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A Comprehensive Analysis of Small-Passerine Fatalities from Collision with Turbines at Wind Energy Facilities

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Abstract

Small passerines, sometimes referred to as perching birds or songbirds, are the most abundant bird group in the United States (US) and Canada, and the most common among bird fatalities caused by collision with turbines at wind energy facilities. We used data compiled from 116 studies conducted in the US and Canada to estimate the annual rate of small-bird fatalities. It was necessary for us to calculate estimates of small-bird fatality rates from reported all-bird rates for 30% of studies. The remaining 70% of studies provided data on small-bird fatalities. We then adjusted estimates to account for detection bias and loss of carcasses from scavenging. These studies represented about 15% of current operating capacity (megawatts [MW]) for all wind energy facilities in the US and Canada and provided information on 4,975 bird fatalities, of which we estimated 62.5% were small passerines comprising 156 species. For all wind energy facilities currently in operation, we estimated that about 134,000 to 230,000 small-passerine fatalities from collision with wind turbines occur annually, or 2.10 to 3.35 small birds/MW of installed capacity. When adjusted for species composition, this indicates that about 368,000 fatalities for all bird species are caused annually by collisions with wind turbines. Other human-related sources of bird deaths, (e.g., communication towers, buildings [including windows]), and domestic cats) have been estimated to kill millions to billions of birds each year. Compared to continent-wide population estimates, the cumulative mortality rate per year by species was highest for black-throated blue warbler and tree swallow; 0.043% of the entire population of each species was estimated to annually suffer mortality from collisions with turbines. For the eighteen species with the next highest values, this estimate ranged from 0.008% to 0.038%, much lower than rates attributed to collisions with communication towers (1.2% to 9.0% for top twenty species).

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Introduction

Wind energy production in the United States (US) and Canada has increased greatly in recent years. More so than for any other industry, monitoring the effects of wind turbines on wildlife has been an integral part of this development. For example, the US Fish and Wildlife Service (USFWS) provided guidelines to wind energy developers and identified the following species of concern that could be affected by development: "migratory birds; bats; bald and golden eagles and other birds of prey; prairie and sage grouse; and listed, proposed, or candidate endangered and threatened species" [1]. Research is on-going regarding the effect of wind turbines on bats, raptors, and grouse (e.g., [2–8]). In addition, several efforts have been made to broadly quantify the effects on birds [9–13], and statistical methods associated with these efforts have evolved.

In this paper we use new methods to quantify effects for birds known as passerines (sometimes referred to as songbirds or perching birds). Many passerine species are migratory and protected by the Migratory Bird Treaty Act (MBTA) [1]. Passerines are the most common type of bird observed both during surveys prior to construction and as fatalities resulting from collisions with turbines after construction [14]. The population-level effect for most small-passerine species may be smaller compared to other bird types, in part because they are shorter-lived and typically reproduce at a higher rate than other taxa, such as raptors [15], [16]. However, we are not aware of any existing comprehensive analyses specifically addressing the interactions of passerine species with wind turbines. This analysis will provide federal and state regulatory agency personnel, the wind industry, and other stakeholders with a better understanding of the overall rate of passerine fatalities from collisions with wind turbines and identify research and monitoring needs.

Our objectives for this evaluation were to 1) identify monitoring studies from wind energy facilities in the US and Canada that contained adequate information for evaluation of small-bird fatality rates; 2) derive estimates for rates of annual mortality for small birds in studies that did not include small-bird mortality rates but rather reported mortality rates for all birds combined; 3) adjust all small-bird rates for bias and derive biome-level and continent-wide rates; 4) determine the seasonal timing of fatalities for small