Five years of feather identification for the Israeli Air Force

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ABSTRACT

We report birdstrike statistics to military aircraft in Israel during 1991-1995. Feather remains were identified by examining the microstructure of downy barbules and macroscopically comparing feathers to bird skins. Although most birds involved in birdstrikes were passerines (36%) and other small birds (Charadriiformes 17%, Columbiformes 10%, Apodiformes 9%), most strikes with considerable damage were caused by heavy soaring birds, mainly raptors and storks (involved in 42% of the strikes with damage) or high flying, but lighter birds, such as swifts (16%). Most nocturnal birdstrikes were appparently due to migrating passerines (41%) and ground birds (Charadriiformes 36% and Galliformes 9%) which hit the aircraft generally during takeoff and landing.

Key Words: Identification, Feathers, Statistics, Military Aviation

1.0 INTRODUCTION

Feather remains identification is an integral part of birdstrike statistics. Such data can and should be used when considering new preventative measures and when evaluating presently used techniques. Feather identification during several years can show patterns in bird behavior relevant to flight safety. During the last five years feather remains have been systematically identified for the Israeli Air Force (ILAF).

In order for birdstrike statistics to be reliable, as large a proportion of bird remains as possible should be collected and identified. Experts involved in bird remains identification can help to improve general awareness and collection standards. These points and a summary of feather identification from 1991-1995 will be discussed in this paper.

2.0 MATERIALS AND METHODS

Hundreds of feather remains, from 1991-1995, have been examined (the exact number is classified). The microstructure of feather remains were compared to a printed reference collection of 150 avian species found in Israel. For methods, see Shamoun and Yom-Tov (1994) and Laybourne and Dove (1994).

3.0 RESULTS AND DISCUSSION

3.1 Collection standards and levels of identification

In the 1970's and 1980's feather remains were rarely collected, but since the laboratory for feather remains identification was opened, in the ILAF bird remains are collected in an average of 31% of the annual birdstrikes. This is a disturbingly low proportion of birdstrikes, therefore, during the last few years we have worked to improve the awareness among the military birdstrike prevention crews; the standard of collection has increased, more complete data is collected following birds strikes, as well as smaller remains. The continuously low percentage of feather remains collected seems to be the failure of the technical crews to report birdstrikes. Therefore, we have supervised the production of a video and poster explaining the importance of collecting and identifying feather remains.

All feather remains collected were identified to order level and 85%, 81% and 74% were identified to family, genus and species level respectively. This is a significantly higher level of identification than reported by us previously (Shamoun and Yom-Tov 1994): a total of 63 species from 13 orders were identified as compared to only 35 species previously reported.

3.2 Birdstrike statistics

Passeriformes were responsible for 36% of all birdstrikes. The other orders responsible for a large proportion of birdstrikes (Figure 1) included Charadriiformes (17%), Columbiformes (10%), Apodiformes (9%), Accipitériformes (9%), and Galliformes (8%). These proportions are similar to those reported by us in 1994. In the years previous to microscopic examination of feather remains swifts were not reported in birdstrike statistics. Upon closer examination throughout the last five years, the annual proportion of birdstrikes involving swifts varied from 3.4% in 1991 to 16% in 1992. Such fluctuations reflect the importance of collecting data over several years, and comparing the data annually.

An interesting picture arises when examining which birds are involved in collisions at night (Figure 2). Forty one percent of the birdstrikes are caused by passerines. Though the species was often not determined, most of these strikes were probably caused by nocturnal migrants. Charadriiformes were responsible for 38% of the nocturnal birdstrikes. Though many waders migrate across Israel (Liechti and Bruderer 1995), 27% of the nocturnal strikes were caused by wintering and resident Stone Curlews. Interestingly, 4% of the nocturnal strikes were caused by raptors, during the migratory months. This might be explained by the fact that some small raptors, such as *Accipiter brevipes* (Stark and Liechti 1993), also migrate at night.

Most of the species involved in a significant proportion of birdstrikes (Table 1) are those which are common around the airfields. Stone Curlews, Spur-winged Plovers and Chukars are known to nest in the airfields, often very close to the runways. Forty two percent of the birdstrikes examined occurred within the airfields below 500 feet.

Table 1: Avian species involved in over 2% of the birdstrikes from 1991-1995.

Avian species	Percent of birdstrikes
Stone Curlew (*Burhinus oedicnemus*)	9.1
Skylark (*Alauda arvensis*)	7.2
Chukar (*Alectoris chukar*)	6.9
Rock Dove (*Columba livia*)	5.6
White Stork (*Ciconia ciconia*)	4.1
Kestrel (*Falco tinnunculus*)	2.8
Spur-winged Plover (*Vanellus spinosus*)	2.8
Swift (*Apus apus*)	2.8
Alpine Swift (*Apus melba*)	2.2
Hooded Crow (*Corvus corone cornix*)	2.2

To determine which birds cause a greater hazard to flight safety, one must examine which birdstrikes result in damage, and which avian groups are responsible. Though, soaring birds are responsible for only 10% of the birdstrikes examined, 42% of the birdstrikes resulting in damage are caused by soaring birds including birds of prey, White Storks and one Common Crane (*Grus grus*) (Figure 3). These are also the most costly birdstrikes which have resulted in the loss of some fighter aircraft and the death of several crew members (Leshem 1994). The soaring birds are a high risk group for two reasons; (1) their large mass increases the force with which they hit the aircraft and (2) most of these strikes are on-route and at relatively high speeds, again increasing the force of impact. On the other hand, swifts which weigh less than 100 g are responsible for 16% of the birdstrikes resulting in damage. The damage caused to the IAF by swifts is below $10,000 per strike. Stone Curlews and Chukars are also high risk groups. All the collisions resulting in damage, which involved these species, occurred on the runways. Though flight speeds are relatively low at takeoff and landing, the engines are vulnerable to serious damage when foreign objects are ingested.

4.0 SUMMARY

Clearly the birds involved in the majority of birdstrikes do not always form the high risk group. In order to properly assess the hazards birds pose to aircraft, all aspects of the birdstrikes including flight phase, altitude, speed, season, time of day, avian species and damage should be analyzed. Bird remains should be identified by experts, and data should be collected and examined over several years.

5.0 ACKNOWLEDGEMENTS

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Figure 2 Percent of avian orders involved in birdstrikes at night 1991-1995

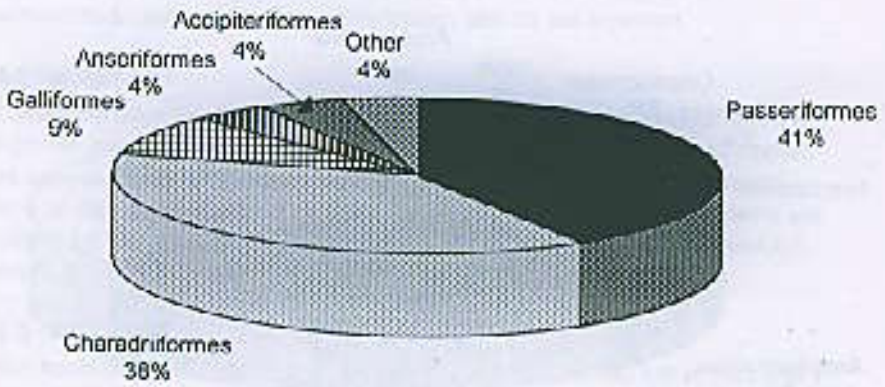

Figure 3. Birds which caused damage to aircraft 1991-1995