PREVENTION AND IDENTIFICATION

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Abstract

Prevention of aircraft-bird collisions has many aspects, one of these being a thorough knowledge of the species of birds causing problems. In the years in which I acted as chairman of the Bird Remains Identification Working Group, this message has been spread profusely. Nevertheless, at the moment there is a tendency for authorities to try and make sure that birds do not pose a risk by attempting to remove them entirely from the vicinity of airfields (zero tolerance). This is socially unwanted and biologically impossible. The created vacancies in the local bird population may well attract an influx of birds that are less able to avoid aircraft than the birds captured or killed during the control operations.

I am firmly convinced that safety measures should be aimed at the species and individuals causing the real risks and that sound strike statistics show which these species are. The identification of the bird remains is no longer the problem here. Several techniques are widely available, ranging from macroscopical feather recognition to sophisticated biotechnological tests. The emphasis should now be on the systematical collecting of remains, not only of bird strikes causing accidents or extensive damage, but of all recorded strikes. On this a solid statistical analysis can be derived. With the results of this in hand, measures of bird strike prevention can be chosen, based upon knowledge of behaviour and ecology of the bird species.

Extensive collection and identification of bird remains will presumably never become standard at all airfields in all countries. It would be a considerable step forward if the collection and identification of remains in a particular situation and for a limited amount of time could be given the form of a special project. Such a project can be statistically sound in its planning. The outcome can be incorporated in comprehensive safety efforts for the studied situation, including ecological ways of controlling the populations of birds giving cause for real concern.

Introduction

In 1959, my predecessor, professor Karel Voous, who died last year at the age of 81, wrote a short note in the Dutch ornithological journal Limosa about a feather of a duck, presumably a mallard, found on the wing of a KLM aeroplane. The crew had noticed a bump when the plane was flying at a height of 2700 m over Germany on 2 April 1958. The plane had suffered no damage. For professor Voous the importance of the incident was that it showed how high migrating birds may move in clear moonlit nights. In his note, he cited a paper by A. H. Miller who had collected a feather of a bunting hitting a plane high over the Sierra Nevada in California. So at about the same time on both sides of the Atlantic it was realized that birds could be identified from feathers collected from aircraft. Shortly afterwards, professor Voous found out that the Royal Netherlands Air Force was interested in these identifications, not so much for information on bird migration, but in their strategy of preventing bird strikes.

As this entire conference is devoted to the prevention of bird strikes, I need not go deeply into that matter, but I think that it is important to stress that prevention has to start from a thorough knowledge of the problem. Planes are not just hitting any bird. Birds come in species of which there are a little over 500 breeding in Europe and about 10,000 worldwide. Only a fraction of these will ever cross the path of an aeroplane. A species spending its entire life at the tropical forest floor will obviously never end up in a bird strike. Also among the members of a species there will be great differences in the accident-proneness of different population categories or different phases of the yearly cycle. Quite a few of the lectures presented during this week are concerned with these aspects of bird life. The very first thing we want to know however, will always be the name of the bird species.

Identification from feathers

In the first ten years or so, we identified feathers sent from the air bases to the Zoological Museum only by comparison with the bird skins in the collection. Someone with a first-class knowledge of bird species, like professor Voous or like Kees Roselaar (who performs these identifications now), can identify a reasonable proportion of bird remains, say 40 – 50%, from inspection and comparison of feathers by the naked eye. In some cases this may involve time-consuming checks bird skins from many museum drawers, before one is found with convincingly matching feathers. In the mid nineteen seventies, the present IBSC chairman, Luit Buurma, suggested that we should embark on the study of feather characters which can only be seen with help of a microscope.

At the Smithsonian Institution in Washington DC, Roxy Laybourne had applied with remarkable success microscopical characters to bird remains recognition. These characters had before been used in forensic studies and in the analysis of prey items found in pellets and droppings. She trained a whole group of followers who alle returned to their home bases with a sound knowledge of the application of this technique. Her student at the Smithsonian, Carla Dove, is still actively identifying the bird remains collected from aircraft of the US Air Force. In a minute I'll explain that the technique alone is not sufficient. Like with entire feathers, a thorough knowledge of the distribution of the characters over the avian world is also essential.

With support from the RNLAF, Tim Brom, working at the Zoological Museum in Amsterdam produced a first identification key for European birds. At several conferences of BSCE (as IBSC was formerly named) he demonstrated the possibilities. With help of this method the proportion of identified birds can almost be doubled. In many countries microscopical identification was taken up, most systematically in Israel where the problem of bird strikes was tremendous. Jointly the Israeli and Dutch ornithologists incorporated their knowledge into a CD-Rom bringing microscopical identification of bird remains within the grasp of any interested researcher. It is now routine wherever bird remains are studied in the context of bird strike prevention. Again, I can skip the details as members of the Bird Remains Identification Working Group can easily exchange these among their number. A significant point, however, is that identification becomes only possible after a great many species have been studied and the findings are presented in the form of a dual choice or multiple choice identification key.

Characters and keys

The same is true for any method of identification. In the course of the various BSCE and IBSC conferences we have witnessed the development of several additional techniques, such as electrophoretical comparison of patterns resulting from keratine analysis, studies of the surface sculpture of the quills of feathers and, most promising, DNA studies. For all these techniques to be of practical significance a relatively large data set has to be assembled against which information of birds to be identified can be checked. Studying a particular set of remains in a great number of ways makes no sense as long no relevant comparisons can be made. Before starting an identification we simply do not know which species is involved and this means that a comparison has to be made with a great number of species. The choice of characters for bird strike analysis is therefore limited to those characteristics of which we know the distribution over the avian world. Only these can meaningfully be brought together in an identification key, either on paper or in a computer programme.

This applies also to DNA studies. Of course these are going on everywhere, but the fact that we know the complete sequence of man (*Homo sapiens*) does not help us in comparisons of birds. What we need is a relatively short part of the DNA sequence for a large number of bird species. The most sophisticated computer programmes can only compare sequences if the information is available. Not that I am pessimistic about the possibilities in this respect, but the fact remains that a DNA sequence comparison is still quite a bit more expensive than the inspection of a small piece of feather under a microscope. Identification of bird remains using DNA will be a great help in cases in which it is vitally important to know which species of bird hit an aircraft in a particular situation. This type of information serves the analysis of serious birdstrike incidents.

Reading the meaning of the identifications

What I am aiming at is something different. Identification of bird remains is not just needed in the analysis of incidents, it should be used in the reduction of the bird strike risk. Finding the name of the bird of which the remains were found on or inside an aircraft is just the beginning. We want to be able to interpret the meaning of a bird strike at a particular spot and at a particular time. In fact, the situation resembles what I just told you about the need of database for identification. Characters by itself do not tell us much, characters release their story only when comparison is possible. Only in that way they find their place in the family tree of birds. Similarly, the name of a bird species found to be the cause of a nasty accident does not tell us much about how to prevent such an accident in future. We need an extensive database of similar incidents to unravel the pattern of bird strikes in a particular country at a particular time of the year or of the day. It has been said many times before, but still tolerates some repetition: these similar incident may not have resulted in any damage. What we need to learn is the general distribution of birds in the airspace used for air traffic and the chance that a bird present in that airspace hits a plane. Other discipline, physics and construction engineering, are needed to explain why one strike results in damage and similar one does not.

However, judging from what the members of the Identification Working Group tell me, a strike not resulting in damage often does not get reported. Still more rarely the bird species involved is properly indentified. This means that neither collision physicists nor aircraft construction engineers are able to compare strikes in relation to the amount of damage incurred. For a great number of reasons bird strike statistics are still rather defective. Again this is not a new message, it is one that has been delivered at almost all IBSC conferences. But is not less true for being a little bit stale. Both to evaluate bird strike risks, deploying all available knowledge of bird biology, and to evaluate the factors responsible for the amount of damage done, we need more extensive bird strike statistics.

The future of our statistics

That said, I am enough of a realist to appreciate that after so many years of insistence on just this point without much result, we may not expect a wholesale change in the near future. Officials of military aviation are usually more easily convinced that cooperation in the building up of a worldwide reliable database deserves support. For several countries the data are reasonably complete over an range of years and allow a really informative analysis.

In civil aviation the situation is much more complicated. Even a reporting system under the aegis of ICAO will suffer from a huge variation in reporting rate among airports, airlines and other involved parties. This means that statisticians working with the available data will have to make allowance for these inconsistencies. As I am not a statistician myself, I cannot predict how informative such an analysis could be a this point in time. I think that it would be wise to turn the problem upside down and no longer to complain that aviation officials so rarely send in bird remains. Instead the statisticians should devise projects, limited in space and time, in which a particular airliner, airport or other organisation will be asked to cooperate in an effort to collect really all bird remains for a limited period. The statistical analysis of the outcome will form a little piece in a great jigsaw puzzle which will never be complete. By a clever choice of projects, however, the picture may become much clearer than it is at present.

There is much to be won by such an approach. It will make clear how a particular problem depends upon time and space. As all data will be linked to particular bird species from the start, it will suggest solutions fully in line with the biological characteristics of the species causing the problem. In our conferences we have heard many reports about the positive results of making the vicinity of airfield unattractive for birds by draining wetlands, removing rich sources of food or even relocating breeding colonies. All these measures are certainly better than calling for eradication of all and sundry birds from a wide circle around airfields as is sometimes done. We might term that a zero-tolerance strategy and be convinced that it will not do the trick. An honest pest control specialist will tell you that he likes to earn a good income for an indefinite period of time, but that eradication of all birds from a substantial area is absolutely impossible. Like aircraft, birds are flying objects and may turn up anywhere. A area with plenty of food and no competitors will act as a magnet on birds from far and wide. The created void will continue to be filled from all sides by birds not previously acquainted with the phenomenon of low flying aircraft. It is to be expected that the number of strikes will increase rather than decrease. It goes without saying that in most countries an eradication programme needed to free a region around an airport of birds would be socially unacceptable. For the reduction of the risk of bird strikes there does not exist such a quick and dirty strategy. Only patient research and data gathering will help in approaching the goal, probably never fully reached, of an aviation absolutely free of bird strikes.