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Analysis and assessment of procedures for management of avifauna presence implemented in airports of Ukraine

Different procedures and approaches to the management of avifauna presence at the airport are analysed. The factorial assessment of the most common bird control strategies in airports of Ukraine is presented.

One of the main and most important elements of the ornithological management system at airports is the planning and implementation of procedures for controlling the presence of birds, which are also called implementation. Their purpose is to prevent and/or eliminate the presence of birds in the territories of enterprises. In order to ensure a safe environment for the operation of aircraft, four aspects of wildlife hazard management are generally distinguished: (1) prevention; (2) deterrence; (3) detection; (4) persecution.

Prevention of wild animals from entering the area of the airfield is usually carried out by installing a suitable fence around the perimeter of the airfield area, the structure is normally a concrete fence. Obviously, this type of bird presence management is the least effective, but it is used to discourage birds that are less likely to take to the wing or do not fly at all (e.g. *Perdix perdix*), as well as smaller birds that are reluctant to climb to great heights, tend to form big flocks and actually constitute a significant danger of collision (resulting in death of birds and sometimes – damage to aircraft, economic losses and even injuries).

Deterrence is implemented by reducing the attractiveness of the airfield area. The main tools for this are:

1. Management of land resources, that is, measures for the care and supervision of the natural environment, which include:
   a. maintenance of runways in a state of operational readiness;
   b. extraction of fodder (dry fruits) that can serve as a feeding base;
   c. maintenance of an appropriate height of the grass cover (mowing procedures can attract predators, so the procedure is combined with persecution if necessary);
   d. removal of dead birds and animals;
   e. management and removal of nesting sites and nests.
2. Management of threats that arise outside airports' boundaries, particularly – maintenance and management or elimination of places that can attract birds in the area near the airport (15 km): cemeteries, landfills, abattoirs, warehouses for the sale of animal fodder, farms, garbage pits, sedimentation ponds and other technical water bodies etc.

The detection consists of procedures of population assessment, statistical processing and analysis of avifauna records at the site, as well as data on collisions, records on inspection of airports during increased bird activity periods, records on identified bird or animal remains, as well as work with a long-term database of

ornithological monitoring. This category is mainly forward-looking and focuses on understanding ornithological patterns to improve risk assessment and prevention, and manipulating bird behaviour and adaptations to create a sustainable and safe environment in the airport area. Obviously, detection is also vital in the context of collision prevention, and immediate and urgent bird removal during flight operations, which is achieved via well-established communication and signalling systems, rapid transmission of bird surveys and monitoring data inside the airport.

Persecution is the most active, highly effective and operational method of bird control. At the same time, persecution procedures are mostly applied under specific conditions, to control the presence of birds in critical areas and situations to achieve immediate, often short lived effects, as opposed to permanent or continuous application and stable long term outcomes. Methods of chasing and dispersing birds include:

A. Use of automobiles, including headlights, sirens and horns. This method is the most effective from a financial and technical point of view, easy to implement, manageable and relatively safe for the environment. However, it has limitations in use in adverse weather conditions (in particular, rain), usually requires more time to achieve the desired effect, and can also cause habituation in birds in case of exclusive use. Nevertheless, this method is the most widely used on the airports' territories.

B. Bioacoustic means. This method consists in reproducing signals-cries of "trouble" and "hazard" of various types of birds. Causes rapid habituation in case of frequent use, thus most often used in combination with other methods.

C. Laser tools. This method is implemented by directing a coloured (often, green) spark laser beam in the direction of the bird(s). Birds do not get used to this product, but the effectiveness of its action in sunny weather decreases three times. It also can temporarily blind birds resulting in unintended deaths and/or injuries to wildlife.

D. Pyrotechnic means. This method lies in deterring birds by creating smoke, light and noise effects using pyrotechnics (for example, firecrackers). The explosion is a very noticeable visual and auditory stimulus for most bird species, which causes an immediate response to it. The effectiveness of pyrotechnics is enhanced if a shot is used to increase the threat associated with the auditory stimulus of the birds. Downsides also include possible injuries to the sensory system or accidents amongst avifauna.

E. Lethal control via firearms. This method involves killing some birds to scare away the main flocks, or killing singular birds, which were not driven away by any other means. For this approach, wildlife hazard management personnel must have firearms licences and appropriate training and qualifications. For obvious reasons the method is highly undesirable, causes public reprobation and is used only in critical cases.

F. Biological means. This method is more unconventional and utilises trained birds of prey to scatter and deter other birds.

In critical cases, lethal methods of control through the use of firearms are also applied in some locations. For these reasons, wildlife hazard management personnel must have firearms licences and appropriate training and qualifications. For obvious

reasons, this method is highly undesirable. Below is an indicative assessment of different approaches to managing the presence of avifauna at the airport (Table 1).

Table 1.

Factorial assessment of bird control strategies in airports of Ukraine

Assessment factors / indicators	Alternative solutions / approaches								
	Preventive			Control					
	A1	A2	A3	A4	A5	A6	A7	A8	A9
F1	1	3	1	3	3	3	3	3	2
F2	1	1	2	2	2	1	2	2	2
F3	3	2	3	2	2	2	2	3	3
F4	3	2	3	1	2	1	1	1	1
F5	1	1	3	3	3	3	3	3	3
F6	2	2	2	1	1	1	1	1	2
F7	2	1	3	2	2	1	1	0	2
F8	3	3	3	3	3	3	3	3	3
F9	1	3	3	1	1	3	2	2	1
F10	2	2	2	2	2	1	2	2	2
F11	3	3	2	1	3	1	1	1	1
F12	1	1	0	3	2	2	3	3	3
Total	**23**	**24**	**27**	**24**	**26**	**22**	**24**	**24**	**25**

The assessment is based on the matrix method of comparison, based on the principles of Multi-Criteria Analysis and optimization, which are widely used in appropriate adaptation for solving problems and making decisions in many areas [1]. In the process of assessment the following alternatives were evaluated:

- A1 – Prevention;

- A2 – Deterrence;
- A3 – Detection;
- A4 – Persecution (automobiles, headlights, sirens and horns);
- A5 – Persecution (bioacoustic means);
- A6 – Persecution (laser tools);
- A7 – Persecution (pyrotechnic means);
- A8 – Use of firearms for lethal control;
- A9 – Biological control.

The assessment itself entailed scoring of alternatives from 0 to 3 (zero – for the least effective and most economically straining, environmentally unfriendly, socially unacceptable, technically complex and unfeasible, unsustainable, delayed, temporary, short-term solutions etc., while 1, 2 and 3 respectively representing gradual improvements) relatively to the following factors:

- F1 – the effectiveness of solving the given task;
- F2 – financial costs/investments;
- F3 – negative consequences for the environment;
- F4 – negative consequences for avifauna (direct impact);
- F5 – negative consequences for avifauna (indirect impact);
- F6 – positive consequences for avifauna;
- F7 – social implications and resonance;
- F8 – impact on health and safety of people/population;
- F9 – durability/permanence of the effect;
- F10 – technical complexity/feasibility;
- F11 – dependence of the implementation of the alternative on external factors;
- F12 – the speed of achieving the effect in the process or after the implementation of the decision.

Given the division of methods into preventive and control ones, it is appropriate to separately compare alternatives within each of these groups. Thus, among control measures, the application of bioacoustic measures stands out with the highest rating. This is due to the simplicity and safety of its implementation, and the possibility of integration of this approach together with any other alternative from the presented list, including preventive ones (for example, use for the gradual development of behavioural adaptations in birds). Next to the highest stands usage of trained birds of prey – the option which is highly variable in its results due to unpredictability of living organisms. Nevertheless, in the optimal scenarios, it proves to be more environmentally friendly and socially acceptable, as it imitates natural processes of deterring the birds. Then, in order of decreasing efficiency follow the use of cars, pyrotechnics, and firearms – these methods offer quick and effective solutions to urgent problems of the presence of birds, but they are not very sustainable in every meaning of this term, and they often offer a direct danger to birds, as well as high levels of dependency on external factors. Finally, a more specific, complex, expensive, as well as potentially harmful method is the use of laser technologies.

Among preventive measures, detection seems to be the most promising, because it is relatively simple, profitable and safe to implement, and at the same time has the highest potential. Investing efforts in research, monitoring and tracking populations will allow for more effective decision-making, development of more

flexible management strategies and taking into account all variables and factors, while gently influencing the avifauna to achieve a sustainable effect, developing behavioural adaptations in the form of avoidance of the airport area by birds. At the same time, it is necessary to be careful and understand that with the application of detection and monitoring, the result depends greatly on the intentions and the goal of the enterprise, and the corresponding efforts to achieve it. Next comes deterrence, which has similarly promising benefits, but is more difficult and expensive to implement, and has indirect unfavourable impacts on avifauna and the environment. Obviously, the last in this category is prevention by erecting fences that are unable to effectively resist organisms, which can easily overcome such an obstacle. However, it is worth noting that prevention as a control concept has some potential and needs to be researched and developed more actively.

Comparing the measures from both categories with each other indicates relative equivalence among the different alternatives for managing the presence of birds at the airport. It should be emphasised that from the point of view of the safety of the avifauna itself, preference should be given to preventive measures, because they are safer, cause less stress and offer a milder influence to achieve a more sustainable effect. At the same time, it may seem that the interests of the enterprises themselves come into conflict with the interests of wildlife, because preventive solutions often require more resources, and their effectiveness is significantly delayed in time, so they do not have the same potential to solve urgent problems, which is inherent to control alternatives. Yet in truth, it is author's opinion that, taking into account the completely different functional purpose and advantages, as well as the need to develop and implement both short-term solutions to solve urgent issues and long-term solutions to create ecologically, socially and economically sustainable systems, it seems optimal and necessary to combine the use both options.This can provide conditions for the implementation of a "win-win" strategy.

References

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