INTERNATIONAL BIRD STRIKE COMMITTEE **IBSC 24/WP 12**
Stara Lesna, Slovakia, 14-'8 September 1998

Comparison of Israeli Air Force birdstrike statistics resulting from various bird remains identification methods

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Summary

Reliable estimates of the species involved in bird strikes are essential for properly assessing bird hazards to military and civilian aircraft. Expert identification of bird remains is the key for providing accurate representation of bird hazards. Israeli Air Force bird strike statistics for 19911497 were compared between field identification of bird remains and a combination of microscopic and macroscopic identification. Field identification of bird remains showed an over-representation of common birds found on the air fields such as Rock Dove, Chukar, Spurwinged Plover, Cattle Egret, House Sparrow and the Hooded Crow while grossly underestimating small birds such as passerines and swifts. Only 18 species were identified in the field compared to 90 by combining microscopic and macroscopic examination. The results emphasize the importance of expertise identification of bird remains for reliable bird strike statistics.

Keywords: Military aviation, feather identification, statistics. Israel

1. Introduction

Bird strike statistics are an essential factor in understanding and reducing bird strike hazards around the world. Before investing time and money in reducing bird hazards, whether in military or civil aviation, it is important to obtain reliable estimates regarding which birds are involved in strikes and which birds cause damage.

Several techniques are used to identify birds involved in aircraft collisions. The simplest technique is macroscopic identification of bird remains found on runways during routine runway sweeps (Linnell et.al. 1996). Other techniques requiring expertise and laboratory assistance include microscopic examination of downy barbules of feathers (Shamoun & Yom-Tov 1996, Laybourne & Dove 1994, Laybourne et. al. 1992, Brom 1991), electrophoretic identification (Ouellet 1994, Doran et. al. 1990), and DNA examination (Hermans et.a1.1996). Each technique has its drawbacks and benefits (Brom 1992).

One of the main advantages of expertise identification of bird remains is that they should sample a larger proportion of the birds involved in collisions and give a more reliable representation of the bird hazard. This paper attempts to show the difference between birdstrike statistics acquired when birds remains are identified in the field compared to a combination microscopic and macroscopic feather remains identification, in the Israeli Air Force from 19911997. It is expected that systematic identification will provide a more diverse species list as well as a larger proportion of small birds and proportionately fewer "common" birds.

2. Methods

As of 1991, feather remains were collected at Israeli Air Force bases and sent to the Laboratory for Feather Remains Identification at Tel Aviv University, Previously, birds were sporadically identified either by ground or air crew and occasionally large feather fragments were shown to Ornithologists for macroscopic comparison. Feather remains are received along with relevant bird strike data such as time, altitude. area of birdstrike, damage etc. Feather remains are identified at the laboratory by combining microscopic identification of downy barbules of feathers (see Laybourne & Dove 1994 for technique) and macroscopic comparison of feather remains with a reference collection at Tel Aviv University's Zoological Museum. In some cases, bird remains are identified on the airfields by the bird control units or by the pilots during flight, not all these cases are sent to the laboratory for verification. In the following comparisons, the birdstrike statistics for 1991-1997, where birds were identified, ++ere broken do-wn into three groups: 1. Bird Control Units and air crew identification, not verified by laboratory examination. labeled "field identification" throughout the text. 11. Laboratory examination of feather remains (several of these cases were first identified in the field then sent to the lab for verification), III. All identifications, combining laboratory as well as field analysis. A combination of field and laboratory identification should provide the most accurate assessment of the species involved in all bird strikes, as well as sample a larger proportion of the bird strikes. Remains were identified for a total of 527 bird strikes, 144 of which were identified in the field without laboratory analysis, 383 were identified in the laboratory. Summary statistics before systematic feather remains identification began could not be compared, data on bird species was rarely recorded before 1991.

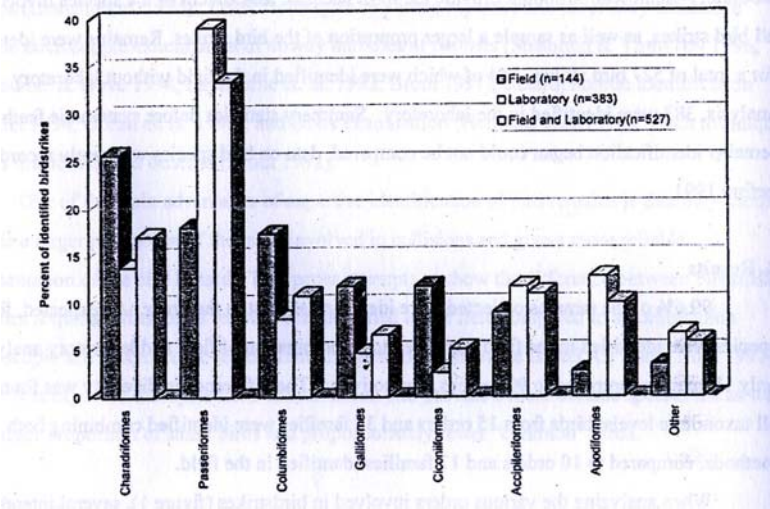
3. Results

99.6% of the remains collected were identified at least to the order. As expected, fewer species were identified in the field compared to a combination of field and laboratory analysis, only 18 species compared to 90 species, respectively. The difference in diversity was found on all taxonomic levels: birds from 15 orders and 35 families were identified combining; both methods, compared to 10 orders and 17 families identified in the field.

When analyzing the various orders involved in birdstrikes (figure 1), several interesting trends are apparent. The figure shows three bars, one for field identification only, one for laboratory identification and one combining both methods. Only 18% of the 'birdstrikes identified in the field were caused by passerines, compared to 39% identified in the laboratory and 3;% identified by both methods. A similar trend was seen with the swifts, 2.8% ,of the bird strikes were identified as swifts in the field, compared to 10% by both methods combined. This same increase in proportion of passerines and swifts using a combination of microscopic and macroscopic identification was also shown by Bran (1992) for north western Europe. Yashon and Shy (1992) identified bird remains in the field at Ben Gurion lnternational Airport and reported only 9% of the bird strikes involving passerines and no bird strikes involving swifts.

Part of this deviation may also be a result of the differences between aircraft (speed, size, noise factor, etc.) on civil and military airfields. Charadriiformes, Galliformes and Columbifonnes were all overestimated by field identification, mainly because they include the species commonly found on the air force bases which are easily identifiable.

Figure 1: Percent of avian orders involved in bird strikes identified by various methods 1991-1997



Comparison of the top species involved in bird strikes (table 1) showed several differences between identification methods, which can help explain the results in figure 1.

Table 1: Percentages of the most common birds involved in birdstrikes from 1991-1997 according to field identification compared to a combination of field and laboratory identification.

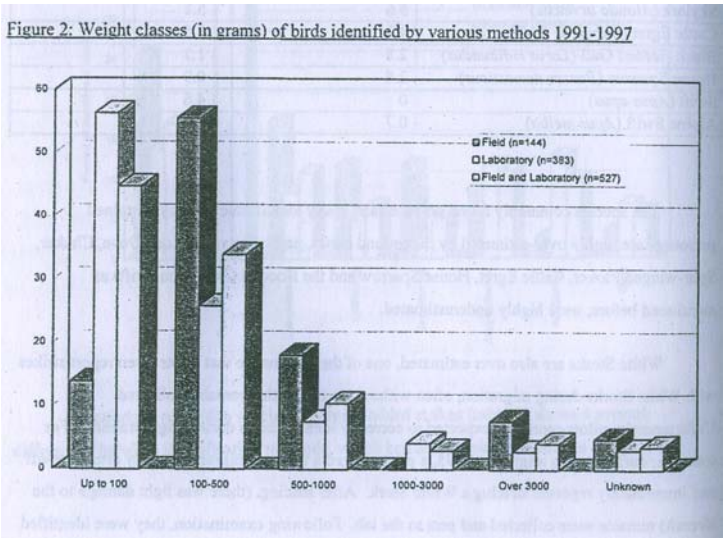
Species	Percent of birdstrikes identified in the field (n=144)	Percent of birdstrikes identified in the field and/or laboratory (n=527)
Rock Dove (*Columba livia*)	16.0	7.4
Stone Curlew (*Burhinus oedicnemus*)	11.1	9.1
Chukar (*Alectoris chukar*)	11.8	5.1
White Stork (*Ciconia ciconia*)	7.6	3.6
Spur-winged Plover (*Vanellus spinosus*)	6.9	3.2
Kestrel (*Falco tinnunculus*)	6.3	3.2
Hooded Crow (*Corvus corone cornix*)	6.3	2.5
Skylark (*Alauda arvensis*)	5.6	5.1
Cattle Egret (*Bubulcus ibis*)	4.2	1.5
Black Headed Gull (*Larus ridibundus*)	2.8	1.3
House Sparrow (*Passer domesticus*)	2.8	0.9
Swift (*Apus apus*)	0	4.6
Alpine Swift (*Apus melba*)	0.7	2.1

The species commonly found on bases and easily identifiable even by untrained personnel are highly over-estimated by the ground crews, particularly the Rock Dove, Chukar, Spur-winged Plover, Cattle Egret, House Sparrow and the Hooded Crow. The swifts as mentioned before, were highly underestimated.
White Storks are also over estimated, one of the reasons are that pilots often report strikes with White Storks during migration, often without having feather remains collected. Unfortunately, pilots cannot be expected to correctly identify birds during flight training. For example, during spring

migration 1995, a. pilot entered a flock of migrants directly after take-off and immediately reported striking a White Stork. After landing, (there was light damage to the aircraft) remains were collected and sent to the lab. Following examination, they were identified as a Eurasian Crane *(Grus grus),* the first known birdstrike in Israel with this species. Other cases of incorrectly identified birds have been recorded casting further doubt on the reliability of field identification alone, especially by air crew.

Minute feather remains cannot be identified in the field. explaining Ally smaller birds are underestimated (figure 2). Only 14% of the strikes involved birds weighing up to I 00 grams, according to field identifications, compared to at least 56°% when laboratory analysis is used and 45% when both methods are combined. Other reasons why smaller birds are underestimated in the field is that they are harder to identify and probably harder to find on runway sweeps. A large proportion of the passerine species identified in the laboratory are migrants and not easily recognized by unskilled observers when alive, let alone when small fragments are found. Birds weighing 100-1000g are overestimated in the field. these weight classes include most of the common species found on bases that were already mentioned.

Figure 2: Weight classes (in grams) of birds identified by various methods 1991-1997



4. Conclusions

This study, as well as others of its kind, has clearly shown the importance of expert identification of bird remains. Expert identification of bird remains will help avoid misinterpreting data and increase the reliability of bird strike databases. In the case of the Israeli Air Force where a proportion of bird remains are identified in the field and a proportion in the laboratory, the most accurate representation of species involved in bird strikes is achieved by combining both data sets. This is only true if identification in the field is reliable and limited to carcasses and easily identified remains in order to reduce the error factor.

On average, bird and feather remains are identified either in the field and/or in the laboratory for 35% of the birdstrikes in the Israeli Air Force (1991-1997). Efforts are constantly being made to improve the level of bird remains collection, identification and reporting in order to receive sound statistics for further analysis and decision making. It is strongly Urged that this be the policy in both civil and military installments elsewhere. In addition, even when remains are identified in tile field, if not identified by trained personnel it should be emphasized that the remains should always be sent to the respective laboratory for examination. When such a laboratory is unavailable, it is recommended to cooperate with local biologists or consult an expert identification system such as the Bird Remains Identification System (BRIS) developed at CD-ROM (Prast et. al. 1996). BRIS was designed to expand the field of bird remains identification, make the data accessible to more people and create possibilities for expertise cooperation around the world. This reference system is being expanded to include other techniques of identification as well as providing other sources of data important for bird hazard reduction (Prast et.al. 1998). Following a visit by Yossi Leshem with the Commander of the Ethiopian Air Force (Leshent et. al. 1998). Ethiopia may start developing a feather structure database for 200

African species. This system should be expanded to other regions such as North America. Australia and Asia through the BRIS network or on a local scale.

5. Acknowledgments
I would like to thank the Israeli Air Force for their cooperation and support. particularly the Bird strike control unit soldiers and the officers at the Radar Control Unit. I would also like to thank the Israel Ornithological Center of the Society for the Protection of Nature and Tel Aviv University for their support and Prof. Yoram Tom-Tov and Dr. Yossi Leshem for their comments on this manuscript. To my feather identification colleagues. Dr. Roxie Laybourne and Carla Dove from the Smithsonian Institute and Willemijn Prast, ETI.

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