Avian power line collisions: Potential impact on Central Valley bird populations

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BACKGROUND

California's bird populations face numerous threats including habitat loss and degradation, disease processes, and exposure to pesticides and other environmental pollutants. As a result, many species populations have declined precipitously and some of these species have been listing under the federal Endangered Species Act (ESA) or California Endangered Species Act (CESA) or assigned other designations based on population declines or range retractions.

While many of these threats are well documented and understood, collision impacts remain something of an enigma. In particular, the effect of decades of avian mortality from collisions with power lines, radio tower guy lines, and related structures has received little attention. A recent emphasis by the California Energy Commission (hereafter, CEC) to document the problem (Hunting 2002) revealed the potential for significant, population-level effects from these impacts in California.

The types of collision impacts discussed here occur when birds collide with transmission (>69 kilovolt [kV]) or distribution (<70 kV) power lines or related power transmission structures. The primary agent in these collisions is the ground wire that is usually attached to the top of transmission line towers and is generally thinner, and hence more difficult to see, than energized electrical lines. About 80% of all collisions along transmission lines in studies within noted collision fatality areas were attributed to impact with the ground wire (Meyer 1978, James and Haak 1979, Beaulaurier 1981).

Power line collision fatalities are a worldwide phenomenon and have been documented for nearly 350 species (Manville 1999), representing 15 orders and 35 families and subfamilies in 14 countries worldwide and 28 states in the United States (Hunting 2002). Of the 28 states for which collision fatalities have been reported, California is second only to North Dakota in the number of affected bird orders and families yet very few scientific studies have been conducted in California to determine high-risk areas or the magnitude of impacts. The Edison Electric Institute (EEI 2001) estimated there were 800,000 km (500,000 miles) of transmission lines in the United States alone raising the specter of significant and chronic impacts.

Estimating bird mortality from strikes with power lines usually involves walking transects under power lines and directly counting dead birds to which fatalities from a strike can be attributed. However, this method typically underestimates actual fatalities because 1) some birds mortally wounded by a strike fly outside of the survey area and are not counted (crippling bias), 2) some birds are killed by strikes but are not detected during surveys (survey bias) and 3) scavengers often remove carcasses before than can be counted (scavenger bias). These bias factors can greatly influence mortality estimation. Studies in California (Pearson 1993), Oregon (James and Haak 1979, Beaulaurier 1981), Washington (Meyer 1978), North Dakota (Faanes 1987), The Netherlands (Heijnis 1976), Montana (Hugie et al 1993), and Spain (Alonso and Alonso 1999) which measured and incorporated these factors, reported a crippling bias of 74-75% (i.e., 74-75% of birds killed by strikes flew outside of the survey area and were not counted during surveys), a survey bias of 7-39%, and a scavenger bias of 10-71%. Mortality estimates for all studies using bias factors and applying a standardized approach to methods ranged from 2 to 1339 birds/km/year (n=25, mean=247.6, sd=340.1, [Hunting 2002a]).

Based on review of over 100 reports of collision fatalities worldwide, members of the Falconiformes (20%), Anseriformes (18%), and Charadriiformes (12%) comprise half of all documented collision fatalities (Hunting 2002a). Species in these groups share many common structural and behavioral traits that increase collision risk. These traits include relatively large body size, fast flight, flocking behavior (except Falconiformes), long appendages relative to body size, poorly developed fovea, and spending a relatively high proportion of time in the air.

Recent estimates place collision fatalities within the United States at 174 million birds annually although there are currently no published estimates for California. Assuming California supports about 3% of the nation's linear extent of transmission lines, and applying this estimate to the 174 million annual bird fatalities from wire strikes, there may be as many as 4.6 million annual strike fatalities in California. This is likely a conservative estimate considering the exceptional diversity and patterns of habitat use by birds in California.

California's Central Valley falls within the Pacific Flyway and supports more than 60% of the states total waterfowl populations and about 25% of the nations waterfowl population. During an average year, the Central Valley supports 100% of the world's population of Aleutian Canada Goose (*Branta canadensis leucopareia*) and Tule Greater White-fronted Goose (*Anser albifrons elgasi*); 80% percent of North America's Ross's (*Chen rossii*) and Cackling Canada geese (*Branta canadensis minima*); and 65% percent of North America's Tundra Swan (*Cygnus columbianus*), Pacific Greater White-fronted Goose (*Anser albifrons frontalis*), and Northern Pintail (*Anas acuta*) populations (unpublished CDFG file data). As previously noted, there have been few studies to determine wire strike mortality in California, and none in the Central Valley, where wintering concentrations of waterfowl, frequent winter fog, and over 35% of the state's transmission lines create a potential for considerable fatalities.

Using a Geographic Information System (GIS), I estimated approximately 21,400 km (13,300 miles) of transmission lines in California with approximately 37% (4,930 miles) in the Central Valley. About 1,456 km (905 miles) of these lines transect National Wildlife Refuges, state Wildlife Areas, and other natural resource conservation lands. Unfortunately, the characteristics of the Central Valley that attract an avian group (Anseriformes) highly susceptible to wire strikes (flat terrain supporting extensive wetlands) are also ideal for constructing transmission line towers.

Based on the linear extent of transmission lines, estimates of waterfowl usage in the region, mortality rates reported in the literature, and the above analysis, I estimate a conservative 300,000 annual waterfowl fatalities in the Central Valley region alone.

BIOLOGICAL SIGNIFICANCE

Fatalities from collisions with transmission lines can be biologically significant when they directly or indirectly cause large or sustained population declines or result in chronic population-level effects. Most authors agree that collision fatalities are not a population decline factor and have little population-level significance, except in areas where birds are concentrated for breeding or roosting and for species with naturally low populations or for species whose populations are threatened or endangered with continued existence (e.g., Alonso and Alonso 1999, Meyer 1978, James and Haak 1979, Faanes 1987). However, Mathiasson (1999) noted that collision mortality in swans in Sweden was probably sufficiently high to be a significant cumulative factor when considered with other human-induced fatality factors. This may also be the case in California and other areas. However, so few studies have been conducted in California that determination of biological significance is impossible. Indeed, it may be that collision mortality is still considered insignificant in most areas largely because recovery of dead birds is a superficial measure of the magnitude of the problem as most power lines are in remote areas and, therefore, most fatalities go undocumented (Bevanger 1999).

SOLUTIONS

The extent of avian power line collision fatalities in California remains unknown largely due to the lack of requirements designed to ensure reporting of collision events by line operators and the time consuming nature of mortality estimation based on dead bird counts. Reporting of collision mortality would provide for implementation of pro-active measures to reduce collision risk and promote research on the relative benefits of alternative transmission line designs and installations. Almost all resident and migratory birds are protected under the Migratory Bird Treaty Act and other state and federal laws making collision fatalities a potentially significant legal issue.

Reducing collision risk requires evaluation of the physical characteristics of transmission lines, the location and orientation of the line, the surrounding landscape-level physiognomy, and life history and habitat association information for potentially effected species. Pre-construction siting should avoid transecting wetlands or separating known roosting and foraging habitats, should be parallel to prevailing winds and prominent landscape features such as cliffs and bluffs, and should utilize existing transmission line corridors wherever possible to reduce the number of times birds must cross a power line (APLIC 1994). Ground wire removal is the most effective means of risk reduction but potential damage from lightning may prohibit removal in areas with >10 isokeraunics (thunderstorm days per year [NOAA 2001]).

Additional research is needed to further identify the scope and magnitude of impacts in California. The CEC (Hunting 2002) has identified several priorities for short term research in California including:

- Continued funding and development of remote collision sensing devices
- Development of standardized collision data collection and analysis
- Evaluate the species-specific effectiveness of existing mitigation devices
- Revision of largely outdated avian collision reference materials
- Focus collision risk studies in areas identified as high-risk based on transmission line characteristics and landscape features
- Development of a consensus-based reporting requirement that benefits both industry and the regulatory community.

I am collecting information on collision events and would appreciate notification of either directly observed collisions or suspected collisions based on dead birds under lines. Please contact me via email at kwhunting@attbi.com with the specific location, date and time of observation, the species involved and other information you feel is relevant.

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