2.4. Ornithological Researches in the USSR in Connection with the Bird Strike Problem.

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The ornithological researches being carried out in the USSR to prevent bird strikes are being made in direction to investigate various aspects of bird behaviour in wide sense.This is: first-the study of bird behaviour peculiarities when a new factor-plane-appears in the environment;then-the investigation of factors attracting birds to airport,the study of various means to repel birds;and finally adaptive behaviour of birds in connection with weather conditions,particularly during migration.

The observation and collection of facts have been carried out during the inspection of series of Baltic,Caucasian and Ukrainian civil aviation airports.By present time we have data about more than 1200 bird strikes in the civil aviation,mainly in these regions og the country.On basis of airport and of analysis about 600 bird strike,common situation in the civil aviation and Air Forces was reported in 1969(Jacoby,1969).Series of measures to prevent bird strikes have been outlined on the basis of these researches(Якоби ,1966; Рыльский,Якоби, 1967; Панин,Якоби 1969; Якоби, 1969b; Якоби,Липинский, 1969; Якоби, 1972;Jacoby,1969).

The main attention has been turned to biological analysis of bird strikes.Apart from interesting facts of general biological importance,such as,for example,the bird strike at 7200 meters altitude over Kazbek mountain or Mistle Thrush strike at night at 3600 meters altitude(Якоби ,1970) and several cases of bird strikes in solid clouds or in darkness- there has been ascertained the extremely rapid bird adaptation to learn how to avoid strikes with planes.Only the birds come into collision with planes who see for the first time a plane rapidly approaching them and who don't have any experience how to avoid such a collision.It has been ascertained on basis of analysis of victim's species structure that these were first of all migrating birds(Якоби, ,1970,1972a,b;Jacoby 1970,1971).Thus,for examp-

le, The Lesser Black-backed gull fell victim of plane September 6-th 1971 at one of Moscow airports. It is extremely uncommon migrating bird in Moscow region. Only one specimen of this bird was obtained here in 1886. The strike with migrating lapwing took place in Turkmenia, where this bird appears only during migration. By autumn the strikes occure frequently enough with flocks of starlings who appear at airports for the first time. There are registered many cases of strikes with wigrating waterfowl and other birds within the area of large airports. For example a series of cases took place literally over Leningrad and Chita cities(Якоби ,1970)where only migrating birds could appear. At Mineral wody airport a plane when starting to land, strikes in the night a flock of Bitterns(Botaurus stellaris). These are typically migrating birds here.

The analycis of seasonal distribution of bird strikes, being taken separately by various geographical zones, shows that in the spring the wave of strikes comes from the South, from wintering districts to the North and North-est over direction of migration. Thus the bird strike over Kazbek mountain mentioned above took place March 1-st 1970. These were most probably geese or cranes because there are no soaring birds of pray here at this time. There are characteristic the Gadwall strike with TU-104 plane at night in the Sukhumi area March 2-nd 1971; AN-2 plane strike with flock of ducks and AN-24 plane strike with ~~mmmmmm~~ unknown birds in the middle of March in Turkmenia(Newspaper Prawda. 31.03.72). In northern regions, for example in Baltic republics this wave passes during April and May. The sharp increase of the number of strikes is characteristic also for the period of fall migration in September, October and partly in November. The number of cases in the autumn is considerably greater than that in the spring at the expense of general increase of number of bird after reproduction season and first of all at the expense of young unexperienced birds who strike planes more frequently. In the autumn the wave of strikes moves in the direction opposite to spring one, that is-from the North to the South or South-West. As birds are moving to the South during the autumn migration the number of strikes by the end of migration falls to the minimum because birds are gaining their own experience to avoid

strikes when flying through many airports as well as because of learning from other more experienced birds. The increase of number of bird strikes in June and July is timed, in our opinion, to the period when young birds fly out of their nests. During this period just young badly flying and badly orienting birds, particularly those who just now flew out their nests, fall victims of strikes in the first turn. Adult birds both-settled and migrating, but locally nesting, do not strike with a plane, as a rule. These birds have learned how to avoid strikes because they know dangerous places being used by a plane to take-off or to land at given airport, as well as dangerous distance to a plane when it necessary to fly up in order not to become plane's victim(Якоби ,1972 a,b; Jacoby, 1971).

Proceeding from this analysis the birds represent the greatest danger during migration period and in the time when young birds appear on the way of planes. The main measures to prevent bird strikes during this period are: to repel birds away from airport and to create unattractive ecological situation for their feeding and rest; to use the airport's radar means to inform about dangerous bird migration within the area of plane's flights; to clear out the regularities of bird's mass migration and to try to forecast them.

At USSR airports the birds are scared away the most frequently and in the most efficient way with help of rocket Very. During 1967-1968 the possibilities were studied to use acustic method to scare birds away of airports. For this purpose the distress calls of Black-headed gull, Common gull, Herring gull, roocks, starling, jackdaws and magpies were recorded by tape-recorder. The reproduction of distress call by means of powerfull 25 or 50 watt long speakers has displayed an efficient repel action at places of bird accumulation on rubbish dump(Якоби, Липинский ,1969).

Proceeding from this facts 10 powerful long speakers(from 10 to 50 watt) have been installed along Tallin's airport runway (Якоби ,1970 b). The transmission of record of Black-headed gull distress call has scared away not only this species of gull but also the Herring gull and Common gull who used to sit down for the rest on airport's runway in time of sea storms.

During two years of this installation operation no gull strikes have occured here.Only in the fall of 1971,when the installation had been in disrepair,the strike of Herring gulls flock with TU-124 plane has occured.It is interesting to note that the testing of british records of distress calls of gulls and lapwings in Estonia has given the same result as the transmission of our records.But the estonian Herring gull did not pay any attention to the transmission of american and canadian records of distress call of the same species of gulls(Якоби ,1971).

Since 1964 the USSR started the radar observation of bird migration by means of 10 cm surveyllance airport radar(Якоби ,1966, 1968,1971 a).

In the South-West Turkmenia,where these observations have been carried out,the large water fowl birds-pelicans are flying the considerable part of their way over the desert where visually their migration has not been observed.Visually their migration has not been observed only at Murgab river reservoirs where birds have been gathering some time by large flocks(up to 2000)for the rest and feeding after having migrated over the desert.The combination of radar and visual observations has made it possible to ascertain some interesting peculiarities of pelican's flight over ecologically unfavourable landscape.The pelican's flight has occured in extended front(up to 60 klm)at altitudes up to 3 klm. Practically they can not be seen from the ground in this time. The behaviur of bird flocks which has been ascertained as a result of radar observations points at possibility of visual contact between individual flocks.This can be considered as adaptive peculiarity.Owing to the visual intercommunication between flocks there appears the possibility to select the most favourable- in aerodinamical aspect(wind power and direction,presence of uprising airstreams)- way of migration found by one of flocks. When one of the flocks,flying ahead of others had turned to go to feeding and rest place or to clamber up in circles,the other flocks changed their flight direction and flew to the same place. When visibility was good the size of flocks was greater and they flew at higher altitude at larger distance between each other. Under worse visibility or under low cloudiness they flew at lower altitude and at lesser distance between each other.The same

phenomenon we have observed in Baltic when wathing wood pigeons migration. Judging from the flight duration of wood pigeon flocks going one after another and from distance between flocks-the visual communication between flocks amounted to 800 klm. Proceeding from radar observations of sparrows migration made by Bruderer(1971)the distance between flying individually at night is such that there can be acustic communication between them.

Another series of radar observation has been carried out in Estonia.About 2 million sea ducks fly during two weeks in the spring across the strait between the Saremaa Island and the continent only.These birds fly towards the Finnish bay.The spring migration of common scoter and long-tailed ducks(predominant species of migrating birds here) has been studied here with help of radars(Bergmann,Donner,1964).

At present time the estonian ornithologists jointly with the other soviet ornithologists at Baltic sea costs,as well as with the ornithologists of the Finland,Sweden,Denmark,East and West Germany are carrying out periodically the visual observation of common scoter migration according to united programm.

In 1968 simultaneously with the visual observation of mass common scoter summer moult migration which has been performed during the period between July 20 and August 4 th(Якоби,Инги 1970).This had made it possible to increase considerably the space observed from one point,to observe the flight at high altitudes and night and to define precisely the altitude,the speed and direction of birds flight. The comparison of data, obtained from visual observation in 9 points of Estonia,with radar observation,covering all Estonia,has made it possible to ascertain some peculiarities of common scoter moult migration which have not been noticed here before. The migration took place not only alongside seacost but over continental part of Estonia, too,in more than 100 klm far from coast.It is surprisely for this sea ducks.The common scoter flight over land has been marked mostly before and after sunset up to two o'clock in the night or early in the morning after sunrise to 8 o'clock in the morning.At this time the mass common scoter flight has been noticed mainly at 1200-1600 meters altitude and sometime at 3000-4500 meters altitude.

Our observation that the altitude of birds flight is increasing immediately before and after the Sunset have confirmed the observation of finnish ornithologists(Bergmann,Donner,1964),who also have observed at night common scoter flight over the land but at 2-3 klm distance from the seacoast.The radar observations have confirmed the estonian ornithologist's assumption that large flocks of common scoter fly over land from Chudskoye lake toward the South-West.

During visual observations which had been made before(Ивгин 1961) it was noted that the flight of common scoter and of other sea ducks takes place mainly under wind speed up to 5 m/sec it does not depends on wind direction.According to our data the maximum of flights has been noted under northern fair winds. In such a way common scoter moult migration may be considered as a good model to study regularities of bird migration and to forecast them in connection with the weather conditions.

The joint radar and visual observations were carried out repeatedly in 1971 from July 12 th to July 27 th. For the first time in the USSR these surveys have been accompanied with photo registration by radar's moving target indicator.

Although by now are not yet processed in full,but they have confirmed the conclusions obtained in previous observations about mass night flight of sea ducks over land at high altitudes.These observations are intended to be continued in future.

Finally the ornithological data have been used to choos criterie on to test bird-stableness of civil plane's engines(Якоби,Горячев ,1972).

The comparison of the frequency of plane strikes with birds weighting more than 1,5 kgr at flight speed more than 450 klm/h; the definition of possible number of birds of different size and weight getting simultaneously into air intake the definition of various peculiarities of their flight in flock;the comparison of the weight and the number of birds having hit the engine with damage done by such a strike-makes it possible to ascertain the acceptable standards of engine's bird-stableness which secure the minimum probability of heavy consequences.

Such index is represented by relative kinetic energy of strike (according to the formulae $\frac{mv^2}{2}$) which is equal to 1200 kgm.

It is equivalent to the strike of a bird weighting 1.5 kgr at a speed 450 klm/h.

Attraction of airports personel attention to the danger which birds may represent for planes and as a result of this the more frequent use of the most simple means to repel birds;liquidation of some factors attracting birds(dumps,little gutter and others); warning about bird appearance on the plane's course who are seen at moving target indicators of airport radars have decreased in 1970(as against 1968 and 1969) by 40% the number of bird strikes at inspected civil aviation airports in Baltic Republics,in Caucasus and Ukraine.

References

1. Jacoby I96[illegible].On orientation of migrating birds."Mechanisms flight and orientation of birds",Moscow,I68-222

* 2. Jacoby I966 a.To avoid collision between aircraft and birds. J.Aviatsiya i kosmonavtika N9.,35.

* 3. Jacoby,Rylski I967.Caution,Bird on Route. J.Aviatsia i Kosmo - navtika,N8, 49-52.

* 4. Jacoby I968. Visual and radar observations of spring mig - ration of pelicans in south-eastern Turkmenia. "Mechanisms movement and orientation of animals", Kiew,I42-I48.

* 5.Panin,Jacoby.I969 a. And again the migratory flight of birds. J. Aviatsiya i kosmonavtika N4,38-39.

* 6.Jacoby. I969 b.Radar studies of bird migrations"Itogi nauki. Zoologiya.I967".VINITI.Moscow,3I-5I.

* 7. Jacoby. I969 .Biological principles of bird strike prevention.Ibidem,52-87.

* 8.Jacoby. I969 i .Problem of bird strike and purposes of the ornithological investigation in this problem. Ornitologiya v USSR.5 All Union ornithol.conf.Ashkchabad

9.Jacoby,Lipinskii.I969.Prevention of bird strike in civil aviation. MGA.NIIGA,ONTEI,page 62.

* I[illegible].Jacoby. I970a.Problem of bird strike on Baltic airports. Proc.7 Baltic Ornithol.conf.Riga.,97-I0[illegible].

II.Jacoby. I970b.Accustic repellent at Tallin airport.J.Civil Aviation,N6.

* I2.Jacoby.I970 .Analysis bird strike against aircraft.Priroda N9.

* I3.Jacoby,Iygi.I970.Radar and visual observation of the moulting flight of common scoter.Proc.7 Baltic Ornithol.conf. Riga,I0I-I04.

I4.Jacoby .I97I.Acoustical repellents and their using in practic. Proc.sympos"Analisatornie Systemy i orientacionnoe povedenie ptits".Moscow,4I-43.

I5. Jacoby.I97I a.Radar and orientation of birds.Ibidem. Proc.sympos."Analyzing Systems and Orientational Behaviour of Birds",Moscow,II6-II[illegible].

I6.Jacoby.I972 a. Bird behaviour and aircrafts.Proc.I Conf.on Animal Behaviour.Moscow.

I7.Jacoby.I972 b.Aircraft's damage from bird strikes."Problems of the biological damage of materials,goods and construction".Moscow.

18.Jacoby. 1972 .Bird behaviour and planes. J.Priroda N3,94-96.

19.Jacoby,Goryachev. 1972.On criterion airworthiness test of the engines USSR civil aircrafts."Proc.2 Sympos.Biol. damage mater.,goods and constructions",Moscow,136-138.

20.Jacoby.1969.Bird strikes in the USSR.Proc World Confer.Bird Hazards to Aircraft.Kingston.Canada.,101/109.

21.Jacoby.1970.Bird behaviour and technics.XV Congr.Intern.Ornith Abstracts.Haague.Holland, 128.

* 22.Jacoby.1971.Bird behaviour and man-made objects.Minutes of the 5C Meeting Assoc Comm.on Bird Hazards to Aircraft. Ottawa.19.C3.71. and in Field Note N 57.

23.Jorgmann,Donner.1964. An analysis of the spring migration of the common scoter and the long-tailed duck in southern Finland."Acta zool.fennica" N105., 3- 59.

24.Bruderer.1971. Radarbeobachtungen Über den Frühlingszug im Schweizerischen Mittelland(Ein Beitrag zum Problem der Witterungsabhängigkeit des Vogelzugs). "Ornithol.Beob.",68,N3.,89-158.

25.Iogy.1961.Migration waterfowl birds and weather. Proc.4 Baltic.Ornithol.Conf.Riga.

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