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Using Bird Strike Information to Direct Effective Management Actions within Airport Environments

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Abstract: Wildlife-aircraft collisions (wildlife strikes) pose a serious safety risk to aircraft. Many bird species, especially gulls, are very difficult to manage within airport environments as many traditional methods (e.g., trap and remove from the airport) can be relatively ineffective due to the birds' various activities on airports (e.g., feeding, loafing, and flying). Such challenges have greatly impacted the Los Angeles International Airport and the Van Nuys Airport, as documented through historical bird strike records collected since 1990. Using information contained in these bird strike records, USDA APHIS Wildlife Services personnel conducted strategic planning efforts to reduce the risk of bird strikes. Since 2009, efforts have been made to improve the quality of wildlife strike reporting at Los Angeles World Airports facilities through the distribution of bird strike collection kits to airline maintenance offices, subcontract aircraft maintenance companies, and Airside Operations personnel. These kits are intended to facilitate an increase in wildlife strike reporting and the number of wildlife strikes identified to the species level. Following intensive management efforts that included trapping and removal of doves (i.e., rock pigeons, mourning doves), bird strikes by these species have decreased significantly at these airports. Airport-specific integrated wildlife damage management programs at airports that use bird strike information to guide management activities toward problem species have great potential for reducing the risk of bird strikes.

Key Words: airports, birds, bird strikes, California, management, vertebrate pest control

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INTRODUCTION

Wildlife-aircraft collisions (wildlife strikes) pose a serious safety risk to aircraft. Wildlife strikes cost civil aviation at least $682 million annually in the United States. Over 109,100 wildlife strikes with civil aircraft were reported to the U.S. Federal Aviation Administration (FAA) during 1990-2010. Aircraft collisions with birds accounted for 97% of the reported strikes, whereas strikes with mammals and reptiles were 3% and <1%, respectively (Dolbeer et al. 2012).

Los Angeles World Airports (LAWA) has been reporting wildlife strikes since 1990, the year the Federal Aviation Administration (FAA) began recording wildlife strikes and collecting this information into a nationwide database. On October 15, 1997 an aircraft from a major airline ingested several rock pigeons (*Columba livia*) into both engines upon departure from the Los Angeles International Airport (LAX), resulting in an aborted take-off and damages to the engine turbine fan blades (Mendelsohn 2000). As a result of this triggering bird strike event, LAWA sought assistance from USDA APHIS Wildlife Services (WS) and provided funding to: 1) conduct Wildlife Hazard Assessments (WHAs); 2) assist in the development of Wildlife Hazard Management Plans (WHMP), and 3) develop and implement an integrated wildlife damage management program at each LAWA airport to reduce the risk of wildlife strikes.

WILDLIFE HAZARD ASSESSMENT AND WILDLIFE HAZARD MANAGEMENT PLAN

WS conducted a WHA during 1998-1999 (Mendelsohn 2000) and again during 2005-2006 (Pitlik 2006) to document and quantify the presence of hazardous wildlife at LAX. In addition, these WHAs are used to evaluate seasonal migration patterns and other behaviors related to occurrence of wildlife hazardous to safe aircraft operations on or near the airport (Wenning et al. 2004, Cleary and Dolbeer 2005, DeVault et al. 2011). WHAs, in addition to analyses of wildlife strike information, provide the basis for the formulation and execution of the WHMP for LAX. The airport's WHMP is reviewed and updated on an annual basis to ensure the most appropriate measures are being taken to address current wildlife hazards (Cleary and Dolbeer 2005).

As part of the integrated wildlife damage management program, efforts to increase communication and collaboration among airport entities were implemented. A Wildlife Working Group (WWG) was formed that includes a variety of airport personnel that are directly or indirectly involved with wildlife mitigation efforts at the airport. The WWG meets annually to review the goals and accomplishments of the wildlife hazard mitigation program at LAX. In addition, the airport's Airside Operations Department (AirOps) appointed a Wildlife Coordinator to work directly with WS and to assist with training requirements, mitigation efforts (e.g., use of pyrotechnics to disperse hazardous birds), and reporting of wildlife strikes.

Working with several departments within LAWA, the FAA, the airlines, and other cooperating groups, WS has implemented an integrated wildlife hazard mitigation program at LAWA airports since 1997. Monitoring of wildlife hazards (e.g., avian surveys conducted each month), reporting of wildlife strikes, use of passive wildlife control tools and techniques (e.g., habitat management, installation of anti-perching devices), non-lethal harassment (e.g., use of pyrotechnics), and lethal control to remove prob-

lematic species (e.g., trapping to remove red foxes, *Vulpes vulpes*) represent some of the wildlife hazard management activities conducted by WS to reduce the risk of wildlife strikes at LAWA airports.

REPORTING OF WILDLIFE STRIKES

Wildlife strikes are voluntarily reported to the FAA National Wildlife Strike Database (see http://wildlife-mitigation.tc.faa.gov/wildlife/strike) and often include information such as the name of the airline, aircraft type, phase of flight, runway location, damage estimate, and species of wildlife involved (Wenning et al. 2004, Dolbeer et al. 2012). In situations where the wildlife specimens cannot be identified in the field, blood or feather samples are collected and express-mailed to the Smithsonian Institution's bird identification lab for identification (Pitlik 2006, Dove et al. 2007). Airline pilots and maintenance personnel, the air traffic control tower (ATCT), AirOps, and WS personnel typically file the reports electronically using the Form FAA 5200-7. Reporting efforts vary tremendously from airport to airport and usually require a coordinated effort to promote airline pilot and maintenance awareness, obtain damage estimates, and the collection of wildlife strike remains for identification (Wenning et al. 2004, Dolbeer 2009, Dolbeer and Wright 2009). WS developed a wildlife strike reporting protocol for LAWA in an effort to standardize data collection related to a reported wildlife strike incident. This protocol requires classification of each strike as either 'Real Time' – airline pilot information is reported on an FAA 5200-7 form or relayed to the ATCT, AirOps, or WS immediately following the incident to follow-up with damages and the collection of remains or as 'Delayed' – AirOps recovery of wildlife strike remains from the runway following a strike (which usually does not include pertinent flight information and estimates of aircraft damage).

Figure 1. Total number of reported bird strikes (all species combined) at the Los Angeles International Airport prior to the implementation of a wildlife hazard mitigation program (1990-1997) and concurrent with an active wildlife hazard mitigation program (1998-2011).

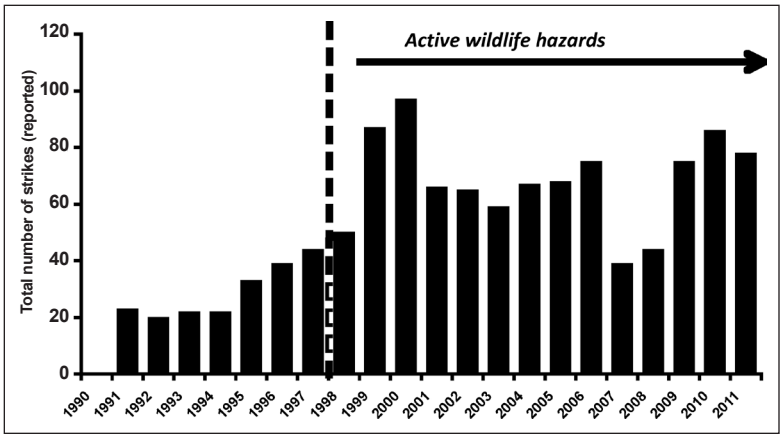
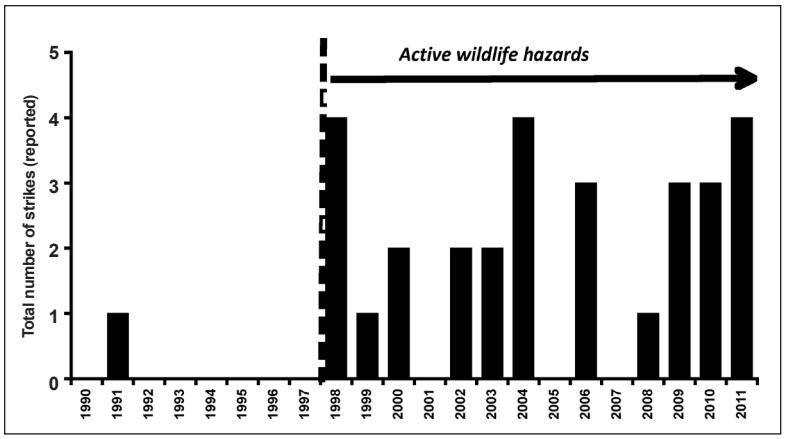


Figure 2. Total number of reported bird strikes involving western meadowlarks at the Los Angeles International Airport prior to the implementation of a wildlife hazard mitigation program (1990-1997) and concurrent with an active wildlife hazard mitigation program (1998-2011).



BIRD STRIKES AT LAX

Since the ditching of US Airways Flight 1549 into the Hudson River following a wildlife strike with Canada geese (*Branta canadensis*) in January 2009 (Marra et al. 2009) and the distribution of bird strike collection kits to airline maintenance, subcontracted aircraft maintenance company, and AirOps personnel, LAWA has seen a dramatic increase in the number of wildlife strikes reported to the FAA and in the proportion of strikes that are identified to species. Since the implementation of an integrated wildlife mitigation program at LAX in 1998, bird strike reporting more than doubled, increasing from 27.8 (±3.39 SE) reported bird strikes per year during 1990-1997 to 68.3 (±4.42 SE) reported strikes annually during 1998-2011 (Figure 1). Concurrently, there was a decrease in the proportion of 'unknown species' since the integrated wildlife mitigation program at LAX was initiated. Prior to the wildlife hazard mitigation program (i.e., during 1990-1997), 46% of the reported strikes (on average) were identified to species each year, whereas an average of 57% of the annually reported strikes included species identification while the program has been in place (i.e., during 1998-2011).

Species involved in bird strikes at LAX have typically included individuals from the following groups: gulls, raptors, owls, larks, waterfowl, and wading birds. The implementation of the wildlife hazards mitigation program and having dedicated airport wildlife professionals has greatly increased the information gained from wildlife strike reporting at LAWA airports. During the 8 years prior to the wildlife hazards mitigation program, only one western meadowlark (*Sturnella neglecta*) was reported as being struck at LAX; since the program has been active (during 1998-2011) an average of 2.1 western meadowlarks strikes are reported each year (Figure 2). Similarly, only 3 waterfowl were reported as being struck during 1990-1997, whereas on average 2.8 waterfowl strikes per year have been reported at LAX during the 14 years of the wildlife hazards program (Figure 3). Almost half (48%) of the reported gull strikes that occurred during the wild-

Figure 3. Total number of reported bird strikes involving waterfowl (e.g., ducks and geese) at the Los Angeles International Airport prior to the implementation of a wildlife hazard mitigation program (1990-1997) and concurrent with an active wildlife hazard mitigation program (1998-2011).

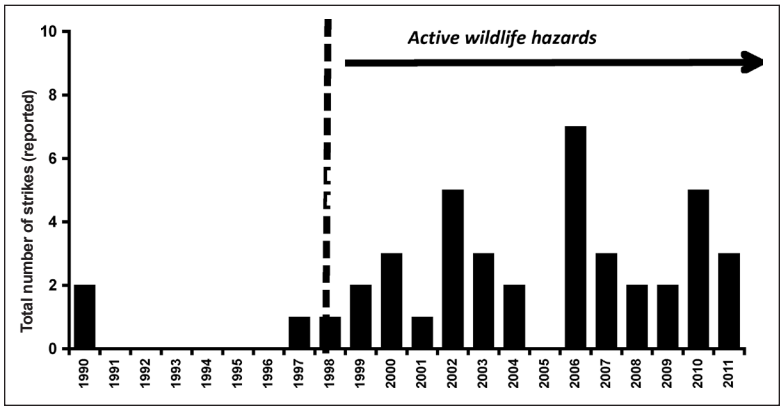
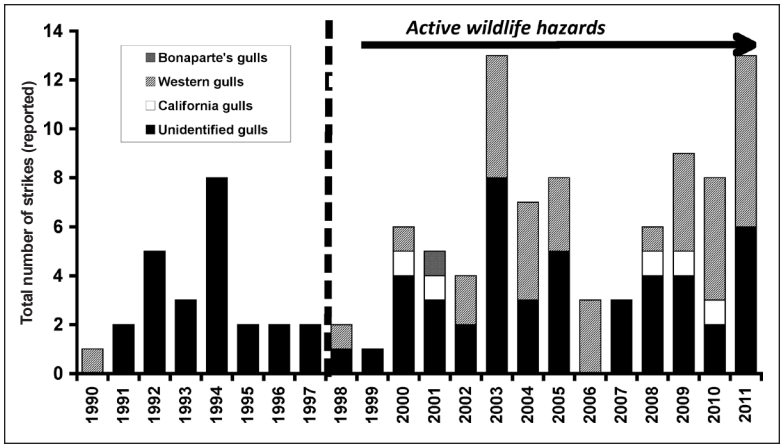


Figure 4. Total number of reported bird strikes involving gulls of various species at the Los Angeles International Airport prior to the implementation of a wildlife hazard mitigation program (1990-1997) and concurrent with an active wildlife hazard mitigation program (1998-2011).



life hazards program were identified to species, whereas only 4% (one gull) was identified to species during the 8 years prior to the wildlife hazards mitigation program at LAX (Figure 4). Clearly, the assistance provided by a professional airport wildlife biologist greatly improves the quality and quantity of information gained from reported wildlife strikes.

SPECIES-SPECIFIC WILDLIFE MITIGATION EFFORTS

Modification of airport habitats and the removal of prey and other food resources (e.g., feeding of wildlife by airport employees) from the airport environment have a more long-term effect on the occurrence of hazardous wildlife when conducted in conjunction with non-lethal dispersal and strategic lethal removal of individuals (Washburn and Seamans 2004, Cleary and Dolbeer 2005). Wildlife strike information is particularly useful for the development of an effective integrated wildlife hazards mitigation program for an airport.

Raptors are commonly struck by aircraft at LAWA airports and represent a hazard to safe aircraft operations throughout the year, although migratory patterns clearly influence the abundance and species composition of raptors using LAWA airfields. American kestrels (*Falco sparverius*) are attracted to grasshoppers (Washburn et al. 2011) between the runways in the summer months. Red-tailed hawks (*Buteo jamaicensis*) are attracted to pocket gophers (*Thomomys* spp.) between the runways and prefer to perch on equipment near runways. Live-capture and relocation of raptors (Schafer et al. 2002) is an integral part of the wildlife hazard mitigation program at the LAWA airports. Raptor use of the airfield environment can also be reduced by the use of various non-lethal harrassment methods (e.g., vehicles, pyrotechnics) and the installation of anti-perching devices onto airfield equipment and facilities.

Western gulls (*Larus occidentalis*) are non-migratory and commonly found using LAWA airfields and airspace throughout the year, whereas California gulls (*Larus californicus*) only spend the fall and winter months along the southern California coast. Gulls forage in densely populated (e.g., highly urbanized) areas adjacent to the airport itself and are frequently observed flying over the runways as they travel to and from inland feeding sites and their roosting areas on or near Dockweiler Beach (located immediately west of LAX). Gulls can be very difficult to remove by lethal methods (e.g., trapping and shooting) or to disperse with pyrotechnics due to their foraging behavior near human activity in a complex airport environment. Installation of perching deterrents, use of gull effigies, and the removal of open dumpsters and trash cans are typically used to discourage gull presence on the airport (Cleary and Dolbeer 2005, Seamans et al. 2007a,b).

Waterfowl typically migrate through the airport environment in the fall and spring and are usually struck by aircraft during early morning hours. Habitat modification (e.g., removal of temporary standing water), dispersal (e.g., pyrotechnics), and lethal control (i.e., shooting) have been the most effective methods for reducing the presence of waterfowl on the airfield itself.

Rock pigeon and mourning dove (*Zenaida macroura*) hazard mitigation involves a wide variety of wildlife control methods on the airports and within the highly urbanized areas surrounding the LAWA airports. Rock pigeons are a non-migratory species and thus represent an important wildlife hazard to safe aircraft operations at the LAWA airports throughout the year. In constrast, mourning doves are migratory and the abundance within the LAWA airport environments varies by season. On the airport itself, rock pigeons and mourning doves are lethally removed (e.g., shooting with air rifles, live-trapping and euthanasia) from structures where they feed and roost. As with other problematic hazardous bird species (e.g., European starlings, *Sturnus vulgaris*), decoy trapping techniques can be used within the airport environment to effectively reduce mourning dove use of an airport. Furthermore, trapping efforts wthin the areas surrounding the airport (i.e., within

Figure 5. Total number of reported bird strikes involving rock pigeons at the Los Angeles International Airport (LAX) prior to the implementation of a wildlife hazard mitigation program (1990-1997) and concurrent with an active wildlife hazard mitigation program (1998-2011) and the total number of rock pigeons lethally removed as part of the wildlife hazard mitigation program on or near LAX (1998-2011) .

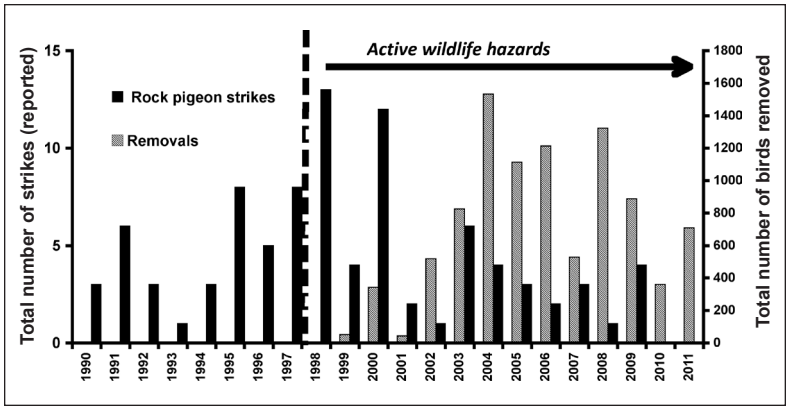
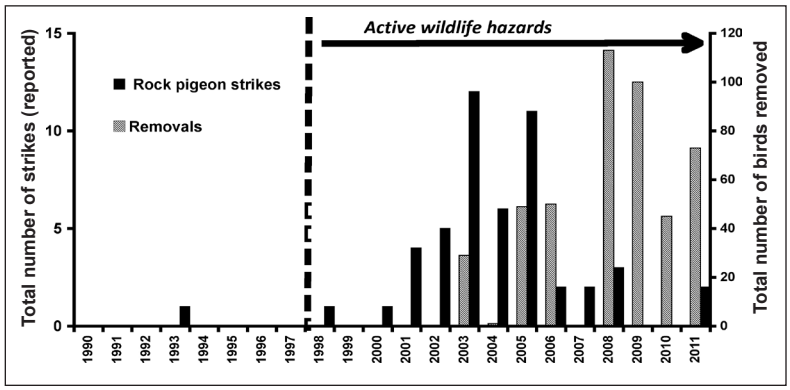


Figure 6. Total number of reported bird strikes involving rock pigeons at the Van Nuys Regional Airport (VNY) prior to the implementation of a wildlife hazard mitigation program (1990-1997) and concurrent with an active wildlife hazard mitigation program (1998-2011) and the total number of rock pigeons lethally removed as part of the wildlife hazard mitigation program on or near VNY



5 km) has also been very effective in reducing local rock pigeon populations and consequetly the frequency of rock pigeon-aircraft collisions.

EFFECTIVENESS OF WILDLIFE MITIGATION EFFORTS

An average of 8.2 rock pigeon strikes per year were reported at LAX from 1995 to 2000 (Figure 5). WS implemented an intensive management program to reduce the abundance of rock pigeons on or near LAX in 1999 and continuted this effort through 2011. As a result of these efforts, the average annual strike rate for rock pigeons was reduced by 71% (from 8.2 to 2.4 rock pigeons strikes per year) during the 9 years concurrent with the wildlife hazards mitigation progarm (Figure 5). Similarly, rock pigeon strikes increased dramatically at Van Nuys Regional Airport (VNY) during 2000-2005; however, the strike rate returned to lower levels following the implementation of intensive rock pigeon control efforts by WS at VNY (Figure 6). Analysis of airport-specific wildlife strike information led to the identification of rock pigeons as a major issue at both airports and later demonstrated the effectiveness of the control programs employed.

Although almost no mourning dove strikes were reported at LAX during 1990-1997, an average of 1.8 mourning dove strikes per year at LAX were reported during 1998-2011. Similar to rock pigeons, a lethal control program was developed and implemented to reduce the risk mourning doves pose to safe aircraft operations. This program has been very effective at maintained mourning dove strikes at a relative low level. A similar program was developed and implemented at VNY is response to a sudden large increase in mourning dove strikes during 2003-2006.

SUMMARY

Overall awareness of wildlife strike issues, wildlife strike reporting, and species identification of struck wildlife have increased dramatically due to the implementation of the WS wildlife hazard mitigation program in 1997. Since then, WS has demonstrated that certain species of wildlife (i.e., mourning doves and rock pigeons) can be controlled more effectively with a variety of techniques to reduce (e.g., rock pigeons) or maintain a low number (e.g., mourning doves) of bird strikes over time. Other hazardous bird species (e.g., gulls and waterfowl) might be more difficult to manage within complex airport environments and more long-term methods (e.g., harassment, habitat modification) are likely more effective at reducing the number and severity of bird strikes with these species. Wildlife strike reporting, including the identification of bird strike remains to the species level, is essential to document and evaluate the effectiveness of wildlife hazard mitigation efforts at LAX and VNY and should be continuously improved to reflect the need for continued diligence for optimizing human and aircraft safety at LAWA airports and elsewhere.

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