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Review

The state of the art in raptor electrocution research: A global review

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ABSTRACT

We systematically reviewed the raptor electrocution literature to evaluate study designs and methods used in raptor electrocution research, mitigation, and monitoring, emphasizing original research published in English. Specifically, we wondered if three decades of effort to reduce raptor electrocutions has had positive effects. The majority of literature examined came from North America, western Europe, and South Africa. In spite of intensive and often sustained effort by industry and governments across three continents for 30 years, reductions in the incidence of electrocution have been demonstrated in only a few studies. Reliable rate estimates of electrocution mortality generally are unavailable, with some exceptions. Nearly half of 110 studies we analyzed in detail were retrospective reviews of historical mortality records, banding data, or results of necropsies on dead birds received at pathology and veterinary facilities. Among prospective studies, less than half used unbiased approaches to sampling and many did not provide enough detail to assess the sampling design used. At this time, few researchers can demonstrate the reliability of standardized retrofitting procedures or the effectiveness of monitoring techniques. Future progress in reducing raptor mortalities on power lines will benefit from properly designed studies that generate rate estimates of mortality, address biasing factors, and include predictions concerning risk and techniques to reduce risk that can be tested in the field or laboratory.

Contents

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1. Introduction

Raptor electrocution on power lines has been the focus of extensive research, product testing, design standards development, and mitigation in the United States since the early 1970s (Boeker and Nickerson, 1975; Nelson and Nelson, 1976; Olendorff et al., 1981). In spite of these efforts, thousands of power line mortalities continue to occur in the U.S. each year (Franson et al., 1995; Melcher and Suazo, 1999; Harness and Wilson, 2001). Electrocution problems cost U.S. energy suppliers billions of dollars annually in power interruptions, lost revenues, repairs to equipment, and statutory compliance (Hunting, 2002). Since 1999, electrocution problems have resulted in negative media attention, increased scrutiny by regulatory agencies, and a landmark court conviction (Melcher and Suazo, 1999; Williams, 2000; Suazo, 2000). Lehman (2001) reviewed agency and industry responses to the problem over a 30-year period, and argued that optimistic projections from the 1970s to the 1990s that elimination of raptor electrocutions was within reach (Nelson and Nelson, 1976; Wildlife Management Institute, 1982; Phillips, 1986; Gauthereaux, (1993) were not credible, and led to misinterpretation of the problem's actual magnitude. Raptor mortalities have persisted because of the sheer number of potentially lethal distribution poles currently in use, and because mitigation programs since the 1980s have tended to be reactive rather than proactive (Avian Power Line Interaction Committee [APLIC], 1996]). Over 185 million wood distribution poles are currently operating in North America (American Iron and Steel Institute, 2005), and all pose some level of risk to raptors (Lehman, 2001). Yet, most utilities have taken an ad hoc approach to mitigation, i.e., retrofitting of poles after they cause mortalities. Treatment of electrocution hazards at landscape or system-wide scales has been the exception, not the rule. Lehman (2001) also emphasized the need for credible estimates of electrocution mortality, retrofitting at increased scales, and for improved sampling methods and greater scientific rigor in assessing and mitigating power line issues. We now return to the latter topic in greater depth, and expand our focus to assess raptor electrocution issues worldwide.

2. Objectives

Recent evidence of large-scale mortality and questions about the reliability of electrocution data in the U.S. led us to wonder what we know about the causes, consequences, and prevention of raptor electrocutions with reasonable certainty. We wondered specifically to what extent rigorous scientific standards have been applied in studies of raptor electrocution inside and outside the U.S., and what evidence may exist to suggest that global efforts to reduce raptor/power line mortality are having positive effects. Thus, in 2004, we began a state-of-the-art review of the raptor electrocution literature worldwide. Our objectives were: