AIRPORTS COUNCIL INTERNATIONAL

# WILDLIFE HAZARD MANAGEMENT HANDBOOK

Second Edition 2013


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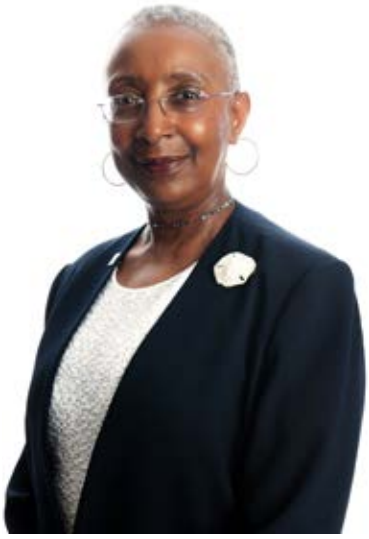
# FOREWORD



**Angela Gittens**
Director General
ACI World

Wildlife Hazard Management is an important element of the operations of all airports. ACI is proud to present the completely updated and expanded Wildlife Hazard Management Handbook. Most of the text it contains has been distilled from excellent guidance material available from several large Civil Aviation Authorities around the world, ACI Member Airports' operational safety procedures, ICAO material and other international aviation and non-aviation organizations' publications pertaining to wildlife management.

The content of this Handbook also builds upon the existing guidance in the ACI Policies and Recommended Practices Handbook, with safety related policies included in this publication for easy reference. While remaining short and succinct, it provides checklists for action, as well as an explanation of risks to be assessed and means of mitigation available. As stated in the text, local risk assessments are inevitably necessary.

This subject is clearly of great importance to Aerodrome Operators, who want to avoid or mitigate all foreseeable risks of accidents occurring from wildlife strikes. These risks and issues have been discussed many times at ACI conferences and committee meetings; therefore, ACI believes that it has the responsibility to put forward a guide to best practice, to assist its members. It forms part of a coordinated approach by ACI to Safety Management Systems for use by its members. It complements the ACI Airside Safety Handbook (4th edition 2010).

In the area of staff development, ACI's Global Training offers several courses which include coverage of wildlife hazard offered by classroom delivery and online, such as the Global Safety Network Diploma. ■

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# INTRODUCTION

A diversity of wildlife species, including birds, mammals, and reptiles, can be found on or around aerodromes the world over. Certain species of wildlife pose a risk to aviation safety. In the USA alone there have been 119,917 strikes involving wildlife reported between 1990 and 2011, with damage costing approximately $480 million (Federal Aviation Administration 2012). Since 1988, 231 people have been killed as a result of bird strikes and over 220 aircraft have been destroyed. Individual aerodromes can reduce the risk to life and property by actively managing wildlife hazards.

Wildlife hazards, just as any other hazards to aviation safety, should be identified, assessed and managed in order to reduce the risk, through a Safety Management System (SMS). The first step is Hazard identification, involving species present in and around the aerodrome, and how much damage each species could cause to an aircraft if struck (Hazard level). This is followed by a review of past wildlife strikes in order to identify which species are likeliest to be involved in a collision (Probability of a strike). The product of these factors gives the risk for that species, and can be shown in a risk assessment matrix (this process Is explained in Chapter 3). An assessment of habitats in and around the aerodrome that have the potential to attract wildlife is also completed, so that the habitat can be managed to reduce the presence of species identified as constituting a risk to flight safety.

Following a Risk Assessment, aerodrome operators must develop a Wildlife Hazard Management Plan (WHMP). The WHMP sets out the actions required to reduce wildlife hazards in and around critical aircraft operating areas, and decrease the risk of a strike.

An aerodrome WHMP should include an evaluation system to assess the success of the WHMP and its actions. This involves maintaining records of wildlife populations in and around the aerodrome, collecting data on actions, and detailing the response of wildlife to management actions. Detailed records of wildlife strikes should be maintained as part of the evaluation system.

Wildlife hazard management presents a unique challenge to aerodrome managers because of the vast diversity of species that can be hazardous to aircraft operations. Each aerodrome will have its own unique hazards to manage, and no two aerodromes will experience wildlife hazards in exactly the same way. Given the unique nature of wildlife hazard management, it is critical for each aerodrome to develop its own WHMP.

This handbook will assist an airport operator to manage wildlife hazards around the aerodrome by describing the responsibilities of the operator, guidelines for conducting a Risk Assessment and the creation of a WHMP, operational practices for Wildlife Hazard Management, training curriculum, and how to evaluate the efficacy of the Plan.

The content of this handbook builds upon the existing guidance:

ICAO standards for States: ICAO Annex 14 chapter 9, section 9.4 (Wildlife strike hazard reduction), including:
ACI policy guidance to members: ACI Policy Handbook 5.19

> **9.4.1** The wildlife strike hazard on, or in the vicinity of, an aerodrome shall be assessed through:
>
> a. the establishment of a national procedure for recording and reporting wildlife strikes to aircraft;
> b. the collection of information from aircraft operators, aerodrome personnel and other sources on the presence of wildlife on or around the aerodrome constituting a potential hazard to aircraft operations; and
> c. an ongoing evaluation of the wildlife hazard by competent personnel.

(Wildlife Management at Airport):

> **5.19.1** Aerodrome operators must remain permanently vigilant to assess the risk in real time and take the necessary measures immediately. It is crucial either to implement a bird hazard prevention and wildlife management unit, or specially trained and equipped staff to manage wildlife on the aerodrome.

# 1. What is Wildlife Management?

Wildlife management involves manipulating an animal's behaviour or its habitat in order to achieve a specific goal with regards to an animal's behaviour, population, or geographic distribution. At aerodromes, the goal of wildlife management is to change the behaviour of animals so that they do not occupy critical safety zones where aircraft operate. The key to managing wildlife at aerodromes is to understand the animals' basic requirements and how their behaviour can lead to an aviation safety hazard. Essentially, it is imperative to know why animals behave the way they do.

## 1.1 Animal Needs and Habitats

All animals have basic requirements for survival and reproduction and these requirements dictate how they will behave. They need energy and nutrients, including water, to survive and thrive. They must maintain the core temperature of their bodies, they must avoid being eaten by other animals, and they must reproduce. All of the behaviour can be traced to these basic requirements. Different species have different behaviours and some of these can lead to high risk situations at aerodromes. Once an airport manager understands the needs of the animal that lead to its high risk behaviour, they can begin to take steps to change that behaviour.

An animal meets its basic requirements by utilizing habitats within the environment. A habitat is any kind of distinguishable feature within the environment, such as an open meadow, a stand of trees or a water body. Different animals use different habitats to meet their requirements, and some vary the types of habitats they use at different times of the year, depending on the specific requirement they are fulfilling.

## 1.2 Manipulating Habitats

With an understanding of how animals behave and use different habitats to meet their requirements, we can begin to manage them. Around the aerodrome, this usually means manipulating habitats, especially around the critical safety zones, so that animals are not able to fulfill their requirements there. This kind of manipulation varies depending on the animals involved and the requirements they need to fulfill. For example, a drainage ditch full of water will provide ducks with a safe place to bathe and feed. If the ditch is directly adjacent to a runway, there may be a risk of ducks being struck by aircraft as they move to and from the ditch habitat. When the drainage ditch is enclosed with a culvert, the habitat that the duck requires is gone. The duck is no longer able to fulfill its requirements in that location, and will have to find another suitable habitat. As a result, there will be fewer ducks in a critical safety zone for aircraft, and, therefore, a reduced risk to aviation safety.

## 1.3 Active Management

Sometimes nothing can be done to change a habitat on an aerodrome, so active management might be necessary to manipulate wildlife behaviour directly. For example, concrete tarmacs commonly required for aircraft operations, can provide a habitat attractive to wildlife. In cold weather, the concrete can warm faster than its surroundings and become the warmest habitat available attracting congregations of birds. To change the behaviour might need an intervention involving stimulating the animal in a way that it perceives a danger that outweighs the gains it will receive by not changing its behaviour. In the case of birds warming themselves on concrete tarmac, a loud noise from a pyrotechnic explosive, rifle shot or air siren

can provide enough stimulus to make the animals fear for their safety and leave.

## 1.4 Removal

In some cases, it may be not feasible to manipulate the habitat or change wildlife behaviour permanently. Removal of an animal or a group of animals may be the only option. This can involve trapping and releasing them in a new location, or in extreme cases killing them. Aerodrome operators must ensure that they are compliant with all regulations regarding the wildlife species in question, and that they carry out removals in a manner as humane as possible.

## 1.5 Ethical Responsibility

Wildlife management at aerodromes is a critical part of safe aircraft operations. Furthermore, aerodrome operators have an ethical responsibility to contribute to the conservation of wildlife and biodiversity. Some of the species that present a high risk to aviation safety might be critically endangered or threatened. It is the responsibility of the aerodrome operator to deliver solutions that maintain aviation safety whilst conserving the species in question.

Wildlife management is a complicated practice that involves thorough understanding of animal biology and behaviour, including the ways in which they fulfill their basic requirements. Aerodrome operators will generally achieve the greatest level of safety if they invest in a dedicated Wildlife Hazaard Management Plan. Each aerodrome will have a different set of challenges associated with wildlife, but the fundamentals of wildlife management apply to all of them. Aerodrome operators must work with an animal's behaviour, and not against it, if they are to successfully maintain aviation safety. ■

# 2. Roles and Responsibilities

## 2.1 Introduction

This chapter describes an organizational structure that can be used to ensure the success of a Wildlife Hazard Management Plan (WHMP) and the mitigation of wildlife hazards. The airport operator's responsibilities should be borne by the senior manager role and this should be specified in the aerodrome Safety Management System (SMS). The Wildlife Control Coordinator is in charge of the implementation of the WHMP. The Wildlife Control Operators carry out the required tasks and field work. A Wildlife Committee will ensure that all stakeholders are engaged in the WHMP.

The assignment of actual roles, titles and tasks will vary from airport to airport. At smaller airports the roles might be divided or merged to just 1 or 2 levels. Larger airports will require larger, possibly dedicated teams. Some tasks or roles may be contracted to an external company or organization.

## 2.2 Senior Manager

The Airport Operator has a responsibility to provide a safe operating environment for aircraft operators, air transport users and neighboring communities.

Accordingly a Senior Manager should be identified who has overall responsibility for wildlife control. This maybe be a dedicated role or included in the responsibilities of the Safety Manager. The role should involve tasks and responsibilities that include:

- Ensuring that the WHMP is developed and implemented;
- Ensuring that the WHMP is referred to and becomes part of both the aerodrome Safety Management System (SMS) and the operational and safety culture of the aerodrome;
- Ensuring sufficient financial and human resources, including initial and on-going training are provided to enable implementation of the WHMP;
- Participating on the Airport Wildlife Committee;
- Working with external parties such as local, regional and national governments in order to avoid or mitigate regulation that might impinge on the safe operation of airports.

Specific responsibilities arising from items that should be included in the WHMP will include the following:

- Ensuring that the protected species register is included in the WHMP and that proper safeguards for these species are in place;
- Ensuring that required reports are submitted (usually monthly) to the national aviation authority;
- Ensuring that, where appropriate, habitats and land uses identified in the WHMP, especially those that will require capital development expenditure, are included in the Airport Masterplan.

Further information can be found:
*ICAO Airport Service Manual, part 3, Wildlife control and reduction, 3.3 Role of the airport operator*

**3.3.1** Because of the importance of bird/wildlife control, each airport operator has the responsibility to develop, implement and demonstrate an effective bird/wildlife strike and wildlife control programme at the airport, and this should be tailored to and commensurate with the size and level of complexity of the airport, taking account of the identification of the bird hazard and the risk assessment of that hazard.

**3.3.2** Airport operators, where practicable, should implement a programme tailored to local conditions, with assistance from the national committee or other outside agencies, as required. Where practicable, the airport operator should appoint an airport bird/wildlife control coordinator who is responsible and accountable for the airport's bird/wildlife hazard control policy and the personnel engaged in bird/wildlife hazard control. This may include the formation of a local airport bird/wildlife committee that will develop and implement the specific programme. It is imperative that personnel responsible for these tasks are able to demonstrate competence, are trained by qualified personnel and are provided with the appropriate resources and equipment to carry out their tasks.

## 2.3 Wildlife Control Coordinator

The Wildlife Control Coordinator will undertake day-to-day management and efficient implementation of the WHMP. The person might be a technical specialist, such as a biologist, or such expertise might be out-sourced. In more detail, this role will involve key duties such as the following:

- Advising the Senior Manager on all matters relating to wildlife hazard prevention, and to assist with the production and development of the WHMP;
- Planning and organizing wildlife control operations in accordance with the WHMP;
- Supervising and monitoring wildlife control operations to ensure that WHMP is implemented correctly;
- Supervising wildlife control record keeping (log, bird counts, wildlife strike recording and reporting, bird dispersal, culling and habitat management diaries, etc.);
- Providing technical supervision of Wildlife Control Operators, intelligence gathering, and planning;
- Facilitating active surveillance, wildlife dispersal, culling and other field tasks;
- Ensuring that all necessary passes and permits are current;
- Ensuring the supply, safe keeping and correct maintenance of wildlife control equipment and consumables
- Coordinating with operation and/or grounds maintenance to ensure that habitat is managed according to the WHMP; and
- Providing a communications channel between the aerodrome policy makers/providers, wildlife control operators and other interested parties, such as airline operators and air traffic control.



## 2.4 Wildlife Control Operator

A Wildlife Control Operator performs the front line role and may be any suitably trained and qualified member of aerodrome staff. This role will involve key duties such as:

- Maintaining surveillance of wildlife activity on the aerodrome and beyond;
- Implementing active wildlife control measures and interventions in accordance with the WHMP to counter any detected wildlife hazards;
- Providing the air traffic service, where applicable, with details of a potential wildlife hazards;
- Recording wildlife control activity;
- Recording actual, potential or suspected wildlife strikes;
- Advising senior personnel on improvements to the wildlife control tasks or WHMP; and
- Assisting with surveys, etc.

Further information can be found:
*ICAO Airport Service Manual, part 3, 3.4 Role of bird/wildlife strike control coordinator*

**3.4.2** The airport bird/wildlife strike control coordinator (or equivalent) should coordinate the activities of the wildlife control programme with air traffic control (ATC) and other stakeholders. The coordinator's responsibilities should allow for the time required to be involved with observations, control and reporting. The wildlife coordinator at the site should also review strike reports, monitor daily activity records and maintenance reports to determine the requirements for short- and long-term management programmes, and this information should be passed to managers accountable for safety on a regular basis (recommended at least monthly).

## 2.5 Airport Wildlife Committee

Wildlife hazard management on an airport often requires communication, cooperation, and coordination among various groups on the aerodrome. This is especially true when identifying hazardous wildlife situations, executing large-scale habitat management actions, or developing management strategies for hazardous wildlife that are endangered or threatened. Establishment of the Airport Wildlife Committee is required to facilitate this communication, cooperation and coordination. This committee might be included within the safety management committee.

Members of the Committee should include the following:

- Senior Manager
- Wildlife Control Coordinator
- Wildlife Control Operator representative
- Aircraft Operator representative
- Airport Planning Manager
- Aerodrome maintenance and operation Manager
- ATC representative
- Local runway safety team representative
- Local authorities
- Depending on the organizational structure of the airport, other representatives can also be included, such as the Fire and Rescue Department or the Runway Control Department

Further information can be found:
*ICAO Airport Service Manual, part 3, 3.4 Role of bird/wildlife strike control committee*

**3.4.1** The airport bird/wildlife strike committee should include those involved in bird/wildlife control, airport planning, maintenance and operations. It should also include air traffic services, flight operators, rescue and firefighting services, security, duty managers, finance, etc. The committee should review strike data collected and observations of birds/wildlife, assess bird/wildlife risks and summarize trends in order to evaluate and determine what effective control measures should be implemented in order to manage the issues arising.

## 2.6 Stakeholders Outside the Airport

Aerodrome operators should also identify which stakeholders will be responsible for providing input and consultation. Stakeholders can include transportation officials (including government), aerodrome staff, airline representatives (including pilots), conservation organizations (government and non-government), local municipalities/cities, and organizations that are responsible for land management in the area surrounding the aerodrome. ■

# 3. Risk Assessment of Wildlife Hazard & Wildlife Hazard Management Plan



## 3.1 Risk Assessment of Wildlife Hazard

The first step of managing wildlife hazard is to assess the level of risk that each species of animal presents to aircraft operations at the aerodrome. This risk assessment is more than simply surveying the species found in and around the aerodrome; it involves assessing the likelihood of each species striking an aircraft and the probability and extent of damage that may result. This allows managers to prioritize their management actions to target the highest risk species. The Risk Assessment should also identify the biological factors that cause different wildlife species to present a risk to aviation safety. Identification of these factors will greatly aid in the formulation of a Wildlife Hazard Management Plan.

There are several methods of conducting a Risk Assessment of Wildlife Hazards. This Handbook will outline a simple, qualitative method that can be used as a starting point for a more detailed Risk Assessment. In its most basic form, a Risk Assessment determines the level of risk that each species of wildlife presents based on the combination of the probability that it will be struck by an aircraft and the severity of the outcome.

### 3.1.1 Define the Area of Risk Assessment

The first step in a Risk Assessment of Wildlife Hazards is to define the area that will be assessed. This generally includes the entire aerodrome. The area of the Risk Assessment should include the take-off routes and landing approaches when significant wildlife hazards are present in these zones.

### 3.1.2 Ranking the Probability of a Strike

The next step of a Risk Assessment is to rate the probability that species will be involved in a strike. The example below uses a scale with 5 levels but fewer or more levels could be used.

The probability can be assessed qualitatively on a scale, for example, from Very Low to Very High. Species that shy away from aircraft noise or that learn to avoid aircraft could be rated as Low or Very Low. Birds that flock in large numbers to certain habitats in the flight path could be rated a High or Very High. Solitary animals might be rated as Medium but other behavioural factors might have to be taken into account. This probability might also vary with the season or other conditions such as grass length or rain and weather conditions.

A quantitative approach could use historical strike records at the aerodrome expressed as the number of strikes (by species) per 10,000 aircraft movements. As a guide, 5 or more strikes per 10,000 movements would constitute a Very High probability of a strike, whereas less than 1 strike per 10,000 movements constitutes a Very Low probability.

### 3.1.3 Ranking the Severity of a Strike

The next step is to rank the expected severity of the impact or damage resulting from a strike event. Sometimes called the Hazard Level Ranking, this can use a scale similar to strike probability scale. This ranking will depend on the size of the animal and its tendency to flock or congregate.

| Probability of Strikes | | | Severity of Strikes | | | | |
|---|---|---|---|---|---|---|---|
| | | | Catastrophic | Critical | Moderate | Minor | Negligible |
| | | | A/C Crash & Severe | A/C Crash & Light Casualty | A/C Severe Damage & No Crash | A/C light Damage | near miss |
| Definition | Meaning | Value | A | B | C | D | E |
| Frequent | 5/10,000 movements | 5 | 5A(Unacceptable) | 5B(Unacceptable) | 5C(Unacceptable) | 5D(High) | 5E(Moderate) |
| likely | 4/10,000 movements | 4 | 4A(Unacceptable) | 4B(Unacceptable) | 4C(Unacceptable) | 4D(Moderate) | 4E(Moderate) |
| Occasional | 3/10,000 movements | 3 | 3A(Unacceptable) | 3B(High) | 3C(High) | 3D(Moderate) | 3E(low) |
| Seldom | 2/10,000 movements | 2 | 2A(Unacceptable) | 2B(High) | 2C(Moderate) | 2D(Low) | 2E(Very Low) |
| Improbable | 1/10,000 movements | 1 | 1A(Unacceptable) | 1B(High) | 1C(Low) | 1D(Very Low) | 1E(Very Low) |

*Table 1* Example of Risk Assessment Matrix for Wildlife

Heavier animals have a greater capacity to damage an aircraft and impact its flight performance. As a guide, birds that tend to flock and weigh more than 1.8 kg can cause the most severe damage to aircraft. The birds (or bats) that are solitary and weigh less than 50 g might be expected to cause the least severe damage. Flocking behaviour might mean that a strike event could include multiple impacts or it could increase the probability of a strike.

Severity can be rated in terms of aircraft damage and human casualty. Negligible could mean near miss and aircraft damage. Minor could mean light aircraft damage. Moderate could mean severe aircraft damage. Critical might mean that the aircraft could crash with no human death, just wounded, and Catastrophic might mean an emergency situation with aircraft crash and severe wounds or death casualty. Each airport should determine its own scale. The range of aircraft sizes operating at an airport will also need to be taken into consideration, so clearly the views of the aircraft operators should be considered.

### 3.1.4 Risk Assessment Matrix

An example of a Risk Assessment Matrix is provided in Table 1. The level of Risk for each species of bird, bat and terrestrial animal is determined as a combination of the Probability of a Strike and the Severity of the Outcome. In the example the Risk is also rated on a scale of 5 – Very Low, Low, Medium, High and Unacceptable. Alternatives might use a scale of 3 and the traffic light colours (Green, Amber, Red) to highlight the high priority species.

The Risk Assessment will rank the risk of each species and highlight those species that should be prioritized for risk mitigation in the WHMP.

### 3.1.5 Identifying Root Causes of Wildlife Hazard

The final stage of the Risk Assessment of Wildlife Hazard is to identify the root cause of each wildlife hazard. Here, it is critical to understand the behaviour and basic requirements of each hazardous species of wildlife. Remember, each animal has a basic requirement for energy and nutrients, including water. They must maintain their bodies core temperature, they must breed and reproduce, and they must avoid being predated by another animal. When identifying root causes of wildlife hazards, consider each species and its basic requirements. Then, observe the aerodrome and surrounding areas to determine how the different habitats may aid the species in fulfilling its requirements.

This stage of the Risk Assessment should involve a trained wildlife biologist who is familiar with ecology and animal behaviour. Ideal habitats for hazardous wildlife may not be readily apparent, and the attractiveness of aerodrome habitats may vary seasonally. Consider all stages of an animal's requirements throughout the annual cycle. Breeding seasons, annual migrations, seasonal weather patterns, and food availability are all factors that can contribute to temporal changed in wildlife hazard.

### 3.1.6 Using Advanced Risk Assessment Methods

The Risk Assessment outlined above is one of the most basic that an aerodrome can utilize to quantify wildlife hazards. Aerodrome wildlife managers may wish to

consider a greater set of variables, and therefore, assess risk more accurately. For example, the type of aircraft using the aerodrome will influence the level of risk; larger, faster aircraft will increase the risk of a damaging wildlife strike.

When considering the probability of a wildlife strike, components of each species behaviour can also be considered. This is especially valuable when detailed records of historical wildlife strikes are not available. Such factors as variations in a species annual abundance around the aerodrome, the animal's propensity to engage in "hazardous" behaviour, and its relative ability to avoid aircraft can be considered.

## 3.2 Wildlife Hazard Management Plan

The Wildlife Hazard Management Plan (WHMP) is a document created to provide the strategy for reducing the risk that wildlife poses to safe airport operations. The plan is based on the Risk Assessment of Wildlife Hazards. An effective WHMP should:

- Identify the wildlife species that are a priority for risk reduction;
- Prescribe the actions necessary to reduce the risk associated with the individual species;
- Clearly identify of the roles and responsibilities personnel are required to fulfill; and
- Describe a Communication Strategy for ensuring that the information necessary for managing wildlife risk is shared effectively;
- Outline a Training Programme for the personnel involved in Wildlife Hazard Management;
- Describe a monitoring and evaluation strategy for the entire WHMP;
- Prioritize the specific research needed to advance the efficacy of wildlife hazard management on the aerodrome.

### 3.2.1 Roles and Responsibilities

The WHMP should explicitly identify the personnel who will be involved in the Wildlife Management Programme, including the roles and responsibilities they will fulfill. Chapter 2 outlines the specific roles and responsibilities associated with wildlife management at as aerodrome.

### 3.2.2 Communication Strategy

Aerodrome operators should create communication procedures for managing and reacting to wildlife hazards and for acting when a strike does occur.

It is critical for safety that key personnel are notified when there is an elevated risk of a wildlife strike. The communication strategy should summarize which personnel are responsible for recognizing and alerting of an increased wildlife hazard, and which personnel should be notified. The communication strategy should be inclusive of wildlife management technicians, pilots, and air traffic control.

A communication strategy is also necessary for when a strike does occur. This allows the effective collection of data pertaining to the strike, including the airline and type of aircraft involved, the stage of flight, the damage to the aircraft and whether there was an effect on flight, and the species of wildlife involved. The wildlife strike data can then be used as an evaluation tool.

### 3.2.3 Taking Action to Reduce Risk

Once the risk presented by various wildlife species is prioritized, a series of actions for reducing that risk is outlined. The actions needed to reduce the risk can take several forms and include managing aerodrome habitats so that they are less attractive (fulfill fewer of the animals basic requirements); dispersing wildlife with behavioural stimulants; physically excluding wildlife from the aerodrome; physically removing wildlife from the aerodrome; and strategies for managing habitats that are within the vicinity of the aerodrome but outside its boundaries. The actions should also include a system for communicating the risk of bird strikes to critical personnel, including pilots, air traffic controllers, and wildlife management personnel.

### 3.2.4 Training Programme

A Training Programme must be established through the WHMP. Effective training ensures that actions taken to reduce wildlife hazards are consistent across all personnel. A basic Training Programme is provided in Chapter 5.

### 3.2.5 Monitoring and Evaluation

Once action is taken to reduce risk, it is important to establish monitoring procedures to collect the information needed to evaluate the efficacy of the action. The WHMP must define this strategy. Chapter 6 outlines the general requirements of monitoring and evaluation.



### 3.2.6 Research Priorities

The final component of the WHMP is a list of research priorities. Research projects should be designed to assess the efficacy of novel management practices and control actions on reducing wildlife hazards. Proper experimental design is critical to the successful evaluation of novel practices, and aerodrome operators should consult with local biologists when considering their research priorities.

# 4. Operational Practices



## 4.1 Introduction

The airport's WHMP should provide details on the actions and procedures necessary to manage both habitat and wildlife given the specific local conditions and considerations. In broad terms, habitat management is a long term issue and may involve capital investment to deal with land, vegetation and water bodies both on and off the airport site. Shorter term activities include the upkeep of the vegetation such as grass cutting and tree trimming.

Actions to deal with wildlife on a daily basis starts with patrols and inspections, observation of wildlife and other conditions, making interventions and assessing the response to inventions. It is also crucial to record all actions and observations in order to be able to review the effectiveness of the WHMP and development improvements.

Most jurisdictions require reporting each month (or a similar) period and equipment should also be checked and reviewed on a similar basis. It is generally difficult to provide definitive guidelines, because best practice depends greatly on the local conditions at an airport, the different key wildlife species and their particular behaviours.

*Flare shooting with shotgun, Dublin International Airport*

## 4.2 Habitat Management

Habitat management can be the most effective method to reduce wildlife hazard at an airport. This section outlines some general concepts and considerations, and more detail is provided in Annex A.

The management of habitats on the airport will be quite different from that on land adjacent and near to the airport. Some considerations are part of the long term development of the airport and should be included in the Airport Masterplan. Others issues are more related to regular maintenance and upkeep of airport lands.

The key to habitat management is avoiding conditions that attract wildlife such as food, water, shelter, and resting and breeding areas.

### 4.2.1 On - Airport Habitats

Major earthwork considerations on airports are usually required to manage storm-water runoff, and drainage channels and settling ponds can become water bodies that attract wildlife. Such work is usually done at the time of runway and taxiway development and future developments would be included in an Airport Masterplan. Wildlife hazard issues must be taken into account at the airport infrastructure planning stages.

Landscaping then usually involves seeding open areas for grass or other appropriate plant coverage to avoid soil erosion. Grass and plant species must be selected taking into account maintenance and watering needs, seeds and fruit, and shelter and nesting for wildlife.

A perimeter fence around the airport airside areas is often required for safety and security reasons. The ability to exclude local wildlife will be a key consideration with designing and constructing a boundary fence.

*Well-maintained fence, at least 3m high, no gap at the bottom and dig protection are required*

The need to protect the habitat of certain native animal and plant species might be a part of the airport's land management and biodiversity plans or obligations. This might in fact conflict with the need to reduce wildlife hazard and airport senior management may need to work closely with government wildlife or conservation department to develop appropriate local regulation. Careful consideration of wildlife hazards will be required when planning such conservation habitats.

### 4.2.2 Off - Airport Habitats

The land use and habitat management on areas near an airport are also an important consideration, although an airport operator may have limited ability to control off-site land use and will need to work in partnership with local landowners and stakeholders.

In principle, the habitats off-site should be more attractive to wildlife than the airport site itself. However extreme cases such as a land fill or garbage dump might attract so much wildlife that it may pose an increased hazard on airport land.

Off-site land uses and activities that can affect wildlife and might need careful consideration might include the following:

- Nature conservation and recreational areas;
- Local agricultural practices;
- Land fill and solid waste management;
- Storm water and waste water treatment plans;
- Water bodies including reservoirs, lakes, rivers and the sea;
- Wetlands including marshes; and
- Gravel pits and quarries.

As noted, further discussion on most of these items is provided in Annex A.

## 4.3 Routine Patrolling

Routine patrolling is the core of the WHMP and should include site tours or inspections, observations, interventions and record keeping. Regular surveillance of the aerodrome is necessary to spot hazardous wildlife. The use of binoculars, spotting scopes and possibly night vision equipment by trained staff allows for optimum observation. During patrols, the wildlife control operators should determine high-risk areas and spend disproportionately more time in those areas.

The frequency of patrols will be highly dependent on local conditions and the behaviour of wildlife. In some locations or during some seasons, daily patrols may suffice. Under certain situations patrols may be required every 30 minutes or even more frequently. Runway safety inspections may be incorporated or performed in parallel with wildlife hazard management patrols. Patrols should be carried out in a random pattern rather than a regular route so that wildlife do not 'learn' or become accustomed to the timing of patrols.

### 4.3.1 Patrols and Inspection

During a patrol, a wildlife control operator should be on the lookout for a range of activities and situations, including the following:

- Observe wildlife in an area, how many, what species, what activity, what it appears to be attracted to;
- Observe signs of occupancy by wildlife such as feeding, nesting, resting, droppings, or carcasses;
- Observe conditions of the habitat such as grass, surface water, trees, fences, FOD (Foreign Object Debris);
- Inspect specific features such as traps or visual deterrents;

- Observe and report any other safety issues associated with the operation of the airport, whether or not it related to wildlife hazard management.

## 4.4 Remote Detection Systems

Some airport might employ remote detection systems such as radar or video monitoring systems. Such technology will probably never replace the need for manned patrols and interventions, but could assist with reducing the frequency of patrols.

Coordination between the remote monitoring center and operators that might respond to wildlife sightings is required.

*A bird detection radar*

## 4.5 Intervention Techniques

Intervention techniques are actions taken by a wildlife control operator to remove wildlife from areas of high risk. More details and discussions are provided in Annex B.

One of the intentions of intervention techniques is to train the wildlife not to occupy areas where they are not wanted. If an animal learns that the effort to occupy a place and get chased away is greater than the benefit provided by the food or opportunity to rest in that area, it may stop returning.

Most intervention techniques rely on scaring wildlife with an audible or visual threat. This can include the following:

- Movement of the patrol vehicle and the human pressure associated with the wildlife control operator. (Care must be taken that the patrol itself does not become a hazard to aircraft operations.)
- Noise to scare wildlife such as sound generators, pistol or gun shots, and pyrotechnics or firecrackers. (Care must be taken that wildlife are moved away from aircraft operations.)
- Noise to deter wildlife such as recorded distress or alarm calls. (Care must be taken that such calls do not attract curious or predatory species.)
- Visual repellents including lasers, kites, balloons, scarecrows and small models.
- Trained predators such as falcons and dogs used to chase wildlife.
- Trapping, tagging and relocation, especially for larger animals and protected species.
- Culling or killing. (This is generally a last resort, as a dead animal is not a trained animal. It is not an option for certain species such as endangered or protected species.)
- In some situation chemical repellents and pesticides might have a role to play, although the use of poisons and environmental pollutants should be discouraged.

Care must be exercised to avoid any intervention from accidentally flushing birds at ill-timed moments in to the path of aircraft. Care must also be taken the patrol vehicle or personnel do not become air safety hazards. Wildlife training discussed in Chapter 5 is a crucial requirement to reduce this risk.

Mobile patrols should be more persistent than the wildlife. Simply moving wildlife and then driving away is seldom effective wildlife control. It often is necessary to remain in the area following control to prevent the immediate return of wildlife or to repeatedly return to the area at frequent intervals to ensure that the controlled wildlife have not returned and to reinforce control if necessary. The aim is to achieve a bird free aerodrome and the control needs to be thorough to ensure the birds leave the airfield.

## 4.6 Recording and Reporting

### 4.6.1 Recording All Daily Activities

Keeping records of all activity related to wildlife hazard management is fundamental to the WHMP. Data is required in order to be able to assess the effectiveness of the Plan

as a whole, as well as specific trends such as habituation.

There is an increased tendency towards airlines and/or their insurers to pursue legal action to recover the costs of wildlife strike damage from airports at which they occur. It is important that airports record the wildlife control actions that they take in order to be able to demonstrate that they had an adequate WHMP in place at the time of an incident and that the Plan was functioning properly. Data gathered as part of a plan is also important in assessing the effectiveness of the actions taken.



A number of different methods for recording this data exist, from simple paper records to sophisticated devices including laptops, tablet PC or other electronic devices. The latter save time and effort, especially if the data is to be subsequently entered into a computer for further analysis. Whatever the means of recording used, the important issue is that a comprehensive record of the bird control activities is kept in order to demonstrate that the airport is following its own policies and procedures. Records need to include the time, location and nature of the following:

- Each patrol or inspection and the route taken;
- Observation of any unusual condition of the habitat or site such as the state of the vegetation, trees, water bodies or perimeter fence;
- Species of wildlife sightings including any particular activity such as feeding or resting, and the discovery of any carcasses, dropping or other signs of activity;
- Interventions that are made;
- The outcome of any intervention, the response of the wildlife and the effectiveness of the hazard elimination.
- Incidents such as wildlife strikes on aircraft and near misses. (Systems will also be in place for such reporting by pilots, airlines and ground staff.).

### 4.6.2 Monthly Reporting

Daily records can be summarized into monthly reports, which aid in the evaluation of trends in wildlife numbers, control actions, and wildlife strikes. Monthly reports should be reviewed by the Airport Wildlife Committee of stakeholders to assess performance of the Wildlife Management Plan. The Committee should be involved in the creation of Performance Indicators for managing wildlife at the aerodrome. Performance indicators can encompass any metric associated with reducing risk to aircraft operations, including reducing the number of wildlife strikes, reducing the total mass of wildlife strikes, reducing the average mass of wildlife strikes, or reducing the number of hazardous wildlife around the aerodrome.

## 4.7 Equipment

The wildlife control operator should be equipped with devices appropriate to the wildlife species encountered, the numbers present, and to the area that they need to control. Staff should have access to appropriate devices for removal of wildlife, such as firearms or traps, or the means of calling on expert support to supply these interventions techniques when required.

### 4.7.1 Portable Equipment

Portable equipment, that requires a staff member on the airfield to operate it, is generally regarded as offering the best control, providing that the staff members involved are properly trained and motivated. Devices such as pyrotechnic, pistols, or vehicle mounted distress call generators produce an impression of a direct threat which can be continually varied in time and location by the operator in a manner not available to static systems. This is to prevent wildlife habituating to a static device as they learn that it is not a serious threat.

*Portable equipment pyrotechnic with assortment of flares, Vancouver International Airport*

### 4.7.2 Static equipment

In general, static wildlife scaring devices, such as gas cannons or other sound generators, gradually lose their effectiveness over time. Although some of the more sophisticated devices, which generate a variety of sounds in random or pre-programmed order, may delay this habituation. They are generally more suitable for providing short-term wildlife deterrence from limited areas (e.g. ground being reinstated after building works).

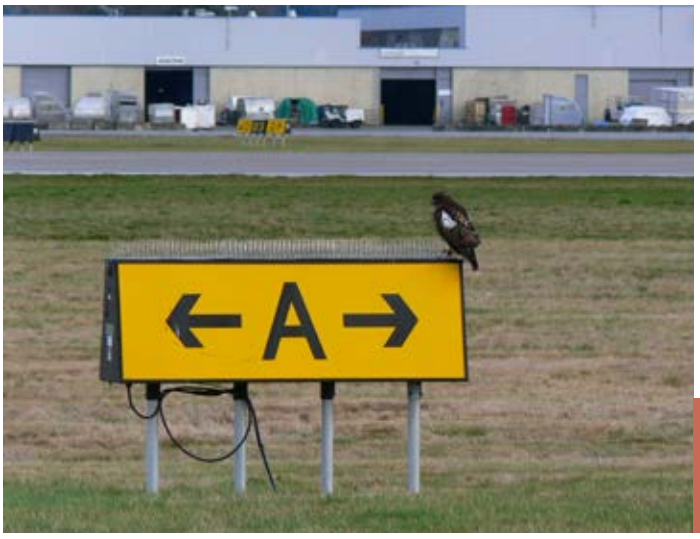
*An underground stationary gas powered noise generator*

Various new methods for either habitat management at airports, detection systems or new dispersal techniques have been developed in the past years. There are many methods of wildlife dispersal available. Aerodrome operators should assess the need before purchasing equipment. ■



## 4.8 Habituation

The classic challenge for wildlife hazard management is that most animals will become accustomed to certain dispersal interventions or find new ways to settle themselves safely in the airport environment. Therefore, it is vital for airport operators to continuously adjust and vary the measures taken. An airport should proactively seek different or new ways to reduce the wildlife hazard.




*Deterrent Spikes don't keep all birds off of signs. Note that this Red Tailed Hawk is marked with a special identification tag as part of a Trap and Release Program, Vancouver International Airport*

# 5. Training



## 5.1 Introduction

The significance of wildlife and habitat management plans must be recognised as a major safety priority of all aerodromes regardless of size, aircraft movements or the lack of a perceived threat.

- Aerodrome must have specific comprehensive wildlife and habitat management training programmes.
- Staff tasked for wildlife and habitat management must be trained and assessed as fully competent to perform their duties.
- It is important that the role is comprehensively explained to staff and that they fully understand their roles and responsibilities.

*Passerines: Over 5,000 identified species 31 % of known species strikes*

## 5.2 Objectives of the Training programme

It is important for aerodromes to outline the objectives of a bespoke wildlife and habitat management plan. It is not sufficient for staff to undertake any role within the aerodrome wildlife team without appropriate wildlife and habitat training.

**PLAN OBJECTIVES**

- Ensure training plan meets best international, national & local standard
- To deliver appropriate wildlife/habitat management training to staff that are tasked with managing and implementing the plan
- Ensure local aerodrome conditions and effective control measure are included in training plan
- Ensure that staff have a full understanding of procedures and practices required to deliver on objectives of the WHMP
- Provide practical training programme that ensure full competency on wildlife control practices

## 5.3 Outline of Training Programme

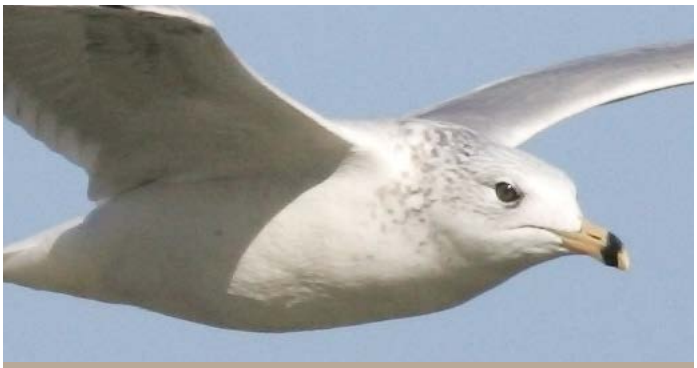
Aerodromes with well managed and researched programmes that are delivered by fully qualified and trained staff are better prepared and positioned to deal with wildlife threats at aerodromes. The following is a guide to help plan training content:

| Overview<br>Theoretical Training | Familiarization<br>Practical Training | Specification<br>Specific Wildlife Training |
|---|---|---|
| • Aerodrome overview<br>• Aerodrome certification<br>• Aerodrome licence<br>• Aerodrome procedures<br>• International regulations<br>• National regulations<br>• Environmental regulations<br>• Aerodrome safety management system<br>• Promulgation of information<br>• Health & Safety overview<br>• Accident & incident reporting/ investigation | • All aerodrome operational procedures & standards<br>• Landside overview<br>• Airside safety<br>• Airside security<br>• Apron driving<br>• Airfield training<br>• Radio telephony<br>• Runway incursion training<br>• Protection of NAVAIDs<br>• Low/reduced visibility programme<br>• On the job training<br>• Recurrent refresher training<br>• Familiarisation programme | • Detailed theoretical aspects of wildlife programmes<br>• Integrated approach to all elements of habitat/wildlife programmes<br>• All practical elements required to support programmes<br>• Familiarisation programme<br>• Equipment training & procedural use of all equipment<br>• Defined on the job training<br>• Recurrent refresher training<br>• Administration programme in respect of the specific Record keeping<br>• On/off field programme |



### 5.3.1 Aerodrome Location

Aerodrome location will dictate much of the content of the training programme and the procedures that are best suited to each aerodrome. Aerodromes located at the coast or close to forests will require a different set of control measures than those aerodromes located near artic or desert locations. Aerodromes developing WHMPs must take the local and regional aspect of wildlife management into consideration.



*Gulls: Account for 18% of known species strikes Wildlife Strike figures: Courtesy of ICAO EB 2009/37*

### 5.3.2 Standardisation of Training

Training must be conducted professionally by appropriately qualified personnel using approved material drawn from appropriate national and international standards and publications. Training content and programmes must be approved by a wildlife manager with guidance from a subject matter expert to ensure that programme content is sufficient and all mandatory safety and operational requirements are met.

### 5.3.3 Blended Learning Approach

Aerodromes must have a targeted WHMP that supports the roles of each person responsible for managing or implementing a WHMP. Training will be delivered from a theoretical, practical, and procedural and will include a familiarisation programme.

### 5.3.4 Liaison Plan

The wildlife team will require training on the importance and significance of a liaison plan in respect of all wildlife stakeholders. Stakeholders identified:

## LIAISON PROGRAMME TRAINING

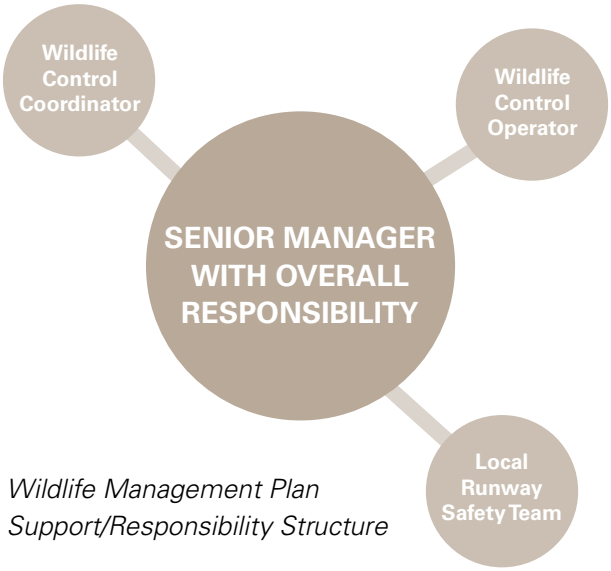
- State Authorities
- Aviation Authorities
- Environmental Authorities
- National Planner
- Critical Infrastructure Authorities
- Local Authorities
- Local Business Entities
- Local residents and representative group
- Local interest farmer/landowners
- Other groups as deemed necessary



## 5.4 Understanding the Different Roles

Aerodromes must understand the importance of aircraft safety from a habitat and wildlife management perspective. This importance will be highlighted in an Aerodrome Safety Management System and will be supported by comprehensive Aerodrome procedures to manage the habitat and wildlife management plans. A named senior manager will have overall responsibility for the plan and will be supported by a wildlife subject matter expert. Additional support will be provided by the aerodrome wildlife committee and local runway safety team. The dedicated wildlife management team should be properly resourced and receive comprehensive training for the specialised role they perform.

### 5.4.1 Aerodrome Senior Manager

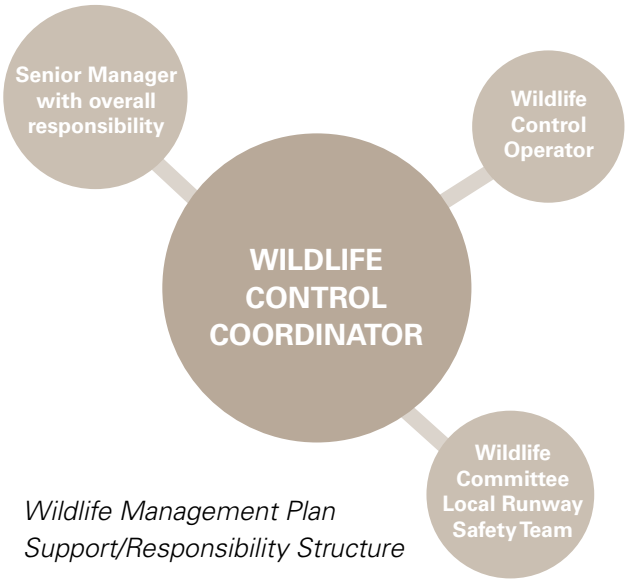



*Wildlife Management Plan Support/Responsibility Structure*

This role is central to managing and directing the aerodrome wildlife and habitat plan. The purpose of training is to ensure this person has all the necessary knowledge and understanding to ensure the proper oversight and management of the plan.

In order to be fully competent this person must receive appropriate training to support the role. A central part of this training will consist of briefings from subject matter experts so that they are fully informed of the potential danger that wildlife habitat & management pose to aircraft and aerodromes.

### 5.4.2 Wildlife Control Coordinator




*Wildlife Management Plan Support/Responsibility Structure*

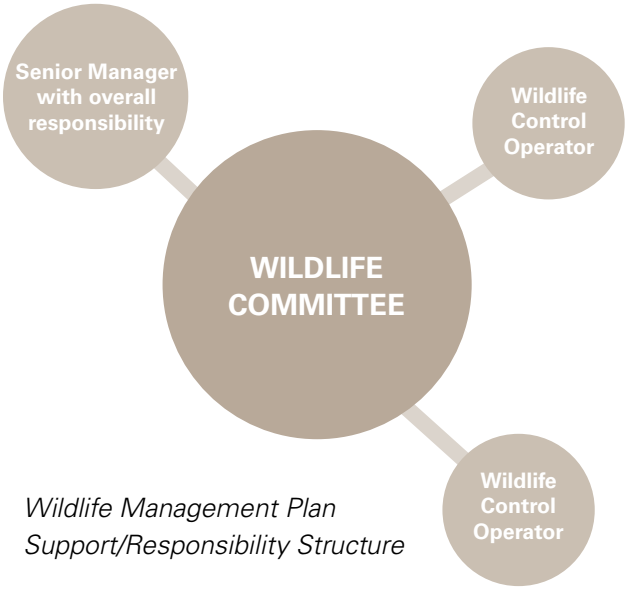
This role within the wildlife and habitat management plan is critical to safety outcomes for aerodromes. This subject matter expert will be responsible for briefing all stakeholders on the best procedures and practices to be followed to ensure a fully effective wildlife management plan.

In order to be fully competent this person must receive appropriate training to support their role. It is also important that this person fully understand the balance between the operational aviation context and the management of wildlife and habitat at an aerodrome.

### 5.4.3 Wildlife Committee

The wildlife committee plays a central role in monitoring

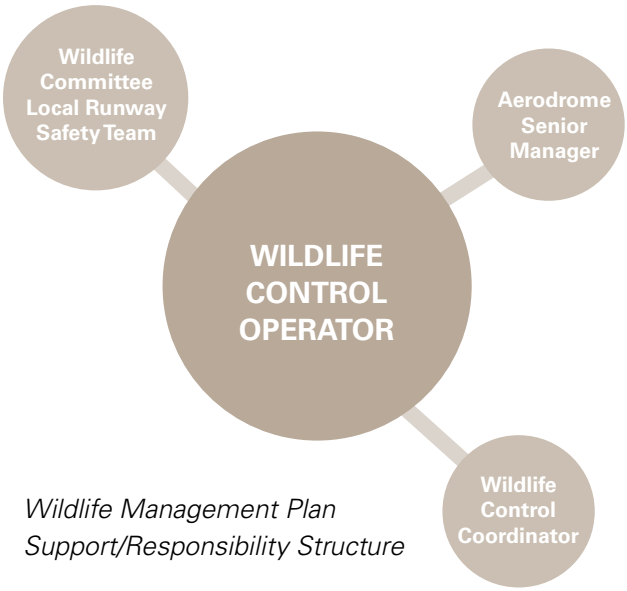
of the wildlife control and habitat programme. Full training should be provided to ensure all members understand the objectives of the programme. Training should include regular briefings from subject matter experts so that they are fully informed of the potential danger that wildlife habitat pose to aviation at the aerodrome.




*Wildlife Management Plan Support/Responsibility Structure*

This committee draws from its own experience and seeks the advice and guidance of a wildlife control coordinator to make recommendations to both the wildlife manager in respect of immediate actions required and to the senior aerodrome manager responsible for wildlife management in respect of issues that require national or international intervention.

### 5.4.4 Wildlife Control Operator




*Wildlife Management Plan Support/Responsibility Structure*

Detailed appropriate training is essential for this role as it is central to the full implementation of an effective wildlife and habitat management plan. This includes a full understanding of all aspects of the wildlife team objectives and how they should best perform the task in a safe and efficient manner.

This group is critical to the safe and efficient delivery of the wildlife and habitat management plan at the aerodrome. A properly resourced and effectively trained personnel can make a decisive difference to wildlife habitat management at any aerodrome.

Detailed appropriate wildlife management and habitat training is essential for this role as it is central to a safe and effective wildlife and habitat management plan. A full understanding of all aspects of the wildlife team objectives and how they should best perform the task in a safe and efficient manner must be central to the training programme



## 5.5 Additional Trainings Requirement

### 5.5.1 Airside Training

All employees operating airside at aerodromes will have received appropriate airside training to ensure that they can perform their airside duties in a safe and efficient manner. Airfield training will include radio telephony procedures and practical assessments.

### 5.5.2 Environmental Training

Awareness of environmental factors are very important for aerodromes and are an ever increasing influence on aerodrome procedures. Wildlife teams must be fully aware of all environmental issues and how they can contribute to the sustainability policy at aerodromes. The following guidelines should apply at aerodromes:

- Understanding of environmental sustainability;
- Environmental evaluation and analysis of wildlife plan;
- Use of best practice environmental techniques.

### 5.5.3 Practical/on the Job Training

It is not sufficient to provide theoretical training for this role as much knowledge will be gained from carrying out the task under a proficient and competent person.

The programme should be sufficiently enough to ensure effective delivery and should have a sign off process on the proficiency of the person across all the practical, procedural and skills required to manage and implement the plan. It is critical that each aspect of the procedures required for wildlife habitat and management are well practiced and understood by the wildlife team.

### 5.5.4 Wildlife Management Control Measures

It is critical that the wildlife team receives comprehensive training on the different techniques that can be used in the wildlife management plan. This must include all procedures and practices that are at the disposal of the aerodrome. Each team member must receive full training on all aspects of the plan to include familiarisation with all equipment that is available to the team.



### 5.5.5 Assessment of Training Process

Aerodromes must be assured that the wildlife training programme is adequate to deliver trained personnel to deliver on the objectives of the plan; accordingly each training programme will require an assessment process that will clearly demonstrate the proficiency of the plan.

**ASSESSMENT PROCESS**

- **Theoretical** assessments that demonstrate team members have the knowledge necessary to deliver the objectives of the wildlife management programme
- **Familiarisation** with procedures, practices & techniques of wildlife management
- **Practical** assessments that demonstrate team members have the practical knowledge necessary to operate all equipment and techniques
- **General suitability**, whereby team members can demonstrate a level of operational competencies to deliver on the objectives of the wildlife management plan

This process will consist of the following components:

All training programmes should be reviewed prior to delivery to ensure that the programme is up to date and reflective of current best practice of wildlife management techniques

### 5.5.6 Runway Incursion Prevention Training

Due to the nature of the role and the requirement to operate close to runways (never inside the flight strip unless with ATC permission) staff must have completed runway incursion prevention training.

### 5.5.7 Post Incident Training

Where a wildlife management person is involved and found to have failed to follow procedures, the option to re-train may exist. It is important that the area of weakness is identified and remedial action taken. All incidents on the airfield are investigated by aerodrome authorities, sometimes in cooperation with ATC.

### 5.5.8 Research Plan

It is very important that aerodromes employ the best possible practices available to them when developing wildlife plans. Detailed accurate information based on proven research is an important element in ensuring that best practice principles apply.

Where possible, aerodromes should have a dedicated resource that will ensure that advances in the field of wildlife management and habitat management, (whether that be scientific, procedural or proven improved control techniques) are reflected in the aerodromes wildlife and habitat management plan.

### 5.5.9 Refresher Training

Each aerodrome should have an effective refresher training programme that the wildlife team will complete on a regular basis. The training must include a dedicated wildlife management and habitat module which will reflect on statistical information, procedural reviews, staff feedback and a central piece by a subject matter expert at the aerodrome (internal or external) and by a senior manager responsible for the aerodrome management and habitat plan.

### 5.5.10 Training Programme for other Aerodrome Users

Aerodrome operator will ensure that all operators at the aerodrome are aware of their responsibilities in respect of Wildlife control. Reference should be made to procedures that apply to all operators at the aerodrome. This plan should be included at induction for all staff and also the main points included in refresher plans. Wildlife habitat management and control should feature in any airport wide safety campaign as a matter of course.

Training awareness programme should be made available the following groups:

Training offered should cover the goals and objectives of the aerodrome wildlife management plan and the role each company and staff member can play their part in this essential programme. ■

**STAKEHOLDER TRAINING PROGRAMME**

- Air Traffic Services
- Airlines(in particular home based pilots and companies)
- Ground handlers
- Food catering companies
- Waste removal companies
- Contractors construction projects
- Other entities as deemed necessity

# 6. Evaluation of WHMP

## 6.1 Introduction

Aerodromes should have a process to review and evaluate the wildlife habitat and wildlife management plan to provide safety assurance that the plan is fully effective and correctly implemented. The review should be completed on an annual basis but also must include an on-going review process to ensure that the plans are always current and fully functional at all times.

A review should consider the general workings of the plans with a view to efficiency and effectiveness. Reference to statistics from previous years (five) should form part of the review. Trend analysis of statistics is a key to ensuring there is an informed view as to the success and effectiveness of wildlife management plans.

## 6.2 Evaluation Process Overview

**Evaluation of the Aerodrome Wildlife & Habitat Management Plan**

- Are roles clearly defined and understood by all?
- Do aerodrome personnel understand their roles and responsibilities?
- Do programmes meet required standards in ALL respects?
- Is the programme effectively resourced & managed?
- Are procedures efficient and effective?
- Are programmes current with all regulations and best practices?
- Is there an effective review process in place?

## 6.3 Evaluation Plan

### 6.3.1 Evaluation Plan Report

This comprehensive annual report should be prepared and compiled by an appropriately qualified person who has full knowledge of the plan and the standards required for effective delivery. The completed report along with all recommendations must be forwarded to the aerodrome wildlife committee and the senior management responsible for the delivery of the plans.

### 6.3.2 Evaluation Inputs

The wildlife manager (or appropriate professional) tasked with performing the annual evaluation should undertake de-briefing from staff on general effectiveness and observations on all aspects of the plan. The evaluation seeks non-performance or areas for improvement. Staff are often best positioned to provide valuable feedback on the plans. Feedback should be sought from:

**ASSESSMENT PROCESS**

- Wildlife team management & staff
- Airline personnel (in particular aircraft engineers and home-based pilots)
- Air traffic control
- Ground handlers
- Other parties as required

### 6.3.3 Aerodrome Survey

A wildlife survey is a valuable tool for aerodromes to ensure their wildlife management and habitat plans are effective, meet all regulations and standards required. The survey will be completed formally on an annual basis by a qualified professional. Evaluation of all operational, practical, procedural and technical aspects of wildlife and habitat management will form part of this survey. A comparison with previous year's findings and recommendations to ensure the survey delivers on the purpose of the survey.

### 6.3.4 Statistical Comparisons Year on Year

It is extremely important that accurate statistics are gathered and interpreted by a competent person to ensure that aerodromes can have effective control measures in a timely fashion. Reference should be made to previous statical data over the last five years and recommendations and action points raised accordingly. Particular attention should be placed on the quality and accuracy of aerodrome wildlife statistics and how these statistics are interpreted so that trends are measured and mitigation measures immediately put into place.

### 6.3.5 Review of Procedures

A full comprehensive review of all control procedures and practices to ensure that effective control measures are in place and are correctly followed and documented. A review of seasonal migration patterns is essential.

### 6.3.6 Equipment Serviceability

A full equipment audit shall be undertaken annually to establish serviceability and effectiveness of all equipment used to support wildlife management.

### 6.3.7 Rotational Procedure

A systematic review of rotational control procedures and the perceived effectiveness of the process. Particular attention to identification of new species and control measures are required to deal with the species.

### 6.3.8 Research Review

Where possible, aerodromes should have a dedicated resource that will ensure that advances in the field of wildlife management and habitat management, whether that be scientific, procedural or proven improved control techniques are reflected in the aerodromes wildlife and habitat management plan.

### 6.3.9 Intelligence Gathering

The importance of gathering intelligence locally at the aerodrome and surrounding areas can contribute greatly to ensuring that control measures are effective. A plan for sharing information with local aerodromes or aerodromes with similar wildlife and habitat issues is a useful process of mutual benefit where control measures are compared and evaluated.

### 6.3.10 Wildlife Documentation Audit

An evaluation of all reports and records to ensure they meet appropriate standards as they must provide accurate information that can be understood and that will be of value in the evaluation process.

A full check of all wildlife team documentation, paying particular attention to following documentation:

- Locations of wildlife, identification, patterns of movement, control measures records;
- What measures were used, what precise method and how effective?
- Nuisance species reports;
- Protected species, endangered species register;
- Monthly alert reports;
- Rotational control measures records;
- Recording aerodrome wildlife hot spots (on/off aerodrome) and potential strike danger records;
- Analysis of wildlife strikes, removal techniques records;
- Reported strikes on near misses (over last 5 years) records;
- Investigated strike and near miss reports;
- Analysis of carcass (on site and external analysis) records.

Emphasis should be placed on quality of all records in particular daily logs to ensure the best quality intelligence is gathered so that this information can be fed back into the plan in a timely fashion. ■

# A ANNEX A
# Habitat Management

## A-1 Introduction

Habitat management is probably the most important method of preventing or reducing wildlife strikes on and around an airport. The airfield habitat should be less attractive to the animals than the surrounding areas. If there are off-airport sites that attract birds these may need dealing with - also these can create flight line of flight paths of birds moving from one area to another (e.g. from an overnight roost to a feeding location) then the airport should, in conjunction with local regulators seek to reduce the attractiveness of these off airport sites also.

Once the attraction has been identified, a management plan should be developed either to remove it entirely, reduce it in quantity, or to deny access to it. It is not possible to define precisely what types of habitat management will be effective at a particular site because airfields around the world are all different and because the bird/wildlife species that frequent them vary from region to region. Typical examples include manipulating the species and/or height of vegetation cover on the airport, removal of trees and bushes fencing off the aerodrome, netting of water bodies, excluding birds from buildings by netting or other means, selection of non-attractive amenity planting around terminals. Regardless of the techniques used, all airports should be able to show that they have assessed the bird attractions on their property and developed and implemented a habitat management plan to reduce these attractions as far as is practicable.

Guidance is structured here into on-airport and off-airport.

## A-2 On Airport Habitat Management

Wildlife can be attracted to particular sites for feeding, breeding, roosting, resting or access to water. Efforts put into reducing the attractiveness of the airfield can be the most productive way to reduce the risk of wildlife strikes. The large expanse of grass, low vegetation or even the lack of vegetation present at airports is attractive to wildlife that prefer open country habitats partly because they rely on being able to observe predators at long distances. When combined with food resources, airports can be very attractive habitats for open-country wildlife. The presence of numerous buildings and hangars along with trees and bushes adjacent to the airfield can also provide suitable habitat for many species.

Therefore, it is necessary to identify and evaluate the attractants present on the airport so that they can be reduced, eliminated, or effectively managed, thereby achieving a long-term solution to the problem of wildlife strikes.

If the aerodrome environment is made less attractive to the wildlife species present, they will seek their needs elsewhere and the resident wildlife population will decline significantly, along with the number of wildlife strikes. By modifying the habitat, it is possible to modify both the quantity and the type of wildlife species active on the airfield.

There are a number of habitats on an airfield to which wildlife may be attracted. These are listed below with an

explanation of what features can be attractive and what steps can be taken to counter this.

- Buildings – provide sites for nesting, roosting and perching;
- Open water – access to water, breeding and roosting sites;
- Trees, shrubs, berries – perching, nesting and feeding;
- Grass – see details below on how to manage airfield grass.

Controlling the attractiveness of an airport to birds and other wildlife is fundamental to good control. Indeed, it is probably more important than bird dispersal in terms of controlling the overall risk. If an airport provides easily accessible resources to birds/wildlife in terms of food, water, shelter or breeding sites, then they will continue to try and return despite any dispersal tactics that are used to dissuade them. Habitat management to deter birds/wildlife involves two processes, identifying the attractive features and implementing changes to either remove the attraction or to deny access.

An airport should undertake a review of the features on its property that attract hazardous birds/wildlife. The precise nature of the resource to which birds are attracted should be identified and a management plan developed to eliminate or reduce the quantity of that resource, or to deny birds access as far as is practicable. Documentary evidence of this process, its implementation and outcomes should be kept.

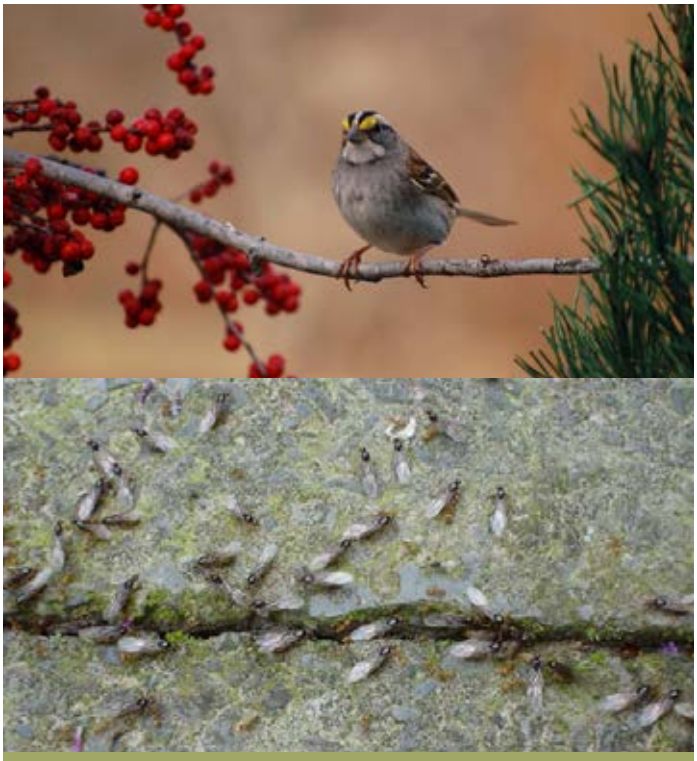
## Food

An aerodrome has the potential to offer a great variety of food sources to wildlife. The main sources of food for wildlife are:

- Grass used by grazing animals such as geese, rabbits, deer, etc.
- Other vegetation, such as fruit bushes and trees, seed-producing plants and grasses, green weeds, aquatic vegetation;
- Dense populations of small mammals (e.g. mice), birds or amphibians, as well as invertebrates (e.g., insects, earthworms); and
- Rubbish/garbage/waste, especially food waste.

The production of seeds by herbaceous plants, particularly the many species of graminaceous plants which provide a favourable source of food for some bird species.

If the presence of birds is to be decreased substantially, it is necessary to take action mainly at the source by reducing their food supply. The use of pesticides and herbicides may be a solution in some cases.



*The presence of berries and insects attract wildlife.*

## Water

Insofar as possible, very wet land and stagnant water on aerodromes should be drained. The presence of water is a major factor in attracting wildlife, particularly birds, aquatic mammals and amphibians and creates habitat for aquatic invertebrates that often hatch synchronously in large numbers thereby attracting large numbers of insect predators (e.g. birds, bats).

It is often difficult and costly to eliminate all wet areas from an aerodrome. Where construction measures, such as drainage, cannot be undertaken, airport operators should identify water bodies that are used by significant numbers

of hazardous wildlife and undertake action to limit the access of wildlife to these bodies. Placing floating balls, netting or overhead wires, can be excellent solutions, depending on the species present.

*Floating balls and bird netting to cover the water, and drainage opening protection*

## Shelter

Buildings can provide numerous opportunities for roosting and or nesting by birds and are often inhabited by small mammals. For certain species of birds and mammals that are well adapted to the human environment, aerodromes are attractive sites.

Analysis of buildings can identify places that can be used by wildlife. The elimination of these potential shelters will decrease the numbers of animals present. All dilapidated or ruined buildings, on or in the direct vicinity of the aerodrome, should either be repaired or demolished. Those structures are often colonized by wildlife that uses them as shelters and for breeding purposes.

Signs and lights along runways and taxiways are ideal perches for birds, and particularly raptors, which use them as observation posts when hunting. Limiting their use as perches can be an excellent solution to reduce the presence of birds. The installation of metal spikes, preferably the 'rotating 3-spike version', prevents birds from landing on them.

## Grass

Aerodrome operators may need to obtain advice from specialists working in conjunction with local agronomists on the seed mixes to be used for planting on the airfield. The mix should permit development of slow-growing plants producing a minimum of seeds, to avoid providing food for birds, yet with sufficient regeneration to maintain good soil coverage. Consideration should be given to using high entophyte type plants to minimize wildlife use of the vegetation.

Most evidence shows that short grass (5-10 cm) attracts more birds than longer grass (15-20 cm). In some cases, very long grass (1 m) is necessary to deter the major hazardous species of birds. Predators, including raptors and certain terrestrial grassland bird species, do not like to hunt for their prey, particularly small mammals, in long grass. When birds are not hunting, they like to have clear all-round vision to avoid danger. Longer grass creates an insecurity factor and discourages them from landing, resting or nesting in this type of grassland habitat.

*Long grass maintenance regime*

Therefore, the larger and most hazardous species, because they are usually much taller than 20 cm, require grass heights well in excess of the typical "tall" grass range. Grass management has to be adapted for each aerodrome. No general principles can be adopted on this subject at the international level.

Aerodromes which do not have vegetation covering the soil do not offer much food to birds, but may attract certain species to nest or roost directly on the soil. At airports where sparse or no vegetation attracts hazardous species, studies could be conducted to determine possibilities for plant coverage that prevents nesting and roosting without increasing food sources. It is not automatically the best choice to provide a grass covered airfield. If the surrounding areas are arid desert then the green grass may well attract birds.

Depending on the type of grass used and the local climate, grass coverage needs to be maintained. Depending on the type of grass, the machinery used to mow will have to be adapted to pick up maximum amounts of grass after mowing, and must not create ruts, which may offer wildlife a favourable environment. For example, if they become filled with water. The continual collection of grass may also lead to reduced soil fertility and may require periodic added fertilization, preferably in the form of low-nutrient organic fertilizer.

The period during which grass is cut is a determining factor in wildlife hazard management. It is essential to be able to carry out this work under dry weather conditions and be sure that it can be completed as rapidly as possible. Consideration should also be given to conducting grass cutting at night time. Night cutting eliminates the risk of attracting birds to the mowers to feed. The period after mowing should allow for grass to grow to its optimal height before the next mowing is carried out.

The grass that is cut must be sufficiently mulched, or preferably collected and removed from the aerodrome. The presence on the ground of decomposing grass creates a thatch layer that favours an increase in invertebrate numbers which will in turn attract birds. Clumps of grass also provide ideal nesting habitat for field rodents and can contribute to high rodent populations which can attract raptors.

This may mean an airfield should have grass cut to a particular length such that local bird species cannot find food and cannot rest because their sight in interrupted by the grass. At other locations it may be more important to not provide perching opportunities on structures or, in dry areas not to provide access to surface water. A study of the airport environment should lead to the implementation of a Habitat Management Plan that describes the management needed for the different areas and habitats of the airport perimeter.

Where grass does grow naturally in the environment it can be managed as described elsewhere. In terms of operational procedures this will mean a plan to achieve the following:

- Soil sampling to ensure there are no insects and larvae that will attract birds to feed;
- Weed-killer to reduce weeds upon which birds may feed;
- Insecticide to remove insects upon which birds may feed;
- Fertiliser application to ensure the grass can grow to the required length;
- Bottoming out – cutting the grass very short in spring;
- – to ensure fresh vigorous growth and to remove grass cuttings or thatch that can build up and harbour insects and attract birds;
- Regular topping cuts to maintain upright grass of the required height. In warm wet periods the grass may grow more quickly and in hot dry periods it may cease to grow – these variations in the weather will need to be taken into account so as not to strictly follow a time based plan for cutting.

However, general guidelines are difficult to establish for all climates and locations. According to the type of vegetation, growing conditions and wildlife at the location, an appropriate mowing regime must be determined.

## A-3 Off Airport Habitat Management in the Aerodrome's Surroundings

Generally, the airport does not have the opportunity to directly manage habitats outside of the airport. Therefore, it is necessary for the airport to develop good relationships with the adjacent landowners and the local government to be able to influence land uses that affect hazardous wildlife

distribution, movements and abundance.

The first stage consists of gathering specific data on wildlife outside the physical boundaries of the aerodrome. While it is critical to know the seasonal abundance of each hazardous species on and near the airport, it is also important to know how those species interact with the airport. For example, knowledge of movement routes makes it possible to provide pilots with reliable information on potential hazards within approach and departure paths. Knowing where species nest/den etc. can be very important in determining control strategies for young animals that are frequently most at risk of causing a strike.

The areas surrounding the aerodrome have a direct impact on the presence of wildlife on the aerodrome. Their physical location may also result in animals crossing the aerodrome regularly. It may be necessary to gain an understanding of wildlife behaviour outside the aerodrome.

The types of environments in the vicinity of an aerodrome, have a direct impact on the presence of wildlife are described below.

The list is not exhaustive:



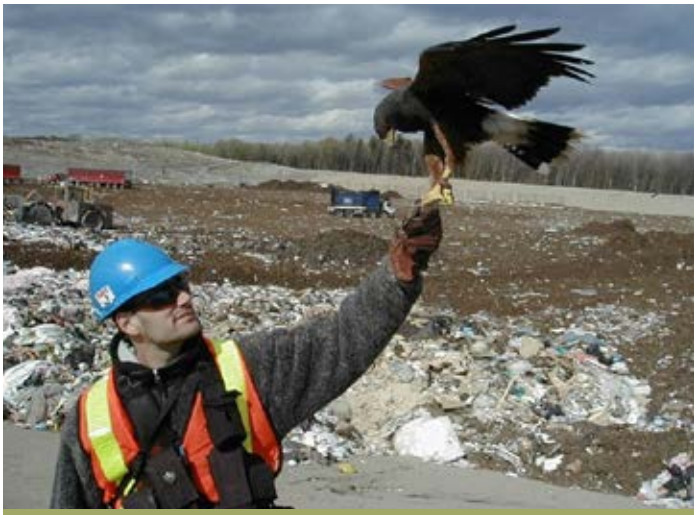
## Local Agricultural Practices

In general, experts advise against growing agricultural crops on the aerodrome. Outside the aerodrome site, it is difficult to influence the choice of crops, unless national legislation has been adopted on this subject. Whatever the situation, it may be necessary to engage with local farmers in the vicinity of the aerodrome to influence their activities.

Many countries already regulate the use of agricultural land in the vicinity of aerodromes to minimize the attraction of wildlife. The planning of crops around the aerodrome may take the form of crop plans, recommendations for farming methods, or even the adoption of legislation. In all cases, it is extremely essential for the aerodrome operator to establish coordination with the local authorities and to ensure that they are aware of the risks to aviation which may arise from wildlife.

## Landfill/Garbage Disposal Sites

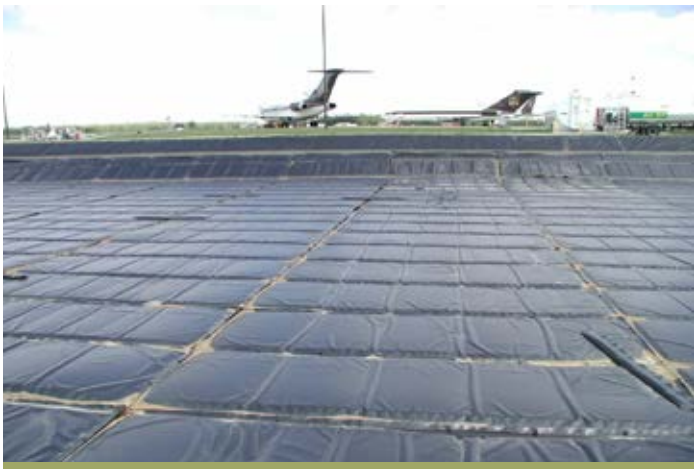
Landfills and garbage dumps are a significant source of food for birds. Certain species will travel several kilometres to reach a dump. Birds flying to and from these sites may cross over an aerodrome or aircraft flight paths. It is not uncommon to observe birds, in particular gulls, soaring over dump sites in the thermals created by composting garbage. The greater presence of birds may give rise to problems for approaching aircraft. The presence of garbage dumps on aerodromes must be totally prohibited. In accordance with various national recommendations for the prevention of bird hazards, regulations call for the elimination of garbage dumps within a radius of up to 13 kilometres of the aerodrome. Even this regulation may be inadequate to prevent hazards if the airport is located between the landfill and the roosting site of the birds using the landfill.



*Trained falcon at landfill and garbage disposal site, Falcon Environmental Service*

## Sewage Treatment and Wastewater Plants

These plants and their settling ponds often attract large numbers of birds. The closer the plant to the aerodrome, the greater the potential hazard is likely to be. It is necessary for aerodrome operators to develop agreements with those responsible for the plants to ensure that birds hazards that result from sewage ponds are suitably mitigated. New plants should not be constructed near an airport or where bird movements to and from the plant may affect aircraft movements.



*Permeable floating cover at sewage*

## Reservoirs, Lakes, Ponds, Rivers and Salt Marshes

Wetlands are often used by significant numbers of waterbirds, which tend to be among the higher hazard species due to their size and flocking behaviour. If possible changes to these waterbodies should be undertaken to reduce their attractiveness to birds if the birds are known to present a flight safety risk.

The existence of several bodies of water may result in bird movements from one to another, thereby increasing the risk of bird strikes especially if the airport lies between those waterbodies. Particular attention has to be paid to the risk of bird strikes at aerodromes situated in coastal areas or near estuaries.

## Gravel Pits and Quarries

Areas from which raw materials and stone are extracted are often filled with water. It is common for these areas to be left without being restored, thereby attracting birds. In the case of any new excavations, it important to ensure that, following its exploitation, the site is restored to its initial state. In some cases old extraction pits are being enhanced to increase the biodiversity of an area which, if near an airport, may increase the bird hazard.

## Nature Reserves

The establishment of nature reserves in the vicinity of aerodromes can attract wildlife, especially if hunting exists outside of the reserve. In general, nature reserves are formed where unique, diverse or remnant habitats exist. They may or may not harbour hazardous species. Airports should develop a solid relationship with reserve management, so that if habitat enhancement is conducted on the reserves' wildlife hazards to aircraft are a primary consideration.

## Possible Future Hazards in the Vicinity of the Aerodrome - Safeguarding

Airport operators should take steps to prevent new or increased hazards caused by developments in the vicinity of the aerodrome and should also encourage developments that reduce wildlife hazards. ICAO quotes a distance of 13km from the airport. However, developments beyond 13km can still create a hazard if animals move past the airport or runway ends, to and from the newly developed land use. Information needs to be collected by the appropriate State authority and/or the airport operator about the local wildlife species, their abundance and their movements to and from feeding and roosting areas at different times of the year.

Where such developments are likely to increase the hazard, the airport operator should communicate those concerns to the developer, municipal planners and the national aviation authority.

## Landscaping of Aerodromes

In many projects for the revitalization, extension or construction of new aerodromes, external landscaping is given importance in the project in order to welcome aerodrome users in an agreeable manner. The planting of trees, bushes and other plants has the undesired effect of attracting wildlife, and particularly birds. The management of the wildlife hazard should be considered part of the project planning from the very beginning. Care should be taken with the selection of sites for planting and the varieties used which can have a significant impact on the presence of wildlife. In all cases, plants which produce food such as berries and fruit should be avoided. Also, continuous stands of vegetation should be avoided. Preferably, trees should be spaced so that they do not form a continuous

canopy and shrubs should not be planted under the canopy of trees and should also be spaced so as to not touch each other. Open form trees and shrubs should be selected, avoiding coniferous trees and shrubs which provide year-round shelter.

Airports should conduct an inventory of bird attracting sites within the ICAO defined 13km bird circle, paying particular attention to sites close to the airfield and the approach and departure corridors. A basic risk assessment should be carried out to determine whether the movement patterns of birds/wildlife attracted to these sites means that they cause, or may cause, a risk to air traffic. If this is the case, options for bird management at the site(s) concerned should be developed and a more detailed risk assessment performed to determine if it is possible and/or cost effective to implement management processes at the site(s) concerned. This process should be repeated annually to identify new sites or changes in the risk levels produced by existing sites.

Once sites that support birds/wildlife that are, or might, cause a flight safety problem are identified, management options can be developed. These can range from minor habitat modification, changing cropping or other agricultural practices, major drainage operations or large scale removal of bird/wildlife populations. Again the choice of technique will depend on the particular situation encountered and expert advice should be sought if necessary. Larger scale off-airport bird/wildlife management may also involve liaising with local conservation interests, especially if the sites that need to be managed are nature reserves. In some cases it may be impossible to resolve the conflicting interests of flight safety and conservation, but in trying to do so the airport will be in a better position to show due diligence in the event of an accident or legal claim in the future. ■

# B

# ANNEX B
# Wildlife Intervention Techniques

Effective control requires the use of a mobile patrol, operated by trained and equipped staff who are able to disperse wildlife immediately as they are detected. This patrol should operate 24hrs or at least during aircraft operational hours or daylight hours.

Wildlife dispersal techniques have been in use at many aerodromes for a long time and it is important to use a variety of these techniques to remain effective. However, in-depth knowledge of the airport and vicinity habitats and the distribution, movement patterns and behaviour of the wildlife present remains the determining factor in the choice of methods. The management of the hazard should involve the regular monitoring of wildlife and analysing their behaviour, rather than being limited to simply harassing wildlife.

The levels of sophistication of hardware available, and hence cost, are highly variable and can include:

- The simple scarecrow, (a static visual device);
- Complex radio controlled sound generators (static acoustic);
- Pyrotechnic pistols and vehicle mounted distress call apparatus (mobile acoustic), handheld lasers (mobile visual),
- Traps (static lethal); and
- Shotgun (mobile lethal).

## Cartridge, Cracker Shell and Pyrotechnics

Cartridges and shell crackers are the most common means used throughout the world to scare birds. The visual and auditory effect of cartridges and crackers vary but is a direct and variable method that can be taken to wherever birds are situated. Certain types produce an explosion when they are fired or when they have traversed a certain distance while others only detonate at the end of their trajectory. Some leave smoke trails or flares and others produce a whistling sound. Pyrotechnics are fired using revolvers, pistols or shotguns.

The scaring effect of cartridges or crackers fired from firearms is well known. Cartridges and shell crackers should be used carefully. They should not be fired from within a vehicle. They should always be fired between the risk area and the birds so they will be scared away from the area where they pose a risk to the airport operation.

Pyrotechnics should not be launched into flocks of birds. This typically causes uncontrolled dispersal in all directions. Typically pyrotechnics should be directed to one side of the flock opposite to the desired direction the controller wishes the birds to flush.

*Pyrotechnic pistol with an assortment of flares, Vancouver International Airport*

To be really effective, the goal should always be to aim projectiles to detonate below the sight line of birds. For birds on the ground, the detonation should take place at ground level. Once the birds have taken flight, another shot fired between the ground and the birds should scare them away. For birds in flight, cartridges should be fired behind them. If the intent is to change the trajectory of a flock in flight, several cartridges could be fired in their flight line.

The direction and speed of the wind should be taken into account to avoid errant shots. Care should be taken not to accidentally fire cartridges and crackers into aircraft movement areas, such as the apron. Where there is dry grass, care should be taken due to the fire hazard.

## Distress/Alarm Calls

Birds emit distress calls when captured by a predator. The use of distress calls is therefore effective as long as the birds are correctly identified to species and the right distress calls are then used. This involves recording and emitting distress calls through high-quality loud speakers which emit the full range of call frequencies and are then mounted on the bird hazard prevention vehicle.

Depending on the geographical situation of the aerodrome and the species present, the use of distress calls can be an excellent solution. Their effectiveness is well proven in the case of gulls, for example.

Birds normally react to distress calls in the following manner:

- They are alerted and take flight;
- They approach the source of the sound and circle overhead;
- Certain birds dive to assess the source of the threat.

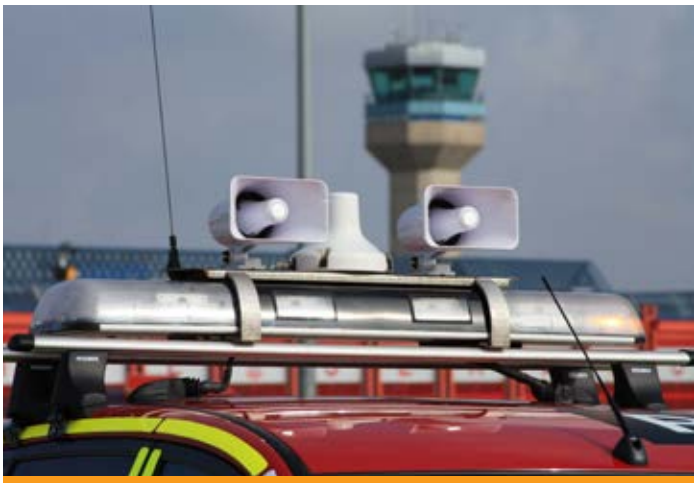
When the calls cease, the birds very often leave the area. It can be effective to combine audio methods with visual methods such as the use of cracker shells or models or effigies. When calls are associated with a dead or distressed bird, the reaction of most birds is to leave the area. According to expert opinion, when distress calls alone are used, birds cannot precisely identify the threat or the predator and the safest action for them is to disperse. In view of this, the dispersal of birds through the use of distress calls may take time.

*Squawker using high fidelity natural sounds such as distress call, alarm calls and cries of predators*

It is important to mount loudspeakers on the wildlife hazard prevention vehicle. They should be mounted facing the front of the vehicle. In this way, the driver always has the birds being dispersed in sight and can monitor their response and take any necessary follow-up measures.

Some guidelines for the use of bird distress calls are as follows:

- The vehicle should be stationary;
- The vehicle should be upwind of the flock of birds;
- The vehicle (and loudspeakers) should face the flock of birds;
- The ideal distance between the vehicle and the birds is less than 100 meters;
- The broadcasting of distress calls should last for around 90 seconds.



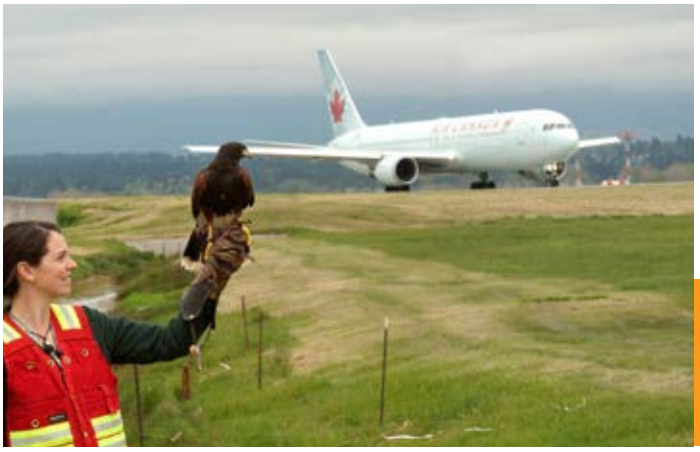
*Loudspeaker mounted on a vehicle*

The use of distress and alarm calls are one of the most challenging control methods to use. Not only is their effect somewhat subtle, the proper application of the method is challenging. As a result, few controllers use the method appropriately and effectively and as a result tend to abandon using the method all together. Repeated training by individuals who have successfully mastered the use of alarm and distress calls and the effective use of models should be used to provide controllers with expertise in the use of this method.

Fixed and mobile noise makers, such as propane canons, can also be a potential means of dispersal for certain species. If properly equipped with remote control, the advantage of this method is that staff in the control tower can operate them when necessary. If the wildlife hazard prevention patrol is on the other side of the airfield, this method can allow them to extend their range by activating a device remotely. However, the effectiveness of each device is limited to a set range and when positioned at a fixed location, only birds within this range are exposed. Even then, without a significant negative experience associated with the noise birds very rapidly habituate and the effectiveness rapidly declines.

## Trained Falcons and Dogs

Trained falcons and dogs, which are both potential predators for many species of hazardous birds found at airports, are undoubtedly effective in dispersing birds. To work properly, however, considerable investment in the training of both the animals and their handlers needs to be made. This training is essential to both in orde to ensure that the animals do not become a strike risk and also to ensure that the deterrent value of deploying the falcon or dog is maximised. Airports should not underestimate the staff time and cost involved in incorporating falcons or dogs in their bird control programmes.



*Falconry deployed to stimulate a predator response in hazardous wildlife, Vancouver International Airport*

It is also important to remember that falcons and dogs are not effective at dispersing all hazardous birds in all conditions. They should be regarded as one tool amongst many that the bird controller can use. The use of trained predators alone is not an adequate substitute for the other bird management techniques described above. These can be particularly effective with large flocks of birds on the ground around an airport – however the deployment of such methods needs close coordination with ATC so as to not create a hazard by lifting the birds when aircraft are landing or taking off.

*Trained dogs, Schiphol International Airport*

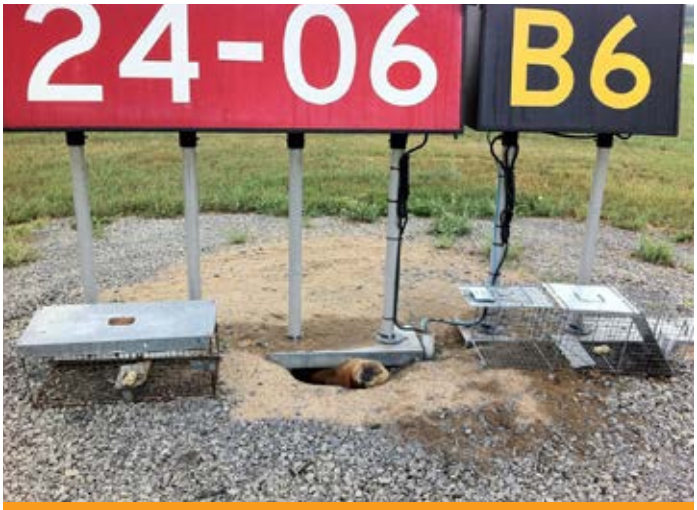
## Lasers

Lasers can be used to scare birds away. Trials have been conducted with fixed devices that use laser beams to scare off birds. Fixed lasers units and hand held lasers can be useful in dusk/dawn or night time, however it is recommended that trials are undertaken before purchasing expensive equipment. Some birds species react only to some colours of laser, so local testing needs to verify what works. Procedures need to be put in place to ensure lasers are used safely and do not create any hazard to users of the airfield or people off-airport.

*Bird Laser, Dublin International Airport*

## Trapping/Killing/Culling

Constructive measures should be taken to limit the presence of mammals. If removal is desired or required, experienced hunters or trappers should be called upon to assist in the trapping or removal of wildlife. If they persist despite these measures, it is likely that more permanent measures should be taken such as habitat modification or exclusion methods. The destruction of animals through the killing of individuals and removal of nests or eggs should be carried out in accordance with local legislation. In no case should the destruction of animals be used as the primary and /or sole method of wildlife management on an aerodrome. The use of limited, targeted, lethal control by trained staff may be necessary either to reinforce non-lethal control measures or to remove individual problem wildlife that cannot be controlled through any other method. Where wildlife is shot or captured, operatives should be trained in wildlife identification to insure that the correct species it targeted, and trained in proper removal methods and handling of live and dead animals. Trapping and handling of live animals takes considerable training to be successful and guarantee the safety of both the animals and the trapper and likely requires additional permitting by the government.




*Living trapping for immigration, Falcon Environmental Service*

## Visual Repellents

Predator models can exist in the form of kites, balloons, scarecrows and even small models. Experience throughout the world shows very rapid habituation by birds. The more mobile the model, the longer it will be effective. These methods should only be used for brief periods of time, generally no more than 3-4 hours and if they can be used with other more effective methods their effectiveness can potentially be increased. Scarecrows are also only effective for very short periods of time and then only when there is action or other methods in use. The "Scary Man" scarecrow has been used in some locations, but the effectiveness is very limited both spatially and temporally. ■

# C

# ANNEX C
# Wildlife Strike Statistics

The first recorded human fatality resulting from a bird strike occurred in 1912. Cal Rogers, the first man to fly across the United States, crashed into the ocean after a gull became jammed in his aircraft's flight controls. Since then, bird strikes have become an increasingly serious problem in both civil and military aviation, with many thousands of strikes occurring every year.

According to IBSC, It is believed that the number of fatal accidents has risen to at least 55, killing 276 people and the destruction of 108 aircraft between 1912 and 2011.

An example of reported wildlife strike statics in the USA is below:

| YEAR | BIRDS | BATS | MAMMAL | REPTILES | TOTAL STRIKES | STRIKES WITH DAMAGE |
|---|---|---|---|---|---|---|
| 1990 | 1,748 | 4 | 52 | 0 | 1,804 | 372 |
| 1991 | 2,266 | 3 | 54 | 0 | 2,323 | 401 |
| 1992 | 2,360 | 2 | 73 | 1 | 2,436 | 368 |
| 1993 | 2,409 | 6 | 67 | 0 | 2,482 | 399 |
| 1994 | 2,472 | 2 | 82 | 1 | 2,557 | 464 |
| 1995 | 2,679 | 5 | 84 | 8 | 2,776 | 500 |
| 1996 | 2,856 | 1 | 91 | 3 | 2,951 | 505 |
| 1997 | 3,353 | 1 | 95 | 14 | 3,463 | 582 |
| 1998 | 3,691 | 3 | 111 | 7 | 3,812 | 588 |
| 1999 | 5,022 | 7 | 96 | 1 | 5,126 | 706 |
| 2000 | 5,870 | 16 | 124 | 3 | 6,013 | 765 |
| 2001 | 5,676 | 8 | 140 | 8 | 5,832 | 650 |
| 2002 | 6,104 | 19 | 119 | 15 | 6,257 | 675 |
| 2003 | 5,886 | 20 | 127 | 5 | 6,038 | 635 |
| 2004 | 6,411 | 27 | 129 | 6 | 6,573 | 628 |
| 2005 | 7,092 | 27 | 132 | 7 | 7,258 | 609 |
| 2006 | 7,053 | 49 | 142 | 10 | 7,254 | 599 |
| 2007 | 7,538 | 53 | 175 | 7 | 7,773 | 571 |
| 2008 | 7,417 | 46 | 183 | 5 | 7,651 | 528 |
| 2009 | 9,229 | 67 | 232 | 10 | 9,538 | 607 |
| 2010 | 9,546 | 113 | 247 | 11 | 9,917 | 598 |
| 2011 | 9,730 | 139 | 199 | 15 | 10,083 | 541 |
| **TOTAL** | **116,408** | **618** | **2,754** | **137** | **119,917** | **12,291** |

# D

# ANNEX D
# Wildlife Strike Report Form

| | | | | | |
|---|---|---|---|---|---|
| Operator : | Aircraft Model :<br><br>Engine Model : | | | Aircraft Registration : | |
| Date of Incident (local time) :<br>_____ /_____ /_____<br>Month \| Day \| Year | Local Time of Incident :<br>_____ HR _____ MIN<br>☐ AM ☐ PM | | | ☐ Dawn<br>☐ Dusk<br>☐ Day<br>☐ Night | ☐ Height (AGL) :<br><br>☐ Speed (IAS) : |
| Phase of Flight | Part(s) of Aircraft | Struck | Damage | Sky Condition | Precipitation |
| ☐ A. Parked | A. Radome | ☐ | ☐ | ☐ No Cloud | ☐ Fog |
| ☐ B. Taxi | B. Windshield | ☐ | ☐ | ☐ Some Cloud | ☐ Rain |
| ☐ C. Take-off Run | C. Nose | ☐ | ☐ | ☐ Overcast | ☐ Snow |
| ☐ D. Climb | D. Engine No. 1 | ☐ | ☐ | | ☐ None |
| ☐ E. En Route | E. Engine No. 2 | ☐ | ☐ | EFFECT ON FLIGHT | |
| ☐ F. Descent | F. Engine No. 3 | ☐ | ☐ | ☐ None | |
| ☐ G. Approach | G. Engine No. 4 | ☐ | ☐ | ☐ Aborted Take-Off | |
| ☐ H. Landing Roll | H. Propeller | ☐ | ☐ | ☐ Precautionary Landing | |
| Aircraft time out of service | I. Wing / Rotor | ☐ | ☐ | ☐ Engines Shut Down | |
| | J. Fuselage | ☐ | ☐ | ☐ Other (Specify) | |
| | K. Landing Gear | ☐ | ☐ | | |
| Estimated cost of replacement, other cost? | L. Tail | ☐ | ☐ | LIGHTS USED | |
| | M. Lights | ☐ | ☐ | Landing | ☐ Yes ☐ No |
| | N. Other (Specify) | ☐ | ☐ | Strobe Anti-Collision | ☐ Yes ☐ No |
| | | | | Pilot warned of Species | ☐ Yes ☐ No |
| Airport Name : | Runway used : | | | Location if En Route (Nearest Town / Reference & State) | |
| Wildlife Species :<br>(drop down list of species commonly seen on and near airport recommended) | Number of Species | Seen | Struck | Size of Species | |
| | 1 | ☐ | ☐ | ☐ Small ☐ Medium ☐ Large | |
| | 2 – 10 | ☐ | ☐ | | |
| | 11 – 100 | ☐ | ☐ | | |
| | More than 100 | ☐ | ☐ | | |
| Remarks: (Describe damage, injuries and other pertinent information) | | | | | |
| Reported by (Optional)<br><br>Name :<br>Phone :<br>Email : | Organization : | | | Signature : | |
| | | | | Date: | |

# E ANNEX E
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Transport Canada – www.tc.gc.ca
International Bird Strike Committee – www.int-birdstrike.com
Bird Strike Committee USA – www.birdstrike.org
United Kingdom Civil Aviation Authority – www.caa.co.uk
International Union for Conservation of Nature – www.iucn.org
BTEE SA – www.bureaubtee.com

# ANNEX F
# Wildlife Protected Species Register

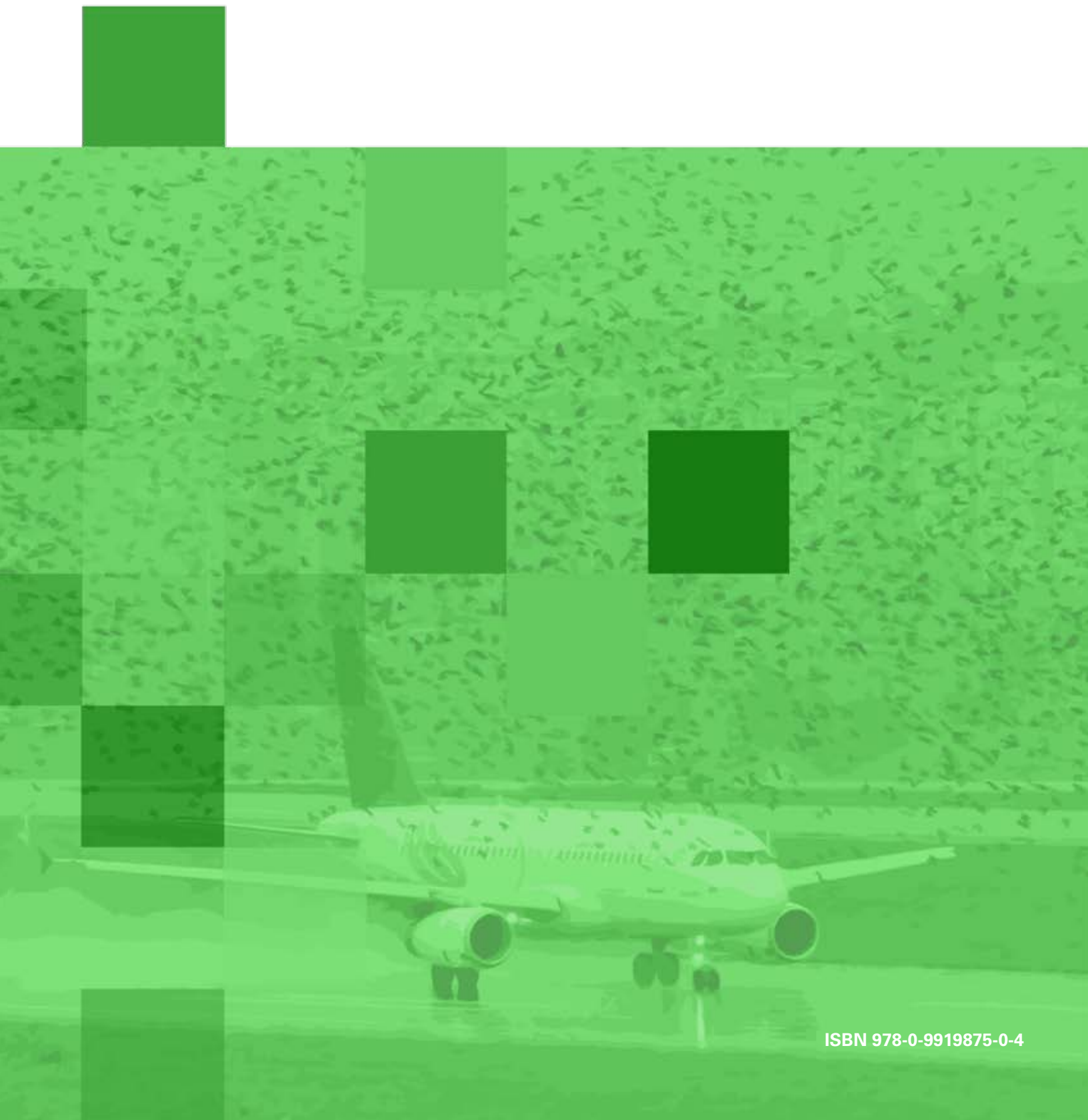
Each Aerodrome must compile a Wildlife Protected /Rare Species Register based on national & local legislation guidelines. Staff engaged in the role of wildlife strike prevention must receive training in recognition of all species to include endangered species. http://www.iucn.org/

| Species name/type (sample examples below) | Reason protected | ✓ Tick | Mitigation factors employed | ✓ Tick & note | Register of sightings | ✓ Tick & note |
|---|---|---|---|---|---|---|
| Indian yellow-nosed albatross (Thalassarche carteri)  | Rare species<br>Endangered species<br>National register<br>International register | ✓<br>✓<br>✓ | Patrol<br>Capture<br>Relocation<br>Rescue agencies<br>Tagging | | Date<br>Numbers<br>Location<br>Direction from/to<br>Other details | |
| Red wolf (Canis Rufus)  | Rare species<br>Endangered species<br>National register<br>International register | ✓<br>✓<br>✓ | Patrol<br>Capture<br>Relocation<br>Rescue agencies<br>Tagging | | Date<br>Numbers<br>Location<br>Direction from/to<br>Other details | |
| Hare (Lepus timidus hibernicus)  | Rare species<br>Endangered species<br>National register<br>International register | ✓<br>✓ | Patrol<br>Capture<br>Relocation<br>Rescue agencies<br>Tagging | ✓<br>✓<br>✓<br>✓<br>✓ | Date<br>Numbers<br>Location<br>Direction from/to<br>Other details | |

## Aerodrome protected species register

Note: Aerodromes may also wish to consider critically endangered, endangered and vulnerable species in addition to protected species

| **Species name/type** *(specific aerodrome protected species list below, include picture)* | **Reason protected** | **✓ Tick** | **Mitigation factors employed** | **✓ Tick & note** | **Register of sightings** | **✓ Tick & note** |
|---|---|---|---|---|---|---|
| | Rare species<br>Endangered species<br>National register<br>International register | | Patrol<br>Capture<br>Relocation<br>Rescue agencies<br>Tagging | | Date<br>Numbers<br>Location<br>Direction from/to<br>Other details | |
| | Rare species<br>Endangered species<br>National register<br>International register | | Patrol<br>Capture<br>Relocation<br>Rescue agencies<br>Tagging | | Date<br>Numbers<br>Location<br>Direction from/to<br>Other details | |
| | Rare species<br>Endangered species<br>National register<br>International register | | Patrol<br>Capture<br>Relocation<br>Rescue agencies<br>Tagging | | Date<br>Numbers<br>Location<br>Direction from/to<br>Other details | |



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