintain bird populations at stable or increasing numbers. This is a daunting challenge with (1) growing numbers of Birds of Conservation Concern (BCCs, currently 273 species and subspecies on the national, Service Regional and Bird Conservation Region lists [USFWS 2008] – periodic reviews and updates required under provisions of

the Nongame Act) and (2) Federally listed species (78 endangered and 15 threatened bird species on the List of Threatened and Endangered Species [50 C.F.R. 17.11-17.12]). Collectively, these numbers represent at least 366 bird species (> 36%) in trouble, with numbers growing. Additionally, the Service is also tasked to maintain stable or increasing populations of Bald and Golden Eagles under implementing regulations of BGEPA (50 C.F.R. 22.26 and 22.27) and the NEPA documents authorizing regulations for "take" pertaining to eagles (i.e., the Final Environmental Assessment and the Finding of No Significant Impact). The Service is also developing an Interpretive Statement identifying how it has and plans to continue to interpret and enforce MBTA. The document is currently under internal development within FWS and Interior Department Solicitors.

Clearly, the activities that impact bird populations and affect their habitats are extensive, and from the cursory legal and statutory overview above, they can be complicated. However, much of the public and industry's attention tends to focus on direct "take" of migratory birds. While direct "take" is important, and can have effects on bird populations as discussed beyond, impacts from "take" are but one component of our anthropogenic footprint. We wish to acknowledge that it is nearly impossible to completely avoid "take." As the Service has previously stated (e.g., APLIC 2006:21), "*although the MBTA ha[s] no provision for allowing take, the USFWS realizes that some birds will be killed even if all reasonable measures to avoid it are used. The USFWS Office of Law Enforcement [OLE] carries out its mission to protect migratory birds through investigations and enforcement, as well as by fostering relationships with individuals, companies, and industries that have programs to minimize their impacts on migratory birds. Since a take cannot be authorized, it is not possible to absolve individuals, companies, or agencies from liability even if they implement avian mortality avoidance or similar conservation measures. However, the OLE does have enforcement discretion and focuses on those individuals, companies, or agencies that take migratory birds without regard for their actions and the law, especially when conservation measures had been developed but had not been implemented."*

Integrated bird conservation requires a multitude of approaches for maintaining, protecting and managing 1,027 bird species. To achieve our goal, the Migratory Bird Program works with a variety of Federal and State agencies, non-governmental partners, industry proponents, academicians and other stakeholders to increase actions that benefit migratory birds and reduce project-specific effects, both direct and indirect, including those that result in "take."

Currently, Service staff are working directly with our many partners to address effects to birds by avoiding or minimizing the production and exposure of birds and their related resources to "stressors." A stressor is defined as any *alteration* or *addition* to the environment that when applied to a resource then becomes a threat to the individual bird and/or its population. Stressors can be both anthropocentric and natural. Common avian stressors include artificial lighting, noise, human disturbance, the addition of structures to the landscape, and the removal and manipulation of vegetation. The principle behind stressor management: focus on the *cause* of the impact rather than its *effect*. Previously, managing project effects had focused on "fixing" the consequences of an action – admittedly costly, often difficult, and not necessarily effective. Stressor management is intended to *"deconstruct"* a project, providing a more tangible impact analysis by identifying the full spectrum of avian stressors associated with the lifecycle of a project. By knowing the stressors produced by each individual activity (e.g., brush clearing, dredging, using heavy machinery, or installing structural lighting), within each phase of a project (i.e., pre-construction, construction, post-construction/operation, and decommissioning), the project proponent

can truly *anticipate* the problems that might be associated with their project, and identify cost-effective ways to minimize or avoid the individual stressors at their source before they become realized threats to birds.

For example, artificial, steady burning red lights (the *stressor*) cause displacement and increased predation (the *threats*), resulting in reduced productivity and survival and population decline (the *consequence*). By replacing steady burning red (L-810) lights on structures with flashing incandescent or strobed red lights, or by turning off L-810 lights where permissible, these activities can minimize mass mortality events at tall, guy-supported communication towers, especially at night under inclement weather conditions. This represents a cost-effective best management practice by essentially removing the stressor. As another example, the addition of a structure to the landscape (the stressor) can result in barriers to movement, displacement, collisions and reduced gene flow (the threats), with resultant declines in local populations, reduced success in pairing, reduced genetic diversity, injury and death (the consequences). The bottom line: if you as a project proponent do not produce avian stressors (i.e., you take all practicable measures to minimize or reduce any potential stressors associated with your project or activity), you are unlikely to have negative effects on birds (Morris and Kershner 2013; E. Kershner pers. comm.). For a number of reasons, this proactive approach is much more desirable and effective than managing consequences of actions that have already occurred such as "take" – addressed under the tenets and regulations of MBTA.

The Migratory Bird Program strives to address all effects to migratory birds, including "take." To be successful, we want to emphasize that strategic conservation must include much more than simply "avoiding and minimizing [direct] take." It must include the "big picture" regarding bird conservation, including stressor management. The presentations on this Panel will exemplify this comprehensive approach in attempts to deal with systematic and strategic bird conservation. Some of these key issues are *briefly* summarized within this white paper.

Current Bird Status; Comparing Estimates of Take; Variables to Consider in Assessing Impacts:

In an assessment of the nationwide status of breeding bird populations in North America, several Service biologists previously estimated a minimum of 10 billion breeding landbirds in the United States exclusive of Alaska and Hawaii, and a minimum fall population of 20 billion migratory birds in North America north of Mexico (Manville 2005:1052, citing Aldrich *et al.* 1975, Banks 1979, and J. Trapp 2001 pers. comm.). While it remains difficult to reliably quantify the total spring and fall breeding landbird populations in North America, it remains clear that the number of imperiled North American birds continues to increase, the number of imperiled populations continues to grow continent-wide, and the numbers of birds on bird conservation, species of concern and bird watch lists are growing in North America – in some cases at troubling levels.

The large, estimated annual loss of birds is due to a number of factors. In addition to natural mortality (e.g., starvation, disease, predation, parasitism, and natural accidents), the direct and indirect impacts from humans and our human footprint are extensive – some sources of mortality becoming additive to natural, compensatory mortality. The mortality factors related to our human footprint include collisions with structures (e.g., building windows, power lines, communication towers and guy wires, wind turbines, monuments, and bridges) – several of which are discussed on this panel. Birds are also killed or injured by domestic and feral cats, shootings, collisions with vehicles and aircraft, poisoning from pesticides and

contaminants, drowning in oil and wastewater pits, impacts from oil and contaminant spills, electrocutions at power line infrastructure, entanglement and drowning in fishing gear, drowning in stock tanks, take from hunting and crippling loss, poisoning from lead and other metals, direct loss of breeding habitat, and documented impacts to birds from climate change, among others.

Not infrequently, proponents from one industry sector, concerned citizens, and conservationists supporting a specific type of industry will compare estimated levels of mortality from one sector of industry to another. For example, building windows are estimated to kill upwards of 1 billion birds/yr in the U.S. (Klem 2013, Loss *et al.* 2013b) while collisions with communication towers may take 6.8 million/yr in North America (Longcore *et al.* 2012).

In yet another example, a recent estimate by Loss *et al.* (2013a) suggests a median estimate of 2.4 billion birds killed annually in the U.S. by domestic and feral cats – the largest projected source of human-related mortality to birds yet published in North America. By comparing mortality from cats to the most recent estimates of mortality caused by commercial land-based wind turbines, for example, the wind energy estimates are several orders of magnitude smaller, resulting in what might at face value be interpreted as insignificant. This comparison can be very misleading. Collisions with land-based, wind energy turbine blades were recently estimated to kill 440,000 birds/yr based on a 2008 estimate of some 22,000 operating turbines (Manville 2009), and are now estimated to kill 573,000 birds/yr in the U.S. based on a 2012 estimate of some 34,400 operating turbines (Smallwood 2013).

There is a problem with these comparisons. This relatively low level of estimated wind energy mortality does not account for the current disproportionate take of Golden Eagles (GOEAs) by wind turbines in the West. In addition to the approximately 65 to 70 GOEAs killed per year at Altamont Pass Wind Resource Area, CA, there are records of more than 85 GOEAs that have been documented killed in the West at commercial wind energy facilities (Pagel *et al.* 2013 in press). While these figures likely represent a substantial underestimate of the number of GOEAs killed at wind facilities in the West, the concern centers around the growing "take" of eagles and effects to their territories and eagle use areas as more wind facilities are built and become operational. Additionally, there is a growing – but still low – level of take of Bald Eagles nationwide at wind energy facilities, as well as a disproportionate but still poorly substantiated level of take of passerines (Smallwood 2013).

While these comparisons do provide a relative index of "take," they generally only represent overall, gross estimates. Furthermore, when used and assessed alone – especially for comparative purposes – such comparisons are not especially helpful since they represent only a portion of the overall impacts to migratory birds and generally fail to provide the details regarding specific impacts (e.g., the specific suites of birds most vulnerable to take, the take of specific species of Birds of Conservation Concern, and the effects of habitat loss and fragmentation on birds, among others).

Assessment of "take" and other impacts to birds, including impacts to their habitats, must include other important variables. These include but are not necessarily limited to the following:

(1) An analysis of bird species most at risk from both direct and indirect effects should be conducted. Birds most at risk may include Birds of Conservation Concern (USFWS 2008 – currently under revision), Federally and State-listed threatened and endangered species, candidate species, Breeding Bird Survey declining species, WatchList species, and others.

(2) The focus must be on species most at risk from impacts of human development, not simply an overall gross number of estimated deaths not tied to suites of species or individual species most at risk and likely impacted.

(3) Cumulative effects (CE) should be addressed, including from a variety of perspectives. CEs not only should include an analysis of impacts from direct "take" – including the combined "take" of all migratory bird species, regardless of their conservation status – but an analysis of "take" at a range-wide population scale. An analysis of impacts to habitats should also be included. The review should also consider the foreseeable indirect effects which may occur later in time or which are further removed from the project "footprint." Indirect effects can include displacement, the introduction of barriers to movement, habitat fragmentation, site avoidance/abandonment, disturbance, behavioral modification, creation of sub-optimal or marginal habitats, stress, and intra- and interspecific competition for resources, among others, which may be brought about by the project. Essentially, any natural and human-caused sources of mortality and impacts to habitats should be included in any cumulative impacts analyses. Either under or in addition to NEPA review, many of these indirect effects are difficult to quantify but still need to be reviewed. However, given the complexity of these issues and the paucity of expertise in both the industry and the agencies needed to perform these assessments, federal partners and project proponents may still be better equipped to evaluate the impacts side of this equation while the resource agencies may be better equipped to assess the effects side. This provides the opportunity and the responsibility of the Federal resource agencies to partner with and assist project developers, respectively, where practicable.

(4) Methods for assessing impacts to species need to be vetted and improved. Reliably estimating anthropogenic sources of mortality generally remains imprecise, approaches for reaching these estimates can be highly variable and inconsistent, and data from some mortality studies may be "cherry picked" to depict low impacts. Additionally, if mortality estimates are to be used to assess biological impacts to bird populations, we also need accurate information on survival and fecundity (Loss *et al.* 2012). This issue suggests that we should not focus our attention on the number estimates but rather focus on how to reduce impacts – in turn reducing morality in most cases.

(5) The focus on "stressor" management – as previously discussed – should help to identify impacts *before* they occur, allowing the selection, siting, and development of projects to efficiently and effectively include measures which will reduce these impacts *before* the fact. This is the proactive approach which cannot be emphasized enough. It requires pre-planning, including landscape and site assessments, and ideally coordination with State and/or FWS field staff prior to initiation of projects.

Thumbnail Comparisons of Some Causes of Bird Mortality:

During this Panel, Scott Loss and Christine Bishop will present an overview of bird mortality in the U.S. and Canada, respectively. This white paper overview will briefly recap some of the current estimates of bird mortality from the most common known sources in descending order (highest to lowest) with respect to the number of birds estimated to be "taken" by each source in the U.S. annually. The following is a brief summary of information on some of the top anthropogenic sources, and some sources of rising concern, of impacts to birds in the United States. As a cautionary note, it is important to focus *less* on comparing estimates of various industry and anthropogenic sources of mortality, and focus *more* on impact reduction.

- **Domestic and feral cats** top the list for estimated "take" of birds, with between 1.4 and 3.7 billion birds (median = 2.4 billion) estimated killed per year, approximately 69% of which are due to un-owned cats (Loss *et al*. 2013a) based on a meta-review of existing published literature. Other than recommending "cats indoors" initiatives which FWS includes in our Urban Treaties Program, this white paper will not address the cat issue.
- The second greatest source of bird mortality is estimated to result from collisions with **building glass and windows**, and the related effects of light attraction, especially nighttime interior and exterior vanity lighting. Klem (1989, 1990) estimated a range of 1-10 birds killed/building structure/yr within the U.S., reporting at least 50% of the strikes as fatal, regardless of bird size. Dunn (1993) estimated a range of 0.65 – to 7.70 bird deaths/home/yr based on a 1989- 1990 winter study, suggesting Klem's (1990) range of 1-10 bird deaths/building was realistic. Klem (1990) developed a predictive model estimating overall mortality at 97.6 – 976 million bird deaths/yr in the U.S. More recently, Klem (2009) echoed previous concerns, with Klem and Saenger (2013) indicating that window collisions were estimated to be greater than any other source of human-associated mortality. They also suggested the need to develop more accurate estimates of mortality and implement management actions for specific species. Loss *et al.* (2013b) conducted a meta-review of the available collision data, modeling estimates based on building classes (i.e., residences = 1-3 stories tall, low-rises = 4-11 stories, high-rises $\geq$ 12 stories). High rises and low rises were estimated to cause the greatest levels of mortality, with much lower rates at residences. They estimated between 365 – 988 million bird deaths/yr in the U.S. (median = 599 M) and concluded that window collisions may contribute to or exacerbate the declines of some populations of Birds of Conservation Concern.
- **Power Line Collisions and Electrocutions.** The impacts of transmission and distribution lines on migratory birds have not and continue not to be carefully and systematically monitored due in major part to the millions of miles of distribution line and nearly 0.75 M miles of transmission lines in the U.S., lack of adequate utility and agency staff to systematically survey them, and for other reasons (Manville 2009, 2011). Collisions primarily with transmission wires are estimated to kill from hundreds of thousands to 175 million birds/yr in the U.S., based on extrapolations, while electrocutions primarily at distribution lines and their infrastructure are estimated to kill from tens of thousands to hundreds of thousands of birds/yr (Manville 2005). In addition, much research has been and continues to be conducted on addressing the indirect effects of transmission and distribution lines on prairie grouse, including prairie-chickens, sage-grouse and sharptail-grouse (*e.g.*, Connelly *et al.* 2000, Braun *et al.* 2002, Hagen 2003, Wolfe *et al.* 2003a and 2003b, Pitman 2003, Hagen *et al.* 2004, Patten *et al.* 2004, and Connelly *et al.* 2004, summarized in Manville 2004; UWIN 2011). Careful evaluation and proper line routing are suggested by APLIC (2012) for addressing direct and indirect effects on Whooping Cranes. Pagel (2013 final manuscript) provides a detailed review of the direct and indirect effects of wire infrastructure on GOEAs. Efforts to address indirect effects of electric utility infrastructure continue and may be briefly reviewed by Sherry Ligouri of Northwestern Power and Chair of the Avian Power Line Interaction Committee, and Mike Green, FWS Landbird Coordination for our Pacific Northwest Region, both of whom will present on this Panel.

- **Pesticides** may annually kill several hundred million birds in the U.S., but reliable estimates are difficult to acquire due to confounding factors and difficulty in finding carcasses (Manville 2011). Pimental *et al.* (1992) estimated 67 million bird deaths from a limited agricultural study. With new information on bird densities provided by Boutin *et al.* (1999), Pimental *et al.* upgraded their estimate to 72 million bird deaths (D. Pimentel pers. comm.). The study did not include nestlings abandoned by their dead parents, or nestings fed poisons that subsequently died. The impacts of lawn and garden pesticides on songbirds and other avifauna and other non-agricultural applications of pesticides were not included in their estimate.
- **Communication tower collisions.** Mortality has previously been conservatively estimated at 4-5 million birds killed in the U.S. annually (Manville 2002, 2005, 2009). Mortality is currently estimated at 6.8 million birds/yr in the U.S. and Canada, the vast majority in the U.S. (Longcore *et al*. 2012), with at least 13 species of Birds of Conservation Concern being impacted at the population level simply by tower collisions in the U.S. (Longcore *et al.* 2013). Up to 350 species of songbirds and birds from other suites of avifauna have been documented killed at communication towers (Manville 2007, 2009).
- The effects of **radiation from communication towers** on nesting and roosting wild birds are yet unstudied in U.S., although in Europe, Balmori (2005) found strong negative correlations between levels of tower-emitted microwave radiation and bird breeding, nesting, and roosting in the vicinity of electromagnetic fields in Spain. He documented nest and site abandonment, plumage deterioration, locomotion problems, and death in House Sparrows, White Storks, Rock Doves, Magpies, Collared Doves, and other species. While these species had historically been documented to roost and nest in these areas, Balmori (2005) did not observe these symptoms prior to construction of the cellular phone towers. Balmori and Hallberg (2007) and Everaert and Bauwens (2007) found similar strong negative correlations among male House Sparrows. Under laboratory conditions, T. Litovitz (pers. comm.) and DeCarlo *et al.* (2002) raised troubling concerns about impacts of low-level, non-thermal radiation from the standard 915 MHz cell phone frequency on domestic chicken embryos – with lethal results (Manville 2009). Given the findings of the studies mentioned above, field studies should be conducted in North America to validate potential impacts of communication tower radiation – both direct and indirect – to birds and potentially other animals. However, these have yet to be performed.
- **Land-based commercial wind energy facilities** are relatively new structures on the landscape, only operating in the U.S. since the 1980s at Altamont Pass Wind Resource Area, CA (Smallwood and Thelander 2004). However, from the 1980s to present, commercial wind generation in the U.S. has grown explosively. As of December 2012, there was an installed capacity of more than 60,000 MW of wind generation (NREL 2013) – approximately equivalent to 40,000 operating turbines. Not surprisingly, estimated bird mortality has grown from what was first presented as an average of 34,000 bird deaths in 2000 (Erickson *et al.* 2001, estimating mortality based on a review of 12 projects). By 2008, an estimated 440,000 bird deaths were suggested by Manville (2009) where he corrected for 6 major biases inadequately addressed in existing project review, including 1) variability in duration and intensity of carcass searches, 2) failure to address carcass searches during some migration and most nesting, 3) effects of inclement weather, 4) size of

the search areas, 5) unaccounted for crippling loss incidents, and 6) impacts from wind wake and blade wake turbulence. By 2012, 573,000 bird deaths from wind facilities nationwide were estimated by Smallwood (2013). This estimate included a correction for inadequate survey and assessment of passerines killed based on approximately 34,400 then operating turbines across the U.S.

Addressing Problems and Attempting to Resolve Impacts to Birds:

Hundreds of millions to more than one billion birds are conservatively estimated killed annually in the U.S. as a direct result of human stressors (Loss *et al.* 2012, Manville 2009, 2011) – several of which are discussed above. In addition to direct anthropogenic structural and activity-related impacts known to kill birds, there are numerous indirect effects caused by anthropogenic structures and structural footprints (reference the previous examples) which can alter the viability, vigor and overall density of avian populations either locally or population-wide. These stressors can produce or result in fragmented habitats, disturbance, barriers, loss of refugia, and creation of suboptimal patches – i.e., the stressor causes a threat which can result in a consequence (Morris and Kershner 2013). Regarding specific consequences, some populations can exhibit reduced nesting, site abandonment, increased isolation between patches, attraction to modified habitats, stress, behavioral modification, and displacement. While it has been argued that both direct and indirect effects can be extremely difficult to quantify, improved study design, better use of analytical techniques and better quantification of data can improve inference of effects at the population level (Loss *et al.* 2012). While admitting that the challenges facing migratory birds are daunting, FWS prefers to use its limited funding, staff and expertise to address the many human-related stressors *before* migratory birds are affected, ideally in proactive ways – as a result, getting the most "bang for the taxpayer's buck." Several examples below clearly benefit migratory birds.

Electric Utility-Service Partnership

The first example is represented by the partnership between members of the electric utility industry, including investor-owned utilities, electric cooperatives, electric administrations, several Federal agencies, the Edison Electric Institute, Electric Power Research Institute, and FWS – called the Avian Power Line Interaction Committee (APLIC). While Sherry Liguori and Mike Green will briefly address this partnership during their Panel presentation, it deserves a closer examination due to APLIC's proactive approach in addressing impacts from avian stressors as well as dealing with threats associated with electric utility infrastructure.

Begun as an ad hoc collaborative in the early 1970s to specifically address Whooping Crane-power line collisions and GOEA electrocutions at distribution line infrastructure, the APLIC partnership has significantly expanded and was "codified" in 1989 with the creation of the Committee "housed" within the Edison Electric Institute. It has grown to more than 55 members including representatives from many of the investor-owned utilities, the National Rural Electric Cooperative Association, public service and utility commissions, U.S. Department of Agriculture Rural Utilities Service, Edison Electric Institute, Department of Energy's Western Area Power Administration and Bonneville Power Administration, AltaLink (an Alberta transmission utility), Iberdrola Renewables, pending membership from the Bureau of Land Management, and active FWS participation, among others. Representatives from the Government of Mexico have also expressed much interest in APLIC's efforts, including the Secretariat of Environment and Natural Resources and the Institute of Ecology, often using APLIC documents as

"tools" in addressing wire issues during meetings of the Bird Table, annual Trilateral meetings between parties.

While APLIC's initial and early focus centered on avoiding raptor electrocutions and Whooping Crane collisions, its orientation has expanded to all birds, including much more involvement among company members, other stakeholders including vendors, members of academic and research communities, and the interested general public. Similarly, the Service's involvement with electric utilities has focused, in descending order of priority, on education, exchange of information, and lastly enforcement – the 3 "E's" (J. Birchell pers. comm.). APLIC has set the industry standard for a proactive approach to addressing stressors *prior* to wire and infrastructure placement and operation. These include the development and release of APLIC's 2005 *Avian Protection Plan (APP) Guidance*, a collaborative effort between APLIC and FWS. The *APP Guidance* lays out 12 principles for companies, cooperatives, public service and utility districts, and electric administrations to follow, developing and implementing a proactive plan to address potential impacts from wire collisions and electrocutions – based on the size and number of users within each utility's service territory. By developing and implementing an APP, a utility is ideally focusing on the *cause* of a problem (e.g., wire collision and infrastructure electrocution, disturbance to nesting GOEAs due to excessive noise, or removal of vegetation negatively affecting birds) and taking steps to address it proactively, including through any new construction. As a result, the APP becomes a business and operational tool. There are, to date, more than 100 APPs already developed or under development by electric utilities and cooperatives, exclusive of any additional APPs required under court order.

To proactively deal with stressors as well as deal with existing threats, APLIC periodically publishes best management practices and best operational technologies based primarily on peer-reviewed, published scientific studies to address electrocutions (most recently, *Suggested Practices for Avian Protection on Power Lines: the State of the Art in 2006*. 207 pp) and collisions (most recently, *Reducing Avian Collisions with Power Lines: the State of the Art in 2012*. 159 pp). These documents and their recommendations are designed for use on existing power infrastructure (e.g., retrofits – focused on addressing threats) and for all new construction (i.e., anticipating and avoiding potential stressors, where possible). Both documents, in part, "deconstruct" the power line/infrastructure projects, focusing on the "true" problems, helping to identify other activities that may produce stressors, and suggesting cost-effective ways to identify and minimize or avoid the stressor component of an activity while still allowing the activity to proceed. This includes in the 2006 *Suggested Practices* document, chapters on regulations and compliance, biological aspects of avian electrocution, power line design and avian safety (in considerable detail), and the development of an APP, among others. Similarly, in the 2012 *Collision Manual*, there are chapters on progress in dealing with collision issues (in North America, internationally, with the need for future research priorities), avian regulations and compliance, understanding bird collisions, minimizing collision risks, line marking to reduce collisions, and APPs, among others.

APLIC also teaches "short courses" dealing with avian-wire interactions, funds bird-utility research, and holds bi-annual meetings open to the public – including 1.5-day avian interaction workshops. The work of APLIC and its members have resonated in Canada, Mexico, Europe, Asia, Australia, and elsewhere. Fundamentally, APLIC has set the benchmark for other industries to follow in enabling a means to proactively address 2 significant threats to birds by identifying, avoiding and minimizing the primary

avian stressors associated with that activity, while still allowing the activity to proceed in an effective and efficient way.

Birds-Buildings-Glass-and Lighting

Until very recently, the Service has only been peripherally involved in addressing avian-window glass and building lighting issues. Aside from serving as a technical scientific advisor to New York City Aubudon's Bird-Safe Glass Initiative, and speaking periodically at various conferences, the FWS had not yet launched a concerted Agency effort to attempt to systematically begin addressing the issues.

There exist a number of conservation/non-governmental organization (NGO), academic, residential, city government, architectural, Leadership in Energy and Environmental Design (LEED), and commercial initiatives dealing with architectural re-design, glass fretting, window alert markers, window deterrents, proper planting, and lights out efforts, among others. These, for example, range from New York City Audubon's Project Safe Flight Bird Migration to Toronto's Fatal Light Awareness Program (FLAP), academic and conservation research efforts such as the longest-standing research effort at Muhlenberg College to the American Bird Conservancy's tunnel testing. There also are efforts to make campus buildings more bird-friendly such as at Augustana College and SUNY Brockport, efforts by architects and building designers to develop more bird-friendly buildings and use better lighting options including the U.S. Green Building Council and Bass Pro Shops, among numerous others. However, there has not been a systematic and comprehensive effort to begin coordinating and integrating all these initiatives – until now.

On April 18, 2013, the Service chaired and facilitated a meeting in Arlington, VA, of the leading stakeholders in North America to begin discussing how a coordinated and systematic effort could best be accomplished to integrate all the key issues and best practices. Very recently, FWS was able to initiate an Interior Department sharepoint site, *Birds-Buildings-Glass-Lighting Initiative – a U.S. Fish & Wildlife Service Collaborative*, which will be accessible to any interested stakeholders once each has requested permission to use the site – permission already granted to all the meeting participants. The goal of the site is to reference the most current and best scientific information, the recognized and validated best management practices and best operational procedures, and research needs and gaps in our knowledge regarding the interactions with birds, buildings and lighting. By implementing a strategic and ideally proactive approach, mortality could be substantially reduced and habitats better utilized to accommodate birds and buildings. The approach, in major part, is intended to use the "stressor" management concepts previously discussed better addressing threats to existing window infrastructure, and assessing stressors dealing with vanity lighting and new building construction. Christine Sheppard will discuss this issue during her Panel presentation.

Communication Tower Collisions

DMBM has been actively involved in the avian-tower collision issue since early 1998 with a large, single-night bird kill of up to10,000 mostly Lapland Longspurs at a lighted, gas pumping facility and 3 surrounding communication towers in western Kansas. To begin addressing the issue, the Service published voluntary communication tower guidance in September 2000, developed and continues to chair the Communication Tower Working Group, focusing on the science surrounding bird attraction to lights, the dynamics of bird collisions, and efforts focused at dealing with stressors and their threats. The

interim, voluntary communication tower guidance published in 2000 have been updated based on Service recommendations provided on the record to the Federal Communications Commission (FCC) in 2007, 2011, and 2012 – soon to be republished once the Federal Aviation Administration (FAA) updates their 2007 lighting circular, and once the FCC finalizes rulemaking on "the effects of communication towers on migratory birds" (Manville 2013).

Most noteworthy are the latest scientific developments regarding tower lighting which you will hear Joelle Gehring discuss on this Panel. Specifically, new breakthroughs in better understanding the roles of lighting (especially steady-burning, red incandescent L-810 lights), tower height and use of guy support wires could – once fully implemented by the FCC and the FAA – reduce bird attraction and collision mortality by more than 50% based on recent research and meta-reviews (Gehring *et al.* 2009, Gehring *et al.* 2011, Longcore *et al.* 2012, 2013). The vast majority of the Service's recommendations are intended to proactively address the effects of stressors and their threats before tower siting and construction occur. This, for example, includes recommendations for collocation, use of a lattice or monopole construction, avoiding wetlands and other important bird areas, building in already degraded sites, no longer using L-810 lighting, keeping towers unlit and unguyed, following APLIC recommended standards for wire infrastructure, minimize habitat "footprints," down-shielding security lighting using only motion or heat-sensitive types, decommission inactive towers, and other steps. Since lighting changes will ultimately result in energy cost savings for tower owners and lessees, it is our hope that the majority of communication tower construction projects will comply with the suggested lighting practices, and other best practice recommendations, and that re-licensing, existing retrofits and new construction will collectively result in significant reductions in both "take" and habitat alteration and fragmentation. Since the impacts of tower radiation, especially on nesting birds, are still unknown in the U.S. at this time, until independent research can be conducted and results analyzed, no recommendations can yet be provided on this issue.

Land-based Commercial Wind Energy Development

The Service went through a long and detailed, multi-year process, working through the Wind Energy Federal Advisory Committee to develop and update the Service's 2003 interim, voluntary wind energy guidelines. The resultant product is the *2012 Service Wind Energy Guidelines* (WEG) available on the Service's website. While the specific guidelines are not prescriptive, they do provide a detailed, recommended tiered process for addressing stressors and their threats – notably Tiers 1, 2 and 3 focused on preconstruction landscape and site review. *If* a wind developer does indeed perform its due diligence, and properly sites wind facilities in bird, bat and habitat-friendly locations, they are unlikely to impact trust resources including birds in a significant way. However, other than proper site location, there are no best practices or best available technologies yet available for wind energy developers that have been independently peer reviewed, scientifically validated, and acknowledged by independent experts as accepted "tools" to avoid or minimize take and/or affect habitats from the placement and operation of commercial wind generators. This is a situation quite different than what APLIC has published through its 2006 and 2012 *Suggested Practices* documents addressing stressors and their threats in considerable detail for collisions, electrocutions and habitat alterations.

Studies are beginning to be published on the indirect effects of commercial wind energy facilities, including the avoidance by some grassland species to turbines. The most recent publication was just released through the Digital Repository at Iowa State University (Gillespie 2013).

Based on public comment, review and internal assessment, the Service published its updated, *Eagle Conservation Plan Guidance, Module 1, Land-based Wind Energy, Version 2* (ECPG) in April 2013. Like the WEG, it recommends approaches to avoiding and minimizing eagle "take" and impacts to eagle territories and eagle use areas based on a tiered protocol using the stressor management approach – i.e., identifying the stressors, their threats and the consequences. While following the ECPG is voluntary, where "disturbance take" and/or "take resulting in mortality" are likely to occur, a permit (50 C.F.R. 22.26 or 22.27) is strongly recommended as unpermitted "take" may have legal consequences. The goal of the ECPG is to ensure that the breeding population of both species of eagles remains stable or increasing. While the Service published the authorization for the take permits in 2009 (50 C.F.R. 22.26 for eagle "take" and 22.27 for nest "take"), and the required NEPA documentation, the implementation of the regulations and permitting are a work in progress.

Summary Thoughts:

In addition to the efforts discussed above, the Service has an excellent opportunity to assist Federal partners and project proponents. Our goal is to achieve more effective and efficient conservation through strategies dealing with partnerships and active engagement. To that end, we suggest less of a focus on direct "take" and more of a focus on project developers achieving "due diligence" – i.e., doing everything to reasonably and practicably avoid, minimize, or mitigate for project-related impacts. To achieve due diligence, one needs to deconstruct the action, identify the stressors produced by the project activities, and develop and implement conservation measures to avoid the production of the stressor, or avoid or minimize the exposure of birds and their resources to stressors. For example, the Service continues to work with our Federal partners to develop and implement Memoranda of Understanding under Executive Order 13186. We continue to develop job aids and other information resources to reduce impacts to birds. We are developing and refining decision-support tools for more efficient impact reduction (e.g., using the Information and Planning Conservation System [IPaC] and Avian Knowledge Network [AKN]). We provide training to ensure that Federal partners and project proponents understand their responsibilities, can effectively analyze impacts, and can build conservation stewardship actions into their project-related work.

No matter what kind of anthropogenic issue is being addressed – including all of those previously discussed – it is always advisable to contact State and/or local FWS field staff early and often in the process of developing, designing, building and operating structures and performing activities that may directly and indirectly affect migratory birds. Coordination is critical. By working with Service staff to "deconstruct" a project and implement stressor management prior to project or activity implementation, you are less likely to have significant negative effects on birds. This is, in many ways, preferable to having to address and attempt to "fix" the consequences of impacts after they have already occurred. Hopefully this white paper will set the stage for a very productive discussion regarding this topic on August 27, 2013.

Acknowledgements:

The author wishes to thank E. Savage, M. Sadlowski, D. Whittington, and E. Kershner for their critical review, constructive comments, and suggested changes to this document, and to C. Morris and J. Pagel for their assistance in providing some of the details.

Literature Cited:

Aldrich, J.W., R.C. Banks, T.J. Cade, W.A. Calder, F.G. Cooch, S.T. Emlen, G.A. Greenwell, T.R. Howell, J.P. Hubbard, D.W. Johnston, R.F. Johnston, and L.R. Mewaldt. 1975. Report of the American Ornithologists' Union *ad hoc* Committee on Scientific and Educational Use of Birds. Auk 92 (3, Suppl.): 1A-27A.

Avian Power Line Interaction Committee. 2006. Suggested practices for avian protection on power lines: the state of the art in 2006. Edison Electric Institute, APLIC, and the California Energy Commission. Washington, DC, and Sacramento, CA. 207 pp.

Avian Power Line Interaction Committee. 2012. Reducing avian collisions with power lines: the state of the art in 2012. Edison Electric Institute and APLIC, Washington, DC. 159 pp.

Balmori, A. 2005. Possible effects of electromagnetic fields from phone masts on a population of White Stork (*Ciconia ciconia*). Electromagnetic Biology and Medicine 24:109-119.

Banks, R.C. 1979. Human related mortality of birds in the United States. U.S. Fish & Wildlife Service, Natl. Fish & Wildlife Lab., Special Scientific Report – Wildlife No. 215: 1-16. GPO 848-972.

Boutin, C., K.E. Freemark, and D.A. Kirk. 1999. Farmland birds in southern Ontario: field use, activity patterns and vulnerability to pesticide use. Agriculture, Ecosystems and Envir. 72 (1999):239-254.

Braun, C.E., O.O. Oedekoven, and C.L. Aldridge. 2002. Oil and gas development in Western North America: effects of sagebrush steppe avifauna with particular emphasis on sage grouse. Transactions 67th North American Wildlife and Natural Resources Conf.:337-349.

Connelly, J.W., M.A. Schroeder, A.R. Sands, and C.E. Braun. 2000. Guidelines to manage sage grouse populations and their habitats. Wildlife Society Bulletin 28(4):967-985.

Connelly, J.W., S.T. Knick, M.A. Schroeder, and S.J. Stiver. 2004. Conservation assessment of greater sage-grouse and sagebrush habitats. Western Association of Fish and Wildlife Agencies. Cheyenne, WY. 610 pp.

DiCarlo, A., N. White, F. Guo, P. Garrett, and T. Litovitz. 2002. Chronic electromagnetic field exposure decreases HSP70 levels and lowers cytoprotection. Journal Cellular Biochemistry 84: 447-454.

Dunn, E.H. 1993. Bird mortality from striking residential windows in winter. Journal Field Ornithology 64: 302-308.

Erickson, W.P., G.D. Johnson, M.D. Strickland, K.J. Sernka, and R.E. Good. 2001. Avian collisions with wind turbines: a summary of existing studies and comparisons to other sources of avian collision mortality in the United States. Western EcoSystems Technology, Inc., Cheyenne, WY. 60 pp.

Everaert, J., and D. Bauwens. 2007. A possible effect of electromagnetic radiation from mobile phone base stations on the number of breeding House Sparrows (*Passer domesticus*). Electromagnetic Biology and Medicine 26:63-72.

Gillespie, M.K. 2013. Bird and bat responses to wind energy development in Iowa. Master's Thesis, Iowa State University, Ames. 82 pp.

Hagen, C.A. 2003. A demographic analysis of lesser prairie-chicken populations in southwestern Kansas: survival, population viability, and habitat use. Ph.D. Dissertation, Division of Biology, College of Arts and Sciences, Kansas State Univ., 199 pp.

Hagen, C.A., B.E. Jamison, K.M. Giesen, and T.Z. Riley. 2004. Guidelines for managing lesser prairie-chicken populations and their habitats. Wildlife Society Bulletin 32(1):69-82.

Kerlinger, P., J. Gehring, and R. Curry. 2011. Understanding bird collisions at communication towers and wind turbines: status of impacts and research. Birding Magazine, American Birding Association, January.

Klem, D., Jr. 1989. Bird-window collisions. The Wilson Bulletin 101: 606-620.

Klem, D., Jr. 1990. Bird injuries, cause of death and recuperation from collisions with windows. Journal Field Ornithology 61(1): 115-119.

Klem, D., Jr. 2009. Avian mortality at windows: the second largest human source of mortality on earth. Pp. 244-254 *In* T.D. Rich, C. Arizmendi, D. Demarest, and C. Thompson (eds.). Tundra to Tropics: Connecting Birds, Habitats and People, Proceedings 4th International Partners in Flight Conference 2008, McAllen, Texas. Partners in Flight.

Klem, D., Jr. and P. G. Saenger. 2013. Evaluating the effectiveness of select visual signals to prevent bird-window collisions. The Wilson Journal of Ornithology 125(2): 406-411.

Longcore, T., C. Rich, P. Mineau, B. MacDonald, D.G. Bert, L.M. Sullivan, E. Mutrie, S.A. Gauthreaux, Jr., M.L. Avery, R.C. Crawford, A.M. Manville, II, E.R. Travis, and D. Drake. 2012. An estimate of avian mortality at communication towers in the United States and Canada. PLoSONE 7(4) 17 pp, Open Access.

Longcore, T., C. Rich, P. Mineau, B. MacDonald, D.G. Bert, L.M. Sullivan, E. Mutrie, S.A. Gauthreaux, Jr., M.L. Avery, R.C. Crawford, A.M. Manville, II, E.R. Travis, and D. Drake. 2013. Avian mortality at communication towers in the United States and Canada: which species, how many, and where? Biological Conservation 158: 410-419.

Loss, S.R., T. Will, and P.P. Marra. 2012. Direct human-caused mortality of birds: improving quantification of magnitude and assessment of population impact. Frontiers in Ecology 10(7):357-364.

Loss, S.R., T. Will, and P.P. Marra. 2013a. The impact of free-ranging domestic cats on wildlife of the United States. Nature Communications 4:1396, DOI: 10.1038/ncomms2380: 7 pp.

Loss, S.R., T. Will, S.S. Loss, and P.P. Marra. 2013b. Bird-building collisions in the United States: data-driven estimates of annual mortality and species vulnerability. Briefing memo for April 18, 2013,

stakeholder information meeting at U.S. Fish and Wildlife Service HQ Office, Arlington, VA. 1 pp.

Manville, A.M. II. 2001. Avian mortality at communication towers: steps to alleviate a growing problem. Pp. 75-86, 227-228. *In:* B.B. Levitt (ed.). Proceedings of the "Cell Towers Forum" State of the Science/State of the Law, December 2, 2000, Litchfield, CT. ISBN 1-884820-62-X.

Manville, A.M. II. 2002. The ABC's of avoiding bird collisions at communication towers: the next steps. Proceedings of Workshop on Avian Interactions with Utility and Communication Structures, December 2-3, 1999, Charleston, SC. Electric Power Research Inst. 16 pp.

Manville, A.M., II. 2004. Prairie grouse leks and wind turbines: U.S. Fish and Wildlife Service justification for a 5-mile buffer from leks; additional grassland songbird recommendations. Division of Migratory Bird Management, USFWS, Arlington, VA, peer-reviewed briefing paper. 17 pp.

Manville, A.M., II. 2005. Bird strikes and electrocutions at power lines, communication towers, and wind turbines: state of the art and state of the science – next steps toward mitigation. Pages 1051-1064 *In* C.J. Ralph and T.D. Rich (eds), Bird Conservation Implementation in the Americas: Proceedings 3rd International Partners in Flight Conference, U.S.D.A. Forest Service Gen. Technical Report PSW-GTR-191, Albany, CA.

Manville, A.M., II. 2007. Comments of the U.S. Fish and Wildlife Service submitted electronically to the FCC on 47 CFR Parts 1 and 17, WT Docket No. 03-187, FCC 06-164, Notice of Proposed Rulemaking, "Effects of Communication Towers on Migratory Birds." February 2, 2007. 32 pp.

Manville, A.M. II. 2009. Towers, turbines, power lines and buildings – steps being taken by the U.S. Fish and Wildlife Service to avoid or minimize take of migratory birds at these structures. Pp 262-272 *In* T.D. Rich, C. Arizmendi, D.W. Demarest, and C. Thompson (eds.). Tundra to Tropics: Connecting Birds, Habitats and People. Proceedings 4th International Partners in Flight Conference, McAllen, Texas.

Manville, A.M., II. 2011. Estimates of annual human-caused mortality to North American birds (with literature citations). Division of Migratory Bird Management, USFWS, for public distribution. 12 pp.

Manville, A.M., II. 2013. U.S. Fish and Wildlife Service (USFWS) revised guidelines for communication tower design, siting, construction, operation, retrofitting, and decommissioning -- Suggestions based on previous USFWS recommendations to FCC regarding WT Docket No. 03-187, FCC 06-164, Notice of Proposed Rulemaking, "Effects of Communication Towers on Migratory Birds," Docket No. 08-61, FCC's Antenna Structure Registration Program, and Service 2012 Wind Energy Guidelines. Division of Migratory Bird Management, Arlington, VA. 5 pp.

Morris, C., and E. Kershner. 2013. Migratory bird conservation for Federal partners. National Conservation Training Center, USFWS, Division of Migratory Bird Management Training Module.

Pagel, J.E., K.J. Kritz, B.A. Millsap, R.K. Murphy, E.L. Kershner, and S. Covington. 2013 in press. Bald eagle and golden eagle mortalities at wind energy facilities in the contiguous United States. Journal of Raptor Research 47.

Pagel, J.E. 2013. Golden eagle (*Aquila chrysaetos canadensis*) risk, status and trends – an assessment of cumulative effects. Revised draft white paper for USFWS Region 8. 36 pp peer-reviewed manuscript.

Patten, M.A., D.H. Wolfe, E. Shochat, and S.K. Sherrod. 2004. Habitat fragmentation, rapid evolution, and population persistence. Evolutionary Ecology Research. 29 pp. Provisionally accepted for publication.

Pimentel, D., H. Acquay, M. Biltonen, P. Rice, M. Silva, J. Nelson, V. Lipner, G. Giordano, A. Horowitz, and M. D'Amore. 1992. Environmental and economic costs of pesticide use. BioScience 42: 750-760.

Pitman, J.C. 2003. Lesser prairie-chicken nest site selection and nest success, juvenile gender determination and growth, and juvenile survival and dispersal in southwestern Kansas. M.Sc. Thesis, Division of Biology, College of Arts and Sciences, Kansas State Univ. 169 pp.

Smallwood, K.S., and C.G. Thelander. 2004. Developing methods to reduce bird mortality in the Altamont Pass Wind Resource Area. Final Report by BioResources Consultants, Ojai, CA to California Energy Commission, Public Interest Energy Research-Environmental Area, Contract No. 500-01-019, L. Spiegel (Progr. Mngr.). 363 pp., appendices.

U.S. Fish and Wildlife Service. 2008. Birds of Conservation Concern 2008. United States Department of Interior, Fish and Wildlife Service, Division of Migratory Bird Management, Arlington, VA. 85 pp. (http://www.fws.gov/migratorybirds/>).

Wolfe, D.H., M.A. Patten, and S.K. Sherrod. 2003a. Factors affecting nesting success and mortality of Lesser Prairie-Chickens in Oklahoma. ODWC Federal Aid in Wildlife Restoration Project W-146-R Final Report. OK Dept. Wildlife Conservation, 23 pp.

Wolfe, D.H., M.A. Patten, and S.K. Sherrod. 2003b. Causes and patterns of mortality in Lesser Prairie-Chickens. Poster presented at meetings of The Wildlife Society, Burlington, VT, and Prairie Chicken Technical Committee, OK Dept. Wildlife Conservation. OK Biological Survey and George M. Sutton Avian Research Center.