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Sunshine, Beaches, and Birds: Managing Raptor-Aircraft Collisions at Airports in Southern California

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ABSTRACT: Wildlife-aircraft collisions (wildlife strikes) pose a serious safety risk to aircraft. Raptors (i.e., hawks and owls) are one of the most frequently struck guilds of birds within North America. Integrated wildlife damage management programs combine a variety of non-lethal and lethal management tools to reduce presence of raptors on airports. Live-capture and translocation away from an airport is a commonly used non-lethal method to reduce the risk of raptor-aircraft collisions. In southern California, USDA Wildlife Services airport biologists live-captured, marked with auxiliary markers (i.e., airport program-specific plastic leg band), and translocated approximately 1,232 raptors from seven airports and military bases located within the highly urbanized environment of the Los Angeles Basin during January of 2010-December of 2016. Ten different raptor species were marked and relocated during this effort. The composition of translocated raptors was red-tailed hawks (38.9%), Cooper's hawks (27.5%), American kestrels (20.7%), barn owls (7.4%), and great horned owls (3.7%). Overall, the percentage of translocated raptors that returned to an airport was 11.1%. Although research is needed to better understand and increase the efficacy of such management efforts, this non-lethal method of reducing the presence of individual raptors at airports in southern California will be an important component of future wildlife management programs.

KEY WORDS: airports, birds, management, raptors, vertebrate pest control, wildlife strikes

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INTRODUCTION

Wildlife-aircraft collisions (wildlife strikes) pose a serious safety risk to aircraft. Wildlife strikes cost civil aviation at least $708 million annually in the U.S. (Dolbeer et al. 2015). Over 156,100 wildlife strikes with civil aircraft were reported to the U.S. Federal Aviation Administration during 1990-2014 (Dolbeer et al. 2015). White-tailed deer (*Odocoileus virginianus*), gulls (*Larus spp.*), waterfowl [e.g. Canada geese (*Branta canadensis*),] raptors (hawks and owls), blackbirds (Icterinae), and starlings (*Sturnus vulgaris*) are the species presently of most concern at airports (Dolbeer et al. 2000, DeVault et al. 2011, Dolbeer et al. 2015). Management techniques that reduce the presence and abundance of wildlife hazardous to aviation in and around airports are therefore critical for safe airport operations (DeVault et al. 2013, Cleary and Dolbeer 2005).

Live-capture and translocation of problematic individual animals is a common practice used in the management of human-wildlife conflict situations (Fisher and Lindenmayer 2000, Sullivan et al. 2015). This method is often used to reduce the hazards posed by raptors using airport environments (Guerrant et al. 2013, Schafer and Washburn 2016).

Raptors pose a risk to safe aircraft operations in the highly urbanized environment of southern California, as they do at many airports in North America. Effective and publically accepted methods to reduce the hazards posed by raptors to aviation safety are needed. Here, we discuss a non-lethal management program to reduce the airfield presence of raptors and the frequency of raptor-aircraft collisions at airports in an urbanized environment in southern California.

Table 1. Total number of individual raptors and total number of raptor translocations away from 7 airports in southern California conducted by California Wildlife Services during 2010-2016.

Airport	Number of Birds	Number of Translocations
Los Angeles International Airport	500	508
Long Beach Airport	250	266
Ontario Airport	221	242
Joint Forces Training Base Los Amalitos	144	145
Van Nuys Airport	47	51
Riverside Airport	44	44
San Diego International Airport	26	28

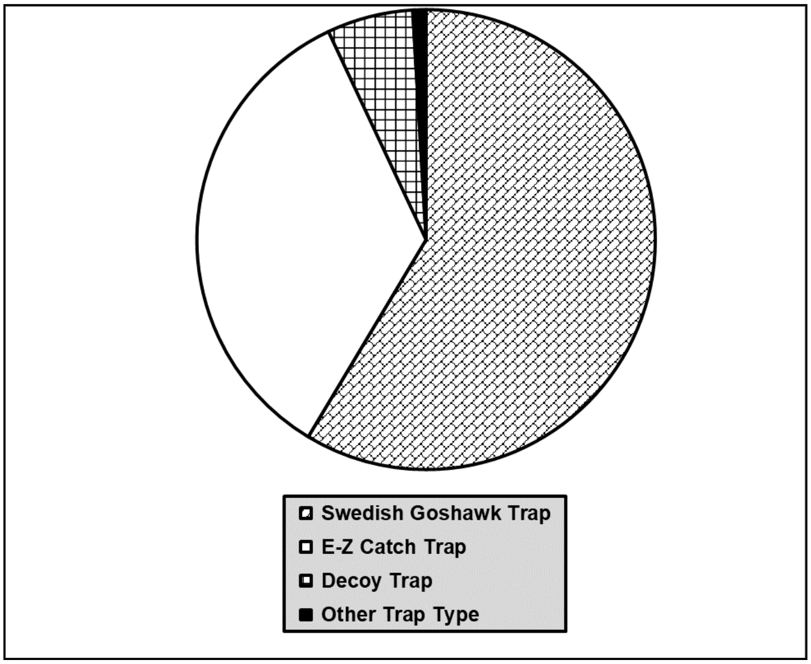

Figure 1. Distribution of trap types used to live-capture 10 species of raptor on civil airports or military airfields as part of California Wildlife Services' airport program during 2010-2016.

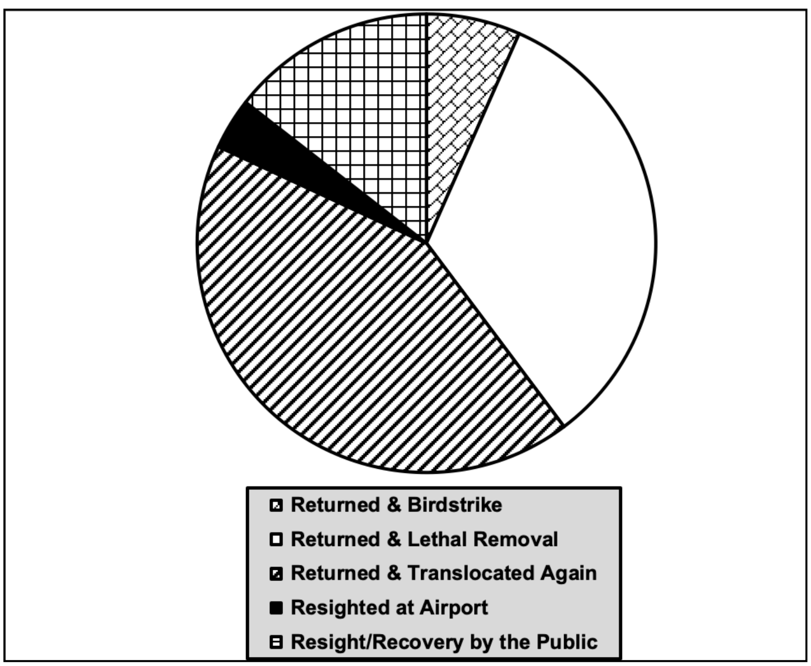

Figure 2. Distribution of the known fate of 166 raptors that were translocated from civil airports or military airfields as part of California Wildlife Services' airport program during 2010-2016.

LIVE-CAPTURE AND MARKING OF RAPTORS

USDA Wildlife Services (WS) operations personnel in southern California used a variety of standard methods to live-capture individual raptors of 10 different species that were presenting a hazard to aircraft on an airport or military airfield during 2010-2016 (Bub 1991, Bloom et al. 2007). Almost two-thirds of all raptor live-captures on airports occurred using Swedish Goshawk traps and approximately one-third of the raptors were caught using modified E-Z Catch™ net traps (Figure 1). All raptor-trapping activities were conducted under Federal Depredation Permits issued by the U.S. Fish and Wildlife Service.

All raptors that were live-captured and translocated as

Table 2. Total number of individual raptors of 10 species and total number of raptor trans-locations away from 7 airports in southern California as part of California Wildlife Services' airport program during 2010-2016.

Common Name	Scientific Name	Number of Birds	Number of Translocations
Red-tailed hawk	*Buteo jamaicensis*	479	503
Cooper's hawk	*Accipiter cooperii*	339	349
American kestrel	*Falco sparverious*	255	264
Common barn owl	*Tyto alba*	91	99
Great horned owl	*Bubo virginianus*	46	47
Red-shouldered hawk	*Buteo lineatus*	13	13
Sharp-shinned hawk	*Accipiter striatus*	5	5
Peregrine falcon	*Falco peregrinus*	2	2
Swainson's hawk	*Buteo swainsoni*	1	1
Merlin	*Falco columbarius*	1	1
All species combined		**1,232**	**1,284**

part of this WS operational program were marked with a project-specific color-coded leg band. These leg bands were black with yellow alpha-numeric codes. Each band had the two-letter abbreviation for the state of California (i.e., CA) and a three-digit numeric code. These unique markers allowed for the identification of individual raptors when the birds were not "in hand." Federal bird bands were not placed on the birds. When possible, the age of raptors [primarily red-tailed hawks (*Buteo jamaicensis*) and Cooper's hawks (*Accipiter cooperii*)] were classified as either hatching-year (HY), second-year (SY), after-second-year (ASY), third-year (TY), and after-third-year (ATY) accordingly to plumage characteristics.

TRANSLOCATION OF RAPTORS

During 2010-2016, 1,232 individual raptors were involved in 1,284 translocation events conducted by WS airport wildlife hazard management programs in southern California (Table 1). Notably, some individual raptors were translocated more than once.

Release sites for translocated raptors were selected in a manner to avoid other airports or areas with known presence of threatened or endangered species. Release sites targeted areas of (presumed) suitable habitat with easy access from major highways (e.g., to minimize time investment and maximize efficiency). Preference was given to sites within parklands managed by local, state, or federal entities. Release sites were chosen based on a variety of factors including land cover type (e.g., oak woodlands, agricultural areas within the desert, coniferous forest). Initially, potentially suitable release sites were located using satellite imagery, but final selection/use required physical visits and visual assessments at the actual locations.

Red-tailed hawks, Cooper's hawks, and American kestrels (*Falco sparverious*) accounted for 39%, 27%, and 21% of these translocation actions, respectively (Table 2). Across the 10 species, the average translocation distance was 120 miles away from the airport or airfield where a raptor was live-captured. On average, American kestrels were taken the shortest distance (82 miles) and red-tailed hawks were transported the farthest (166 miles). The minimal distance raptors were transported was 18 miles, whereas the maximum distance was 545 miles.

FATE OF TRANSLOCATED BIRDS

When a translocated (and marked) raptor was resighted/recovered by a member of the public or WS personnel, the pertinent information was entered into a database. The overall known fate (e.g., bird strike, second translocation, resight) of 166 individual raptors was reported. Twenty-four raptors (14.5% of the birds with a known fate) were observed or found by the public (Figure 2). In total, 142 (85.5%) of all raptors returned to an airport or military airfield (Figure 2). Of the raptors that returned to an airport, 7.7% were involved in bird strikes, 88.0% were managed (i.e., lethally removed or translocated again), and the rest (2.8%) were resighted but were not

Table 3. Percent of birds that returned to an airport and the average, minimum, and maximum days until birds returned for the 5 raptor species that at least 40 individuals were translocated as part of California Wildlife Services' airport program during 2010-2016.

Species	Recovery/Resight Rate	Days to Return		
		Average	Minimum	Maximum
Red-tailed hawk	16.5%	210.1	1	1,045
Cooper's hawk	5.4%	263.1	1	1,328
American kestrel	6.8%	128.1	1	885
Common barn owl	21.2%	150.3	5	830
Great horned owl	2.1%	323	323	323

Table 4. Percent of Cooper's hawks, among various age classes, that returned to an airport after they were translocated as part of California Wildlife Services' airport program during 2010-2016.

Age Class	Recovery/Resight Rate
Hatching-year	5.3%
Second-year	14.3%
After-second-year, third-year, & after-third-year	10.8%

Table 5. Percent of red-tailed hawks, among various age classes, that returned to an airport after they were translocated as part of California Wildlife Services' airport program during 2010-2016.

Age Class	Recovery/Resight Rate
Hatching-year	11.3%
Second-year	17.4%
After-second-year, third-year, & after-third-year	25.8%

recaptured or managed. Policies regarding management of raptors that return to an airport following a translocation event vary among the airports and military airfields.

For all raptor species where more than 45 individual birds were live-captured and translocated during this program, we examined each species (*n* = 5) individually. The return rate (i.e., proportion of translocated raptors that return to the same airport or military airfield) varied among the five raptor species; barn owls (*Tyto alba*) had the highest return rate, whereas great horned owls (*Bubo virginianus*) had the lowest (Table 3). Overall, the return rate of all raptors (all species combined) was below 12% based on the information gained during this operational program.

For the aforementioned 5 species of raptors, we also estimated the number of days to return (i.e., the number of days from translocation until the bird was resighted or recaptured at the airport) for each species. The average number of days to return varied among the 5 species, with American kestrels returning the quickest and great horned owls taking the longest amount of time to return Table 3). Except for great horned owls, at least one individual raptor from each of the species returned within one week of translocation. Overall, the return rate for individual raptors appears to vary considerably.

Several biological (e.g., age/sex of individuals) and logistical factors (e.g., season, distance translocated from airport) likely influenced the return rate and days to return for raptors (Pullins et al. 2018). We strongly suggest that researchers and wildlife managers evaluate these factors in regionally specific areas to increase our understanding of raptor management. The information we examined in this effort was obtained from an operational program with a goal of reducing raptor-aircraft collisions. We were unable to conduct rigorous analyses of our data related to some biological and logistical factors because the raptor translocations were not conducted in a standardized, consistent manner (for example, raptors of the same species were taken to and released at a wide variety of locations at varying distances and directions from the airports). We strongly suggest that researchers and wildlife managers conduct well-designed research studies and evaluate these factors in regionally specific areas to increase our understanding of raptor management (e.g., Pullins et al. 2018).

Of the live-capture and translocation events where age of the bird was determined, almost all were red-tailed hawks (*n* = 377) and Cooper's hawks (*n* = 252). For both species, the lowest resight/recovery rate was for HY hawks; SY resight/recovery birds were intermediate, and the more mature birds (e.g., ASY, TY, and ATY) exhibited the highest resight/recovery rates (Table 4, Table 5). This finding is consistent with a study involving translocation of red-tailed hawks in Illinois (Pullins et al. 2018). Raptors exhibit high site fidelity during breeding and migration periods (Rosenfield and Bielefeldt 1993, Preston and Beane 2009), a factor that could result in older birds being more likely to return to an airport than younger hawks.

We believe these return rates are likely conservative, as detection and identification of marked raptors using colored leg bands can be challenging and not all raptors that returned to airport environments were observed or recaptured. Similarly, the days to return estimates for some raptors might be somewhat longer due to the same issues. We suggest that future research efforts should be conducted to evaluate the use of other auxiliary markers (e.g., patagial wing tags), which could allow for higher detectability rates of raptors that return to airport environments (e.g., Pullins et al. 2018).

SUMMARY

Live-capture and translocation of raptors is an important component of integrated wildlife damage mitigation programs at some airports. As part of a large multi-year program, WS personnel successfully live-captured and translocated a variety of raptor species that were posing a risk to safe aircraft operations at civil airports and military airfields in southern California. Overall, the return rates of translocated raptors appear to vary by species and could be influenced by a number of other factors. Banding or marking birds is an essential component of any raptor relocation program. Future research efforts will be important for increasing our understanding and the efficacy of regionally based raptor-aircraft collision reduction programs.

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