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TRANSPORTATION
FEDERAL
AVIATION
ADMINISTRATION**

WILDLIFE STRIKES TO CIVIL AIRCRAFT IN THE UNITED STATES 1990–2003



**U. S. Department
of Agriculture
Animal and Plant
Health Inspection
Service
Wildlife Services**



**FEDERAL AVIATION ADMINISTRATION
NATIONAL WILDLIFE STRIKE DATABASE
SERIAL REPORT NUMBER 10**

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**REPORT OF THE ASSOCIATE ADMINISTRATOR OF AIRPORTS
OFFICE OF AIRPORT SAFETY AND STANDARDS
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COVER

This is the number 2 engine on a Fokker 100 that struck at least five Canada geese at 125 feet above ground level when departing an East Coast USA airport in September 2003. Two geese entered the #2 engine. The pilot was unable to shut the engine down with the fuel cutoff lever; the fire handle was pulled and the engine finally shut down, but continued vibrating. The flight made an emergency landing at a nearby airport. A fan blade separated from the disk and penetrated the fuselage. Several fan blades were deformed and a 20- by 36-inch-wide depression was found on right side of nose behind radome.

The non-migratory Canada goose population in North America increased from 1 million to 3.6 million birds, between 1990 and 2003.

The authors encourage anyone with quality photographs of aircraft damage resulting from wildlife strikes or of wildlife at airports to submit them for consideration in future wildlife strike publications.

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Preface



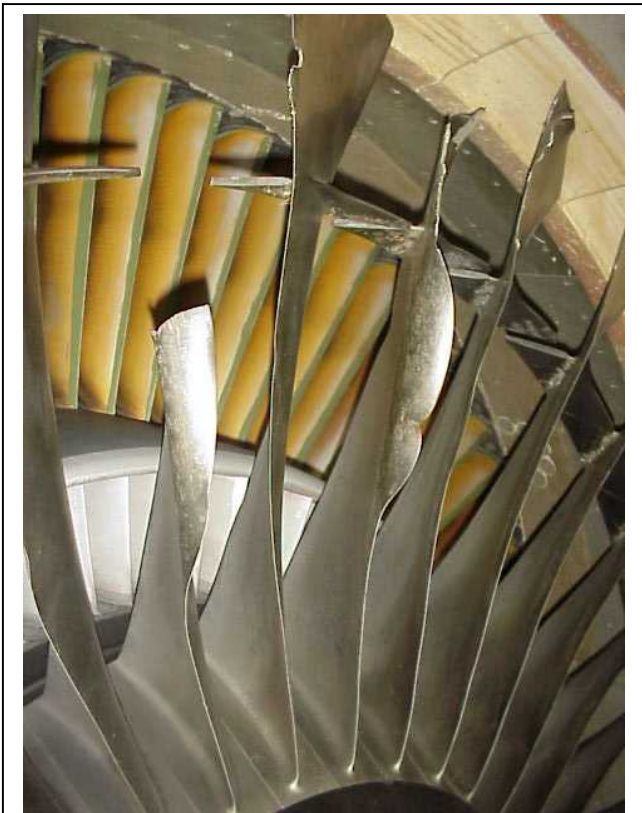
The pilot of this Cessna 172 made a Mayday call to nearby Air Traffic Control Tower in Texas after hitting a bird (likely a vulture) with the left wing at 800 feet AGL on 8 July 2003. The pilot attempted to make an emergency landing in a field but lost control and crashed, killing himself and his passenger. Worldwide, over 157 people have been killed by wildlife strikes since 1990. (Photo by FAA)

The civil and military aviation communities widely recognize that the threat to human health and safety from aircraft collisions with wildlife (wildlife strikes) is increasing (Dolbeer 2000, MacKinnon et al. 2001). Globally, wildlife strikes have killed more than 157 people and destroyed over 140 aircraft since 1990 (Richardson and West 2000; Thorpe 2003; Dolbeer, unpublished data). Several factors contribute to this increasing threat.

Commercial air carriers are replacing their older three- or four-engine aircraft fleets with more efficient and quieter, two-engine aircraft. In 1969, 75 percent of the 2,100 USA passenger aircraft had three or four engines. In 1998, the USA passenger fleet had grown to about 5,400 aircraft, and only 30 percent had three or four engines. It is estimated that by 2008 the fleet will contain about 7,000 aircraft, and only 10 percent of which will have three or four engines (Cleary and Dolbeer 1999). This reduction in

engine redundancy increases the probability of life-threatening situations resulting from aircraft collisions with wildlife, especially with flocks of birds. In addition, previous research has indicated that birds are less able to detect and avoid modern jet aircraft with quieter engines (Chapter 3, International Civil Aviation Organization 1993) than older aircraft with noisier (Chapter 2) engines (Burger 1983, Kelly et al. 1999). Noisier (Chapter 2) aircraft engines will be phased out by 2005.

Many populations of wildlife species commonly involved in strikes have increased markedly in the last few decades. For example, from 1980 to 2003, the resident (non-migratory) Canada goose population in the USA increased at a mean rate of 8.5 percent per year; the ring-billed gull population increased at a mean annual rate of about 2.6 percent; the red-tailed hawk population increased at a mean annual rate of 2.4 percent; and the turkey vulture population increased at a mean annual rate of 2.2 percent (Sauer et al. 2003). Thirteen of the 14 bird species in North America with mean body masses greater than 8 pounds have shown significant population increases over the past three decades (Dolbeer and Eschenfelder 2002). In addition, the white-tailed deer population increased from a low of about 350,000 in 1900 to about 24 million in 1994 (Jacobson and Kroll 1994).



A B-757 aircraft struck a Canada goose on take-off from an east coast USA airport on 11 March 2003. One engine ingested a goose which caused an uncontained failure. Aircraft returned to safely to airport. The aircraft was out of service for 48 hours and repair costs were \$740,000. See page 8 for additional photos.

Air traffic has increased substantially since 1980. Passenger enplanements in the USA increased from about 310 million in 1980 to 643 million in 2003 (2.1 percent per year), and commercial air traffic increased from about 17.8 million aircraft movements in 1980 to 28.1 million in 2003 (2.1 percent per year, FAA 2004). USA commercial air

traffic is predicted to continue growing at a rate of about 2 percent per year to 33 million movements by 2010.

As a result of these factors, experts with the FAA, U.S. Department of Agriculture (USDA), and U.S. Air Force expect the risk, frequency, and potential severity of wildlife-aircraft collisions to escalate over the next decade.

The FAA has initiated several programs to address this important safety issue, including the collection and analysis of data from wildlife strikes. The FAA began collecting wildlife strike data in 1965. However, except for cursory examinations of the strike reports to determine general trends, the data were never submitted to rigorous analysis. In 1995, the FAA, through an interagency agreement with the USDA, Wildlife Services,



An Embraer ERJ-135ER struck a double-crested cormorant (DCCO) at 13:35 (local time) at about 400 AGL and 170 knots while climbing and banking left after departure from an east coast USA airport on 31 March 2003. The aircraft returned to the airport for a precautionary landing with a large dent in the leading edge of the right wing. The DCCO population in North America increased at a mean annual rate of 10.5%, 1966–2002 (Dolbeer and Eschenfelder 2003).

(USDA/WS), initiated a project to obtain more objective estimates of the magnitude and nature of the national wildlife strike problem for civil aviation. This project involves having specialists from the USDA/WS (1) edit all strike reports (FAA Form 5200-7, *Birds/Other Wildlife Strike Report*) received by the FAA since 1990 to ensure consistent, error-free data; (2) enter all edited strike reports in the FAA National Wildlife Strike Database; (3) supplement FAA-reported strikes with additional, non-duplicated strike reports from other sources; (4) provide the FAA with an updated computer file each month containing all edited strike reports; and (5) assist the FAA with the production of annual reports summarizing the results of analyses of the data from the National Wildlife Strike Database. Such analyses are

critical to determining the economic cost of wildlife strikes, the magnitude of safety issues, and most important, the nature of the problems (e.g., wildlife species involved, types of damage, height and phase of flight during which strikes occur, and seasonal patterns). Once these questions are answered, corrective actions can be taken and defended.

The first annual report on wildlife strikes to civil aircraft in the USA, covering 1994, was completed in November 1995 (Dolbeer et al. 1995). Since then we have published subsequent reports covering the years 1993–1995, 1992–1996, 1991–1997, 1990–1998, 1990–1999, 1990–2000, 1990–2001, and 1990–2002 (Cleary et al. 1996, 1997, 1998, 1999, 2000, 2002a, 2002b, 2003). This is the tenth report in the series and covers the 14-year period 1990 through 2003.

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Wildlife Strikes to Civil Aircraft in the United States, 1990–2003



A B-737-300 departing a Midwestern USA airport on 26 December 2003 hit a flock of snow geese while climbing through 2,900 feet above ground level (AGL) at 240 knots. The birds damaged the radome, nose, wing, tail, and lights; and part of one bird was ingested into an engine. The aircraft returned to the airport where passengers were rerouted to other flights. The aircraft was out of service for 11 days, and repair costs exceeded \$500,000. The snow goose population in North America increased at a mean annual rate of 3.5%, 1980–2002 (Dolbeer and Eschenfelder 2003).

Introduction

This report presents a summary analysis of data from the FAA's National Wildlife Strike Database for the 14-year period 1990 through 2003. Unless noted, all totals are for the 14-year period, and percentages are of the total known. Because of the large amount of data, Tables 2 through 17 present 14-year totals only and do not display data for individual years.

In addition to the summary analysis for 1990 through 2003, a sample of significant wildlife strikes to civil aircraft in the USA during 2003 is presented at the end of the report. These strike examples demonstrate the widespread and diverse nature of the problem.

Results

Number of Reported Strikes

For the 14-year period (1990–2003), 52,493 strikes were reported to the FAA. Birds were involved in 97.4 percent of the reported strikes, mammals in 2.4 percent, and reptiles in less than 0.2 percent (Table 1).

The number of strikes annually reported tripled from 1990 (1,739) to 2000 (5,979). From 2000 to 2003, reported strikes plateaued at about 6,000 per year with 5,940 strikes reported in 2003 (Table 1, Figure 1). We suggest that the steady increase in reports for 1990 to 2000 was the result of several factors: an increased awareness of the wildlife strike issue, an increase in aircraft operations, an increase in populations of hazardous wildlife species, and an increase in the number of strikes (Dolbeer 2000, Dolbeer and Eschenfelder 2003). The plateau in reported strikes from 2000 to 2003 may be related to a slight (<6%) decline in air traffic after the events of September 2001 and to more aggressive wildlife hazard management programs at airports (e.g., Wenning et al. 2004).

Methods of Reporting Strikes

Most (66 percent) of the 52,493 strike reports submitted between 1990 and 2003 were filed using the paper (60 percent) or electronic (6 percent) version of FAA Form 5200-7, *Bird/Other Wildlife Strike Report*. Since the online version of this form became available in April 2001, use of the electronic reporting system has climbed dramatically. Almost 28 percent of the strike reports filed in 2003 were done using this system (Table 2).



A Piper 34 aircraft struck two red-breasted mergansers at 800 feet AGL at night (21:25 local time) on approach to a southern USA airport on 9 March 2003. The birds penetrated the left and right windshield panels. The pilot was able to land the plane safely. Feather remains were identified by the Smithsonian Feather Identification Lab. (photos provided by Air Reldan, Inc.)

Source of Reports

Pilots and airline personnel filed 28 percent and 27 percent, respectively, of these 52,493 reports (Table 3). About 84 percent of the reported strikes involved commercial aircraft; the remainder involved business, private, and miscellaneous aircraft (Table 4). Reports were received from all 50 states, from some USA territories, and from foreign countries when USA-registered aircraft were involved (Table 5). California, Florida, and Texas had the most (3,416 to 4,325) bird strike reports. Twelve other states had over 1,000 bird strikes reported. New York, Illinois, Michigan, New Jersey, Pennsylvania, and Texas each had 60 or more mammal strikes. In all, strikes were reported at 1,382 airports (1,212 airports in the USA and 170 foreign airports where USA-based aircraft were involved).

Timing of Occurrence of Strikes

Most bird strikes (51 percent) occurred between July and October (Table 6); 63 percent occurred during the day (Table 7); 58 percent occurred during the landing (descent, approach, or landing roll) phase of flight; and 39 percent occurred during takeoff and climb (Table 8). About 61 percent of the bird strikes occurred when the aircraft was at a height of 100 feet or less AGL, 74 percent occurred at 500 feet or less AGL, and 92 percent occurred at or below 3,000 feet AGL (Table 9, Figure 2).



Various medium-sized mammal species, such as these black-tailed jackrabbits at a southern USA airport in 2003, not only have the potential to be sucked into engines of jet aircraft but also serve as a food source for birds of prey.

Most mammal strikes (50 percent) occurred between August and November, with 35 percent of deer strikes concentrated in October and November (Table 6). Most mammal strikes (64 percent) occurred at night (Table 7), 52 percent occurred during the landing roll, and 33 percent occurred during the takeoff run. About 10 percent of the reported mammal strikes occurred while the aircraft was in the air, e.g., when the aircraft struck deer with the landing gear or encountered bats (Table 8).

Aircraft Components Damaged

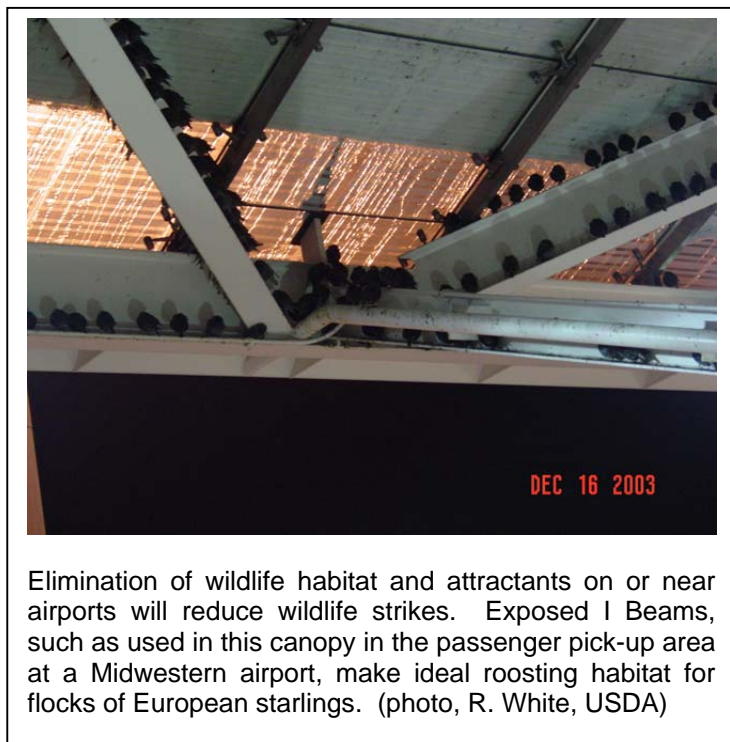
The aircraft components most commonly reported as struck by birds were the nose/radome, windshield, engine, wing/rotor, and fuselage. Aircraft engines were the component most frequently reported as being damaged by bird strikes (33 percent of all damaged components). Of the 7,511 aircraft engines reported as being struck by birds, 34 percent (2,591) were damaged (Table 10). There were 6,761, 350, 10, and 5 incidents in which one, two, three, or four engines, respectively, were struck by birds on a single aircraft. There were 2,424, 80, 1, and 1 incidents in which one, two, three, and four engines, respectively, were damaged by birds on a single aircraft.

Aircraft components most commonly reported as struck by mammals were the landing gear, propeller, and wing/rotor. These same components ranked highest for the parts most often reported as damaged by mammals (Table 10).

Reported Damage and Effect on Flight

Of the 51,154 bird strikes reported, 42,822 provided some indication as to the nature and extent of any damage. Of these 42,822 reports, 36,122 (84 percent) indicated the strike did not damage the aircraft; 3,659 (9 percent) indicated the aircraft suffered minor

damage; 1,845 (4 percent) indicated the aircraft suffered substantial damage; 1,184 (3 percent) reported an uncertain level of damage; and 12 reports (less than 1 percent) indicated the aircraft was destroyed as a result of the strike (Tables 11 and 12). In addition, the reports indicated that 103 bird strikes resulted in 124 human injuries, and 6 strikes resulted in 8 fatalities. Waterfowl (geese and ducks) were involved in 31 (39 percent) of the 79 strikes where injury or death occurred and the type of bird involved was identified (Table 13). These 31 strikes with waterfowl were responsible for 32 percent of the 98 deaths or injuries where the type of bird was identified.



Of the 1,272 mammal strikes reported, 912 reports provided some indication as to the nature and extent of any damage. Of these 912 reports, 348 (38 percent) indicated the strike did not damage the aircraft; 262 (29 percent) indicated the aircraft suffered minor damage; 247 (27 percent) indicated the aircraft suffered substantial damage; 39 (4 percent) reported an uncertain level of damage; and 16 (2 percent) indicated the aircraft was destroyed as a result of the strike (Tables 11 and 12). Not surprisingly, a much higher percentage of mammal strikes (62 percent) resulted in aircraft damage than did bird strikes (16 percent). Reports were received of

21 mammal strikes that resulted in 29 human injuries and 1 fatality. Deer were responsible for 16 (76 percent) of the mammal strikes that resulted in injury or death and for 23 (77 percent) of the 30 deaths or injuries (Table 13).

In 14 percent and 56 percent of the bird and mammal strike reports, respectively, an adverse effect-on-flight was reported (Table 14). Four percent of the bird strikes resulted in an aborted takeoff compared to 18 percent of mammal strikes.

Wildlife Species Involved in Strikes

Table 15 shows the number of reported strikes, the number of strikes that damaged one or more aircraft components, the number of strikes that had a negative effect-on-flight, the reported aircraft down time, and the reported costs by identified wildlife species for the period 1990 through 2003.

Only 21,684 (42 percent) of the 51,154 bird strike reports provided information on the type of bird (e.g., gull or hawk). Furthermore, only 11,236 (52 percent) of these 21,684 reports provided identification to species level (e.g., ring-billed gull or red-tailed hawk; Table 15). Thus, birds were identified to species level in only 22 percent of the 51,154

reported strikes. In all, 292 identified species of birds were struck; 137 identified species were reported as causing damage.

Gulls (25 percent), doves (14 percent), raptors (12 percent), and waterfowl (10 percent) were the most frequently struck bird groups (Table 16). Gulls were involved in more than twice as many strikes as waterfowl (5,323 and 2,217, respectively). Waterfowl, however, were involved in more damaging strikes (1,023 or 32 percent of all damaging strikes in which the bird type was identified) than were gulls (891 or 28 percent of all damaging strikes in which the bird type was identified). Gulls were responsible for the greatest number of bird strikes (710 or 30 percent) that had a negative effect-on-flight.



About 60 starlings were released in Central Park, New York City, in 1890 by Eugene Shieffelin in his misguided effort to have all birds mentioned by Shakespeare introduced to North America. With a population now exceeding 150 million birds, starlings are the second most abundant bird species in North America. Flocks of starlings, such as those recorded in this photo in Ohio in 2001, are strongly attracted to airports where large areas of grass often provide abundant invertebrates and seeds for food. (photo R. A. Dolbeer, USDA)

The most frequently struck mammals were Artiodactyls (primarily deer—51 percent) and Carnivores (primarily coyotes—25 percent) (Table 16). Artiodactyls were responsible for 94 percent of the mammal strikes that resulted in damage and 85 percent of the mammal strikes that had a negative effect-on-flight. In all, 38 identified species of mammals were reported struck; 17 identified species caused damage.

Losses Due to Wildlife Strikes

For the 14-year period, reported losses from bird strikes totaled 244,510 hours of aircraft downtime and \$163.51 million. Reported losses from mammal strikes totaled 211,421 hours of aircraft downtime and \$31.52 million (Table 15).

Of the 9,583 reports that indicated the strike had an adverse effect on the aircraft and/or flight, 2,630 provided an estimate of the aircraft down time ($\Sigma = 455,931$ hours, avg. = 173.4 hours down time/incident). Of the 1,759 reports providing a damage cost estimate for the incident, 1,637 gave an estimate of the direct aircraft damage cost ($\Sigma = \$169.05$ million, avg. = \$103,265 damage/incident), and 595 gave an estimate of other monetary losses ($\Sigma = \$25.99$ million, avg. = \$43,679 lost/incident, Table 17). Other monetary losses include such expenses as lost revenue, the cost of putting passengers up in hotels, re-scheduling aircraft, and flight cancellations.

Analysis of strike reports from three major USA airports showed that less than 20 percent of all strikes occurring at these airports were reported to the FAA (Cleary et al. 1996, 1997, 1998; Dolbeer et al. 1995). Additionally, many reports received by the FAA

were filed before aircraft damage had been fully assessed. As a result, the information on the number of strikes and their associated costs compiled from the voluntary reporting program is believed to severely underestimate the magnitude of the problem.

Assuming (1) all 9,583 reported wildlife strikes that had an adverse effect on the aircraft and/or flight engendered similar amounts of downtime and/or monetary losses and (2) that these reports are all of the damaging strikes that occurred, then at a minimum, wildlife strikes cost the USA civil aviation industry 118,663 hours per year of aircraft downtime and \$100.58 million in monetary losses (\$70.68 million per year in direct costs and \$29.90 million per year in associated costs, Table 17).

Further, assuming a 20 percent reporting rate, the annual cost of wildlife strikes to the USA civil aviation industry is estimated to be in excess of 593,317 hours of aircraft downtime and \$502.91 million in monetary losses (\$353.42 million per year in direct costs and \$149.49 million per year in associated costs, Table 17).

Trends in Canada Goose Strikes



The North American population of non-migratory Canada geese increased from about 1 million to 3.6 million birds, 1990–2003. During these years, Canada geese were responsible for 32% of reported costs from bird strikes to civil aircraft in USA where the bird species was identified.

Canada geese were identified in 824 reported bird strikes to civil aircraft between 1990 and 2003. In an additional 295 strikes the birds were simply identified as “geese” and in 67 strikes, as other species of geese (Table 15). Because Canada geese represented 91 percent of the geese identified to species, we believe it reasonable to assume that most of the 295 unidentified geese were in fact Canada geese. We have merged the 1,119 strikes for the two groups (Canada geese and “geese”) for the following analysis.

Being the most massive bird (typically weighing 8 to 10 pounds, Dolbeer and Eschenfelder 2003) commonly struck by aircraft, Canada geese were responsible for a disproportionate amount of damage. Canada geese were involved in 5 percent

of all reported bird strikes where the bird was identified at least to species group. However, these strikes represented 19 percent of the strikes causing damage, 28 percent of the reported aircraft down time, and 32 percent of reported costs attributable to identified birds (Table 15).

Based on Breeding Bird Survey results, the resident (non-migratory) Canada goose population in the USA increased at a mean annual rate of 8.5 percent from 1980 to 2002 (Sauer et al. 2003). Based on mid-winter and nesting season surveys conducted by the U.S. Fish and Wildlife Service, the resident Canada goose population increased at an

annual rate of 9.5 percent from about 1 million birds in 1990 to 3.6 million birds in 2003 (Seubert and Dolbeer 2004, Figure 3).

There was a significant, positive correlation between the annual increase in the Canada goose population and the annual number of reported strikes from 1990 to 1998 (Figure 3). However, the annual number of reported Canada goose strikes has declined from 1999 to 2003, even though the resident goose population has continued to grow (Figure 3). The decline in reported goose strikes during this period may be related in part to a slight (<6 percent) decline in air traffic after the events of September 2001 (Table 1). However, the decline is also likely related to aggressive management programs at airports that are targeting hazardous species such as Canada geese (e.g., Dolbeer et al. 2000, Wenning et al. 2004). For example, USDA/WS biologists provided assistance at 565 airports nationwide to reduce wildlife hazards in 2003 compared to only 193 airports in 1998 (Dolbeer 2004). We recommend a continued annual analysis of data on goose strikes, the resident goose population, and management efforts at airports to determine if this encouraging trend in strikes in relation to population levels is sustained and if additional management actions against geese are needed.



Standing water is a strong attractant to waterfowl, gulls, and wading birds such as egrets and herons. Airport managers should strive to eliminate all standing water. (photo R. A. Dolbeer, USDA)

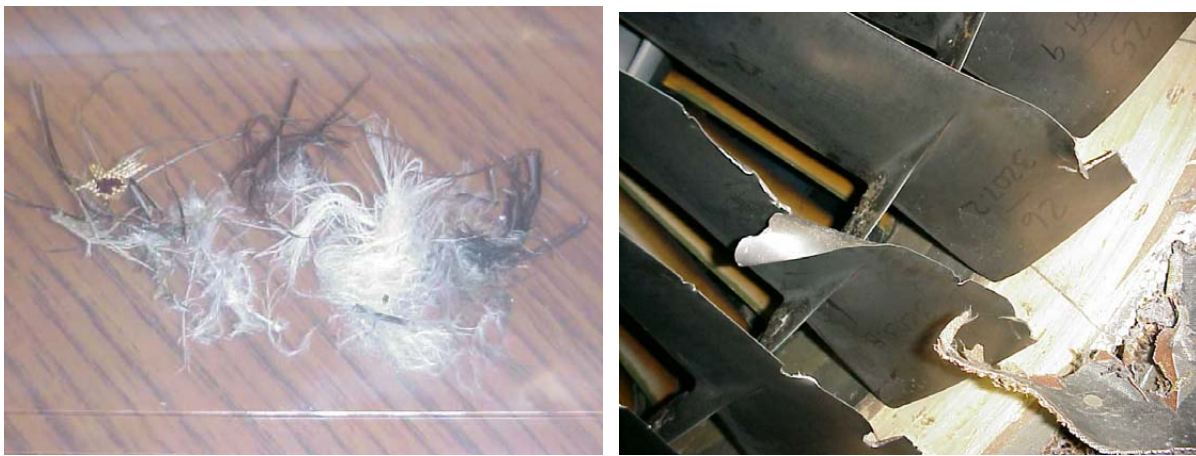
Conclusions

An analysis of 14 years of strike data reveals the magnitude and severity of the wildlife-aircraft strike problem for civil aviation in the USA. Although there are some indications that the strike rate may be leveling off or even declining for some species, wildlife strikes still pose a significant economic and safety risk for civil aviation in the USA. Management actions to reduce wildlife strikes are being implemented at many airports, but much work remains to be done to reduce wildlife strikes.

To address the problem, airport managers need to be aware of the wildlife hazards on their airports (Dolbeer et al. 2000). They must take appropriate actions, under the guidance of professional biologists trained in wildlife damage management, to minimize the problems. The aviation community must also widen its view of airport wildlife management needs to consider habitats and land uses in proximity to the airport. Wetlands, dredge spoil containment areas, waste-disposal facilities, and wildlife refuges can attract hazardous wildlife. Such land uses are often incompatible with aviation safety and should either be prohibited near airports or designed and operated in a manner that minimizes the attraction of hazardous wildlife.

The manual *Wildlife Hazard Management at Airports* (Cleary and Dolbeer 1999) provides guidance to airport personnel in developing and implementing wildlife hazard management plans. Copies of this manual (stock number 050-007-012837) can be ordered from the Superintendent of Documents, P.O. Box 321954, Pittsburgh, PA 15720-7954. Adobe Acrobat© PDF versions are available online in English, Spanish, and French at <http://wildlife-mitigation.tc.faa.gov>.

Finally, there is a need for increased and more detailed reporting of wildlife strikes. For example, our previous analysis indicated that less than 20 percent of all wildlife strikes involving USA civil aircraft are reported. Further, only about 42 percent of all reported bird strikes for the period 1990 through 2003 provided information on the type of bird struck, and only about 22 percent of the reports identified the birds struck to species level. In addition, only 18 percent of strike reports indicating an adverse effect on the aircraft or flight provided an estimate of economic losses resulting from the strike.



In March 2003, a B-757 aircraft departing an east coast USA airport struck a Canada goose that literally destroyed the engine. The bird species was identified from feather remains sent to the Smithsonian Feather Identification Laboratory. See page vi for an additional photo.

Reporting a Strike

Pilots, airport operations, aircraft maintenance personnel, and anyone else having knowledge of a strike should report the incident to the FAA. It is important to include as much information as possible on FAA Form 5200-7. All reports are carefully screened to identify duplicate reports prior to being entered into the database. Reports of the same incident filed by different people are combined and often provide a more complete record of the strike event than would be possible if just one report were filed.

The identification of the exact species of wildlife struck (e.g., ring-billed gull, Canada goose, American wigeon, mourning dove, or red-tailed hawk as opposed to gull, goose, duck, dove, or hawk) is particularly important. Bird strike remains that cannot be identified by airport personnel can often be identified by a local biologist or by sending feather and other remains in a sealed plastic bag (with FAA Form 5200-7) to —

Material sent via Express Mail Service:	Material sent via U.S. Postal Service:
Dr. Carla Dove	Dr. Carla Dove
Smithsonian Institution	Smithsonian Institution, Division of Birds
NHB, E610, MRC 116	PO Box 37012
10 th & Constitution Ave. NW	NHB, E610, MRC 116
Washington, DC 20560-0116	Washington, DC 20013-7012
(Identify as “safety investigation material”)	(Not recommended for priority cases)

Please send whole feathers whenever possible. Because diagnostic characteristics are often found in the downy barbules at the feather base. Wings, as well as breast and tail feathers should be sent whenever possible. Beaks, feet, bones, and talons are also useful diagnostic materials. Do not send entire bird carcasses through the mail.

Strikes can also be reported online at <http://wildlife-mitigation.tc.faa.gov>. in addition to the traditional means of filling out and mailing FAA Form 5200-7. A print version of FAA Form 5200-7 can be accessed at the same website.

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Tables

Table 1. Number of reported wildlife strikes to civil aircraft by wildlife group, USA, 1990–2003 (See Figure 1).

Year	Number of reported strikes				Commercial aircraft only ¹		
	Birds	Mam- mals	Rep- tiles	Total	Total	Move- ments (x 1 million) ²	Strikes/ 10,000 move- ments
1990	1,719	20	0	1,739	1,319	25.20	0.523
1991	2,122	39	0	2,161	1,651	24.92	0.663
1992	2,258	58	1	2,317	1,711	25.32	0.676
1993	2,284	59	0	2,343	1,671	25.70	0.650
1994	2,347	75	1	2,423	1,795	26.74	0.671
1995	2,498	73	8	2,579	1,877	27.23	0.689
1996	2,690	92	3	2,785	1,937	27.75	0.698
1997	3,351	94	15	3,460	2,460	27.92	0.881
1998	3,653	108	7	3,768	2,519	28.17	0.894
1999	4,992	96	1	5,089	3,842	28.95	1.327
2000	5,840	136	3	5,979	4,452	29.71	1.498
2001	5,613	145	8	5,766 ³	4,131	29.37	1.407
2002	5,993	136	15	6,144	4,392	27.80	1.580
2003	5,794	141	5	5,940	4,268	28.07	1.520
Total	51,154	1,272	67	52,493	38,005	382.84	0.993

¹ See Table 4.

² Departures and arrivals by air carrier, commuter, and air taxi service (FAA 2004).

³ The decline in reported strikes in 2001 was likely related at least in part to the decrease in air travel after 11 September. There was a 9 percent increase in the number of reported strikes for January–August 2001 compared to the same months in 2000; there was a 24 percent decline in reported strikes for September–December 2001 compared to the same months in 2000.

Table 2. Source of information for reported wildlife strikes to civil aircraft, USA, 1990–2003.

Source	14-year total	% of total known
FAA Form 5200-7 (Paper) ¹	31,497	60
FAA Form 5200-7E (Electronic) ²	2,948	6
Airline Report	7,003	13
Multiple ³	4,704	9
Airport Report	2,861	5
Other ⁴	1,059	2
Engine Manufacturer	793	2
Aircraft Incident Report	720	1
Preliminary Aircraft Incident Report	628	1
Aviation Safety Reporting System	152	<1
Aircraft Incident Preliminary Notice	60	<1
National Transportation Safety Board	57	<1
U.S. Air Force BASH Program	11	<1
Total	52,493	100

¹ Bird/Other Wildlife Strike Report

² Electronic filing of reports (<http://wildlife-mitigation.tc.faa.gov>) began in April 2001. In 2001, 0.4 percent of reports were filed electronically compared to 20.6 percent in 2002 and 27.8 percent in 2003.

³ More than one report was filed for the same strike.

⁴ Various sources, such as news media and Commercial Incident Reports.

Table 3. Person filing report of wildlife strike to civil aircraft, USA, 1990–2003.

Person filing report	14-year total	% of total known
Airline Operations	11,313	28
Pilot	10,762	27
Tower	6,672	17
Carcass Found ¹	5,809	15
Airport Operations	3,971	10
Other	1,520	4
Total known	40,047	100
Unknown	12,446	
Total	52,493	

¹ Airport operations personnel found wildlife remains within 200 feet of a runway centerline that appeared to have been struck by aircraft and no strike was reported by pilot, tower, or airline.

Table 4. Number of reported wildlife strikes to civil aircraft by type of operator, USA, 1990–2003.

Type of operator	14-year total	% of total known
Commercial	38,005	84
Business	5,596	12
Private	1,567	4
Government/Police	266	<1
Total known	45,434	100
Unknown	7,059	
Total	52,493	

Table 5. Number of reported bird, mammal, and reptile strikes to civil aircraft by USA state, including the District of Columbia (DC), Puerto Rico (PR), USA-possessed Pacific Islands (PI), and the U.S. Virgin Islands (VI), 1990–2003.

State	Reported strikes				State	Reported strikes			
	Birds	Mammals	Reptiles	Total		Birds	Mammals	Reptiles	Total
AK	393	14	0	407	NC	997	20	0	1,017
AL	489	12	0	501	ND	121	3	0	124
AR	222	13	0	235	NE	461	13	0	474
AZ	712	51	0	763	NH	297	10	0	307
CA	4,325	54	0	4,379	NJ	1,427	67	7	1,501
CO	1,290	59	0	1,349	NM	94	2	0	96
CT	561	16	0	577	NV	248	3	0	251
DC	1,307	30	0	1,337	NY	2,903	96	10	3,009
DE	36	1	0	37	OH	1,626	53	0	1,679
FL	3,622	49	40	3,711	OK	470	19	2	491
GA	866	15	0	881	OR	810	8	0	818
HI	1,047	4	0	1,051	PA	1,962	63	0	2,025
IA	335	12	0	347	PI	80	0	0	80
ID	102	5	0	107	PR	85	0	5	90
IL	2,521	71	1	2,593	RI	209	7	0	216
IN	527	11	0	538	SC	248	12	0	260
KS	148	5	0	153	SD	82	6	0	88
KY	1,203	12	0	1,215	TN	1,328	15	0	1,343
LA	949	18	1	968	TX	3,416	60	0	3,476
MA	684	12	0	696	UT	535	10	0	545
MD	556	40	0	596	VA	735	42	0	777
ME	157	8	0	165	VI	67	0	0	67
MI	1,248	70	0	1,318	VT	41	1	0	42
MN	435	13	0	448	WA	785	11	0	796
MO	1,040	26	0	1,066	WI	437	43	0	480
MS	171	4	0	175	WV	123	45	0	168
MT	61	5	0	66	WY	39	4	0	43
				Total known¹	44,633	1,243	66	45,942	
				Foreign²	983	8	0	991	
				Unknown	5,538	21	1	5,560	
				Total	51,154	1,272	67	52,493	

¹ Strikes were reported at 1,212 airports in the USA.

² Strikes to USA air carriers were reported at 170 foreign airports.

Table 6. Number of reported bird and mammal strikes to civil aircraft by month, USA, 1990–2003.

Month	All birds		All mammals		Deer only ²	
	14-year total	% of total known	14-year total	% of total known	14-year total	% of total known
Jan	1,969	4	60	5	27	4
Feb	1,806	4	50	4	21	3
Mar	2,712	5	73	6	31	5
Apr	3,537	7	83	7	40	7
May	4,729	9	65	5	27	4
Jun	3,806	7	102	8	45	7
Jul	5,678	11	127	10	50	8
Aug	6,845	13	154	12	50	8
Sep	6,919	14	150	12	64	10
Oct	6,685	13	171	13	85	14
Nov	4,100	8	168	13	126	21
Dec	2,368	5	69	5	48	8
Total	51,154	100	1,272	100	614	100

¹ In addition, 67 strikes with reptiles were reported of which 16 (24%) occurred in September.

² Deer strikes comprised 574 white-tailed deer, 24 mule deer, and 16 deer not identified to species. Other wild ungulates reported struck (but not included in this column of table) were 8 elk, 7 pronghorns, 7 moose, and 1 caribou.

Table 7. Reported time of occurrence of wildlife strikes to civil aircraft, USA, 1990–2003.

Time of day	Birds		Mammals	
	14-year total	% of total known	14-year total	% of total known
Dawn	1,567	4	23	3
Day	22,632	63	200	24
Dusk	1,922	5	81	10
Night	9,562	27	536	64
Total known	35,683	100	840	100
Unknown	15,471		432	
Total¹	51,154		1,272	

¹ In addition, 67 strikes with reptiles were reported: 56 reported no time of day, and 6 occurred during the day, 3 at night, 1 at dawn, and 1 at dusk.

Table 8. Reported phase of flight at time of wildlife strikes to civil aircraft, USA, 1990–2003.

Phase of flight	Birds		Mammals	
	14-year total	% of total known	14-year total	% of total known
Parked	24	<1	0	0
Taxi	161	<1	24	3
Takeoff run	7,810	20	318	33
Climb	7,327	19	26	2
En route	1,148	3	1	<1
Descent	1,463	4	4	<1
Approach	15,065	38	82	8
Landing roll	6,461	16	498	52
Total known	39,459	100	953	100
Unknown	11,695		319	
Total¹	51,154		1,272	

¹ In addition, 67 strikes with reptiles were reported.

Table 9. Number of reported bird strikes to civil aircraft by height (feet) above ground level (AGL), USA, 1990–2003 (see Figure 2).

Height of strike (feet AGL)	Reported strikes			Strikes with damage		
	14-year total	% of total known	% cumulative total	14-year total	% of total known	% cumulative total
0	14,471	41	41	1,383	27	27
1-100	6,716	19	61	860	17	44
101-200	1,704	5	65	233	5	49
201-300	1,126	3	69	158	3	52
301-400	682	2	71	115	2	54
401-500	1,204	3	74	191	4	58
501-600	333	1	75	68	1	59
601-700	262	1	76	54	1	60
701-800	561	2	77	123	2	63
801-900	186	1	78	60	1	64
901-1,000	1,002	3	81	224	4	68
1,001-2,000	2,570	7	88	649	13	81
2,001-3,000	1,517	4	92	375	7	89
3,001-4,000	776	2	95	164	3	92
4,001-5,000	575	2	96	110	2	94
5,001-10,000	1,062	3	99	223	4	98
10,001-20,000	237	<1	99	75	1	99
20,001-30,000	11	<1	99	7	<1	100
>30,000	1	<1	100	1	<1	100
Total known	34,996	100		5,073	100	
Unknown	16,158			1,627		
Total	51,154			6,700		

Table 10. Civil aircraft components reported as being struck and damaged by wildlife, USA, 1990–2003.

Aircraft component	Birds (14-year total)				Mammals (14-year total)			
	Number struck	% of total	Number damaged	% of total	Number struck	% of total	Number damaged	% of total
Radome/nose	12,044	26	1,201	15	69	6	65	6
Windshield	8,145	18	482	6	16	1	11	1
Engine(s)	7,511 ²	16	2,591 ²	33	98	8	95	9
Wing/rotor	6,243	14	1,751	22	144	12	141	14
Fuselage	5,726	12	275	3	82	7	91	9
Landing gear	2,252	5	249	3	452	37	239	24
Propeller	1,415	3	153	2	169	14	157	15
Tail	693	2	305	4	37	3	45	4
Light	386	1	305	4	15	1	22	2
Other	1,675	4	631	8	146	12	148	14
Total¹	46,090	100	7,943	100	1,228	100	1,014	100

¹ Of the 67 reported reptile strikes, 15 indicated the part struck and 5 indicated the strike damaged an aircraft component: Windshield (1 struck, 1 damaged); Wing/rotor (1 struck, 1 damaged); Fuselage (1 struck, 1 damaged); Landing gear (10 struck, 0 damaged); Tail (1 struck, 1 damaged); and Other (1 struck, 1 damaged).

² There were 7,126 bird strike incidents in which a total of 7,511 engines were reported as struck (6,761 incidents with one engine struck, 350 with two engines, 10 with three engines, and 5 with four engines). In 2,506 (35%) of these 7,126 strike incidents, a total of 2,591 engines were damaged (2,424 incidents with one engine damaged, 80 with two engines, one with three engines, and one with four engines).

Table 11. Number of civil aircraft with reported damage resulting from wildlife strikes, USA, 1990–2003.

Damage category ²	Reported strikes					
	Birds		Mammals		Total ¹	
	14-year total	% of total known	14-year total	% of total known	14-year total	% of total known
None	36,122	84	348	38	36,481	83
Damage	6,700	16	564	62	7,265	17
Minor	3,659	9	262	29	3,921	9
Uncertain	1,184	3	39	4	1,223	3
Substantial	1,845	4	247	27	2,093	5
Destroyed	12	<1	16	2	28	<1
Total known	42,822	100	912	100	43,746	100
Unknown	8,332		360		8,747	
Total	51,154		1,272		52,493	

¹ Included in totals are 67 strikes involving reptiles of which 11 reports indicated no damage, 55 failed to report damage (if any), and 1 reported substantial damage.

² The damage codes and descriptions follow the *International Civil Aviation Organization Bird Strike Information System (1989)*: Minor = the aircraft can be rendered airworthy by simple repairs or replacements and an extensive inspection is not necessary; Uncertain = the aircraft was damaged, but details as to the extent of the damage are lacking; Substantial = the aircraft incurs damage or structural failure that adversely affects the structure strength, performance, or flight characteristics of the aircraft and that would normally require major repair or replacement of the affected component (specifically excluded are bent fairings or cowlings; small dents or puncture holes in the skin; damage to wing tips, antenna, tires, or brakes; and engine blade damage not requiring blade replacement); Destroyed = the damage sustained makes it inadvisable to restore the aircraft to an airworthy condition.

Table 12. Identified wildlife species groups involved in reported strikes with civil aircraft that resulted in damage, USA, 1990–2003 (page 1 of 2).

Species group ¹	Number of strikes by damage category ²					% of total known
	De-stroyed	Sub-stantial	Minor	Un-certain	Total	
Birds						
Loons		5	2		7	0.2
Grebes		3			3	0.1
Albatroses/shearwaters			1		1	0.0
Tropicbirds		1	1		2	0.1
Pelicans	1	4	8	3	16	0.5
Cormorants		6	5	3	14	0.4
Anhinga		1	2		3	0.1
Frigatebirds		1	2		3	0.1
Hérons/bitterns		8	22	6	36	1.1
Egrets		15	19	6	40	1.2
Storks/ibis		1		2	3	0.1
Waterfowl	2	307	530	184	1,023	31.8
Raptors	1	158	296	82	537	16.7
Grouse/pheasants/turkeys		11	15	2	28	0.9
Cranes		7	14		21	0.7
Rails/gallinules		2	3	2	7	0.2
Shorebirds		13	14	13	40	1.2
Gulls	1	285	452	153	891	27.7
Terns			4		4	0.1
Pigeons/doves		99	90	56	245	7.6
Cuckoos			1		1	0.0
Owls		19	21	6	46	1.4
Nightjars			2		2	0.1
Swifts			2		2	0.1
Woodpeckers			1		1	0.0
Misc. Perching birds				1	1	0.0
Flycatchers		1			1	0.0
Larks		3	2	1	6	0.2
Swallows		3	6	3	12	0.4
Starlings		17	25	12	54	1.7
Crows/jays/magpies		12	23	3	38	1.2
Wrens				1	1	0.0
Mimics			1		1	0.0
Thrushes		3	7	2	12	0.4
Meadowlarks		3	1	1	5	0.2
Blackbirds/orioles		16	45	16	77	2.4

Table 12. Continued (page 2 of 2).

Species group ¹	Number of strikes by damage category ²					% of total known
	De- stroyed	Sub- stantial	Minor	Un- certain	Total	
Birds (continued)						
Buntings		2		1	3	0.1
Sparrows		3	21	6	30	0.9
Total known birds	5	1,009	1,638	565	3,217	100.0
Unknown birds	7	836	2,021	619	3,483	
Total birds	12	1,845	3,659	1,184	6,700	
Mammals						
Xenarthras (armadillos)			1		1	0.2
Chiropteras (bats)		2	2		4	0.7
Lagomorphs (rabbits/hares)			1		1	0.2
Rodents			2		2	0.4
Carnivores	1	5	15	2	23	4.1
Artiodactyls (deer/cattle)	15	235	238	36	524	93.9
Perissodactyls (horse)		3			3	0.5
Total known mammals	16	245	259	38	558	100.0
Unknown mammals		2	3	1	6	
Total mammals	16	247	262	39	564	
Reptiles						
Alligators	0	1	0	0	1	100
Total known (all species)	21	1,255	1,897	603	3,776	
Total unknown	7	838	2,024	620	3,489	
Total	28	2,093	3,921	1,223	7,265	

¹ See Table 15 for a listing of species within each species group.

² The damage codes and descriptions follow the *International Civil Aviation Organization Bird Strike Information System (1989)*: Minor = the aircraft can be rendered airworthy by simple repairs or replacements and an extensive inspection is not necessary; Uncertain = the aircraft was damaged, but details as to the extent of the damage are lacking; Substantial = the aircraft incurs damage or structural failure that adversely affects the structure strength, performance, or flight characteristics of the aircraft and that would normally require major repair or replacement of the affected component (specifically excluded are bent fairings or cowlings; small dents or puncture holes in the skin; damage to wing tips, antenna, tires, or brakes; and engine blade damage not requiring blade replacement); Destroyed = the damage sustained makes it inadvisable to restore the aircraft to an airworthy condition.

Table 13. Wildlife species involved in strikes with civil aircraft causing human injury or fatality, USA, 1990–2003 (page 1 of 2).

Wildlife group	Species or species group	Injuries		Fatalities	
		No. of strikes causing injuries	No. of injuries	No. of strikes causing fatalities	No. of fatalities
Birds	Unknown bird	25	27	5	7
	Ducks	11	13		
	Canada goose	11	12		
	Turkey vulture	7	9		
	Gulls	7	8		
	Ring-billed gull	1	7		
	Vultures	7	7		
	American kestrel	1	5		
	Geese	5	5		
	Red-tailed hawk	3	4		
	Hawks	2	3		
	Black vulture	2	2		
	Mallard	2	2		
	Osprey	2	2		
	Rock dove	2	2		
	Sharp-tailed grouse	1	2		
	American coot	1	1		
	Double-crested cormorant	1	1		
	Doves	1	1		
	Egrets	1	1		
	Golden eagle	1	1		
	Great frigatebird	1	1		
	Herring gull	1	1		
	Horned grebe	1	1		
	Lesser scaup	1	1		
	Owls	1	1		
	Red-tailed tropicbird	1	1		
	Sandhill crane	1	1		
	Snow goose	1	1		
	Western grebe	1	1		
Brown pelican			1	1	
	Total birds	103	124	6	8

Table 13. Continued (page 2 of 2).

Wildlife group	Species or species group	Injuries		Fatalities	
		No. of strikes causing injuries	No. of injuries	No. of strikes causing fatalities	No. of fatalities
Mammals	White-tailed deer	14	20	1	1
	Cattle	2	3		
	Domestic dog	1	2		
	Mule deer	1	2		
	Deer	1	1		
	Horse	1	1		
Total mammals		20	29	1	1
All species	Total	123	153	7	9

Table 14. Reported effect-on-flight of wildlife strikes to civil aircraft, USA, 1990–2003.

Effect-on-flight ²	Reported strikes					
	Birds		Mammals		Total ¹	
	14-year total	% of total known	14-year total	% of total known	14-year total	% of total known
None	26,493	86	315	44	26,821	85
Negative effect	4,316	14	403	56	4,726	15
Precautionary landing	2,235	7	63	9	2,299	7
Aborted takeoff	1,072	4	130	18	1,202	4
Engine shutdown	251	1	22	3	273	1
Other	758	3	188	26	952	3
Total known	30,809	100	718	100	31,547	100
Unknown	20,345		554		20,946	
Total	51,154		1,272		52,493	

¹ Included in totals are 67 strikes involving reptiles of which 13 reports indicated no effect-on-flight, 47 failed to report an effect-on-flight (if any), 1 reported a precautionary landing, and 6 reported “other”.

² Effect-on-flight: None = flight continued as scheduled, although delays and other cost caused by inspections or repairs may have been incurred after landing; Aborted takeoff = pilot aborted the takeoff; Precautionary landing = pilot landed at other-than-destination airport after strike; Engine shut down = pilot shut down the engine or the engine stopped running because of strike; Other = miscellaneous effects, such as reduced speed because of shattered windshield, emergency landing at destination airport, or crash landing; Unknown = report did not give sufficient information to determine an effect-on-flight (Dolbeer et al. 2000).

Table 15. Number of reported strikes, strikes causing damage, strikes having a negative effect-on-flight (EOF), total reported aircraft downtime, and total reported costs by identified wildlife species for civil aircraft, USA, 1990–2003 (page 1 of 12).

	14-year totals				
	No. of strikes	No. with damage	No. with neg. EOF	Aircraft down time (hrs)	Reported costs (\$)
Birds					
Loons	10	7	4	2,789	257,200
Loons	3	3	2	557	251,200
Common loon	7	4	2	2,232	6,000
Grebes	24	3	3	82	117,772
Grebes	5				
Eared grebe	5	1		10	100,000
Western grebe	5	1	1		
Pied-billed grebe	4		1		
Horned grebe	4	1	1	72	17,772
Red-necked grebe	1				
Albatrosses/shearwaters	10	1		2	
Albatrosses	2	1		2	
Laysan albatross	1				
Bonin petrel	1				
Wedge-tailed shearwater	3				
Townsend's shearwater	2				
Fork-tailed storm-petrel	1				
Tropicbirds	3	2	2	10	10,800
Tropicbirds	1	1	1	10	5,200
Red-tailed tropicbird	2	1	1		5,600
Pelicans	32	16	11	117	36,000
Pelicans	3	2		80	
Australian pelican	1	1	1		
Brown pelican	28	13	10	37	36,000
Cormorants	30	14	8	72	1,893,600
Cormorants	3	1			
Great cormorant	2	1			
Double-crested cormorant	24	12	8	72	1,893,600
Pelagic cormorant	1				
Anhinga	10	3	3	92	3,800
Frigatebirds	7	3	1	3	4,900
Great frigatebird	5	2	1	3	4,900
Magnificent frigatebird	2	1			
Hérons/bitterns	214	36	24	807	2,048,792
Hérons	37	11	6	98	3,000
Great blue heron	118	22	17	191	2,011,592

Table 15. Continued (page 2 of 12)

	14-year totals				
	No. of strikes	No. with damage	No. with neg. EOF	Aircraft down time (hrs)	Reported costs (\$)
Black-crowned night-heron	11	2		14	31,000
Little blue heron	1				
Green heron	2				
Yellow-crwnd night heron	1				
American bittern	1	1	1	504	3,200
Yellow bittern	43				
Egrets	333	40	50	3,632	2,806,240
Egret	224	28	35	3,451	965,140
Cattle egret	78	8	12	61	300
Great egret	19	2	3	96	1,840,800
Snowy egret	12	2		24	
Storks/ibis	17	3	3	1	
White stork	1	1			
Wood stork	2				
Ibises	7		1		
Glossy ibis	1				
White ibis	3	1	1		
White-faced ibis	2	1			
Roseate spoonbill	1		1	1	
Waterfowl	2,217	1,023	477	64,008	55,664,017
Ducks, geese, swans	109	56	25	641	747,775
Ducks	537	191	87	4,105	3,559,292
American wigeon	11	8	4	238	867,089
Northern pintail	17	13	6	862	50,889
Green-winged teal	8	3	2	54	235,250
Blue-winged teal	6	4	1	97	600,000
European wigeon	1				
Mallard	269	71	35	2,614	1,361,959
Common eider	2	2	1		
Ring-necked duck	4	2	2	48	9,568
Greater scaup	1	1	1		
Wood duck	11	4	2	54	38,000
Muscovy duck	1	1		120	443,332
Red-breasted merganser	1	1			
Hooded merganser	1	1			
Common merganser	1	1	1	72	2,500
Northern shoveler	10	6	2	600	1,043,300
Gadwall	8	1	1		
Canvasback	3	1			
American black duck	8	2			
Mottled duck	2	1	1	24	

Table 15. Continued (page 3 of 12)

	14-year totals				
	No. of strikes	No. with damage	No. with neg. EOF	Aircraft down time (hrs)	Reported costs (\$)
Lesser scaup	6	4	1	480	
Ruddy duck	4	1			8,446
Redhead	1	1			
Bufflehead	2				
Geese	295	166	77	15,965	1,839,746
Snow goose	50	36	18	3,001	9,326,726
Canada goose	824	433	205	34,457	34,745,317
Brant	13	6	3	40	1,271
Greater white-fronted goose	3	2	1	200	653,767
Emperor goose	1				
Swans	2	1			
Mute swan	2				
Tundra swan	3	3	1	336	129,790
Raptors	2,666	537	351	51,636	12,912,421
Hawks, eagles, vultures	23	12	5	255	9,050
Vultures	175	104	52	14,571	750,175
Black vulture	21	13	13	4,609	365,987
Turkey vulture	178	102	64	14,206	2,114,681
Lappet-faced vulture	1	1	1	240	4,000,000
Osprey	75	17	9	1,579	183,700
Kites, eagles, hawks	3	1	1		
Kites	4	3			
Black kite	1		1		
Eagles	4	2	1		
Bald eagle	58	23	17	4,468	156,974
Golden eagle	2	1	1	72	1,000
Hawks	695	151	97	8,111	769,868
Red-tailed hawk	477	87	64	2,865	3,728,143
Rough-legged hawk	6				
Red-shouldered hawk	9	1		39	900
Swainson's hawk	8				
Sharp-shinned hawk	5				
Cooper's hawk	4				
Ferruginous hawk	1				
Broad-winged hawk	3				
Harris's hawk	1				
Common buzzard	1			24	
Northern harrier	35	1			200,000
Falcons	26	2	3	80	30,000
Peregrine falcon	52	6	2	30	235,500

Table 15. Continued (page 4 of 12)

	14-year totals				
	No. of strikes	No. with damage	No. with neg. EOF	Aircraft down time (hrs)	Reported costs (\$)
Gyr Falcon	1				
Merlin	17		2	3	130
American kestrel	780	10	18	484	366,313
Grouse/pheasants/turkeys	105	28	24	510	484,287
Grouse	5	2		2	
Greater sage grouse	2	2	2		226,077
Sharp-tailed grouse	1	1	1	24	500
Ptarmigans	5	3	1	33	54,500
Quails, pheasants	1				
Black francolin	1				
Quails	6		2		
Northern bobwhite	5	2	3	73	800
Pheasants	1			1	
Ring-necked pheasant	46	10	8	14	2,000
Gray partridge	3	2	1	24	120
Chukar	1				
Grey francolin	1				
Guineafowl	1	1			
Wild turkey	26	5	6	339	200,290
Cranes	58	21	18	2,209	364,760
Cranes	14	4	5	34	250,300
Sandhill crane	44	17	13	2,175	114,460
Rails/gallinules	30	7	2	99	611,486
Rails	1	1			
Sora	1				
Common moorhen	1				
American coot	22	6	2	99	611,486
Purple gallinule	2				
Virginia rail	1				
Clapper rail	2				
Shorebirds	995	40	59	571	2,553,956
Shorebirds	14				
American oystercatcher	15				
Plovers	24		2		
European golden-plover	3				
American golden-plover	18		1		
Black-bellied plover	16	2	2	12	38,622
Snowy plover	1				
Killdeer	468	18	23	167	2,268,153
Pacific golden-plover	183	1	3	15	1,200

Table 15. Continued (page 5 of 12)

	14-year totals				
	No. of strikes	No. with damage	No. with neg. EOF	Aircraft down time (hrs)	Reported costs (\$)
Semipalmated plover	8				
Northern lapwing	1	1	1	25	
Southern lapwing	1	1	1		8,000
Sandpipers	105	8	15	159	106,560
Upland sandpiper	47	4	5	12	1,000
Spotted sandpiper	2				
Willet	3				
Common snipe	14	2	1		12,615
American woodcock	9		1		
Dunlin	4				
Bairds' sandpiper	1				
Western sandpiper	14	1		60	94,311
Pectoral sandpiper	1				
Sanderling	3		1	0	
Buff-breasted sandpiper	4				
Ruddy turnstone	2				
Least sandpiper	12		1	1	
Semipalmated sandpiper	5				
Lesser yellowlegs	2				
Short-billed dowitcher	2				
Hudsonian godwit	1	1	1	96	23,495
Solitary sandpiper	1				
Whimbrel	5	1	1	24	
Long-billed curlew	2				
American avocet	3				
Black-necked stilt	1				
Gulls	5,323	891	710	33,975	20,049,658
Gulls	4,304	771	610	31,556	15,697,820
Herring gull	321	47	47	330	1,377,145
Mew gull	13	2	1		1,000
Ring-billed gull	424	39	29	1,585	1,689,391
Glaucous-winged gull	16	7	1	181	46,445
Great black-backed gull	40	6	4	27	250,000
Franklin's gull	12	1	1		
Laughing gull	137	6	8	103	247,000
Bonaparte's gull	10	2	2		65,000
Western gull	28	7	4	92	540,857
California gull	14	2	2	101	135,000
Heermann's gull	1				
Thayer's gull	1				
Yellow-legged gull	2	1	1		

Table 15. Continued (page 6 of 12)

	14-year totals				
	No. of strikes	No. with damage	No. with neg. EOF	Aircraft down time (hrs)	Reported costs (\$)
Terns	61	4	1	4	
Terns	30	2			
Caspian tern	6				
Common tern	7				
Gull-billed tern	1				
Arctic tern	3	1			
Forster's tern	4		1	4	
Least tern	4				
Black noddy	3				
Brown noddy	2				
Black skimmer	1	1			
Pigeons/doves	2,966	245	264	12,664	5,963,973
Pigeons, doves	11	1	1	24	400
Pigeons	21	3	3	26	46,050
Doves	564	39	57	498	584,325
Rock dove	971	132	110	11,164	3,678,973
Racing pigeon	12	2	1		
Mourning dove	1,308	66	91	952	1,654,225
Spotted dove	13	2	1		
Zebra dove	41				
Inca dove	13				
Philippine turtle dove	4				
White-winged dove	6				
Common ground-dove	2				
Parrots	6				
Parrots	4				
Budgerigar	1				
Black-hooded parakeet	1				
Cuckoos	4	1			
Cuckoos	1				
Yellow-billed cuckoo	3	1			
Owls	514	46	24	1,170	2,704,683
Owls	193	21	13	956	296,875
Barn owl	182	9	4	89	672,750
Snowy owl	32	3	2	18	27,500
Short-eared owl	39	1	1	11	
Long-eared owl	6	2	1		
Northern saw-whet owl	3				
Burrowing owl	18	1			
Barred owl	3	1	1		
Eastern screech owl	2	1		24	7,558

Table 15. Continued (page 7 of 12)

	14-year totals					Reported costs (\$)
	No. of strikes	No. with damage	No. with neg. EOF	Aircraft down time (hrs)		
Great horned owl	36	7	2	72		1,700,000
Nightjars	62	2				
Nightjars	1	1				
Common nighthawk	54	1				
Whip-poor-will	2					
Common poorwill	2					
Lesser nighthawk	3					
Swifts	45	2				
Swifts	7	1				
Chimney swift	31	1				
Vaux's swift	1					
White-throated swift	6					
Anna's hummingbird	1					
Belted kingfisher	6					
Woodpeckers	24	1	2			
Woodpeckers	7		1			
Northern flicker	14	1				
Yellow-bellied sapsucker	2		1			
Hairy woodpecker	1					
Misc. perching birds	42	1				
Perching birds	8	1				
Red-vented bulbul	1					
Wrentit	1					
American pipit	3					
Cedar waxwing	7					
Loggerhead shrike	2					
Japanese white-eye	1					
House sparrow	19					
Flycatchers	25	1	3			9,800
Tyrant flycatchers	2					
Eastern wood-pewee	1					
Great crested flycatcher	1					
Eastern kingbird	4	1	1			9,800
Scissor-tailed flycatcher	14		2			
Acadian flycatcher	1					
Western kingbird	1					
Ash-throated flycatcher	1					
Larks	232	6	5	5		250
Eurasian skylark	4					
Horned lark	228	6	5	5		250

Table 15. Continued (page 8 of 12)

	14-year totals				
	No. of strikes	No. with damage	No. with neg. EOF	Aircraft down time (hrs)	Reported costs (\$)
Swallows	732	12	22	131	40,532
Swallows	295	4	17	20	
Purple martin	40	2			
Bank swallow	36	1		1	
Barn swallow	225	3	2	99	27,282
Cliff swallow	62	2	1	8	13,250
Tree swallow	69		2	3	
Violet-green swallow	4				
N. rough-winged swallow	1				
Starlings	1,194	54	79	1,071	2,470,374
European starling	1,167	53	78	1,069	2,470,374
Myna	2				
Common myna	25	1	1	2	
Crows/jays/magpies	382	38	36	5,761	1,376,558
Crows	176	14	14	89	82,500
American crow	172	18	17	5,561	1,265,013
Carrion crow	1				
Northwestern crow	1				
Blue jay	5				
Ravens	5	2	1	74	24,990
Common raven	11	2	2	36	3,500
Black-billed magpie	3	2	2	1	555
Yellow-billed magpie	8				
Chickadees	8				
Chickadees	3				
Black-capped chickadee	5				
Wrens	33	1	1		
Wrens	32	1	1		
Rock wren	1				
Mimics	42	1	2		120
Brown thrasher	5				120
Mockingbirds	4				
Northern mockingbird	27	1	2		
Gray catbird	6				
Thrushes	184	12	10	41	51,930
Thrushes	10	2			
Western bluebird	2			3	
Swainson's thrush	6	1			
American robin	161	9	9	38	51,930
Hermit thrush	1				
Eastern bluebird	2				

Table 15. Continued (page 9 of 12)

	14-year totals				
	No. of strikes	No. with damage	No. with neg. EOF	Aircraft down time (hrs)	Reported costs (\$)
Gray-cheeked thrush	1				
Varied thrush	1		1		
Vireos	3				
Yellow-throated vireo	1				
Warbling vireo	1				
Cassin's vireo	1				
Warblers	26				
Wood warblers	16				
Canada warbler	1				
Yellow-breasted chat	2				
Black and white warbler	1				
Ovenbird	1				
Wilson's warbler	1				
Common yellowthroat	1				
American redstart	1				
Nashville warbler	1				
Townsend's warbler	1				
Meadowlarks	322	5	12	30	136,952
Meadowlarks	40	1	3	10	
Eastern meadowlark	190	2	4	4	
Western meadowlark	92	2	5	16	136,952
Blackbirds/orioles	1,016	77	77	1,344	905,775
Blackbirds	882	63	62	478	752,025
Brown-headed cowbird	18	1	1	1	
Bobolink	2		1		
Red-winged blackbird	35	1	3	2	750
Yellow-headed blackbird	5	1	1		
Brewer's blackbird	3				
Grackles	35	5	2	722	108,000
Common grackle	18	4	5	120	45,000
Boat-tailed grackle	4	1	1	20	
Great-tailed grackle	4				
Orioles	5				
Baltimore oriole	2				
Scarlet tanager	2	1			
Western tanager	1		1	1	
Finches	58		4	50	5,000
Finches	31		3	2	
Lapland longspur	2				
Dark-eyed junco	4		1	48	5,000

Table 15. Continued (page 10 of 12)

	14-year totals				
	No. of strikes	No. with damage	No. with neg. EOF	Aircraft down time (hrs)	Reported costs (\$)
Rose-breasted grosbeak	1				
Pine siskin	1				
Purple finch	1				
American goldfinch	9				
House finch	6				
Smith's longspur	1				
Red-crested cardinal	2				
Buntings	81	3	11	15	
Snow bunting	70	2	11	15	
Lazuli bunting	1				
Lark bunting	10	1			
Sparrows	1,479	30	60	38	7,350
Sparrows	1,425	28	60	38	2,250
Savannah sparrow	27	1			1,000
Fox sparrow	3	1			4,100
White-throated sparrow	5				
Golden crowned sparrow	1				
Field sparrow	1				
Lark sparrow	1				
White-crowned sparrow	2				
Grasshopper sparrow	2				
Java sparrow	1				
Vesper sparrow	2				
Chipping sparrow	1				
Lincoln's sparrow	1				
Song sparrow	7				
Towhees	4				
Rufous-sided towhee	3				
Green-tailed towhee	1				
Mannikins	48		1	3	2,000
Mannikins	16				
Nutmeg mannikin	10			1	
Chestnut mannikin	22		1	2	2,000
Total known birds	21,684	3,217	2,364	182,942	113,494,986
Unknown birds	29,470	3,483	1,952	61,568	50,014,118
Total birds	51,154	6,700	4,316	244,510	163,509,104

Table 15. Continued (page 11 of 12)

	14-year totals				
	No. of strikes	No. with damage	No. with neg. EOF	Aircraft down time (hrs)	Reported costs (\$)
Mammals					
Marsupials (opossums)	30				
Xenarthras (armadillos)	14	1	1	8	700
Chiropteras (bats)	96	4	2	72	3,076,015
Bats	74	2			6,615
Old world fruit bats	3	1	2	72	3,069,400
Red bat	6	1			
Hoary bat	1				
Eastern small-footed myotis	1				
Little brown bat	4				
Free-tailed bat	1				
Brazilian free-tailed bat	6				
Lagomorphs (rabbits/hares)	88	1	3	6	
Black-tailed jackrabbit	35				
Rabbits	23		1	6	
Eastern cottontail rabbit	30	1	2		
Rodents	74	2	1		
Rodents	1				
Prairie dog	3				
Woodchuck	50	2	1		
Woodrats	2				
Muskrat	7				
Black rat	1				
Norway rat	3				
North American porcupine	7				
Carnivores	312	23	48	11,847	696,564
Canids	3		1		
Coyote	150	13	30	9,673	660,628
Domestic dog	18	4	11		
Fox	40	3		10	750
Red fox	17		2		
Common gray fox	2	1	1	2	186
Raccoon	29	1	2	2,160	35,000
White-nosed coati	1				
Ringtail	1				
Skunks	5		1	2	
Striped skunk	36				
River otter	1	1			

Table 15. Continued (page 12 of 12)

	14-year totals				
	No. of strikes	No. with damage	No. with neg. EOF	Aircraft down time (hrs)	Reported costs (\$)
Badger		1			
House cat		8			
Artiodactyls (deer/cattle)	643	524	339	198,480	27,727,703
Deer	16	16	7	3,530	134,300
White-tailed deer	574	463	295	131,749	21,695,996
Mule deer	24	19	16	2,856	476,295
Wapiti (elk)	8	8	6	8,680	5,078,012
Moose	3	2	3		
Caribou	1	1	1		
Cattle	8	8	6	46,535	187,000
Pronghorn	7	6	5	5,130	156,100
Swine (pigs)	1				
Collared peccary	1	1			
Perissodactyls (horse)	3	3	3	1,008	23,849
Total known mammals	1,260	558	397	211,421	31,524,831
Unknown mammals	12	6	6		
Total mammals	1,272	564	403	211,421	
Reptiles					
Turtles	50		2		
Turtles	34		2		
Florida soft shell turtle	4				
Box turtle	4				
Common snapping turtle	2				
Diamondback terrapin	5				
Painted turtle	1				
American alligator	12	1	2		
Green iguana	5		3		
Total reptiles	67	1	7		
Total known (all species)	23,011	3,776	2,768	394,363	145,019,817
Total unknown	29,482	3,489	1,958	61,568	50,014,118
Total	52,493	7,265	4,726	455,931	195,033,935

Table 16. Number of reported strikes, strikes with damage, and strikes having a negative effect-on-flight (EOF) for the five most commonly struck bird species groups and two most commonly struck mammal groups, USA, 1990–2003.

Species group ¹	Reported strikes		Strikes with damage		Strikes with EOF	
	14-year total	% of total known	14-year total	% of total known	14-year total	% of total known
Birds						
Gulls	5,323	25	891	28	710	30
Doves/pigeons	2,966	14	245	8	264	11
Raptors	2,666	12	537	17	351	15
Waterfowl	2,217	10	1,023	32	477	20
Blackbirds/starlings	2,210	10	131	4	156	7
All other known	6,302	29	390	12	406	17
Total known	21,684	100	3,217	100	2,364	100
Unknown	29,470		3,483		1,952	
Total birds	51,154		6,700		4,316	
Mammals						
Artiodactyls	643	51	524	94	339	85
Carnivores	312	25	23	4	48	12
All other known	305	24	11	2	10	3
Total known	1,260	100	558	100	397	100
Unknown	12		6		6	
Total mammals	1,272		564		403	

¹ See Table 15 for listing of species within each species group.

Table 17. Number of reported wildlife strikes indicating damage or negative effect-on-flight (EOF) and reported losses in hours of downtime and USA dollars for civil aircraft, USA, 1990–2003.

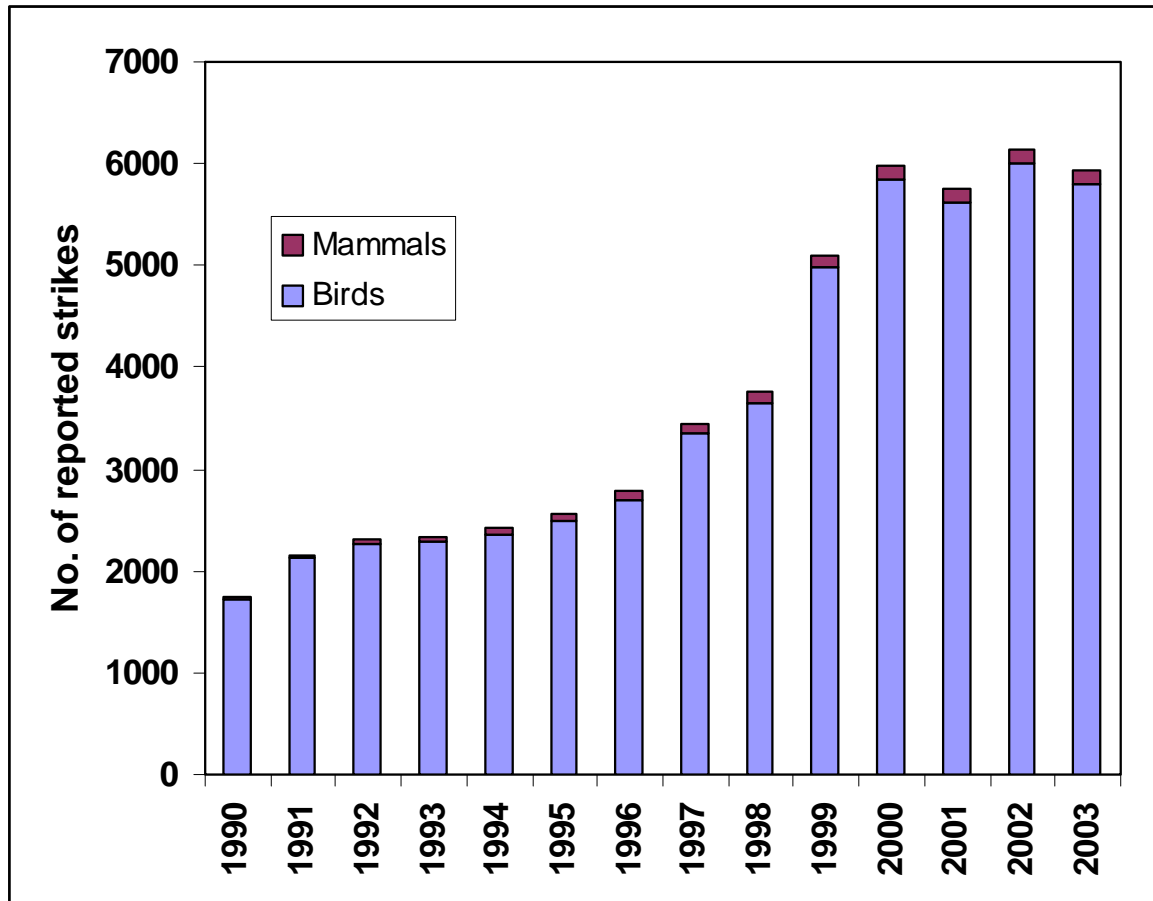
	Number of reports				Reported time (hours) aircraft out of service (No. of reports)	Cost in millions of dollars (Number of reports)		
	Total reports	Reports indicating adverse effect	Reports indicating aircraft damage	Reports indicating negative EOF		Direct cost	Other cost	Total cost
14-yr total	52,493	9,583	7,265	4,726	455,931 (2,630)	169.045 (1,637)	25.989 (595)	195.034 (1,759)
14-yr avg.	3,750	685	519	338	32,567 (188)	12.075 (117)	1.856 (43)	13.931 (126)
Mean losses per incident reported					173.4	0.103	0.044	0.147
Estimated annual losses								
Minimum¹					118,663	70.685	29.898	100.583
Maximum²					593,317	353.424	149.493	502.917

¹ Minimum values are based on the assumption that all 9,583 reported strikes indicating an adverse effect (negative EOF and/or damage) to aircraft incurred similar amounts of damage and/or downtime and that these reports are all of the adverse-effect strikes that occurred.

² Maximum values are based on the assumption that the 9,583 reported strikes indicating an adverse effect represent only 20 percent of the total strikes that occurred.

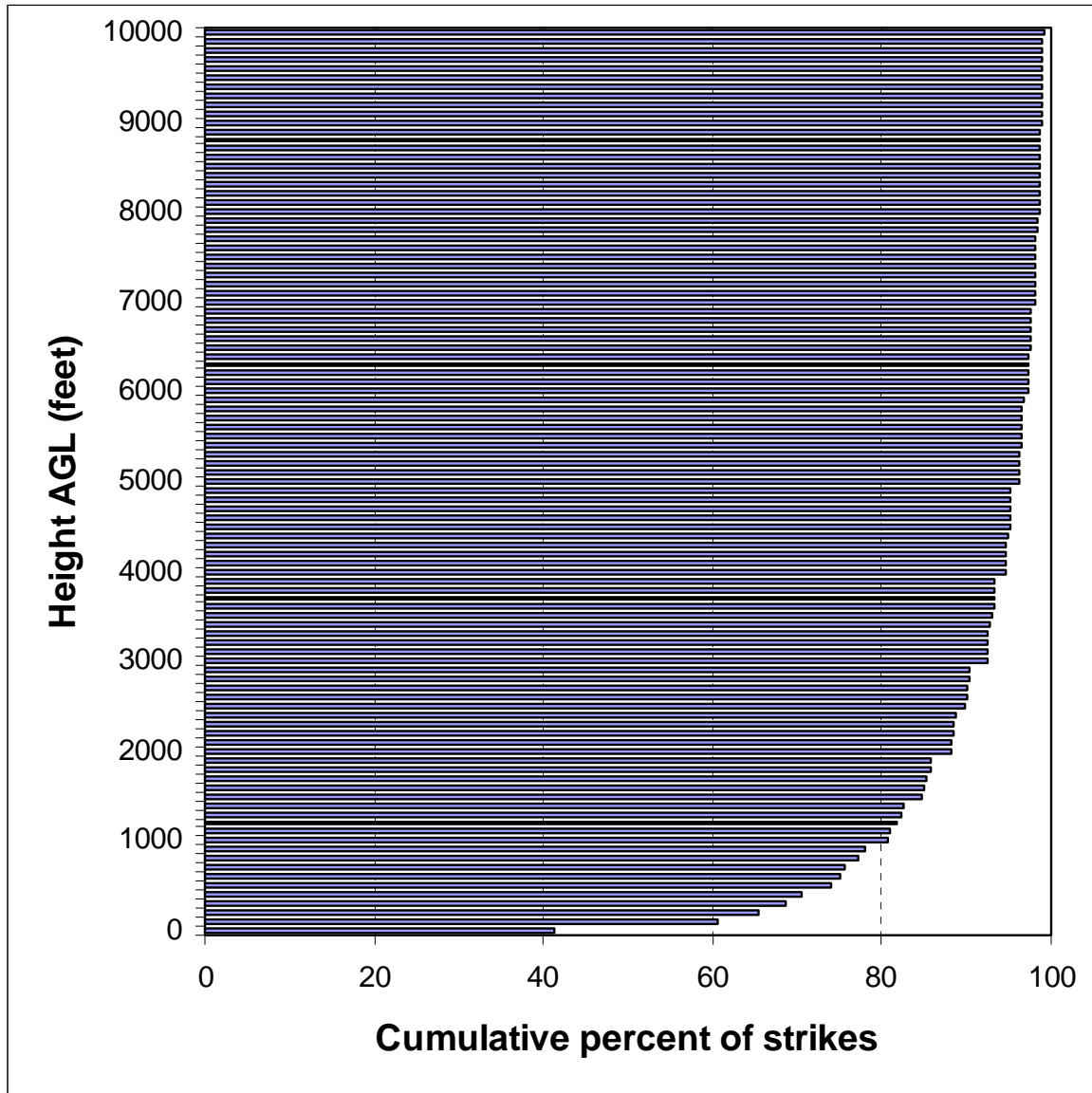
Figures

Figure 1. Number of reported bird (N = 51,154) and mammal (N = 1,272) strikes to civil aircraft, USA, 1990–2003.



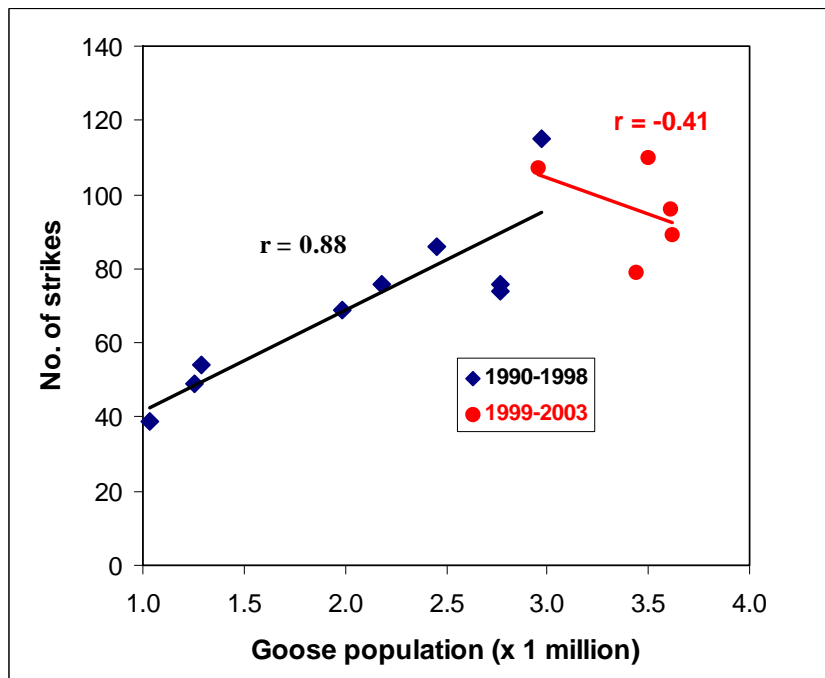
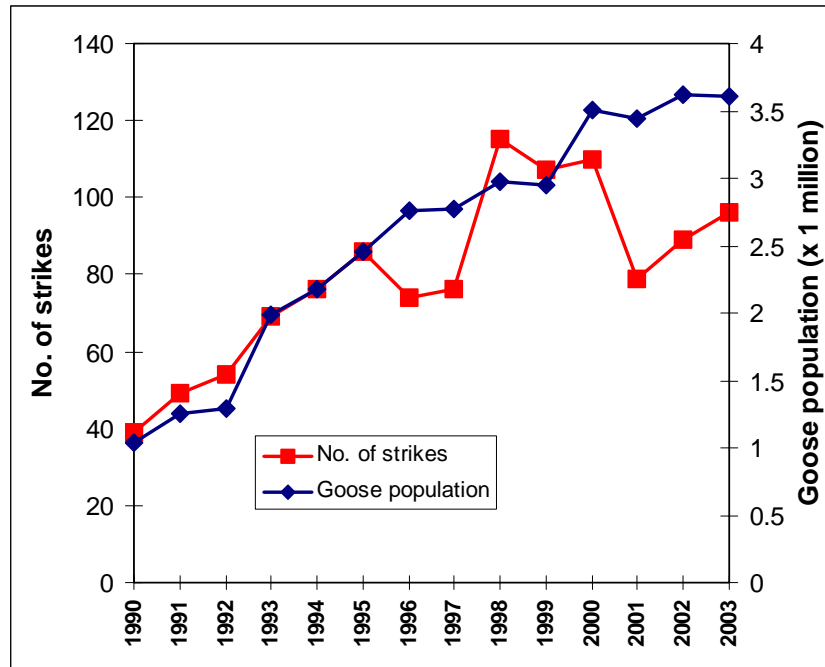
An additional 67 strikes involving reptiles were also reported for this 14-year period (see Table 1).

Figure 2. Cumulative percentage of reported bird strikes to civil aircraft by height above ground level (AGL) from 0 to 10,000 feet (N = 34,747), USA, 1990–2003.



An additional 247 strikes (0.7% of total) were recorded between 10,001 and 32,500 feet AGL. There were 16,158 reports that did not indicate the height of the strike (see Table 9).

Figure 3. Relationship between estimated non-migratory Canada goose population in North America (Seubert and Dolbeer 2004), and number of Canada goose strikes with civil aircraft, USA, 1990–2003.



From 1990–1998, there was a significant ($P < 0.01$) positive correlation ($R^2 = 0.77$) between annual population numbers and strikes. From 1999–2003, there was a negative correlation between population numbers and strikes.

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Selected Significant Strikes to Civil Aircraft in the United States, 2003

The U.S. Department of Agriculture, through an interagency agreement with the Federal Aviation Administration, compiles a database of all reported wildlife strikes to U.S. civil aircraft and to foreign carriers experiencing strikes in the USA. We have compiled over 52,000 strike reports from almost 1,400 airports for 1990 through 2003 (over 5,900 strikes in 2003) but estimate that this represents only about 20 percent of the strikes that occurred. The following examples from the database are presented to show the serious impact that strikes by birds or other wildlife can have on aircraft. These examples, from throughout the USA (and 1 from Mexico), demonstrate the widespread and diverse nature of the problem. The examples are not intended to highlight or criticize individual airports because strikes have occurred on almost every airport in the USA. Many of the strike examples reported here occurred off airport property during approach or departure. For more information on wildlife strikes or to report a strike, visit www.birdstrike.org and <http://wildlife-mitigation.tc.faa.gov>.

Date: 8 January 2003
Aircraft: Bombardier de Havilland Dash 8
Airport: Rogue Valley Intl. (OR)
Phase of Flight: Descent (1,300 AGL)
Effect on Flight: First officer took over controls after pilot was injured
Damage: Radome, windshield, propeller, operating systems
Wildlife Species: Lesser scaup
Comments from Report: Aircraft collided with a flock of lesser scaup. At least one bird penetrated the cabin and hit the pilot, who turned control over to the first officer for landing. Emergency power switched on when the birds penetrated the radome and damaged the DC power system and instruments systems. The pilot was treated for cuts and released from the hospital. Aircraft time out of service was 3 weeks.

Date: 9 March 2003
Aircraft: MD-80
Airport: Los Angeles Intl. (CA)
Phase of Flight: Approach (800 AGL)
Effect on Flight: None
Damage: Windshield
Wildlife Species: Red-breasted merganser
Comments from Report: Aircraft struck two mergansers. One penetrated the right windshield, the other shattered the left windshield.

Date: 11 March 2003
Aircraft: B-757
Airport: Newark Intl. (NJ)
Phase of Flight: Climb (400 AGL)
Effect on Flight: Engine shut down
Damage: Engine
Wildlife Species: Canada goose
Comments from Report: Engine ingested a goose, which caused an uncontained failure. Aircraft returned to airport. Engine was replaced. Time out of service 48 hours. Cost \$740,000.

Date: 30 March 2003
Aircraft: Beech A36
Airport: Tavernaero Park (FL)
Phase of Flight: Takeoff
Effect on Flight: Evasive action
Damage: Aircraft destroyed
Wildlife Species: Dog
Comments from Report: Pilot saw the dog during takeoff roll. He pulled up to avoid it and rolled left. The wing hit the ground and the aircraft impacted trees. Minor injuries were reported.

Date: 31 March 2003
Aircraft: Embraer ERJ 135
Airport: John F. Kennedy Intl. (NY)
Phase of Flight: Climb (400 AGL)
Effect on Flight: Precautionary landing
Damage: Wing
Wildlife Species: Double-crested cormorant
Comments from Report: Bird collided with the right wing. Aircraft returned to the airport for inspection. The leading edge had a large dent.

Date: 24 May 2003
Aircraft: DC-10
Airport: Oakland Intl. (CA)
Phase of Flight: Climb (4,000' AGL)
Effect on Flight: Emergency landing
Damage: Engine
Wildlife Species: Great egret
Comments from Report: Engine ingested a great egret, and the aircraft made an emergency landing. There was substantial damage to the # 3 engine that resulted in NTSB and FAA investigations. The engine was replaced. Bird ID by Smithsonian, Division of Birds. Cost totaled \$1,840,800.

Date: 10 June 2003
Aircraft: Aerostar 601
Airport: Martin State Airport (MD)
Phase of Flight: Climb (1,500' AGL)
Effect on Flight: Precautionary landing
Damage: Windshield, side window
Wildlife Species: Black vulture
Comments from Report: Aircraft hit the vulture about 1 mile west of airport. Pilot saw bird just prior to strike. Bird came through the windshield on right side and slightly injured the co/pilot. An emergency was declared. Windshield was destroyed along with right side forward window. Time out of service was 2 weeks and cost of repairs was \$8,000.

Date: 8 July 2003
Aircraft: Cessna 172
Airport: near McKinney, TX
Phase of Flight: En route (800' AGL)
Effect on Flight: Crashed in field
Damage: Wings, engine, (possibly more)
Wildlife Species: Unknown (possibly vulture)
Comments from Report: Pilot made Mayday call to Dallas Fort Worth Air Traffic Control Tower after hitting a bird with the left wing. He said he could not keep the aircraft straight with the power on. He thought they were going to be all right and wanted someone to pick them up after they landed in a field. The plane came to rest upright with the engine partially separated from the firewall. The left wing was separated at the wing attach points, and both wings had leading edge damage. Someone on the ground saw the plane hit with left wing first and found two people had been killed. The fuel tanks had ruptured and were leaking, but no fire was evident when the fire department arrived. Although the pilot did not say what kind of bird had been struck, the Air Safety Inspector said it was possibly a buzzard.

Date: 13 August 2003
Aircraft: Airbus 310
Airport: Memphis Intl. (TN)
Phase of Flight: Landing roll
Effect on Flight: None
Damage: Engine
Wildlife Species: Unknown birds
Comments from Report: The aircraft struck a flock of small birds at touchdown. The #2 engine ingested four or five birds. Eight fan blades were replaced. Time out of service was 29 hours. Estimated cost of repairs was \$106,000.

Date: 14 August 2003
Aircraft: B-737-300
Airport: Indianapolis Intl. (IN)
Phase of Flight: Approach (500 AGL)
Effect on Flight: None
Damage: Engine
Wildlife Species: Unknown bird
Comments from Report: The aircraft ingested a large bird. The #2 engine vibration monitor increased, but all other indications were normal. Eleven fan blades were replaced. Time out of service was 24 hours. Estimated cost of repairs was \$84,700.

Date: 16 August 2003
Aircraft: MD-80
Airport: Leon, Mexico
Phase of Flight: Climb
Effect on Flight: Engine shut down, precautionary landing
Damage: Engine
Wildlife Species: Unknown
Comments from Report: The aircraft struck a flock of birds just after rotation. Passengers heard multiple banging sounds and an explosion as the plane lurched, struggling to gain altitude. Smoke came from the engine and was noticed in the cabin. One engine was shut down because of fire danger. An emergency landing was made. No injuries. Aircraft was removed from service for 2 days. Cost of repairs was \$243,000 (USA Carrier).

Date: 19 August 2003
Aircraft: BE-1900
Airport: Muskegon County Airport (MI)
Phase of Flight: Landing roll
Effect on Flight: Engines shut down
Damage: Engine
Wildlife Species: White-tailed deer
Comments from Report: After touching down, the aircraft was decelerating when two deer crossed the runway. The smaller of the deer hit the right engine propeller. The crew shut down both engines. The right engine and mounts received substantial damage. NTSB investigated.

Date: 4 September 2003
Aircraft: Fokker 100
Airport: La Guardia Airport (NY)
Phase of Flight: Climb (125 AGL)
Effect on Flight: Engine shut down, emergency landing
Damage: Engine, nose, fuselage
Wildlife Species: Canada geese (~5)
Comments from Report: The aircraft struck a flock of geese shortly after takeoff. Engine vibration occurred. Pilot was unable to shut it down with the fuel cutoff lever so the fire handle was pulled and the engine finally shut down, but vibration continued. The flight was diverted to JFK where an uneventful landing was made. The NTSB found a 20- by 36-inch-wide depression on right side of nose behind radome. Maximum depth was 3–4 inches. Impact marks on right wing. A fan blade separated from the disk. Several fan blades were deformed. Holes were found in the engine cowling and the fuselage was penetrated by a fan blade. Bird remains were recovered and identified by Wildlife Services.

Date: 9 September 2003
Aircraft: Airbus 320
Airport: Washington Dulles Intl. (DC)
Phase of Flight: Approach (2500' AGL)
Effect on Flight: Smoke and bad odor smells in cockpit
Damage: Engine
Wildlife Species: Great blue heron
Comments from Report: Three great blue herons appeared in front of the aircraft then the crew heard a thump. The pilot smelled smoke and a bad odor; the odor spread to cabin. Engine system indicators were normal. Found remains of 1 or 2 birds in the engine." The engine failed and was removed. One flight was cancelled. Cost of repairs \$1.3 million. Bird ID by Smithsonian, Division of Birds.

Date: 22 October 2003
Aircraft: Cessna 152
Airport: Pierson, FL
Phase of Flight: En Route
Effect on Flight: Could not maintain altitude, crash landing
Damage: Windshield, landing gear, nose, fuselage, tail
Wildlife Species: Black vulture
Comments from Report: The aircraft struck a black vulture while doing maneuvers during a student pilot lesson near Lake Disston. The windshield was missing, and the pilot could not maintain altitude after applying full throttle and called "May Day." Aircraft hit nose first in a field and came to a stop inverted. Instructor and student received minor injuries. FAA Inspector recovered part of the windshield. Nose and main landing gear were broken and vertical stabilizer and bottom of fuselage were buckled. Bird ID by Smithsonian, Division of Birds.

Date: 03 November 2003
Aircraft: Bushby Mustang II
Airport: Buckingham Field (FL)
Phase of Flight: Descent (1,000 AGL)
Effect on Flight: None
Damage: Windshield, nose
Wildlife Species: Unknown
Comments from Report: Damage to forward fuselage in front of windshield and to instrument panel on right side. Passenger was hit in face and received a split lip, black eyes and three broken teeth. Replacement for windshield and canopy was \$5,500. Medical and dental costs, \$5,900. Time out of service was about 25 hours.

Date: 12 November 2003
Aircraft: Learjet 24
Airport: St. Louis Downtown Airport (IL)
Phase of Flight: Climb (500 AGL)
Effect on Flight: Engines shut down, forced landing in a field
Damage: Aircraft destroyed
Wildlife Species: Blackbirds suspected
Comments from Report: The pilot heard a loud thump on the right wing as he flew through a flock of small blackbirds shortly after takeoff. Both engines lost power, and the plane crashed into a field and caught on fire. At least two on board were injured. NTSB preliminary report does not indicate anything about birds. No carcasses were found on the airport runway or in adjacent fields. Cost reported as \$750,000.

Date: 13 November 2003
Aircraft: Saab 340
Airport: Minneapolis St. Paul Intl. (MN)
Phase of Flight: Approach (3,200 AGL)
Effect on Flight: None
Damage: Vertical stabilizer and wing
Wildlife Species: Canada geese (~5)
Comments from Report: The aircraft struck a flock of geese on approach. Two large holes were found in the vertical stabilizer, and the left wing leading edge was dented. Estimated cost of repairs was \$153,000; other costs were \$20,000. Time out of service was 22 days. NTSB investigated. Bird ID by Smithsonian, Division of Birds.

Date: 15 November 2003
Aircraft: MD-82
Airport: Newark Intl (NJ)
Phase of Flight: Approach (3,000 AGL)
Effect on Flight: Lost control, engine shut down
Damage: Radome, bulkhead, fuselage, wing, window, nose cowl, nose gear
Wildlife Species: Snow geese (possibly)
Comments from Report: The aircraft struck large birds which was followed by an explosion in the right engine. Pilot lost then regained control and landed without incident. Evidence of ingestion in both engines. Both engines were borescoped and determined to be serviceable by the carrier. Time out of service was 2 weeks. Significant damage to radome, nose gear, and leading edge of left wing.

Date: 26 December 2003
Aircraft: B-737
Airport: Lambert-St. Louis Intl. (MO)
Phase of Flight: Climb (2,900' AGL)
Effect on Flight: Precautionary landing
Damage: Radome, nose, wing, tail and lights
Wildlife Species: Snow geese (~3)
Comments from Report: The aircraft struck approximately three geese on climb at night and returned to land. Engine ingested at least part of a bird with no damage. Radome was dented and nose peeled up. Horizontal stabilizer was dented. Several passenger windows had feathers stuck in them. Aircraft was ferried to Texas for repair. Costs totaled \$502,000, and time out of service was 11 days. Bird ID by Smithsonian, Division of Birds.

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