IALA GUIDELINE

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BIRD DETERRENTS AND BIRD FOULING SOLUTIONS

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CONTENTS

1. SCOPE 5
2. AIM 5
3. INTRODUCTION 5
4. NEGATIVE EFFECTS OF BIRD FOULING 6
4.1. From an availability and structural perspective 6
4.2. From an occupational health and safety perspective 6
5. METHODS FOR DEALING WITH BIRD FOULING PROBLEMS 7
5.1. Physical Solutions 7
5.1.1. Bird spikes 7
5.1.2. Visual bird deterrents 8
5.1.3. Bird rollers 8
5.1.4. Variation of installation of components and fittings 9
5.2. Electrical deterrents 9
5.2.1. Audible bird deterrents 9
5.2.2. Electrical deterrents 10
5.3. Alternative solutions 11
5.3.1. Bird repellent gel 11
5.3.2. Vinyl self-adhesive protection 12
5.3.3. Modification of the paint scheme 12
5.3.4. Additional coatings 13
6. GENERAL COMMENTS 15
7. EVALUATION OF ALTERNATIVES 15
8. ENVIRONMENTAL CONSIDERATIONS 16
9. OTHER REFERENCES 16
10. DEFINITIONS 16
11. ABBREVIATIONS 17

List of Figures

Figure 1 Birds using the buoy as a meeting point 6
Figure 2 Bird spikes 8
Figure 3 Bird rollers 9
Figure 4 Components designed to reduce landing area 9
Figure 5 Buoy with audible bird scarer 10
Figure 6 Audible bird deterrent installed on pontoon 10
Figure 7 Electric fence type bird deterrents 11

CONTENTS

Figure 8 *Installation of vinylic self-adhesive protection on the hull of a buoy* *12*
Figure 9 *Buoy with modified paint system* *13*
Figure 10 *Buoy with additional coating applied* *14*
Figure 11 *Coated buoy before and after pressure washing* *15*

1. SCOPE

The scope of this document is to provide information on the problem of bird fouling on Marine Aids to Navigation (AtoN) by focusing on the identification of the detrimental effects of bird fouling and the possible use of effective bird deterrents or alternative solutions that allow AtoN to be easily cleaned.

This document will also provide details on case studies, trials and measures that authorities and organizations are using or have trialled and the measure of success or level of effectiveness for those particular applications.

2. AIM

The aim of this Guideline is to provide:

- a definition of bird fouling and bird deterrents;
- details of the detrimental effects of bird fouling on AtoN structures, power supplies and lighting systems and its overall impact on AtoN reliability;
- details of occupational health and safety (OH&S) concerns related to working in areas of excessive bird fouling;
- details of possible methods of bird deterrence and other remedial measures used to prevent bird fouling; and
- information on accessing documents detailing previous experience in applications of bird deterrent systems and alternative solutions that allow AtoN to be cleaned easily, as experienced by IALA members.

3. INTRODUCTION

All AtoN systems are affected by a range of factors attributed to the impact of the environment, generating frequent failures, influencing their Level of Service (LOS) and resulting in a significant amount of preventive maintenance tasks on AtoN structures.

One of the environmental factors with a higher impact on the preventive maintenance tasks is the presence of bird colonies due to the fact that they nest and migrate along the coast. They sit on AtoN structures in search of an appropriate place to rest, thus progressively covering the surface, their elements and devices, generating a bird excrement layer (Bird fouling) that turns out to be abrasive, with a resulting loss of conspicuity.

Bird fouling can be defined as the pollution or contamination of an area by bird droppings. In the context of this Guideline, it refers to the pollution or contamination of AtoN sites or associated structures.

Bird fouling of an AtoN site has detrimental effects on its availability and reliability, on workplace health and safety, and, in general, results in accelerated structural deterioration.

A bird deterrent can be defined as a device or object that deters a bird from landing on or using an AtoN or AtoN structure for any purpose. The deterrence of a bird from an AtoN will effectively remove the issues associated with bird droppings.

Bird deterrents can be used in a number of different scenarios such as helipads, lanterns/AtoN and associated structures, day marks, solar panels, buoys, facilities, other marine structures, fittings and components.

When the bird fouling of an AtoN cannot be avoided, alternatives must be developed to facilitate and reduce the task of cleaning it.

Figure 1 Birds using the buoy as a meeting point

4. NEGATIVE EFFECTS OF BIRD FOULING

4.1. FROM AN AVAILABILITY AND STRUCTURAL PERSPECTIVE

Bird fouling comes primarily from sea-birds landing and roosting, or attempting to land and roost, on an AtoN site. The discharge of faecal matter is what causes the bird fouling, but it can also be related to shedding of feathers, nesting debris and presence of rotting food. Bird fouling can have, among others, the following detrimental effects on AtoN sites:

- Excessive bird lime coverage on lanterns or optics, causing obstruction of the light source, resulting in reduced nautical range or in severe cases, total outage of the AtoN.
- Excessive bird lime coverage of solar panels, reducing the active area of the panel and severely limiting battery charging capacity, which can lead to negative effects on night-time signalling functions of the lantern and may eventually lead to total battery discharge and subsequent outages of the AtoN.
- Bird lime coverage on lighthouses or other daymarks can cause a change in the colour, severely affecting the ability of that AtoN to provide clear information to the user.
- Bird lime is highly caustic and can increase corrosion rates on AtoN structures, fittings and components, resulting in accelerated deterioration and reduced life span, higher maintenance costs and unsafe structures.
- Bird fouling on any site generally pollutes and contaminates, causing a number of associated issues.

4.2. FROM AN OCCUPATIONAL HEALTH AND SAFETY PERSPECTIVE

Excessive bird fouling causes serious occupational health and safety (OH&S) risks for personnel involved in routine maintenance or inspection. Whilst the OH&S risks are most commonly associated with the odour caused by bird lime build up, other risks are quite varied. A summary of some of the OH&S risks are provided below:

- Exposure to the excessive odour of birdlime build up can cause respiratory and other illnesses. Dried birdlime can become an air pollutant during cleaning or when disturbed.
- Numerous diseases are carried or caused by birds, from both their bodies and their droppings and serious risks arise from disease organisms growing in the nutrient rich accumulation of bird droppings, feathers and debris. Some of these diseases can be passed onto humans.

- Insects or parasites (ticks, mites, fleas, lice etc.) that live on birds or their droppings may become a problem with particularly severe infestations. These can be passed onto humans with contact and can cause both minor and serious health issues.
- Birdlime can cause slippery conditions on AtoN, especially when wet. This therefore increases risks associated with slipping, falling and generally magnifies all other risks normally associated with working at heights.

5. METHODS FOR DEALING WITH BIRD FOULING PROBLEMS

There are different methods/solutions to mitigate bird fouling on AtoN structures, such as implementing commercial products and deterrent systems, the application of engineering solutions, structural changes or revised installation methods where impossible to deter bird colonies, minimizing the negative effect of birds fouling.

The exact method should be tailored to suit a particular site, situation and, in some cases, may need to be designed to suit the visitation habits of a particular species of bird.

Some examples of methods and solutions can be classified as follows:

Physical solutions:

- Bird spikes
- Bird rollers
- Visual bird deterrents, such as "scarecrows"
- Design of components and fittings

Electronic solutions:

- Installation of electronic audible bird deterrent
- Installation of electric fence type bird deterrent.

Alternative solutions:

- Bird repellent gel to keep away the birds that affect the AtoN.
- Self-adhesive vinyl products that can be replaced at each cleaning operation.
- Installation of specialized paint systems to resist the accumulation of birdlime.
- Addition of clear coat hydrophobic or non-stick coatings to resist the accumulation of birdlime.

It should be noted that each country has its own regulations and laws regarding bird protection and, as such, any solution must be environmentally sustainable.

5.1. PHYSICAL SOLUTIONS

5.1.1. BIRD SPIKES

Bird spikes can be a cheap and effective way of deterring birds from landing on some structures. There are several commercial types of bird spikes available that can be installed on most parts of an AtoN structure, fittings or components.

The effectiveness of bird spikes depends on several factors. The method of installation is critical, and bird spikes must be installed to withstand the effects of wind, waves, bird collision and other environmental factors they may

be exposed to. The level of adhesiveness must be considered to ensure that they remain in situ and do not break off or become knocked off by birds contacting them.

Bird spikes must also be designed and fabricated from durable materials to withstand harsh environmental conditions.

The schedule of inspection and maintenance will also affect bird spikes as they are not necessarily items designed with a long life span in mind.

Many lantern brands now have permanent or semi-permanent "in-built" bird spikes or components and fittings that allow the installation of bird spikes. This can be considered when choosing equipment for a site where exposure to bird fouling may be an issue.

Figure 2 Bird spikes

5.1.2. VISUAL BIRD DETERRENTS

There is a wide range of options and methods of using visual bird deterrents, and it usually involves the installation of a device or piece of equipment that is used to scare or deter a bird from landing, rather than physically preventing a landing. These types of devices are sometimes referred to as "scarecrows". Many interesting variations on this theme have been trialled around the world by AtoN authorities and service providers.

Results of past applications show that certain species of birds may, after some time, tend to habituate and become used to foreign items, thereby negating the usefulness of visual bird deterrents in some circumstances.

5.1.3. BIRD ROLLERS

Bird rollers are commercially available and have proven to be successful when used in the correct application. Bird rollers are usually installed on hand rails or other areas that may provide purchase or a landing for visiting birds. The rollers provide a moving and constantly rotating surface on which birds cannot land. It is important to consider

all aspects of the installation, including the schedule of inspections and visiting, the remoteness of the location and the expected bird pressure.

Figure 3 Bird rollers

5.1.4. VARIATION OF INSTALLATION OF COMPONENTS AND FITTINGS

In the case of solar panels, it is possible to change the method of mounting, i.e., mount them vertically to prevent bird lime smear. However, this requires careful consideration of the effects on power supply and reliability for the AtoN and will usually require additional solar panels to address power loss. In some cases, the limited room available on a structure may prevent this option being feasible. Installing cones on the top of flat lantern surfaces has also proved successful in some applications, as it effectively removes areas for bird purchase.

Depending on the species of bird causing the fouling, another consideration is changing the angle or elevations of possible landings. Practical observations on some types of sea birds, particularly seagulls indicate that they defecate in nearly horizontal bursts, whilst perched on steel buoy guard rails. Therefore, installation of a simple elevating platform may prove effective in redirecting the spray of bird faecal matter, thus removing issues with smearing on nearby lanterns or solar panels. This option needs careful consideration of the species of birds causing issues for a particular site, and also the location of the set out of the different AtoN components.

Figure 4 Components designed to reduce landing area

5.2. ELECTRICAL DETERRENTS

5.2.1. AUDIBLE BIRD DETERRENTS

Audible bird deterrents or bird scarers have been used in many locations, with varying levels of success. Experience shows that it is particularly important to consider the species of bird being targeted when considering audible bird deterrents as a viable option.

Audible bird deterrents can include devices that emit bird calls or other noises that cause birds distress. These devices come in a variety of shapes and sizes and can emit noises at regular intervals or even fitted with remote sensors that ensure noises are only emitted when movement is sensed. The power supply requirements and electronic components may make these items unsuitable for remote area installations, whereas they may prove

to be the preferred choice in areas where power supply is regular and maintenance and inspections can be carried out regularly.

Suppliers of commercial bird deterrent systems can be sourced through internet searches and often provide services to identify the right type of product needed for a specific bird related problem.

Figure 5 Buoy with audible bird scarer

Figure 6 Audible bird deterrent installed on pontoon

5.2.2. ELECTRICAL DETERRENTS

Various versions of electrical systems have also been trialled with good success. Electrical fence systems have the possibility of eliminating birdlime issues, providing the correct engineering and design considerations are taken into account. This process has proved especially successful when built into a structure's design during the initial design phase, as it allows the designer to make considerations in minimizing bird perches and also ensuring that installation of the electrical system is facilitated both in terms of space and power supply. Most components of these systems are commercially available and utilize the same equipment as standard electrical cattle fences. Full systems specifically designed for use for bird control are also commercially available on the pest control market.

Figure 7 Electric fence type bird deterrents

5.3. ALTERNATIVE SOLUTIONS

5.3.1. BIRD REPELLENT GEL

There is a wide range of market ready products that cause insects, birds or animals to stay away, become unstable, or stick to the surface.

The bird repellent gel is an alternative solution, due to being easily applied on a clean dry surface with a palette knife, paint brush or roller. It is non-toxic, can be handled without protection, and is harmless to birds. It is designed to affect birds' senses and produce instability. Heat felt in the birds' claws prevents them from clinging firmly onto the surface, and they tend to fly away.

There are certain practical and functional restrictions to applying this gel solution on certain surfaces, such as:

- Buoy hull surfaces that get wet; as the gel product is water-soluble and will dissolve.
- Product degrades when buoy is exposed to high temperatures during the summer.
- Dirt adheres to the gel, so will need cleaning and replacement at regular intervals.

Large colonies of birds may not learn to associate the gel with discomfort due to the constant change of individuals.

The product should be evaluated for suitability at individual sites.

5.3.2. VINYL SELF-ADHESIVE PROTECTION

Depending on criticality of element requiring protection, an application of vinyl film can be a solution to protect items such as solar panels or lanterns.

A vinyl film is applied to clean components either from new or during a service visit, then at subsequent service visits the dirty film is removed and replaced with a new layer.

Vinyl film is suitable for several types of structure including lighthouses and beacons. Whilst the film can be used on floating AtoN, it is difficult to apply and easily damaged, so its use should be carefully considered and tested prior to general deployment across a fleet.

Images show crew using a heat gun to thoroughly transfer a protective vinyl film onto the test buoy.

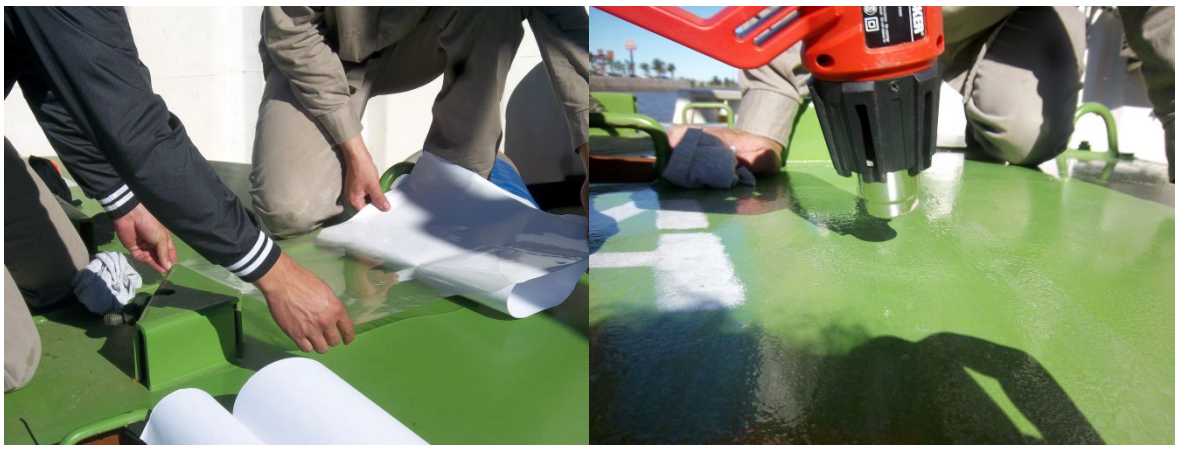

Figure 8 Installation of vinylic self-adhesive protection on the hull of a buoy

5.3.3. MODIFICATION OF THE PAINT SCHEME

When AtoN are built from steel, one solution to protect the surface can be to modify the final stage of the painting process in order to reduce adherence and obtain a vitrified surface which is easy to wash and onto which excrement will not stick.

The cleaning task is thereby faster, the guano is more easily removed, and less water is needed, which is significant when operating in remote locations where fresh water supply is limited and must be carried on board the service vessel.

The images below show a buoy treated with a specialized paint system, the same buoy is shown covered in bird guano and after being pressure-washed.

These solutions require some practical considerations:

Modification of the painting and curing process of steel AtoN will be more demanding and expensive due to the precision required in the control of the process parameters:

- Accelerated degradation of colour produced by the high temperatures and the UV light upon the glass-like surface of the AtoN.
- Increase risk related to crew safety for having to work on a slippery surface.

Figure 9 *Buoy with modified paint system*

5.3.4. ADDITIONAL COATINGS

The application of various additional colourless coatings that act as a non-stick, soluble or hydrophobic coating can be a solution to implement on AtoN structures, lanterns, glass, solar panels, etc. It can be applied on clean surfaces with a paint brush, roller, cloth or sprayer and is generally touch-dry after 15 to 30 minutes depending on the ambient temperature and humidity and requires minimal coating thickness.

To obtain optimum performance from such coatings, it is important to thoroughly clean the surface to be coated prior to product application. Any remaining dirt or birdlime will reduce the performance of the coating significantly.

The image below shows one buoy coated with anti-graffiti paint, before and after pressure washing (top and bottom).

Figure 10 Buoy with additional coating applied

A successful implementation depends on the systematic preventive application of the product on clean dry surfaces. An additional coating application provides several advantages with respect to other options:

- Reduced work time - on sites where it is impossible to avoid the accumulation of birdlime, this represents a significant reduction in time and effort required to clean the site.
- Specific vs. mass implementation on AtoN systems - there exists a wide array of viable solutions depending on the type of AtoN system affected and the degree of impact posed by guano upon them. Whereas an electronic bird deterrent should be an effective solution for a lighthouse, a large deployment of buoys would be better suited to additional coating applications.
- Sustainability and Impact on local fauna - any solution implemented should be biodegradable, harmless, and approved by local environmental protection authorities.
- Operational and Cost effectiveness - the concept of ease of use should be prioritized to optimize onboard workers' daily maintenance tasks.
- Additional coatings, although not providing protection from accumulation of birdlime, do enable easy and effective removal of bird guano from AtoN structures and components.
- It should be noted that certain coatings work by being water soluble, and as such, their effectiveness may be decreased over time and will need replacing at each service.

The images below show a coated buoy before and after being pressure-washed.

Figure 11 Coated buoy before and after pressure washing

6. GENERAL COMMENTS

Rainfall can reduce the adherence of guano to the surface of the AtoN. The longer the surface remains wet, the lower the chances of adherence.

For electronic / electrical devices:

- For remote installations (buoys or beacons) the audible bird deterrent will likely be set at low output in order to limit power consumption, therefore effective coverage radius will be poor - around 15 metres.
- For lighthouses where power supply is normally not an issue, electronic bird deterrents can be highly effective.

For cleaning tasks:

- The position and distance of the water gun and a pressure of at least 120 bar, are critical to the performance of pressure washers during cleaning operations.
- Non-destructive mechanical means, such as bristle brush to remove any stubborn dirt or birdlime may also be necessary.

7. EVALUATION OF ALTERNATIVES

Users of this Guideline are recommended to carry out an assessment of the different alternatives considering the following factors for their specific location, structure, available resources, and local laws and regulations:

- Sustainability
- Durability
- Ease of application
- Cost
- Safety
- Environment
- Effectiveness

From a technical point of view, the decision to implement one or another solution is associated with the operations and maintenance of the AtoN, including:

- Level of Service
- Weather conditions
- Type of AtoN
- Site access methods
- Human resources, suitability of the crew
- Feasibility of implementation across a fleet

8. ENVIRONMENTAL CONSIDERATIONS

Whilst the principal reason of a bird deterrent is to keep birds from landing or roosting on an AtoN component or structure, a fine line must be drawn to ensure that the method is not overly harmful to birds, for the simple reason that not all birds visiting the structure are necessarily pest species. It is possible that birds of high ecological value or a protected status may also attempt to use the structures.

A country environmental or fauna legislation will usually stipulate the regulations to which an authority or service provider needs to act in relation to this subject. There may also be legislation or guidelines that identify bird species of concern.

Competent authorities and responsible service providers should also ensure that this issue is addressed in their environmental management system, so an attempt is made to identify interaction (and its impacts) with any endangered bird species or wildlife in general.

9. OTHER REFERENCES

Additional case studies and reports on bird deterrents and their effectiveness can be found on the IALA Wiki. The IALA Wiki is only available to IALA members and can be accessed from the IALA Website (http://www.iala-aism.org).

10. DEFINITIONS

The definitions of terms used in this Guideline can be found in the *International Dictionary of Marine Aids to Navigation* (IALA Dictionary) and were checked as correct at the time of going to print. Where conflict arises, the IALA Dictionary should be considered as the authoritative source of definitions used in IALA documents.

11. ABBREVIATIONS

AtoN	Marine Aids to Navigation
OH&S	Occupational health and safety