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PERCENTAGE OF WILDLIFE STRIKES REPORTED AND SPECIES IDENTIFIED UNDER A VOLUNTARY REPORTING SYSTEM

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Abstract. Reporting of wildlife strikes with civil aircraft in the USA is voluntary but strongly encouraged by the Federal Aviation Administration (FAA) through Advisory Circulars and FAA publications. The National Wildlife Strike Database contained 59,196 strike reports for civil aircraft, 1990-2004. An initial analysis of independent strike data from an eastern USA airport in 1994 indicated that less than 20% of strikes were actually reported to the FAA for inclusion in the National Wildlife Strike Database. To obtain an improved estimate of the percent of strikes reported, we obtained 14 sets of wildlife strike data maintained by three airlines and three airports for various years, 1991-2004. Only 489 (10.7%) of the 4,561 strikes recorded in these independent databases had been reported to the FAA for inclusion in the National Wildlife Strike Database. The National Wildlife Strike Database contained an additional 591 strike reports for the relevant time periods unknown to the airlines or airports, making a total of 5,152 known strike events in the combined databases. If we assume that these 5,152 known strike events in the combined databases represented all strikes that occurred for those airlines and airports during those time periods, then the National Wildlife Strike Database contained 1,080 (21.0%) of the total strikes. Because it is highly probable that additional strike events occurred that were not recorded in either the national or local databases, the percent of strikes reported to the FAA probably fell somewhere between 10.7 and 21.0%. Thus, our initial estimate from 1994 that less than 20% of wildlife strikes with civil aircraft in the USA are reported to the FAA for inclusion in the national database is supported by this more extensive analysis. Further, only about 44% of the 59,196 wildlife strikes that were reported during 1990-2004, provided information on the type of wildlife struck to species group (e.g., gull, deer) and only 25% identified the wildlife to exact species (e.g., ring-billed gull [*Larus delawarensis*], white-tailed deer [*Odocoileus virginianus*]). Based on these analyses, there obviously is a need for increased and more detailed reporting of wildlife strikes. Improvements in reporting will increase the usefulness of the database as a foundation of information for understanding and managing wildlife hazards to aviation.

Key words: aviation, bird, bird strike, database, FAA, reporting, safety, species identification, voluntary, wildlife strike.

INTRODUCTION

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 194 people and destroyed over 163 aircraft since 1988 (Richardson and West 2000; Thorpe 2003; 2005; Dolbeer, unpublished data). Several factors contribute to this increasing threat:

1. Commercial air carriers are replacing their older three- or four-engine aircraft fleets with more efficient and quieter, two-engine aircraft. In 1969, 75% 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% had three or four engines. It is estimated that by 2008 the fleet will contain about 7,000 aircraft, and only 10% will have three or four engines (Cleary and Dolbeer 2005a). This reduction in engine redundancy increases the probability of life-threatening situations resulting from aircraft collisions with wildlife, especially with flocks of birds (Cleary and Dolbeer 2005b). 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.

2. 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 and Canada increased at a mean rate of 9.1% per year; the red-tailed hawk population increased at a mean annual rate of 2.0%; the wild turkey population increased at a mean annual rate of 12.7%; and the turkey vulture population increased at a mean annual rate of 2.2% (Sauer et al. 2004). Thirteen of the 14 bird species in North America with mean body masses greater than 8 lbs have shown significant population increases over the past three decades (Dolbeer and Eschenfelder 2003). The white-tailed deer population increased from a low of about 350,000 in 1900 to about 24 million by 1994 (Jacobson and Kroll 1994).

3. Air traffic has increased substantially since 1980. Passenger enplanements in the USA increased from about 310 million in 1980 to 686 million in 2004 (2.1% per year), and commercial air traffic increased from about 17.8 million aircraft movements in 1980 to 29 million in 2004 (2.1% per year, Federal Aviation Administration 2005). USA commercial air traffic is predicted to continue growing at a rate of about 2% per year to 33 million movements by 2010.

As a result of these factors, the risk, frequency, and potential severity of wildlife-aircraft collisions will likely escalate over the next decade.

The FAA has initiated several programs to address this important safety issue. Among the various programs is 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 (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 for dissemination to users via the world-wide web (Dickey et al. 2005); 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 (Cleary et al. 2005). 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). The information obtained from these analyses provides the foundation for refinements in the development, implementation, and justification of integrated research and management efforts to reduce wildlife strikes.

The first annual report on wildlife strikes to civil aircraft in the USA, covering 1994, was completed in November 1995 (Dolbeer et al. 1995). Subsequently, the FAA, in cooperation with USDA/WS, has published 10 reports covering the years 1993–1995, 1992–1996, 1991–1997, 1990–1998, 1990–1999, 1990–2000, 1990–2001, 1990-2002, 1990-2003, and 1990-2004 (Cleary et al. 2005).

Reporting of wildlife strikes with civil aircraft is voluntary but strongly encouraged by the FAA (Advisory Circular 150/5200-32A: Reporting wildlife aircraft strikes [22 December 2004]). An initial analysis of independent strike data from an eastern USA airport in 1994 indicated that less than 20% of strikes were actually reported to the FAA for inclusion in the national database (Dolbeer et al. 1995). An accurate estimate of the number of strikes that are unreported is critical to obtaining estimates of the magnitude of the strike problem (Cleary et al. 2005).

OBJECTIVES OF ANALYSES

The primary objective of this analysis was to obtain a more comprehensive estimate of the percent of strikes that are reported to the FAA for inclusion in the National Wildlife Strike Database. To do this, we obtained 14 independent sets of wildlife strike data maintained by three airlines and three airports for various years, 1991-2004. We compared the strikes contained in these independent databases with the strikes reported to the FAA National Database to determine 1) the number of strikes included in both databases; 2) the number of strikes in the independent databases that were never reported to the FAA National Database; and 3) the number of strikes in the FAA National database that were not included in the independent databases.

A second objective of this analysis was to document the percent of strikes reported to the FAA that provide an identification of the wildlife struck to species group (e.g., gull [*Larus* spp.]) or to species (e.g., ring-billed gull [*Larus delawarensis*]). Identification of the species responsible for a strike is critical for aeronautical studies analyzing the impact force of the object striking the

aircraft component. Species identification also is critical for developing focused wildlife hazard management plans to reduce strikes.

RESULTS

Number of Reported Strikes involving Birds, Mammals, and Reptiles

For the 15-year period (1990-2004), 59,196 strikes with civil aircraft were reported to the FAA and entered into the National Wildlife Strike Database. Birds were involved in 97.5% of the reported strikes, terrestrial mammals in 2.2%, flying mammals (bats) in 0.2% and reptiles in 0.1% (Table 1).

Percent of Wildlife Strikes with Civil Aircraft Reported To FAA

Only 489 (10.7%) of the 4,561 strikes recorded in the14 sets of wildlife strike data maintained by three airlines and three airports had been reported to the FAA for inclusion in the National Wildlife Strike Database (Table 2). The National Wildlife Strike Database contained an additional 591 strike reports for the relevant time periods unknown to the airlines or airports, making a total of 5,152 known strike events in the combined databases. If we assume that these 5,152 known strike events in the combined databases represented all strikes that occurred for those airlines and airports during those time periods, then the National Wildlife Strike Database contained 1,080 (21.0%) of the total strikes. Because it is highly probable that additional strike events occurred that were not recorded in either the national or local databases, the 59,196 strikes reported to the FAA from 1990-2004 probably represented between 10.7% and 21.0% of the actual number of strikes that occurred.

Percent of Reported Wildlife Strikes that Identify the Species Struck

Only 25,840 (44 %) of the 59,196 strike reports provided information on the type of wildlife responsible to species group (e.g., gull, hawk, or deer). Furthermore, only 14,600 (57 %) of these 25,840 reports provided further identification to species level (e.g., ring-billed gull, red-tailed hawk [*Buteo jamaicensis*]; white-tailed deer [*Odocoileus virginianus*], Table 1). Thus, the wildlife responsible for the strike was identified to species level in only 25% of the 59,196 reported strikes. In all, 354 different species of wildlife (309 birds, 6 bats, 32 terrestrial mammals, and 7 reptiles) were identified as struck.

CONCLUSIONS

The FAA National Wildlife Strike Database, with 59,196 strike reports for civil aircraft from 1990-2004, is providing much useful information regarding the characteristics and magnitude of the wildlife strike problem in the USA. Over 15,000 queries have been recorded from July 2002-June 2005 for strike information available from the online version of the database (Dickey et al. 2005; http://wildlife-mitigation.tc.faa.gov). Numerous publications, reports, and documents have used data from the database as supportive information for a wide range of analyses, assessments, and management plans regarding wildlife strikes (e.g., Dolbeer et al 2000, Cleary and Dolbeer 2005a, Cleary and Dolbeer 2005b).

However, based on the analyses presented above, there obviously is a need for increased and more detailed reporting of wildlife strikes to enhance the usefulness of the database. Our analyses indicated that only 10.7-21% of all wildlife strikes involving USA civil aircraft are reported which was consistent with the initial estimate provided by Dolbeer et al. (1995). Further, only about 44 percent of the wildlife strikes that were reported during 1990-2004, provided information on the type of wildlife struck to species group, and only about 25% of the reports further identified the wildlife struck to species level.

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 [Branta canadensis], American wigeon [*Anas americana*], mourning dove [*Zenaida macroura*], 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:
Feather Identification Laboratory	Feather Identification Laboratory
Smithsonian Institution	Smithsonian Institution, Division of Birds
NHB, E610, MRC 116	PO Box 37012
10th & Constitution Ave. NW	NHB, E610, MRC 116
Washington, D.C. 20560-0116	Washington, D.C. 20013-7012
(Identify as “safety investigation material”)	(Not recommended for priority cases.)

Please send whole feathers whenever possible as 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. Call the Feather Lab at 202-633-0801 for additional information about shipping bird strike remains.

Strikes can also be reported via the Internet (http://wildlife-mitigation.tc.faa.gov), in addition to the traditional means of filling out and mailing FAA Form 5200-7. FAA Form 5200-7 can be accessed and printed from the above Internet site.

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Table 1. Status of identification of the wildlife species involved in all reported wildlife strikes to civil aircraft, FAA National Wildlife Strike Database, 1990-2004 (Cleary et al. 2005).

Status of species identification	Birds	Bats	Terrestrial mammals	Reptiles	Totals (% of total)
Unknown to species group or species[a]	**33,255**	**89**	**12**	**0**	**33,356 (56)**
Identified at least to species group[b]	**24,447**	**35**	**1,285**	**73**	**25,840 (44)**
Further identified to species[c]	13,337	33	1,193	37	14,600 (25)
Total	**57,702**	**124**	**1,297**	**73**	**59,196 (100)**

[a] A strike report that identifies the wildlife struck as unknown bird, unknown bat, unknown terrestrial mammal, or unknown reptile or simply as bird, bat, terrestrial mammal, or reptile.

[b] A strike report that identifies the wildlife struck at least to species group (e.g., hawk, gull, deer).

[c] A strike report that identifies the wildlife struck to the exact species (e.g., red-tailed hawk [*Buteo jamaicensis*], ring-billed gull [*Larus delawarensis*], white-tailed deer [*Odocoileus virginianus*]). In all, 354 identified species of wildlife (309 birds, 6 bats, 32 terrestrial mammals, and 7 reptiles) were struck.

Table 2. Estimates of the percent of wildlife strikes with civil aircraft in USA reported to the Federal Aviation Administration for inclusion in the National Wildlife Strike Database, based on a comparison of strike reports found in independent databases with strike reports in the national database.

Source of non-FAA strike database[a]	Year	Number of strike reports: In Source data-base (A)	In both Source & FAA database (B)	In FAA but not Source database (C)	In FAA data-base (B+C)	Total known for Source (A+C)[b]	Percent of strikes in FAA database in relation to: Source data-base (B/A)	Total known for source (B+C)/ (A+C)
Airline 1	1991	147	25	43	68	190	17.0	35.8
Airport 1	1992	50	3	11	14	61	6.0	23.0
Airline 1	1992	112	19	47	66	159	17.0	41.5
Airline 1	1993	141	30	65	95	206	21.3	46.1
Airline 1	1994	162	35	81	116	243	21.6	47.7
Airline 1	1995	150	32	79	111	229	21.3	48.5
Airline 1	1996	188	34	77	111	265	18.1	41.9
Airport 2	1998	39	4	5	9	44	10.3	20.5
Airport 3	1998	54	2	41	43	95	3.7	45.3
Airline 1	1999	1,299	92	34	126	1,333	7.1	9.5
Airline 2	1999	113	26	46	72	159	23.0	45.3
Airline 1	2003	928	76	16	92	944	8.2	9.7
Airline 3	2004	85	21	30	51	115	24.7	44.3
Airline 1	2004	1,093	90	16	106	1,109	8.2	9.6
TOTAL		**4,561**	**489**	**591**	**1,080**	**5,152**	**10.7[c]**	**21.0[d]**

[a] U.S.-based airlines and airports that provided the FAA database manager with internally maintained, independent wildlife strike databases for given years which could be compared with strikes reported to the FAA and entered into the National Wildlife Strike Database.

[b] The total number of non-duplicating wildlife strike events that occurred for the airline or at the airport based on the combined Source and FAA databases. The number of additional wildlife strike events not recorded in either database is unknown.

[c] Overall, 10.7% of the 4,561 strikes recorded in the Airline or Airport Databases had been reported to the FAA for inclusion in the National Wildlife Strike Database.

[d] Overall, 21.0% of the 5,152 known strikes for the airline or at the airport, based on the combined Source and FAA databases, had been reported to the FAA for inclusion in the National Wildlife Strike Database. The number of additional wildlife strike events not recorded in either database is unknown.