The quality of identification: its effects on birdstrike statistics

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introduction

In order to reduce the chance of damage and risks due to collisions between aircraft and birds it is essential to gather knowledge on the birdspecies concerned. Not all birdspecies are equally dangerous to aviation. They differ in numerousness, weight, behaviour and their specific ecological position in nature. Considering the improvement in aircraft construction as well as in bird avoidance (detection by radar), bird removal and making the airfield environment unattractive to birds we therefore have to know what species actually cause damage.

Although this necessity is generally accepted it is as a rule rather difficult to establish the name of the species. Collisions just outside the airfield or "en route" and the occasions when the bird entered an engine usually provide only bledsmears and/or minuscule or totally destroyed featherremains. As a consequence, the frequency distribution of hidden species will be easily biased by the nearly complete bird corpses that can be recognised quickly and generally are found especially after birdstrikes on airfields and not "en route". Moreover, both pilots and ground personnel recognise certain species more easily than other birds.

To avoid this type of bias the Royal Netherlands Air Force takes advantage of the assistance in identification of the Zoological Museum in Amsterdam (ZMA). In addition in 1977 a special study on the possibility of using microscopic characteristics of feathers was initiated. In the meantime this study has presented an useful improvement of the only existing identification key. As a result many bird remains could be recognised as yet (see WP 19).

The aim of this contribution is to show how the introduction of this improvement in identification affects bird strike statistics of the RNLAF. Although this air force is rather small, and although as a consequence birdstrike numbers are limited, a comparison of the results over the last five years produces some remarkable results. The approach differs fundamentally from that of Rochard & Norton (1977) who did not include the aspect of damage and the proportion of birdstrike reports without remarks on identified bird remains. Further, an important point is that in the relevant years the air force flew with the same types of jet aircraft during roughly the same number of flying hours.
In view of a possible shift in emphasis on our birdstrike prevention programm, the RNLAF is interested to know your criticism upon our interpretation, and, secondly, wishes to promote the method of professional identification and careful analysis.

improvement in the identification of bird remains from 1974 till 1978

Figure 1 shows the proportion to which safe identifications increased: from 5 % in 1974 to 52 % in 1978, a factor 10.
Of course this result depends to a large extent on what we call "correct" and "unsure" identifications. We have to conclude that all identifications by those not known to be familiar with birds are unsure as long as we have no opportunity to check their observations. Several of these reports may be correct but we cannot separate them from the incorrect identifications that were frequently found. Many flash identifications of pilots result in remarkable bird names while in fact pilots are only able to say that the bird was small or big and looked black or white. Table 1 illustrates the increase in the number of bird species with the proportion of identifications by ornithologists.

Apart from the Zoological Museum our bird controllers, on duty at six jetfighter airbases since 1976, also play an important role in the improvement in the reporting system. On the one hand they can look for nearly complete bird corpses on the runways after local birdstrikes (excluding birds smashed to the ground due to the slip stream of the aircraft), on the other they get possession of the minuscule featherremains before they are washed off the aircraft. In spite of much propaganda even now we have to admit that many menbers of the groundcrews do not realize that even the smallest featherremains are useful. Only due to the alertness of the bird control units did these bird species indicators arrive at the museum.

From figure 2 it appears that the biggest advantage of the ZMA identifications relates to the damage cases. Over 70 % of these accidents are properly documented thanks to the microscopic and macroscopic museum analysis. We have to realize that the proportion of damage strikes increases with the speed of the aircraft and therefore roughly also with the flight altitude (figure 3) while the chance of finding easily recognisable bird remains outside the airfield is small. But fortunately thanks to the damage caused some small featherremains can nearly always be found upon rough structures near cracks in the skin of the aircraft.

speed of the aircraft versus weight of the bird

Knowing the official name of the bird means that we have at least a clue as to its weight (see ornithological manuals).
Since 1977 and 1978 produced a high proportion of useful data in figure 4 we compared the speed of the jetfighter and the weight of the bird with the damage caused by the collision. Clearly the birdstrikes consist of two groups: "at and around airbases" (as a result of the always present local bird population) and "en route" (due to the many hours of low level training flights and bird migrations in higher air layers). Both this figure and figure 3 show the remarkable difference in the proportion of damage cases. According to the physical laws this is ascribed in the first place to the speed of the aircraft. Strangely enough, however, even light birds frequently cause damage. Especially this category of birds would largely remain undetected without microscopic analysis.

In civil aviation, spending a smaller proportion of flying time in the air layers of the birds compared to airforces, the importance of the "en route" group is rather small. However, also to civil aviation the

bias discussed in this paper may comprise a warning. The damage ratio is primarily a matter of aircraft speed while the bias through reporting standards is highly connected to the chanee of finding complete bird-corpses. So, a sharp distinction must be made even between collisions above the runway and ones just outside the airfield.
Several RNLAF pilots noted repeatedly to be even more afraid of singly soaring birds at some altitude (including gulls) than of flocks on the ground.

bird species and damage

Apart from their weight the type of bird itself also seems to affect the chance of damage (figure 5). Although on part of the species included the number of reports is very small some surprising results were obtained. As already has been said the weight of the birds shows no general correlation.

Heavy game birds like pheasants (and some other groundbirds that were not included because the number of collisions was smaller than five) caused no damage. Swifts and starlings, however, were highly dangerous despite their light weights. Within the group of the gulls, oddly enough, only one out of ten herring gulls (a heavy species that frequently visits one of our airbases) caused damage whereas the two smaller species (black headed gull and common gull) ranked "normal". Pigeons appeared to be really dangerous but the most dangerous species of all was the buzzard.

The differences must be explained primarily by the behaviour of the birds. One important factor is their high flying activity causing them to enter the airlayers where aircraft reach high speeds. In this respect it is clear that swifts and pheasants constitute the extremes. The extent of being a migrant may also play a significant role. But we should not exclude the possibility that some bird species (or age groups) avoid aircraft on the basis of inherited skill and learning. Why are there, for example so few data in our files on the numerous crows?
Evasive actions among birds approached by aircraft have been frequently reported while Bellrose (1971) speculated on possible differences between larger and smaller night migrants, the first being most succesful.
And do buzzards just like the golden eagles in Switzerland (Bruderer, 1978) behave aggressively towards aircraft?

Finally, we wish to call your attention to the role of gulls in threatening flight safety. Although we wholly agree that gulls constitute a major danger, we have to conclude that their share in many statistics might frequently been overrated because of their conspiciousness and occurrence on airfields. In our analysis their proportion among damage strikes decreased considerably after improvement in the reporting system (figure 6). If we compare 1974 plus 1975 for all bird strikes (incidents and accidents together, ten ZMA identifications left out) with 1977 plus 1978 (only damage cases, seven unsure identifications left out) we find that the proportion of gulls decreases from 60 % to 32 % !

conclusions

1. The relative importance of different bird species colliding with aircraft changes if we improve identification technics and put our main concern on the birdstrikes with damage.

2. The strongest bias will be caused by overrepresentation of
   a) easily recognizable birds (e.g. white and big ones) and
   b) rather intact bird corpses to be collected easily, especially in case of birdstrikes above the runway.

3. Although data on birdstrikes that did not result into damage may provide information on potential hazards these data are extra vulnerable to the above mentioned biases and, therefore, they should not be mixed up with the analysis of damage cases.

4. If reporting facilities are limited it seems better to focuss all attention to bird strikes with damage in stead of doing everything a little bit.

references

Bellrose, F. C. 1971 — The distribution of nocturnal migrants in the airspace. The Auk, 88: 397 - 424.

Bruderer, B. 1978 — Collisions of aircraft with birds of prey in the Alps. BSCE 13 / WP 5

Rochard, J. B. A. & N. Norton 1977 — Birds killed by aircraft in the United Kingdom 1966 - 76. BSCE 12/World Conf.on Bird Hazard to Aircraft Paris, october 1977. WP 4

BIRD STRIKES AND IDENTIFICATION

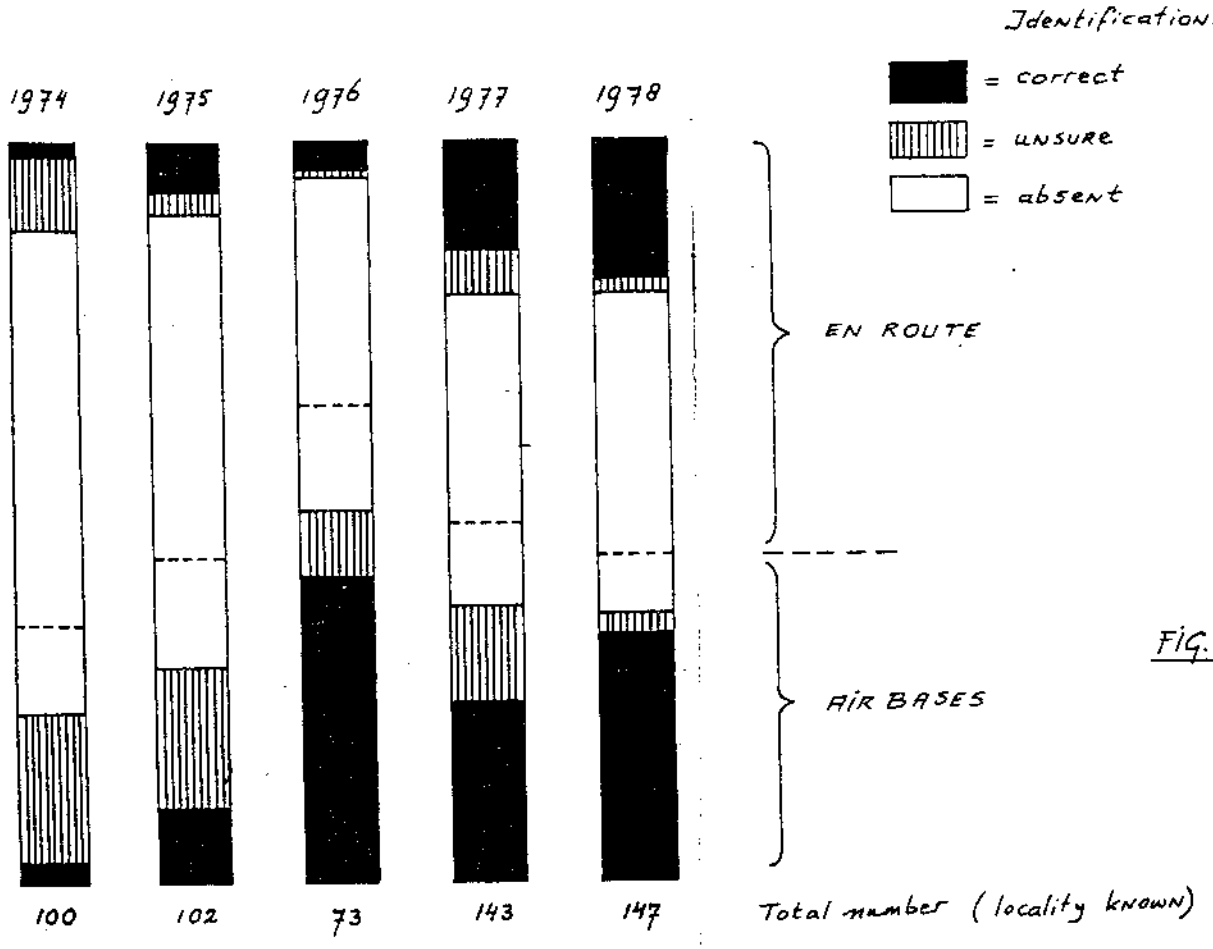


FIG. 1

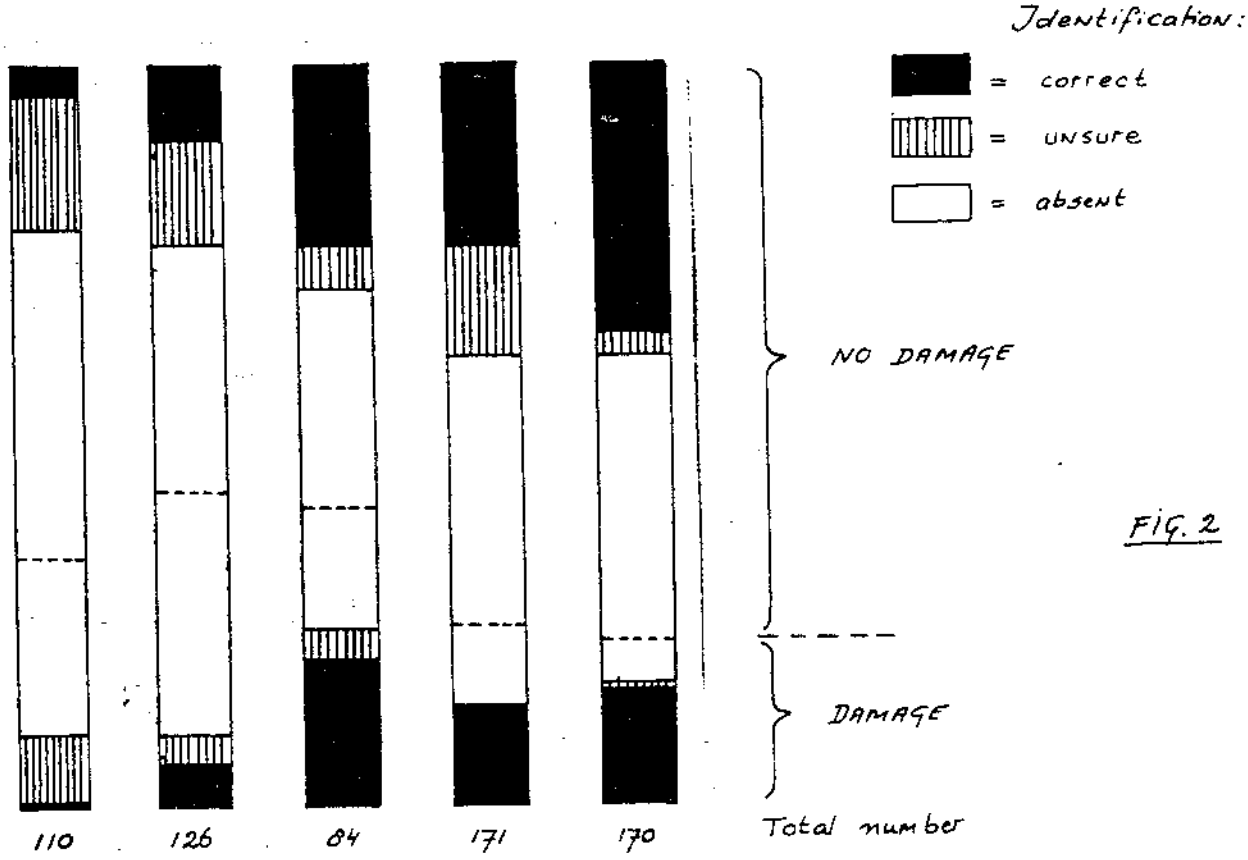
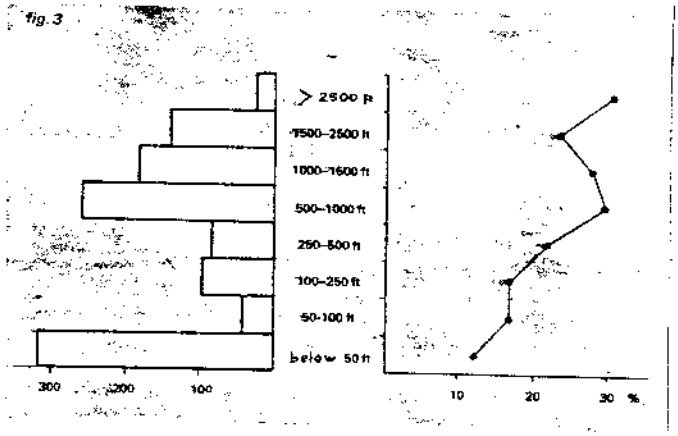


FIG. 2

Table 1

	1974	1975	1976	1977	1978
number of species reported	7	14	12	29	22
proportion (%) of "correct" identifications of all reported birdnames/birdgroups	14	49	82	72	93
					including microscopic method



Total number of birdstrikes (all types of aircraft) over ten years and the percentage of cases with damage per altitude class.

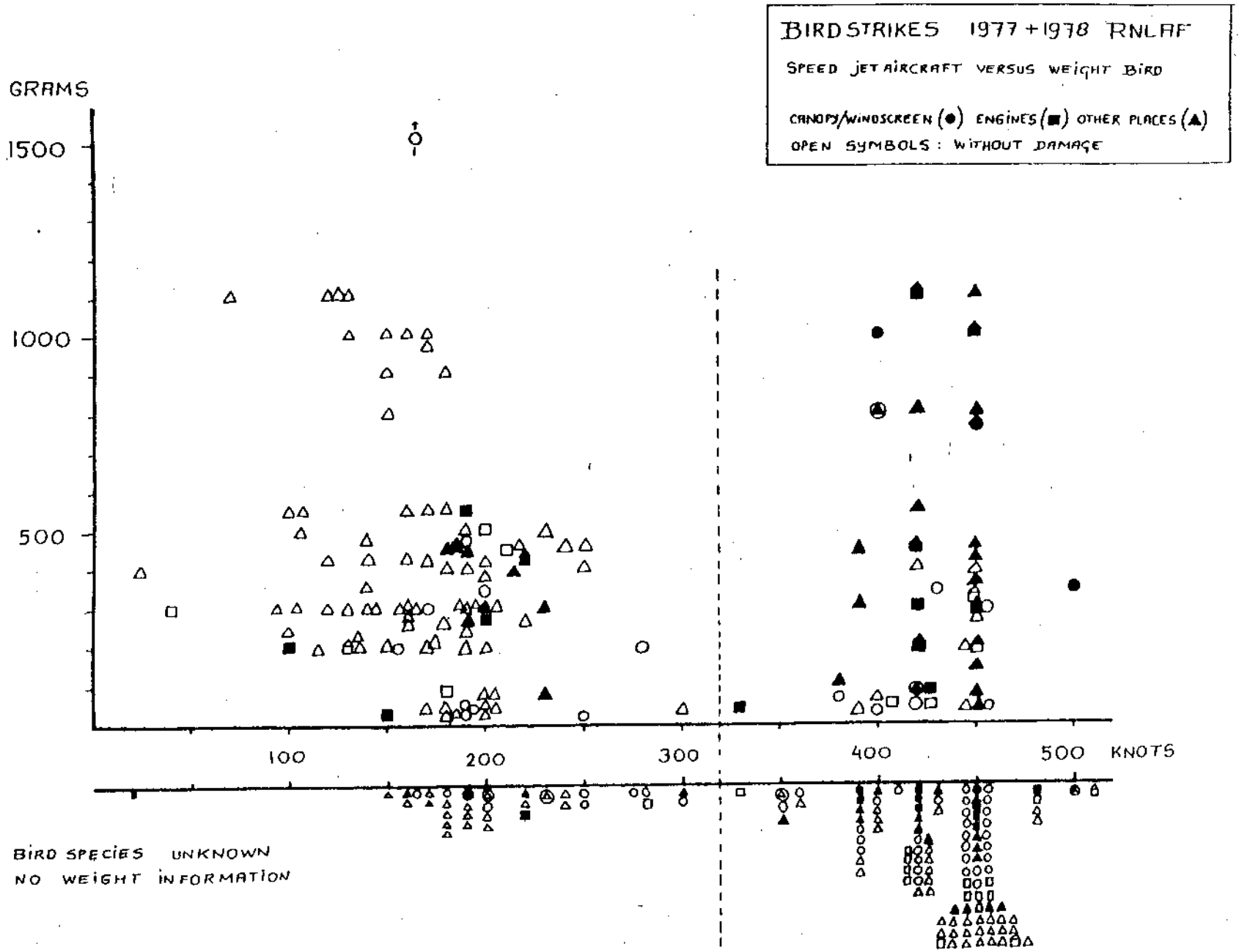

BIRD STRIKES 1977+1978 RNLAF
SPEED JET AIRCRAFT VERSUS WEIGHT BIRD
CANOPY/WINDSCREEN (●) ENGINES (■) OTHER PLACES (▲)
OPEN SYMBOLS: WITHOUT DAMAGE
GRAMS
1500
1000
500
100
200
300
400
500
KNOTS
BIRD SPECIES UNKNOWN
NO WEIGHT INFORMATION
"AT AND AROUND AIRBASES"
"EN ROUTE"

Fig. 4

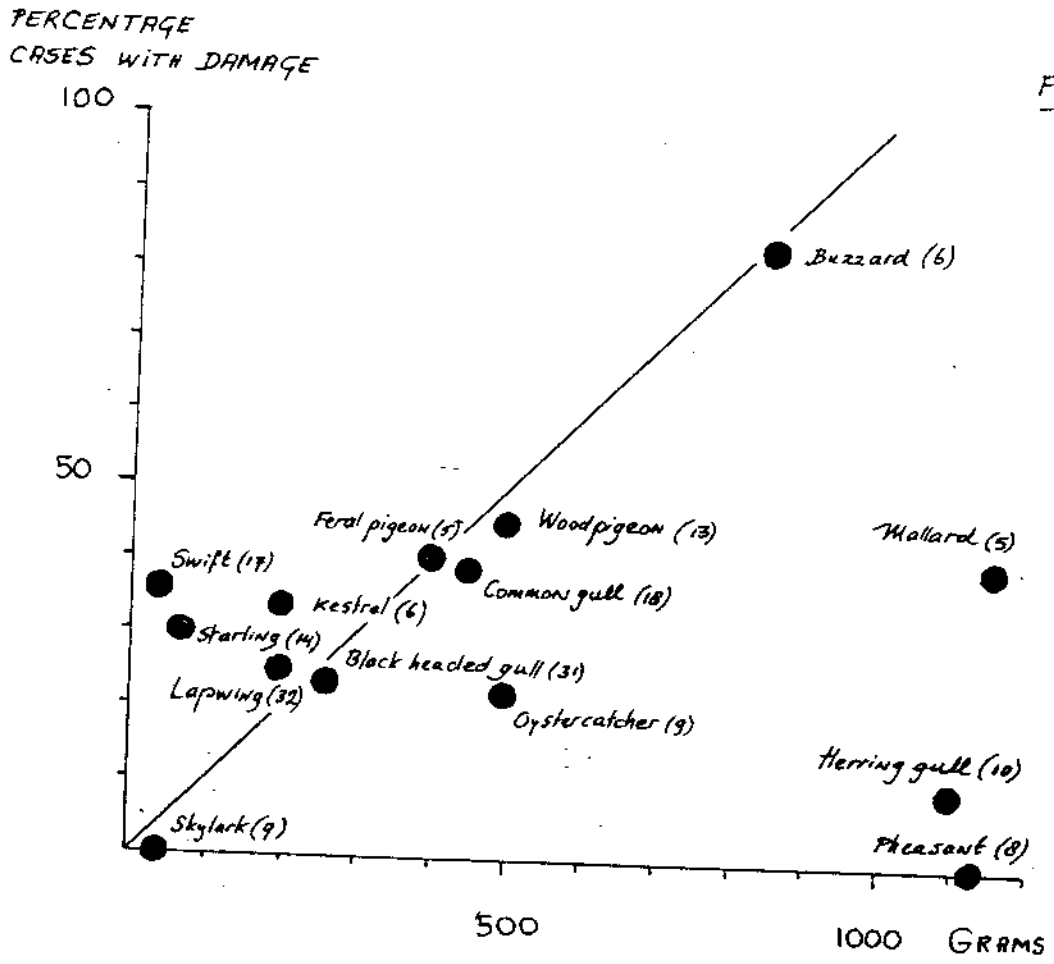

PERCENTAGE
CASES WITH DAMAGE
100
50
Buzzard (6)
Feral pigeon (5)
Woodpigeon (13)
Mallard (5)
Swift (17)
Common gull (18)
Kestrel (6)
Starling (14)
Black headed gull (31)
Lapwing (32)
Oystercatcher (9)
Herring gull (10)
Skylark (9)
Pheasant (8)
500
1000
GRAMS

FIG. 5

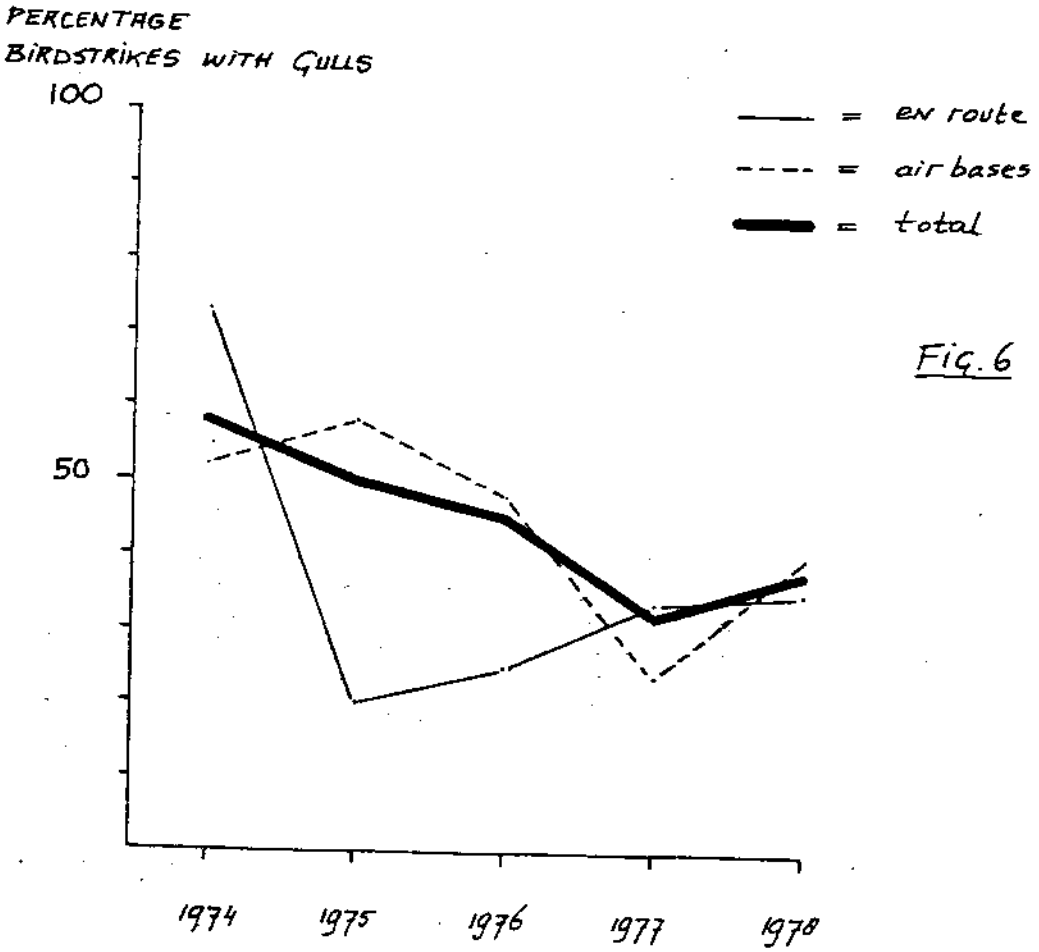

PERCENTAGE
BIRDSTRIKES WITH GULLS
100
50
= en route
= air bases
= total
1974
1975
1976
1977
1978

FIG. 6