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Review

Limitations of population suppression for protecting crops from bird depredation: A review

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ABSTRACT

Blackbirds (Icterinae) in North America, and dickcissels (*Spiza americana* Gmelin), eared doves (*Zenaida auriculata* Des Murs), and monk parakeets (*Myiopsitta monachus* Boddaert) in South America can cause serious economic damage to grain crops. Farmers frequently advocate lethal bird damage abatement measures based on the perceived need to take immediate action to avoid serious economic losses. In comparison, wildlife managers must make informed decisions based on a multitude of factors, including local, state, and national environmental laws, administrative restrictions, logistics, costs, expected outcome, and cultural considerations related to wildlife stewardship. In this paper, we focus on practicality, environmental safety, cost-effectiveness and wildlife stewardship to evaluate efforts to manage avian crop damage using lethal control. In each case where a lethal program was initiated, at least one of these four tenets was violated and there was temporary relief at best.

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1. Introduction

In South America, eared doves (*Zenaida auriculata* Des Murs), monk parakeets (*Myiopsitta monachus* Boddaert), and dickcissels (*Spiza americana* Gmelin) often forage in crops and can cause economically significant damage (Bruggers and Zaccagnini, 1994; Bruggers et al., 1998; Basili and Temple, 1999a; Canavelli et al., 2008; Vitti and Zuil, 2012; Bernardos and Farrell, 2013; Bucher and Aramburú, 2014). In the United States (US), red-winged blackbirds (*Agelaius phoeniceus* L.), common grackles (*Quiscalus quiscula* L.), yellow-headed blackbirds (*Xanthocephalus xanthocephalus* Bonaparte), and brown-headed cowbirds (*Molothrus ater* Boddaert) cause damage to sprouting and ripening crops. The Prairie Pothole Region (PPR) in the northern Great Plains states of the US and southern Canada hosts millions of breeding and migrating blackbirds that damage ripening crops (Peer et al., 2003). In the southern US, blackbirds damage newly seeded and ripening crops, especially rice (Cummings et al., 2005).

Generally, wildlife professionals elect to evaluate all available management options to develop an integrated strategy for resolving crop depredations (e. g., Wildlife Services, 2009). But, the expense and perceived lack of efficacy of nonlethal techniques often frustrate growers urgently trying to protect their crops. This frustration is then manifested when growers exert pressure on government agencies to initiate population reduction programs, or even conduct their own illegal local population reduction campaigns to reduce crop depredations. An accumulation of practical experience and research studies has shown that lethal control alone is not an effective or appropriate response to alleviate crop damage caused by granivorous birds. In this paper, we discuss the ecology of these granivorous birds in relation to the practicality, environmental safety, cost-effectiveness, and wildlife stewardship

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of using lethal population control strategies (Slate et al., 1992).

2. Eared dove (Columbidae) in South America: biology and economics

The eared dove is probably the "worst" bird pest in South America because of its broad geographic distribution, high population levels, and the widespread damage reported in some areas. Crop damage includes mostly ripening sorghum and sunflower but may also affect emergent soybean seedlings, wheat, barley and rice. While farmers consider damage by eared doves to be very high, the few statistically reliable assessments indicate limited damage (≤5%) in most cases, with locally severe damage (>25%) in some regions or crop fields within a region (Canavelli et al., 2008; Bernardos and Farrell, 2013).

Eared doves are nomadic, open woodland species found throughout South America with exception of the Amazonian tropical forest. Eared doves are capable of breeding during the whole year, taking advantage of their ability to detect and exploit food and water sources within 100 km of a roost (Murton et al., 1974; Bucher and Bocco, 2009). Of particular importance is the species' potential for producing significant population outbreaks where rapid expansion of the cultivated area leads to changes in key land cover variables, as observed in central Argentina after introduction of grain sorghum in the 1960's (Murton et al., 1974; Bucher and Ranvaud, 2006). At that time, eared doves congregated in breeding and roosting colonies of up to 10 million birds (Bucher and Ranvaud, 2006). Similar population outbreaks occurred in other areas of Argentina and later in Colombia, Brazil, Uruguay, Bolivia and Paraguay. Outbreaks can be expected in areas where the regional landscape include >3% of grain sorghum or >10% of other suitable grain crops combinations and availability of >100 ha of contiguous breeding and roosting habitat (Bucher and Ranvaud, 2006).

2.1. Eared dove: population management challenges

During the initial dove population increases in Argentina in the 1960s, lethal control gained wide support among farmers (Bucher and Ranvaud, 2006). Pressure from farmers claiming heavy crop losses prompted government agencies to implement large scale lethal control campaigns which included dispersal of poisoned grains, poisoning water sources, aerial spraying of breeding colonies with highly toxic insecticides, burning of the vegetation in the breeding-roosting colonies, promotion of industrial processing of dove meat, and incentives for hunting, particularly international hunting tourism. After >4 years of marked operation effort and economic expenditures the population remained high (Table 1; Bucher and Ranvaud, 2006). During a 1990s dove population irruption in Sao Paulo state, Brazil, a nest and egg destruction program was implemented in an attempt to reduce crop damage.

Table 1
Temporal changes in sorghum-cultivated area and numbers of eared doves in colonies in Cordova, Argentina (Bucher and Ranvaud, 2006).

Year	Sorghum area (ha × 10^3)	Number of colonies
1960–1965	292	2.0
1966–1970	568	3.6
1971–1975	939	7.6
1976–1980	778	7.4
1981–1985	730	4.4
1986–1990	290	2.6
1991–1995	247	1.6
1996–1997	271	1

This strategy also was ineffective and abandoned as the principal method of managing crop damage (Bucher and Ranvaud, 2006).

In Brazil, government agencies compromised between agricultural interests and those of the general public by allowing destruction of nests and eggs but not of adult doves. In Uruguay, from 1975 to 1981 lethal control through toxic bait dispersal was very popular both because of mass killing of doves, and because it was conducted and financed by the government (Bruggers et al., 1998). However, due to increasing environmental concern, lethal control through bait dispersal is currently banned in Uruguay. Since 2000, lethal control options for managing pest birds have been limited to hunting (Ministry of Livestock, Agriculture and Fisheries, decree N° 164/96, May 2nd 1996 and subsequent modifications).

Bucher and Ranvaud (2006) found that the key factor controlling eared dove populations was the food supply (mostly cultivated grain) as long as forest fragments of suitable size to hold breeding colonies were available. Eared doves are capable of long-distance, nomadic movements, and thus can rapidly concentrate in areas where grain is available (Bucher and Bocco, 2009). Further, Bucher and Ranvaud (2006) concluded that density-dependent effects (population factors whose magnitude change according to the population level) lead to rapid compensation of control-induced mortality, neutralizing lethal control efforts. For example, reducing the population could result in less competition for food resulting in decreased mortality and increased natality (Newton, 1998).

3. Monk parakeet (Psittacidae) in South America: biology and economics

The monk parakeet, also known as the Quaker parakeet, is native to South America, occurring from central Bolivia and southern Brazil south to central Argentina (Bucher and Aramburú, 2014). It is considered an agricultural pest throughout its native range in South America (Fallavena and Silva, 1988; Aramburú, 1995). Most losses occur to sunflower, corn, and sorghum, but wheat, soybean (emerging seedlings), rice, and fruit in orchards are also damaged (Bruggers and Zaccagnini, 1994; Spreyer and Bucher, 1998). Crop damage solely attributable to monk parakeets is difficult to estimate because other pest birds also damage the same crops. On a regional level, monk parakeet damage is not considered economically significant (Canavelli et al., 2008; Vitti and Zuil, 2012). Locally, however, damage may exceed 25% (Bucher, 1992; Canavelli et al., 2008).

At the beginning of the 20th century, the monk parakeet colonized across the Pampas grasslands following agriculture expansion and the introduction of *Eucalyptus*, a highly preferred nesting tree (Bucher and Aramburú, 2014). Through the pet trade, the monk parakeet has been introduced to many countries beyond its native range, and populations are now established in North America and Europe. The species lacks some characteristics of an "efficient" bird pest, because it is a resident, non-migratory species that has a seasonally fixed, single-clutch (typically 5–6 eggs) breeding effort and a proportion of the population may not breed every year (Bucher et al., 1991; Bucher, 1992; Navarro et al., 1992; Martin and Bucher, 1993). However, the monk parakeet's unique ability to build its characteristic large compound nests provides great flexibility regarding nesting habitat requirements, as compared with all other parrot species which depend on cavities in trees or cliffs (Forshaw and Cooper, 1989; Spreyer and Bucher, 1998). Breeding and non-breeding parakeets roost in and maintain these nests year round.

3.1. Monk parakeet: population management challenges

Population models suggest that the monk parakeet's ecological