Seasonal dynamics of corvidae presence on the territory of the “Tomsk” airport in terms of ornithological flight safety

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Abstract. The study presents the results of year-round corvidae observations of aircraft dangerous to the aircraft in the airport. The annual dynamics of these birds’ occurrence were traced, their danger to aircraft was evaluated at different periods of the year and the reasons contributing to the increase of danger for aircrafts at certain periods were traced. The factors contributing to the corvidae presence on the airfield were identified.

1. Introduction

The problem of ornithological flight safety is one of the leading positions in aviation. According to statistics [11, 10] aircraft collides with birds on the territory of Russia on a regular basis throughout the year and is the main external damaging factor of biological origin. Every year there is a tendency of increasing number of airplanes collisions with birds, due to factors such as: an increase in the intensity of air traffic, engine noise decrease.

Studies show [1, 5] that only 5% of all bird collisions with airplanes occur on the route. The main number of collisions with birds occur at altitudes of up to 300 meters when the aircraft lands or takes off. Thus, it is obvious that the greatest number of bird strikes occur in and near the aerodrome. The basis of the effective ensuring of the ornithological safety of aircraft flights lies in the knowledge of the ornithological situation in the airfield and in its vicinity.

Regular monitoring of the ornithological situation on the airfield and in nearby areas allows assessing the causes and intensity of bird movements throughout the territory, identifying species dangerous to the aircrafts, predicting the ornithological situation, and promptly taking preventive measures.

2. Theory

According to the theoretical axiom of life-saving safety any bird is a potentially dangerous for the aircraft. Even a small bird can cause damage, for example, a light-engine aircraft. In commercial aviation as practice shows significant damage to aircraft as a rule is caused by medium and large-sized bird species [4] against which first of all, measures should be taken to ensure the ornithological safety of aircraft.

The effective protection of aircraft against birds should be based on the principle of a differentiated approach, the essence of which is that all bird species have different danger for aircrafts and when planning ornithological measures to ensure flight safety, one should focus primarily on minimizing the threat from those birds that pose the greatest threat at a given airport in a given period of time. The danger of different species of birds for aircrafts is determined by a number of species-specific factors,
behavioral activity, age characteristic, size and density in the territory, statistics of collisions with aircraft. Based on these factors the ranging of the most dangerous species and groups of birds found on the territory of the airfield of the Tomsk airport were carried out [6-8]. Subsequently the theoretical substantiation of the air danger of a number of species was confirmed by actual cases.

One of these airborne species is the gray crow (Corvus cornix L.). Birds of this species are found on the airport throughout the year. However, an assessment of the nature of their stay shows that the gray crow represents the greatest air danger mainly in the summer period. A similar conclusion was made on the basis of regular year-round monitoring of the bird population in the airfield, with an emphasis on self-hazardous bird species, in particular, and the gray crow and related species (forty (Pica pica L.), black crow (Corvus corax L.)).

3. Materials and methods

The study was based on data on crows’ occurrence on the territory of the Tomsk airport in period from 2015 to 2017. Evaluation of the dynamics was carried out by birds’ observing not on the territory of the airfield. Observations were carried out regularly, 2-3 times a week all year round. Observations were carried out in the early morning hours, with the rising of the sun, and in the daytime. The duration of observation was at least 1 hour. In order to cover the largest area of the airfield, the observation was carried out consistently from several points or from a car moving in different parts of the airfield. In the process of observation parameters such as the number of birds on the airfield, the number of flocks, the behavior pattern (feeding, sitting, crossing, flying over the airport), the approximate flight level, the time during which the greatest activity of birds is observed, were evaluated. In summer season of 2017 the age composition was estimated, which became possible due to the organization of corvidae catching on the airport [9]. In order to track the corvidae’ movements 40 birds were marked with standard aluminum license rings (Figure 1), and another 6 birds were marked with yellow plastic wings.

![Figure 1. Crows’ capture and ringing (Corvus cornix L.) at the airport "Tomsk"](image-url)
4. Results and discussion
The ornithological situation on the territory of Tomsk airport has pronounced annual fluctuations [7]. From the standpoint of changing the ornithological situation, it is convenient to divide the annual cycle into periods, each of which is determined by the bird activity characteristic of a given annual cycle. Thus, 4 periods are most typical for Tomsk Airport: winter (III decade of November - III decade of March), spring (III decade of March - I decade of June), summer (II June - I decade of September), autumn (II decade of September - II decade November). During changes in ornithological activity on seasons corvidae also demonstrate changes in their behavior and activity during the year.

The lowest occurrence of corvids in the airfield is observed in the winter period. At this time, predominantly single birds and small concentrations of not more than 6 birds are observed on the airfield. The common occurrence of corvids in the morning period (from 8.30 to 10 hours). At this time, the morning fodder movements of the gray crow [2] are observed, the observed birds during this period of time crossed the airfield at altitudes of 50-100 meters, not lingering on it. There is a gray crow sees mating behavior in February-March. At this time, birds in small groups of 2-4 birds can circle above the airfield and close to it in different directions. Such movements are typical in the morning.

There is a black raven in the morning in the airspace above the airfield and near it, these birds fly mostly one by one and by the end of the winter period in pairs and triples. Their occurrence is irregular and ranges from 0 to 5-6 birds per study day. The magpies do not show pronounced daily activity, but their movements are concentrated mainly near shrub vegetation in the peripheral part of the airfield and along the terminal of the terminal. In the winter, magpies appear very rarely near the runway.

Near the runway in winter period corvidae are the most widespread during periods of cleaning the strip from snow. Snowplows expose the asphalt pavement of the runway and the soil cover, destroying the numerous snow shelters of small mouse-like rodents, on which corvidae hunt for, gathering near the working equipment group of up to 4-6 birds. During this period, the birds are engaged in foraging activities and move intensively near the runway, human presence and working equipment do not frighten them, but they don’t let them get close to themselves, keeping a distance of several tens of meters. Such behavior, as well as the temporary separation near the aircraft and birds near the strip, suggest that such fodder corvidae concentrations represent minimal airborne hazards.

In the spring period (the third decade of March - the first decade of June), the nature of corvidae staying on the airfield and their behavior change. In April - the first half of May, the occurrence rate of crows flying by them decreases, which is due to their nesting. The birds encountered during this period in the airfield show mainly feed activity, being single birds or in small groups of 2-3 birds near the runway, less often in the meadow part of the airfield. The main reason why birds do not stay for a long time on the territory of the airfield is the appearance of lapwings on it (Vanellus vanellus L.). With the arrival and the beginning of lapwings nesting on the meadow part of the airfield in the second half of April - they intensively drive birds away from this territory, attacking corvids, kites (Milvus migrans Bodd.) And other birds that may pose a threat to their laying and broods. Individual birds feeding near the runway and not representing a threat - lapwings are ignored. During this period, the ravens show high caution and caution, keeping a distance from a dangerous object (a person is not allowed closer than 100 meters) and leave the territory in advance in the event of a threat. By the end of May and the beginning of June, the activity of the gray crow increases, the occurrence increases, and young birds begin to appear. In June, there are even cases of ravens attacking chicks lapwings, however, during this period the birds hunt mainly on the meadow part of the airfield, in low grass. The zone near the runway is almost not visited by the crow during this period, except for cases when lapwing cheepers are not near the runway, as a result of which the hunting process can occur dangerously close to the runway. The situation is aggravated by the fact that at the moment of hunting in the airspace an increased accumulation of lapwing and crows is formed. For the purpose of prophylaxis, it is recommended that during this period of the year, before taking off or landing aircraft, it is necessary to detour the runway by car, which helps to scare birds away from the borders of the strip and disrupts
In the spring, the magpies still mainly occur in the shrub zone on the periphery of the airfield, but by the end of the period, the magpies more and more often fly over to the side of the runway and taxiways, where they sit on the asphalt surface. In spring, the black raven practically ceases to meet at the airport, only a few birds fly by at the aerodrome territory. In the summer period (June 2nd decade - I decade of September) the occurrence of the gray crow on the airfield reaches its annual maximum, which is due to:

1. increase in the total number of birds due to the appearance of young individuals
2. the attractiveness of the airfield for foraging throughout the summer period.

The intensity of the crow's stay on the airfield is uneven throughout the day, birds in flocks visit the airfield, stopping here for foraging. In the initial summer period, the raven attracts a meadow zone covered with low grass, which facilitates the search for prey: clutches and chicks, rodents (Figure 2), insects [3]. Crows form fodder group of 10-25 birds.

![Figure 2. Lapwing cheepers and vole remains - gray crow food objects on the airfield of airport "Tomsk"](image)

Young birds dominate in flocks. Catches has shown that the balance of adult and young birds reaches 1: 4, respectively. During this period the crows represent the maximum air hazard. Food accumulation is the most dangerous for the runway. Young birds do not have enough experience in avoiding danger and when they appear near the aircraft, they can perform aircraft-hazardous maneuvers along the course of the aircraft, most often this is expressed by the birds crossing the aircraft’s course, or by circling the flock in the air, instead of flying off to the side.

From the end of June until the first half of the period, grass cutting is regularly mowed [10] on the airfield, which additionally attracts corvids (Figure 3). In order to reduce the number of birds during grass cutting, it is recommended to work on haymaking at night, when corvids are inactive.

Magpies, like ravens, are found on the territory of the meadow zone of the airfield and on the asphalt parts of the runway, but much less frequently than the crows, since the magpies find a sufficient food base in the surrounding settlements and in the bush vegetation on the periphery of the airfield. Among the magpies young birds also predominate, but the magpies do not form such large aggregations (maximum up to a of 5 birds), they are more fearful in comparison with the crows and leave the territory in time when danger arises.
The autumn period (II decade of September - II decade of November) is characterized by a gradual decrease in crows' occurrence up to the winter minimum level. In the first part of the autumn period (until mid-October) migratory flocks of corvids had met on the airfield.

A characteristic feature of migratory flocks is
1. timidity (they are acutely reacting to poultry-repellent bioacoustic devices, leaving the territory).
2. inadequate behavior towards the aircraft (instead of leaving the reaction, such a flock can rise into the air and start circling in the danger zone) (Figure 4)

Figure 3. Crows' flock near the runway during the daytime mowing season

Figure 4. Migratory flock of crows. crossing the course of the aircraft (airport "Tomsk")
Considering the general fearfulness of such flocks during this period, it is recommended to make a regular detour of the runway, and when making visual contact with the flock - to use bird-scare pyrotechnic and acoustic means. With the systematic impact of such measures migratory flock leaves the territory of the airfield.

From the second half of October crows’ occurrence begins to decrease down to single individuals. By the end of November, with the beginning of snowfall - the birds mostly cross the territory not lingering on it. Small accumulations can be observed in the late autumn period near the working snow removal equipment, similarly to the winter period.

The occurrence of magpies during the autumn period is noted at a more or less constant level (3-7 individuals per survey). With the falling of snow the magpies practically do not appear near the runway, the majority of the birds are found on the platform and aircraft parking, where they search buildings and aircraft in search of food. The occurrence of the black crow increases by the end of the autumn period from 0–1 specimen / checking up to 1–5 birds / counting.

By the end of the second decade of November, the occurrence rate of corvids on the airfield of Tomsk airport is set at the winter level.

5. Conclusions

According to a study conducted, corvids found on the territory of Tomsk airport year-round. The most tense ornithological situation is created by birds in the summer and in the autumn period, the main reasons for increased air safety are a high proportion of young birds and aggregating behavior as well as the appearance of "inexperienced" birds on the airfield in the autumn. In other periods crows’ presence does not have a critical effect on the accentuation of the ornithological situation. Among corvids that are found on the territory of the Tomsk airport, the most dangerous for the aircraft species is the gray crow which often found in the schooling variant and near the runway. Magpies and black crows are less dangerous for aircraft because occur in smaller quantities, do not form pronounced clusters near the runway and are very cautious.

On the basis of the conducted research duty schedule of the official car on the runway was developed and introduced. As a result of which the incidence of crows in summer and autumn periods was reduced in this zone. It has been established that poultry repellent bioacoustic devices work more efficiently in the first half of the autumn period, since migratory flocks of corvids do not have time for habituation.

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