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NSW Code of Practice and Standard Operating Procedures for the Effective and Humane Management of Pest Birds

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Preface

This document (Code of Practice (COP) and relevant Standard Operating Procedures (SOPs)) provides current information and guidance to government agencies, land managers and pest animal controllers involved in the management of pest birds in NSW. The aim is for control programs to be conducted in a way that reduces the negative impacts of pest birds using the most humane, target-specific, economic and effective techniques available.

Previously published and endorsed COPs and SOPs [1] available via the PestSmart website (https://www.pestsmart.org.au/) can provide general guidance for national use, but some of the content may now be out-of-date. This revision of NSW-specific COPs and SOPs [2] has been developed to provide the most relevant and up-to-date information to support best practice pest animal management in NSW. Outdated information has been removed, while new information has been added to reflect the advancements and changes specific to pest bird management within NSW. For ease of use, the COP and SOPs for each species have been consolidated into one document; however, links are provided to allow printing of individual SOPs as required.

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Introduction

All pest animal management must aim to minimise individual animal suffering while at the same time optimising the population impact of a control program. This requires use of the most humane methods that will achieve the control program's aims. Consideration of animal suffering should occur regardless of the status given to a particular pest species or the extent of the damage or impact they create. While the ecological and economic rationales for the control of pests such as birds are frequently documented, of equal importance is an ethical framework under which these pests are controlled.

A **Code of Practice** (COP) provides overarching context and brings together the SOP procedures in context, and now in one document that specifies humane control options and their implementation. In this way, COPs encompass all aspects of controlling a pest animal species as determined by best practice principles, relevant biological information, guidance on choosing the most humane and appropriate control technique and how to most effectively implement management programs.

This COP provides state-wide guidance and is based on current knowledge and experience in the area of pest bird control. It will be revised as required to take into account advances in knowledge and development of new control techniques and strategies.

Standard Operating Procedures (SOPs) ensure that an ethical approach (including the recognition of, and attention to, the welfare of all animals directly or indirectly affected by control programs) is uniformly applied to each pest animal control option. The SOPs are written in a way that describes the procedures involved and animal welfare issues applicable for each control technique, thus acting as a detailed guide to support best practice control programs.

Definitions and terms

Best practice management – a structured, consistent and adaptive approach to the humane management of pest animals aimed at achieving enduring and cost-effective outcomes. 'Best practice' is defined as the agreed principles and specific techniques at a particular time following consideration of scientific information and accumulated experience [3].

Euthanasia – literally means a 'good death' and usually implies the ending of suffering for an individual; however, when used in regard to animals it usually refers to the means by which an animal is killed rather than the reason for killing it [4, 5].

Humane – refers to an absence of (or minimal) pain, suffering and distress (e.g., a relatively more humane euthanasia method will cause less pain, suffering and distress than a relatively less humane euthanasia method).

Humaneness – level of welfare impact or welfare cost (e.g., assessing level of humaneness is equivalent to assessing welfare impact or cost).

Humane killing – the killing of animals using relatively humane methods in certain situations (e.g., animals used in research or pest management) for reasons other than to reduce their suffering.

Humane vertebrate pest control – the development and selection of feasible control programs and techniques that avoid or minimise pain, suffering and distress to target and non-target animals [6].

Pest animal – (also referred to as vertebrate pest) native or introduced, wild or feral, non-human species of animal that is currently troublesome locally, or over a wide area, to one or more persons, either by being a health hazard, a general nuisance, or by destroying food, fibre, or natural resources [7]. Refer to Vertebrate Pesticide Manual [8] for relevant governance and legislation information as applied to the control of vertebrate pests.

Welfare – an animals' state as regards its attempts to cope with its environment [9]. Welfare includes the extent of any difficulty in coping or any failure to cope; it is a characteristic of an individual at a particular time and can range from very good to very poor. Pain and suffering are important aspects of poor welfare, whereas good welfare is present when the nutritional, environmental, health, behavioural and mental needs of animals are met. When welfare is good, suffering is absent [10].

Best practice in pest animal management

From an animal welfare perspective, it is highly desirable that pest animal control programs are efficient, effective and sustained so that pest populations are reduced to low levels and not allowed to recover, thereby avoiding the need for repeated large-scale killing. Over the last decade, the approach to managing pest animals has changed [3]. Rather than focussing on inputs, it is now realised that like most other aspects of agriculture or nature conservation, pest management needs to be carefully planned and coordinated with the aim of reducing to an acceptable level the damage due to pest animals i.e., the focus is on measurable economic and environmental outcomes. Pest animal control is just one aspect of an integrated approach to the management of production and natural resource systems and management of other factors may also be required to achieve the desired result. For example, for a lamb producer with limited resources, other factors influencing lamb production may include weed control, cover for lambs, ewe nutrition or rams that give a higher twinning rate. Unless pest animal control actions are well planned, collaborative and coordinated at the right temporal and spatial scales, individual control programs are unlikely to have long term benefits. When planning pest animal management, there are some important steps that should be considered (Braysher and Saunders, 2015 [11]):

1. Identify the trigger to undertake pest animal management. Is there a community or political pressure for action on pests and an expectation that pest animals should be controlled? Pest control is unlikely to be effective unless there is strong local or political will to take action and commit the necessary resources.
2. Identify the key group to take responsibility for bringing together those individuals and groups that have a key interest in dealing with the pest issue.
3. Identify the problem. In the past the pest was usually seen as the only problem. We now know that the situation is more complex. First, determine what the problem is. For example, it may be effects on native fauna, reduced levels of agricultural production, and complaints from neighbours or emotional stress from worrying about pest impacts. Several factors impact on each of these problems and control of pests are often only part of the solution.

4. Identify and describe the area of concern. Sometimes it helps to remove agency and property boundaries (nil tenure) so that the problem can be viewed without the tendency to point blame at individuals, groups or agencies. Property and agency boundaries can be added later once agreement is reached on the best approach.
5. Try to break the area into smaller management units for planning. These smaller units may be determined by water bodies, mountain ranges, fences, vegetation that is unsuitable for a particular pest or other suitable boundaries that managers can work to. While it is best to work to boundaries that restrict the movement of pests, this may not be practicable and jurisdictional boundaries, for example, the border of a Landcare group, may have to be used in combination with physical boundaries. Once the management units are identified:
    a. Identify as best you can, the pest animal distribution and abundance in each management unit.
    b. Estimate as far as is practicable, the damage caused by the pest or pests to production and to conservation.
    c. Gather and assess other relevant planning documents such as, recovery plans for threatened species and property management plans. Identify any key constraints that may prevent the plan being put into operation and identify all the key stakeholders.
    d. Develop the most appropriate pest management plans for each of the management units.

Implementing effective and humane pest animal control programs requires a basic understanding of the ecology and biology of the targeted pest, other species that may be affected directly (non-targets) or indirectly (e.g., prey species) by a control program. Managers should take the time to make themselves aware of such information by reading the recommended texts included in this document.

The *Biosecurity Act 2015* and pest animal management

From 1 July 2018, the management of pest animals in NSW needs to account for the requirements and obligations under the NSW *Biosecurity Act 2015*. Everyone in NSW who deals with pest animals, including land managers (public and private), recreational land users, other community members and even visitors to the state must manage those pest animals where they present a risk to biosecurity in NSW.

There are some specific requirements relating to some pest species outlined under the Biosecurity Regulation 2017. For example, under the Biosecurity Regulation, it is illegal for a person to keep, move or release a feral pig, wild rabbit, feral deer or European red fox.

A number of documents are available to help land managers and other community members to understand which pest animals they must manage and how to manage them. Central to these are the Regional Strategic Pest Animal Management Plans that set out the requirements for managing the impacts of pest animals.

Specific members of the Local Land Services' team can investigate if they suspect a person or organisation is not managing pests properly and are able to provide educational material outlining the biosecurity risks presented by the pest animals, and management actions that must be taken to manage the risk posed. If appropriate management action is not taken to

manage the pest animals, trained and authorised staff from Local Land Services can undertake enforcement action.

Animal welfare and humaneness

Pest animals continue to cause significant damage and risks to the environment, agricultural production and to public health. Each year hundreds of thousands of pest animals are trapped, poisoned, shot or otherwise destroyed because of the harm they cause [12]. For most people in today's society the management of pest animals is considered acceptable provided that such management is *humane* and *justified* [13]. However, some deficiencies need to be addressed, inhumane techniques replaced and new, more humane, alternatives developed. For further detail refer to RSPCA Policy E02 *Management of wild animals*.

The humaneness of an individual pest control technique is highly dependent on the way the technique is applied and on the skill of the operator involved. Attention to details such as timing and coordination of control, bait delivery, lethal dose rates, type or calibre of firearm and ammunition have significant effects on animal welfare and target outcomes of control programs. By standardising the way control methods are applied, many of the negative welfare impacts can be reduced or even prevented. This document (COP and SOPs) has been specifically developed to address this issue.

It also contains a summary of the results of humaneness assessments for all individual techniques included as SOPs. The full assessments can be found on the PestSmart website (https://www.pestsmart.org.au/). These assessments were carried out using a model developed by Sharp and Saunders (2008, 2011)[14,15]. The model provides a practical, general means of assessment that can be applied to any control technique. The goal of humaneness assessment is to evaluate the impact of a control technique on individual animals and to use this assessment to determine which methods are more or less humane compared to others.

Assessment of humaneness using the Sharp and Saunders model is based on the five domains approach to welfare assessment developed by Mellor and Reid (1994)[16]. According to this approach, potential or actual welfare compromise is identified in four physical or functional domains and one mental domain:

1: Nutrition – water or food deprivation, malnutrition.

2: Environmental – exposure to excessive heat or cold.

3: Health – disease or physical injury.

4: Behaviour – spatial or interactive restriction.

5: Mental or Affective State – includes impacts from the first four domains (e.g., thirst hunger, anxiety, fear, nausea, pain, boredom, depression, frustration, loneliness, distress) and any other cognitive awareness of external challenges leading to negative affective states.

When considering the humaneness or welfare impact of a control method, impacts are assessed in relation to nutrition, the animal's environment, its health or functional status, its behavioural needs and its overall mental status. As described by Sharp and Saunders (2008, 2011)[14, 15] and Beausoleil and Mellor (2015)[17] when data is available, actual impacts in each of the four domains are evaluated using a range of quantitatively assessed changes in behaviour and physiology along with pathophysiological indicators of functional disruption.

Compromise in one or all of the physical domains is then used to infer potential negative affective impacts in the fifth domain. As welfare is generally considered to be a state within an animal that most directly relates to what the animal experiences, the overall impact of a control method on the animal's welfare generally reflects impacts in Domain 5. When the model is applied to a range of different methods, these can be compared, thus allowing an informed decision on control method choice based on relative humaneness.

Humaneness assessment using the Sharp and Saunders model follows a two-part process: Part A examines the impact of a control method on overall welfare and the duration of this impact; and Part B examines the effects of the killing method on welfare (so is only applied to lethal methods). For example, with live trapping followed by euthanasia, both Part A and Part B are applied, but with fertility control only Part A is applied.

In Part A, overall welfare impact is assessed by looking at the impacts in each of the five domains as described above. In Part B, the killing method is assessed by examining the level of suffering and the duration of suffering based on the time to insensibility criteria described by Broom (1999)[9]. Matrices are then used to determine the score for each part and then the two scores are combined to obtain the overall humaneness score.

Pest bird management

Background

There are over 60 bird species, both native and introduced, which can be classified as pest birds in Australia.

Problem bird species and the damage they cause include:

- *Common starling (Sturnus vulgaris)* – damage to fruit (particularly grapes and cherries), vegetable and cereal crops. Implicated in carrying and transmitting diseases to man and other animals. Competes with native species for nest hollows.
- *Common myna* (*Acridotheres tristis)*- damage to fruit and grain crops. Commensal roosting and nesting habits create aesthetic and human health concerns. Competes with native species for nest hollows.
- *Sulphur-crested cockatoo (Cacatua galerita)*, *little corella (Cacatua sanguinea)* - damage to ripening sunflower crops, fruit and nut crops.
- *Galah* (*Eolophus roseicapilla)* – damage to germinating cereal crops.
- *House sparrow (Passer domesticus)* – damage to fruit vegetable, grain and oilseed crops; competes with native species for nest hollows.
- *Pigeon* (*Columbidae)* – roosting sites cause fouling damage (from build-up of faeces) in urban areas. Implicated in carrying and transmitting diseases to man and other animals.
- *Crows and ravens (Corvus sp.)* – consume fruits and grains. May prey upon sick, dying or mismothered lambs and can injure sheep.
- *Cormorants (Phalacrocorax) and herons (Ardea/Egretta sp.)* – prey on fish, prawns, crayfish etc. in aquaculture ponds.
- Duck species, various (*Anatidae*) – damage to crops particularly rice, implicated in disease transmission.

It is generally acknowledged that there is a paucity of relevant ecological data on pest bird species in Australia. Not all pest bird species and their impacts can be treated the same, with considerable variations in movements, distributions, breeding seasons and feeding strategies. There is also a high variability in spatial and temporal abundance and behaviour within species making it very difficult to predict or estimate pest bird damage and biosecurity risk. With few exceptions, native bird species are protected by legislation and a permit must be obtained for their destruction.

There is a diversity of pest bird problems and issues in Australia. Many horticultural crops are susceptible to bird damage; potentially all fruit crops are at risk, with locally significant damage also reported in many floriculture and vegetable crops. Birds are also pests in other situations and can have a range of impacts that include damage to cereal and oilseed crops; damage to aquaculture; taking and contaminating animal feed at intensive livestock and production facilities; fouling pasture; predation of lambs (rarely); damage to seedlings in plantation forests; competition with native species for nest holes and food; risk to aircraft in terms of air-strike both on runways and in the air, and nesting in engines; being a social/urban nuisance; spreading disease to people or animals; physically attacking people; and causing nutrient enrichment of soils and waterways by faecal contamination.

Over-abundant introduced and native species also compete with and displace less abundant native species, causing impacts on biodiversity.

For further information please see:

- PestSmart: https://www.pestsmart.org.au/pest-animal-species/pest-birds/
- Managing bird damage to fruit and other horticultural crops (Tracey et al. 2006)[18]: https://www.dpi.nsw.gov.au/agriculture/horticulture/pests-diseases-hort/information-for-multiple-crops/managing-bird-damage
- NSW DPI Game Licensing Unit: https://www.dpi.nsw.gov.au/hunting/game-and-pests/native-game-birds

Primary and supplementary control techniques

Pest control programs must be cost-effective. The techniques used within a control program need to be complimentary to each other and lead to a maximum impact reduction, which often requires reducing pest animal densities to low levels over a large scale and maintaining this level of population suppression indefinitely. This leads to a situation where the need for ongoing control is minimised and rates of re-invasion reduced. Follow-up control programs, where the initial reduction is maximised, are also much cheaper to implement as the target population is relatively small. Control techniques can be seen as primary or supplementary based on the following general principles.

Primary techniques are those that can achieve rapid pest population knockdown or reduce damage over large areas in a cost-effective way. Supplementary techniques are generally only effective in helping to maintain pest population suppression once densities have already been reduced to low levels. For example, in the management of pest birds, exclusion netting is a primary method of damage control and supplementary techniques are used as a follow-up (e.g., trapping and deterrents). For effective control regionally appropriate selection of at least one primary control technique and one supplementary control technique should be utilised to help satisfy general biosecurity duty requirements.

Spatial scale is also important. To achieve cost efficiencies and depending on the movement behaviour of the target pest, the area under control may need to be a collaboration of many adjoining land managers. This particularly applies to key bird pest species.

Poorly executed control programs can simply become sustained culling operations that do little to achieve long-term successful outcomes. This in turn can lead to sporadic implementation of crisis management programs where pest numbers have become unacceptable, but the outcome usually becomes sub-optimal. A rotation of primary and supplementary techniques can also be important. Pest animals can become familiar to a particular technique (e.g., bait aversion) that may require switching to another lethal method (e.g., shooting). Another factor to consider is timing of control operations. Time of the year can mean targeting a biological weakness in the pest animal (e.g., a period of food or water stress). Alternatively, application of control can align with the need for the commodity to be protected when it is most vulnerable e.g., when crops are ripening.

Pest bird management methods

Methods of pest bird control include non-lethal techniques such as scaring devices, chemical repellents, habitat manipulation, use of decoy food sources and exclusion netting. Lethal methods of control involve shooting, trapping and poisoning. In many situations lethal control methods have little effect on reducing damage [18].

The most commonly used techniques are exclusion netting, scaring, shooting and trapping. Lethal baiting is sometimes used but usually only by licensed pest control operators. The currently available methods of control are generally expensive, labour intensive, require continuing management effort and can be effective only in limited areas. Cost-effectiveness, humaneness and efficacy for each control technique are useful in deciding the most appropriate strategy. A brief evaluation of the humaneness of control techniques follows.

Humaneness of control techniques

Scaring

A wide variety of bird scarers are available (e.g., gas-operated exploders, alarms, electronic devices, lights, imitation birds of prey), all of them aiming to deter birds by providing frightening visual and/or auditory stimuli. Scaring devices will obviously induce some degree of stress since it is fear aroused in the bird that drives the bird away. However, since these levels of stress would be comparable to a wide variety of 'natural' situations and, because they are free to take appropriate avoidance action, scaring is generally considered to be a humane control method.

Trained raptors can also be used to scare away pest birds in particular areas such as airports and landfill sites. Birds of prey such as falcons are trained to fly over and scare, but not attack, pest birds away from the area, however, this does not have a long-lasting effect. Falconry-based pest bird abatement can also be used to protect farms, orchards, vineyards and crops and may be most cost-effective at vulnerable times such as ripening or when pest birds are at particularly large population densities. This technique uses the natural predator-prey relationship so is considered to be humane.

Exclusion netting

The use of exclusion netting is generally regarded as a humane, non-lethal alternative to lethal control methods. The humaneness of this technique depends on the type and size of the netting used, how it is applied and maintained, and how often it is checked. Problems can occur when birds become entangled in the netting or when they go under the netting and then cannot get back out. Frequent checking of nets is required to prevent mortalities, as entangled and trapped birds can suffer from starvation, shock, exposure, strangulation, and effects of injuries, as well as being vulnerable to predation.

Shooting

Shooting can be a humane control method of killing pest birds when it is carried out by competent, accurate and responsible shooters; the correct combination of firearm and ammunition and optimum shot placement are used; the target bird can be clearly seen and is within range; and all wounded birds are promptly located and euthanased humanely.

Only one bird should be targeted at a time, shooting at a flock is not an acceptable practice. For small to medium birds such as starlings and ducks, the preferred method is a shot to the body of the bird with a shotgun. For larger birds such as emus, the preferred method is a shot to the chest with a large calibre centrefire rifle.

If possible, shooting should be avoided at times when birds are nesting and there are dependent young present. If dependent young are found, they should be killed quickly and humanely. Dependent young will experience significant negative welfare impacts if they are not euthanased humanely after their mother is shot. Shooting can also have negative effects on surviving birds in social groups.

Trapping

Trapping of birds can be a humane method of control provided trapped birds are killed promptly using a humane method and traps are inspected regularly, preferably daily. Traps should be set up to provide shade and shelter as well as protection from predators. If lure (or decoy) birds are used they must be provided with adequate food, water, shelter and a perch.

To minimise the animal welfare implications of leaving dependent nestlings and chicks to die from starvation it is preferable not to undertake trapping during the nesting season. If trapping must occur during nesting, reasonable efforts should be made to find nest hollows containing young birds so they can be killed quickly and humanely.

Non-target birds caught in traps must be visually inspected for injuries and signs of illness or distress before release. Birds which are unharmed should be immediately released at the site of capture.

Cage trapping

All traps have the potential to cause injury and some degree of suffering and distress. Some injuries may occur (e.g., with ducks) but this can be avoided by using the appropriate mesh size for the species of bird being trapped. Injuries to the wing and head can also arise from the birds trying to escape when humans approach the trap. Birds caught in a cage trap are not likely to experience significant injuries unless they make frantic attempts to escape.

Importantly, non-target animals that are caught in cage traps can usually be released unharmed. As well as injuries, trapped birds can suffer from exposure, thirst, starvation, shock, capture myopathy and predation; therefore, traps should be placed in a suitable area protected from extremes of weather and must be inspected at least once daily. Birds captured in small cage traps should be removed within hours, birds captured in large cage traps should be removed no later than 2 days after trapping. Trapped birds should be approached carefully and quietly to minimise panic, further stress and risk of injury. Handling should be minimised to reduce stress.

Net trapping

Birds captured in net traps (such as pull nets, also known as single clap nets or book traps) should be removed quickly. There is a risk of injuries such as wing breaks as birds can get entangled in the net. Birds also must be directly handled to be removed, which increases the risk of injury. Captured birds are likely to experience fear and distress whilst in the net and especially during handling. With this method all trapped birds would be removed from the net within minutes.

Lethal poisoning

In NSW the use of lethal poisons for birds (avicides) is controlled under the *Pesticides Act 1999* and the *Pesticide Control (Avicide Products) Order 2010*, and only authorised pest control operators (i.e. pest management technicians and bird control officers) who hold the appropriate qualifications are able to use these poisons. Currently there are two avicides that are registered for use in NSW: 4-aminopyridine and alpha-chloralose. Fenthion products may no longer be used or supplied in Australia. Check with the Australian Pesticides and Veterinary Medicines Authority (APVMA) or local authorities for any variations in current registrations and use patterns.

Non-target animals including native bird species can also be exposed to poisons either directly by eating baits intended for pest birds (primary poisoning) or through the scavenging of tissues from a poisoned bird (secondary poisoning). Strict guidelines for the use of these avicides, including free feeding and constant monitoring whilst the bait is exposed, are in place to minimise the risk of both primary and secondary poisoning of non-target animals.

4-aminopyridine

4-aminopyridine (e.g., Scatterbird™) is an extremely poisonous bird toxin, which is also highly poisonous to mammals and fish. This compound is applied on grain baits. It is rapidly absorbed into the bloodstream from the gastrointestinal tract and affects the central nervous system. Symptoms of poisoning appear 10-12 minutes after bait consumption and include impairment of normal mental function, vocalisations, over-stimulation, and trembling which can progress to loss of muscular control and convulsions. Time to death ranges between 15 minutes to 4 hours and is a result of respiratory or cardiac arrest. Despite appearances to the contrary, it has been claimed that death from this compound is relatively painless, however, this has not been verified.

As poisoned birds become hyperactive, behave erratically and utter distress calls before they succumb, this poison can also act as a secondary repellent. The number of birds which initially must be poisoned and the repellent capacity is species-specific. In highly

communicative species such as sparrows, only a small number of birds (5% of the flock) need to be poisoned to cause alarm in the rest of the flock, unlike less communicative species, such as pigeons, which may require up to 50% of the flock to consume the poison.

The risk of non-target bird mortality and secondary poisoning of predators is high, although when used by authorised personnel using the manufacturer's recommendations, this risk is thought to be reduced. An authorised person should be present at all times when the treated bait is exposed reducing the likelihood of non-target species feeding on the bait. All uneaten bait and dead birds are to be collected and disposed of safely thereby reducing any risk of secondary poisoning. The treatment of exposed individuals involves symptomatic care and control of seizures.

Alpha-chloralose

Alpha-chloralose (e.g., Rentokil Alphachloralose™) is used for the control of pigeons and sparrows and is considered the most humane of the avicides, with poisoned animals showing few signs of distress and pain. It has previously been used as a hypnotic, sedative and general anaesthetic in human and animal medicine. Alpha-chloralose acts as a soporific, depressing the cortical centres of the brain, initially causing myoclonic movements or tremors followed later by the loss of consciousness and prostration. Symptoms of poisoning include slowing of the heart and respiration and lowering of body temperature. Death occurs from hypothermia or respiratory failure. Birds are highly susceptible to the effects of this poison, which can be incorporated into grain baits or added to water. However, if a sub-lethal dose is received, birds are only immobilised and can recover with no ill effects if kept warm and dry. This can be advantageous if non-targets are present; they can be revived while target birds are collected and euthanased. There is a risk of secondary poisoning occurring, so an authorised person should be monitoring the baiting at all times. All uneaten bait and target birds are to be collected and disposed of safely, so this risk is kept to a minimum.

Fenthion

Fenthion (O, O-dimethyl O-4-methylthio-m-tolylphosphorothioate) (e.g., (Avigel™, Avigrease™ and Control-a-Bird™) is a broad-spectrum organophosphorus insecticide which is moderately toxic to mammals and fish, and highly toxic to birds [19]. Fenthion products are no longer permitted to be used or supplied in Australia following a review by the APVMA in 2014 [20].

Other forms of chemical control

Chemical repellents

Chemical repellents (or deterrents) are aversive substances that can be sprayed onto crops (taste repellents) or perching structures (tactile repellents) to discourage birds. Primary repellents produce an immediate avoidance response by birds because of an unpleasant sensation (e.g., touch, taste, smell, irritation), and secondary repellents act by making the birds feel ill and hence develop a conditioned aversion to the treated food source. Repellents induce some degree of stress however, since these levels of stress would be comparable to a wide variety of 'natural' situations and, because the birds are free to take appropriate avoidance action, the use of repellents is generally considered to be humane.

There are several chemical repellents commercially available in Australia. Aluminium ammonium sulphate is registered as a primary taste repellent for birds. This substance is sprayed on surfaces and acts as an irritant on the moist tissues associated with taste, smell and eyes. Methiocarb is considered a secondary repellent. This compound is a carbonate insecticide that is also used as a snail and slug poison. The practice of spraying methiocarb directly on fruit crops has been discontinued in Australia due to the unavailability of long-term toxicological data, impacts on non-target species and residues in fruit and wine. However, it is available to protect ornamental plants from damage by introduced bird species. Polybutene gel is registered as a tactile repellent and is applied to perching areas around buildings and other structures to discourage introduced birds from landing or roosting. The tacky nature of this compound acts by modifying the surface and making the birds feel insecure and uncomfortable. It should not be applied in such quantity that birds can be trapped on the surface.

Chemical fertility control

A number of chemical products cause infertility in birds when added to their food. One major problem with many of these agents is that they require several doses, and there is no published evidence that fertility chemicals can reduce pest bird damage in the field situation. There are no products currently registered for this use in Australia at the present time.

Egg oils

Application of vegetable and mineral oils directly to the eggs in the nest is sometimes used to prevent hatching. When applied to incubating eggs, egg oil blocks the pores of the eggshells, asphyxiating the developing embryo. Because the eggs are not otherwise disturbed, incubating birds continue incubation to the expected hatching date and beyond, preventing or reducing the potential for a second clutch. This technique is considered humane, although it is very labour intensive, due to the inaccessibility of many bird nests, and is not considered a useful method for broad scale field application.

Other forms of physical control

There are several alternative means of reducing bird damage. Roosting deterrents such as spikes, coils and wires can be placed on buildings and infrastructure to exclude birds. Habitat quality can be manipulated either to reduce the resources available, or alternatively provide a more attractive habitat elsewhere to lure the birds away. As with repellents, these methods of bird control, although causing slight stress, are considered humane as the birds are free to take appropriate avoidance action. Roosting deterrents should be designed and employed in such a way that birds coming into contact do not suffer serious or permanent injuries.

Table 1: Humaneness, Efficacy, Cost-effectiveness and Target Specificity of Pest Bird Control Methods

Control technique	Acceptability regarding humaneness* and Relative humaneness score (Part A [1-8], Part B [A-H]**)	Efficacy regarding population reduction	Cost-effectiveness	Target Specificity	Comments
Exclusion netting (permanent or temporary) *Primary*	Acceptable Score: N/A	Limited	Expensive	Can be in certain situations	Exclusion netting is effective for preventing bird predation of crops and aquaculture systems, but is often not cost-effective or practical. Temporary netting such as drape-over nets are more cost-effective than permanent netting. They can be used for vulnerable periods such as grape and berry ripening season.
Scaring with reinforcement (shooting) *Supplementary*	Acceptable Score: N/A	Effective	Cost-effective	Can be target-specific, although other species may also experience the stress inducing visual/auditory stimuli.	As above.
Scaring *Supplementary*	Acceptable Score: N/A	Limited	Not cost-effective	Can be target-specific, although other species may also experience the stress inducing visual/auditory stimuli.	Birds can quickly become habituated to noise or visual cues. Scaring is most effective when a combination of techniques is used, the sound is reinforced by shooting or some form of threats, scaring starts before birds establish a feeding pattern and the timing and placement of devices are changed frequently.

Control technique	Acceptability regarding humaneness* and Relative humaneness score (Part A [1-8], Part B [A-H]**)	Efficacy regarding population reduction	Cost-effectiveness	Target Specificity	Comments
Ground shooting *Supplementary*	Acceptable Score: 3A (small-medium birds; large birds head), 3B (large birds chest)	Limited effectiveness	Rarely cost-effective	Target specific	Labour intensive for individual landowner/managers and best suited to smaller, isolated areas such as islands.
Cage trapping *Supplementary*	Acceptable Score: 5D (CO_2 or CO with handling), 5C (CO_2 or CO no handling; cervical dislocation)	Relatively ineffective	Rarely cost-effective	May catch non-target animals but they can usually be released unharmed	Labour intensive, therefore, not suitable for broadscale control. May be useful in small areas where eradication is the objective and in semi-rural/urban areas for problem animals.
Net trapping *Supplementary*	Acceptable Score: 4D (CO_2 or CO with handling), 4C (CO_2 or CO no handling; cervical dislocation)	Relatively ineffective	Rarely cost-effective	May catch non-target animals but they can usually be released unharmed	Labour intensive, therefore, not suitable for broadscale control. May be useful in small areas where eradication is the objective and in semi-rural/urban areas for problem animals.
Roosting Deterrents *Supplementary*	Acceptable Score: N/A	Not effective	Not cost-effective (broadscale)	Not target-specific.	Locally effective and cost-effective.

Control technique	Acceptability regarding humaneness* and Relative humaneness score (Part A [1-8], Part B [A-H]**)	Efficacy regarding population reduction	Cost-effectiveness	Target Specificity	Comments
Chemical Deterrents *Supplementary*	Acceptable (Aluminium Ammonium Sulphate) Acceptable (Polybutene) Score: N/A	Not effective	Not cost-effective	Aluminium ammonium sulphate also repels several other small mammals and is an irritant. Non-target species may be exposed to polybutene, but with minimal effects. However, if birds' feathers contact the sticky material, they may become entrapped, or coated with gel, which may be fatal.	Locally effective at protecting crops. Labour-intensive. May be cost-effective for high-value crops suffering high levels of damage.
Poisoning with alpha-chlorolose *Supplementary*	Acceptable Score: N/A	Relatively ineffective	Rarely cost-effective	Potential risk of primary and secondary poisoning of non-target animals. Depending on the dose received, non-target species can be revived and released.	Can be effective for protecting crops if a pre-feeding and poisoning program is established prior to crop damage.
Poisoning with 4-aminopyridine *Supplementary*	Acceptable Score: N/A	Relatively ineffective	Rarely cost-effective	Potential risk of poisoning non-target animals	Varying efficacy depending on the species and dose received.
Poisoning with fenthion *Supplementary*	Not acceptable Score: N/A	Relatively ineffective	Rarely cost-effective	High risk of primary poisoning non-target animals	No longer available in Australia.

Footnotes for Table 1

* *Acceptable* methods are those that are relatively humane when used correctly in accordance with the applicable Standard Operating Procedure. Conditionally acceptable methods are those that, by the nature of the technique, may not be consistently humane. There may be a period of poor welfare before death.

Methods that are not acceptable are considered to be inhumane – the welfare of the animal is very poor before death, often for a prolonged period

** From assessments conducted using a model to assess the relative humaneness of pest animal control methods (Sharp and Saunders 2011)[15]. Humaneness score (AB) consists of Part A - welfare impact prior to death, scale of 1 – 8, less suffering to more suffering and Part B - mode of death, scale of A – H, less suffering to more suffering. For assessment worksheets and matrix of relative humaneness scores see: For assessment worksheets and matrix of relative humaneness scores see: https://www.pestsmart.org.au/animal-welfare/humaneness-assessment/pest-birds/.

N/A = Humaneness score not available.

Control techniques are classified as primary (maximum effect), supplementary (follow-up) or 'not available'. In some situations, techniques can alternate between primary and supplementary.

Relevant legislation

All those involved in vertebrate pest control should familiarise themselves with relevant aspects of the appropriate federal and state legislation. The table below lists relevant legislation. This list is by no means exhaustive and was current at the time of writing.

Commonwealth	*Agricultural and Veterinary Chemicals Code Act 1994* *Environment Protection and Biodiversity Conservation Act 1999*
New South Wales	*Biodiversity Conservation Act 2016* *Biosecurity Act 2015* *Game and Feral Animal Control Act 2002* *Local Government Act 1993* *Local Land Services Act 2013* *National Parks and Wildlife Act 1974* *Pesticides Act 1999* *Prevention of Cruelty to Animals Act 1979*
Other relevant legislation	*Civil Aviation Act 1988* *Civil Aviation (Carriers' Liability) Act 1967* *Dangerous Goods (Road and Rail Transport) Act 2008* *Firearms Act 1996* *Work Health and Safety Act 2011*

Note: copies of the above legislation and relevant regulations may be obtained from federal and state publishing services.

Further information

Local Land Services	https://www.lls.nsw.gov.au/biosecurity/pestplan
NSW National Parks and Wildlife Service	https://www.environment.nsw.gov.au/topics/animals-and-plants/pest-animals-and-weeds/pest-animals
NSW Department of Primary Industries	https://www.dpi.nsw.gov.au/biosecurity/vertebrate-pests
NSW Environment Protection Authority	https://www.epa.nsw.gov.au/your-environment/pesticides/pesticides-nsw-overview/pesticide-control-orders
PestSmart Connect	https://www.pestsmart.org.au/

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Standard Operating Procedures

- Ground shooting of pest birds (NSWBIR SOP1)
- Trapping of pest birds (NSWBIR SOP2)
- Exclusion of pest birds using netting (NSWBIR SOP3)

NSWBIR SOP1
Ground shooting of pest birds

Background

Shooting is used either to directly reduce numbers of pest birds through killing or more commonly as a scaring or dispersal strategy. Shooting may have short-term advantages, but the technique is often labour intensive, opportunistic and may have limited value in bird control.

Shooting can be a humane method of killing pest birds when it is carried out by experienced, skilled shooters, the animal can be clearly seen and is within range, the correct firearm, ammunition and shot placement is used, and wounded animals are promptly located and killed.

This standard operating procedure (SOP) is a guide only; it does not replace or override the relevant NSW or federal legislation. The SOP should only be used subject to the applicable legal requirements including Work Health and Safety (WHS) operating in the relevant jurisdiction.

Individual SOPs should be read in conjunction with the overarching Code of Practice for that species to help ensure that the most appropriate control techniques are selected and that they are deployed in a strategic way, usually in combination with other control techniques, to achieve rapid and sustained reduction of pest animal populations and impacts.

Application

- Shooting should only be used in a strategic manner as part of a co-ordinated program designed to achieve sustained effective control.
- A management plan that specifically targets the main pest species should be developed. Birds differ greatly in their ecology and behaviour, and this influences the way in which they respond to different forms of control.
- Shooting is often used as a scaring strategy to train the birds to associate the sharp, sudden noise with real danger and subsequently, a fear of humans and human activities. Birds can be frightened away without attempts to kill them although small numbers of birds are usually killed with a view to enhance the scaring effect.
- Shooting as a lethal method can be effective in reducing localised populations of birds when low numbers are involved. However, it is labour intensive, costly and rarely effective in achieving long-term reductions in bird numbers or associated damage. Other birds will often move into an area to take the place of those that are killed. Also, some species of bird, particularly parrots, learn to avoid shooters.

- Shooting as a scaring strategy may increase the damage levels in some crops, where birds may drop the fruit or seed head they are feeding on when scared off, and then attack a new one on their return.
- Shooting of pest birds should only be performed by skilled operators who have the necessary experience with firearms and who hold the appropriate licences and accreditation.
- Any control of pest birds must be implemented in accordance with any relevant State and Commonwealth legislation. Permits may be required for the control of some species. Contact the relevant State agency (LLS, NPWS) for further details.
- Native game bird species in NSW can only be killed under the Native Game Bird Management Program (DPI Game Licensing Unit) in accordance with the *Game and Feral Animal Control Act 2002*. The program allows landholders to manage native game birds on agricultural lands in NSW using licensed hunters under a State-wide quota determined by NSW DPI. For details on which birds may be legally hunted and under what conditions/licenses, see https://www.dpi.nsw.gov.au/hunting/game-and-pests.
- Storage and transportation of firearms and ammunition must comply with relevant legislative requirements (*See Firearms Act 1996*, Firearms Regulation 2017).

Animal welfare implications

Target animals

- The humaneness of shooting as a control technique depends almost entirely on the skill and judgement of the shooter. If properly carried out, it is one of the most humane methods of killing birds. On the other hand, if inexpertly carried out, shooting can result in wounding that can cause considerable pain and suffering.
- Shooting must be conducted with the appropriate firearms and ammunition and in a manner that aims to cause immediate insensibility and painless death.
- When using a rifle to shoot a bird, it must be clearly visible and able to be killed with a single shot. A solid rest or support should be utilised to ensure accurate shot placement.
- When using a shotgun, the shooter should aim to have the bird in the centre of the pattern at the point of impact. Shooting of birds in flight must only be carried out by experienced operators who are able to accurately gauge distance and speed to ensure the correct forward-lead is applied to each shot.
- Only one bird should be targeted at a time. Shooting with a shotgun at a group of birds flying overhead often results in welfare problems as the birds aligned with the central cluster of pellets will usually be fatally injured, but those at the perimeter of the volley may only be hit be one or two pellets and stand a good chance of surviving. These birds are likely to experience suffering.
- The shooter must be certain that each animal is dead before another is targeted.
- Wounded birds must be located and killed as quickly and humanely as possible with either a second shot preferably directed to the head or in restrained or immobile birds, a blow to the rear of the skull to destroy the brain. If left, wounded birds can suffer from the disabling effects of the injury, from sickness due to infection of the wound, from pain

created by the wound or from thirst or starvation if unable to drink or eat. Wing fractures, which increase the likelihood of being taken by a predator, are common in wounded birds.

- A trained dog may be used to locate and recover wounded birds as quickly as practicable. The dog must be adequately controlled to prevent it from chasing or catching birds that are not wounded. Dogs should only be trained to retrieve wounded birds, under the direction of the handler, without causing physical injury to the bird. For further information on the use of dogs refer to *GEN004: The care and management of dogs used for pest animal control*.
- If possible, shooting should be avoided at times when birds are nesting and there are dependent young present. If dependent young are found, they should be killed quickly and humanely.

Non-target animals

- Shooting is relatively target specific and does not usually impact on other species. However, there is always a risk of injuring or killing non-target animals, including protected birds that have been mistaken for a pest bird. Only shoot at the target bird once it has been positively identified and never shoot over the top of hills or ridges.
- Shooting should be used with caution around lambing paddocks as it may disturb the lambing flock and cause mismothering. Also avoid paddocks containing sensitive livestock, e.g., horses, deer. They are easily frightened by spotlights and gunshots and may injure themselves by running into fences and other obstacles.

Workplace health and safety considerations

- Firearms are hazardous. Everyone should stand well behind the shooter when a bird is being shot. The line of fire must be chosen to prevent accidents or injury from stray bullets or ricochets.
- Firearm users must strictly observe all relevant safety guidelines relating to firearm ownership, possession and use.
- Firearms must be securely stored in a compartment that meets state legal requirements. Ammunition must be stored in a locked container separate from firearms.
- The shooter and others in the immediate vicinity should wear adequate hearing protection to prevent irreversible hearing damage, and safety glasses to protect eyes from gases, metal fragments and other particles.
- Care must be taken when handling birds as they may carry diseases such as psittacosis (chlamydiosis), aspergillosis, erysipelas, yersiniosis and salmonellosis that can affect humans and other animals. Routinely wash hands after handling all birds. Personal protective equipment, especially face masks, are recommended when handling bird carcasses to reduce the risk of contracting disease.

Equipment required

Firearms and ammunition

- The type of firearm, ammunition and ammunition loads should be appropriate to the species being targeted as well as the location where shooting will occur. A summary of recommended firearms, shot sizes and ranges for some bird species can be found at: https://www.environment.sa.gov.au/topics/plants-and-animals/animal-welfare/Codes_of_practice/codes-of-practice-humane-destruction-wildlife
- Shotguns are recommended for most birds. Twelve-gauge shotguns are commonly used but smaller gauges such as the 410 are effective on smaller birds.
- Non-toxic shot (e.g., tungsten-bismuth-tin, bismuth, tungsten-iron, steel, bismuth-tin, zinc etc.) should be used. Lead shot is potentially toxic to a range of species, however, in NSW the use of lead shot has not been prohibited because all game bird hunting is for mitigation purposes. Hunters participating in the NSW Native Game Bird Management Program are encouraged to use steel shot. Animals may be poisoned by lead in one of two general ways:
  - Species such as waterfowl mistake spent shot for food or grit and ingest it from wetland or terrestrial environments.
  - Other species, especially eagles and other raptors, and scavengers, ingest pellets when they consume prey that have been shot with shotgun ammunition and are carrying shot pellets embedded in their tissues.
- If intending to use steel shot, ensure that it is safe and effective to do so in your gun. Steel shot should only be discharged in modern guns that are capable of withstanding the extra stresses produced.
- When using shotguns, ensure that the choke configuration delivers a dense pattern on the target within the specified distances. For larger birds, tighter chokes are preferred, e.g., ½ to full.
- Centrefire rifles are suitable for large birds such as emus.
- On some occasions birds such as pigeons need to be shot inside shelters, sheds or other buildings. Air rifles are suitable for this task, but they must have sufficient power (e.g., 1,000 feet / second in .17 calibre or 750 feet / second in .22 calibre) to kill humanely and consistently. They must also be fitted with a telescopic sight and because of their high recoil, a sight specifically designed for pneumatic air rifles is required. Magnification of 4x is suitable and ranges kept under 25 metres to ensure adequate energy is applied to the target. Alternatively, .22 rim fire shot cartridge can be used in buildings or shelters. This round is the ordinary .22 rimfire loaded with very fine No. 11 shot (generally known as .22 rat shot or .22 bird shot). Because of their poor patterning characteristics and light weight shot, 15 metres should be regarded as maximum range. Normally the pellets will not penetrate galvanised iron.
- The accuracy and precision of firearms should be tested against inanimate targets prior to the commencement of any shooting operation. Pattern your chosen gun/cartridge/choke combination before shooting to check your accuracy and that the pattern is adequate for the intended target bird.

Other equipment

- First Aid kit.
- Lockable firearm box.
- Lockable ammunition box.
- Personal protective equipment (hearing and eye protection).
- Communication devices (2 way/mobile etc.) are recommended for safety reasons.

Procedures

Identification of birds

- Shooters should have sufficient knowledge and skill to identify the bird species causing the damage. If the identification of the bird is in doubt it must not be shot.

Conduct of shooting

- Shooting should only be conducted during daylight hours. Shooting in poor light conditions makes it difficult to correctly identify birds and to search for wounded birds. Also, accurate marksmanship may be compromised. If shooting needs to occur at night, then a light of sufficient brightness must be used so you can clearly identify the target species.
- Shooting should not be conducted in adverse weather conditions where birds cannot be shot and located/retrieved in a safe and humane manner.
- Birds must NOT be shot from a moving vehicle. Ensure you are in a firm, safe and stable position before taking a shot.

Target bird and point of aim

- Only one bird should be targeted at a time. The shooter should aim to have a single bird in the centre of the shot pattern at the point of impact. Shooting at a flock is not an acceptable practice.
- The objective is to fire at the closest range practicable in order to reduce the risk of non-lethal wounding. Accuracy is important to achieve a humane death. One shot should ensure instantaneous loss of consciousness and rapid death without resumption of consciousness.
- A pest bird should only be shot at when:
  - it can be clearly seen and identified
  - it is within the effective range of the firearm and ammunition being used; and
  - a humane kill is highly probable. If in doubt, do NOT shoot.
- For most small to medium birds, the point of aim should be the centre of the birds' chest.
- For large birds such as emus, a shot to the brain, using a shotgun, is preferred when the bird is in close range (<30 metres). If the bird is > 30 metres from the shooter, a chest shot using a large calibre centrefire rifle (e.g., .243) should be used.

- When using a rifle, the target bird must be stationary and within a range that permits accurate placement of the shot.
- When using a shotgun, the target bird may be stationary or mobile, but must be no more than 30 metres from the shooter. The pattern of shot should be centred on the head (for large birds, e.g., emus) or chest (for small birds, e.g., common myna, to medium birds, e.g., ducks). It is essential that the distance to the target bird is accurately judged. To achieve adequate penetration of shot, the bird must be in range. It is recommended that shooters practice estimating distances before a shooting operation.
- The target bird should be checked to ensure it is dead before moving on to the next bird. When targeting multiple birds in a flock, a number of birds will need to be shot in rapid succession. In this case, the birds in the group should be checked to ensure they are dead before moving on to the next group. Death of shot birds can be confirmed by observing a combination of the following:
  - no heartbeat
  - no breathing
  - no corneal reflex (no blinking when the eyeball is touched)
  - no response to a painful stimulus (e.g., a toe pinch).
- If death cannot be verified, a second shot to the head should be taken immediately or the bird killed with a blow to the skull using a heavy instrument to destroy the brain.
- Killed birds must be collected and disposed of in an appropriate manner in accordance with acceptable practices as required by local councils and applicable State or Federal regulations.

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NSWBIR SOP2
Trapping of pest birds

Background

The aim of trapping is to reduce bird numbers in order to minimise the damage they cause. However, the process is often labour intensive, opportunistic and may have limited value in bird control. After trapping, pest birds are humanely killed.

This standard operating procedure (SOP) is a guide only; it does not replace or override the relevant legislation that applies in NSW. The SOP should only be used subject to the applicable legal requirements (including WHS) operating in the relevant jurisdiction.

Individual SOPs should be read in conjunction with the overarching Code of Practice for that species to help ensure that the most appropriate control techniques are selected and that they are deployed in a strategic way, usually in combination with other control techniques, to achieve rapid and sustained reduction of pest animal populations and impacts.

Application

- Trapping should only be used in a strategic manner as part of a co-ordinated program designed to achieve sustained effective control.
- A management plan that specifically targets the main pest species should be developed. Birds differ greatly in their ecology and behaviour, and this influences the way in which they respond to different forms of control.
- With widespread and common species such as starlings, damage control is best achieved by action targeted at problem areas.
- The optimum time for trapping will often vary depending on the species of bird and the type of crop being protected. During the breeding season most birds are territorial and so trapping may be less effective. At other times of the year, particularly during autumn/winter when food is less abundant, birds may form large flocks and many birds can be caught. However, the efficacy of trapping in terms of reduced density or damage also needs consideration. For example, for bird species with high rates of fecundity (e.g., starlings and mynas) removing birds during or just prior to the breeding season may cause greater reductions in density in the long term or for the approaching ripening season.
- Confinement in a trap causes fear and distress; therefore, traps need to be carefully managed.
- Operators should be competent in bird handling and restraint techniques. This will help to minimise harm to the birds and protect the handler from injury.

- Any control of pest birds must be implemented in accordance with any relevant State and Commonwealth legislation. Permits may be required for the control of some species. Contact the relevant State agency (LLS, NPWS) for further details.
- Trapped pest birds should be euthanased after capture. The National Consultative Committee on Animal Welfare considers that trapping for the local pet or export trade is not an acceptable option on welfare grounds. Also, trapping of pest birds for relocation should only be used where there is a high probability that it will lead to amelioration of the problem and can be conducted with minimal risk to the welfare of the birds.

Animal welfare implications

Target animals

- Trapped birds are likely to suffer from distress when confined and they can sometimes be injured while trying to escape from the trap or during capture or restraint prior to euthanasia.
- Trapped birds must only be killed by humane methods with minimal delay.
- Traps must have sufficient height, length, and breadth to permit the bird to stretch its wings freely.
- When the trap is in use, it must be inspected on a regular basis, preferably daily. At each inspection any birds caught in the trap must be removed from it and killed quickly and humanely. Regular inspections will help to prevent captured birds from being harmed by other captured birds or by predators outside of the trap (e.g., corvids, currawongs).
- If lure (or decoy) birds are used they must be provided with adequate food, water, shelter and a perch. The lure bird/s must be removed when the trap is not in use. Traps containing lure birds must be inspected regularly i.e., for small traps at least once daily, for larger traps at least every two days. Maintaining the same lure birds may be more appropriate with some species (e.g., starlings) rather than rotating with 'fresh' birds, as they become habituated to captivity within a couple of days. Lure birds that show signs of prolonged distress should be euthanased (see Impact on non-target animals section).
- When the cage traps are left in the open but not in use, they must be rendered incapable of holding or catching birds e.g., door secured in open position. Food should be removed when the trap is not in use.
- Adequate shade is essential for the humane operation of the trap. Shade material (e.g., shade-cloth, tarpaulin, plywood etc.) can be incorporated into the trap during construction or added during trap setup. Waterproof material will also provide protection during extremes of weather.
- Where possible, trapping should be avoided in adverse weather conditions.
- Captured birds must be approached carefully and quietly to reduce panic, further stress and risk of injury.
- To minimise the animal welfare implications of leaving dependent nestlings and chicks to die from starvation it is preferable not to undertake trapping during the nesting season. If trapping must occur during nesting, reasonable efforts should be made to find nest hollows containing young birds so they can be killed quickly and humanely.

- Special care and knowledge is necessary for holding or restraining birds, and the most appropriate method should be used for each species.
- Trapped birds are euthanased using one of the following methods:
  - *Cervical dislocation*. This involves separation of the skull and the brain from the spinal cord by pressure applied posterior to the base of the skull. The brain stem - which controls respiration and heart activity – is consequently damaged, stopping breathing and reducing blood flow to the brain, leading to death. Studies in rats have shown that electrical activity in the brain persists for around 13 seconds following cervical dislocation. This may represent a period of remaining consciousness.
  - *Inhalation of carbon dioxide*. When animals are placed into a chamber containing up to 70% CO_2 they lose consciousness very quickly due to the narcotic effect of the high intake of CO_2 on the brain without causing hypoxia. Death is caused by direct depression of CNS, respiratory and cardiac functions. One hundred percent CO_2 can cause severe dyspnoea (difficulty in breathing) and distress in conscious animals, but this higher concentration is recommended for young chicks as they are more tolerant to the gas. CO_2 may also cause discomfort or pain as a result of its conversion to carbonic acid on mucosal surfaces.
  - *Injection of barbiturate*. This causes depression of the central nervous system resulting in cardiac and respiratory arrest. Rapid euthanasia is caused with minimal discomfort. The intravenous route causes the quickest death.
  - *Inhalation of carbon monoxide*. Although there are significant occupational health and safety hazards associated with its use, carbon monoxide gas is also sometimes used to euthanase trapped birds. Cooled and scrubbed exhaust from non-vehicular petrol engines without a catalytic converter is an acceptable source of carbon monoxide. When inhaled, carbon monoxide binds to haemoglobin in the red blood cells with an affinity 250 times that of oxygen. This results in reduced oxygen-carrying capacity and altered delivery of oxygen to cells. Hypoxia - the reduction of oxygen supply to the tissues - eventually leads to unconsciousness and death. See under the heading below *Further information on the use of carbon monoxide for the euthanasia of trapped birds* for further information on the sources and use of carbon monoxide.

Non-target animals

- Traps are not target specific; therefore, other species, usually birds, may be caught.
- To reduce the impact on non-target species, traps should be placed in areas that are frequented by the target species. Free feeding can assist in identifying the likelihood of capturing non-target species, and appropriate areas for capture.
- Using lure birds or taped recordings of target bird calls may help to minimise non-target bird capture and improve trap success.
- Non-target birds caught in traps must be visually inspected for injuries and signs of illness or distress before release. Stressed birds will close their eyes and may also hunch-up their necks and maintain a stiff and unusual looking posture. A rapid heart rate, loss of feathers, change in body temperature, trembling or shaking may also be observed. Birds should be dealt with as follows:

- Birds which are unharmed should be immediately released at the site of capture. If a bird has been handled, do not release it into mid-air. Turn it right side up and allow it to sit in the ground so that it can become oriented.
- Birds which are suffering from thermal stress should receive appropriate attention. A bird suffering from thermal stress can initially be placed in a suitable quiet holding area which provides warmth or shade to allow recovery before release. Honeyeaters and heat stressed birds will drink sugared water while they are being held in the hand.
- Birds that are unable to fly may be suffering from a slight strain to the wings. Place them on a perch in good cover and they will usually recover rapidly.
- Birds with treatable minor injuries that cannot be immediately released or those failing to recover from thermal stress should be presented to a veterinarian or a registered wildlife carer for treatment.
- Birds that have injuries which are untreatable, or which would compromise their survival in the wild should be euthanased using one of the techniques described below in the Procedures section.

Workplace health and safety considerations

- Care must be taken when handling birds (especially pest species) as they may carry diseases such as psittacosis (chlamydiosis), aspergillosis, erysipelas, yersiniosis and salmonellosis that can affect humans and other animals. Routinely wash hands after handling all birds. Personal protective equipment, especially face masks, are recommended when handling birds to reduce the risk of contracting disease.
- Operators need to be wary of the potential for injury when handling birds. Some species of birds can deliver painful bites and scratches. For example, parrots (e.g., cockatoos, galahs, and corellas) have large, heavy beaks and strong jaws that are capable of inflicting serious injury. Raptors, if encountered as non-target species, are ferocious and can use their feet as weapons. Protective gloves can be used if required for handling large birds, although these may hinder dexterity. A towel is useful to place over the birds head or to give raptors something alternative to grip.
- Operators must be protected by tetanus immunisation in case of infection of scratches and bites.
- During set-up of traps and handling of gas cylinders, operators should be wary of the risks of injury from lifting heavy items.
- *Use of carbon dioxide*:
  - Carbon dioxide should only be used in a well-ventilated place.
  - Carbon dioxide is non-flammable, non-explosive and poses minimal risk to personnel when used with properly designed equipment. However, inhalation of significant concentrations of CO_2 can cause narcosis and/or asphyxia.
  - If CO_2 is inhaled, remove patient from the contaminated area to allow them to breathe in fresh air. Early signs of exposure are headache and shortness of breath. If patient is not breathing, make sure airway is clear and apply artificial resuscitation. Keep warm. Oxygen may be given but only under the supervision of a trained person.

- Although prolonged exposure to low levels of CO_2 (up to 1.5 % in inhaled air) are well tolerated, chronic health effects can result.
- For further information refer to the Material Safety Data Sheet (MSDS), available from the supplier.

- *Use of carbon monoxide*:
  - There are significant occupational health and safety hazards associated with the use of carbon monoxide. CO is extremely hazardous as it is difficult to detect and only a very small concentration will induce unconsciousness and death in humans. Chronic exposure at low concentration can also cause serious illness.
  - Carbon monoxide should only be used outdoors and in a well-ventilated place.
  - If CO is inhaled, immediately remove patient from the contaminated area to allow them to breathe in fresh air. If patient is not breathing, make sure airway is clear and apply artificial resuscitation. Keep patient warm and seek medical attention immediately.

Equipment required

Traps

- The traps used should be specific for the target species. Several trap designs exist including walk-in cage traps, clap and sprung traps, the Modified Australian Crow Trap (MAC), roost traps and nest traps:
  - *Walk-in cage traps* operate by attracting birds into a cage with a lure including food or other birds. A trap door is then activated closing the bird inside the cage. The use of lure-birds is applicable for flocking birds such as starlings. Simple designs can capture a single bird at a time; more elaborate designs can capture multiple birds and include holding catches for lure birds. Traps must be checked regularly to prevent attacks from predators.
  - *Clap and sprung traps* rely on a spring to throw a net over an area or close a door on a cage. Some traps can be triggered by a bird, while others rely on a person to trigger the spring. Captured birds must be quickly removed from these traps.
  - *The Modified Australian Crow Trap* has a V-shaped upper entrance and is commonly used for trapping corvids. The same design with a modified entrance can be used for smaller species, such as starlings, mynas and sparrows. The trap can capture and hold a large number of birds, providing that there is adequate shade, food and water. Requires less maintenance than other traps, therefore they may only need to be checked every two days.
  - *Two-stage roost trap* has been developed at the Australian National University for common mynas (*Acridotheres tristis*) as described at: https://fennerschool-associated.anu.edu.au/myna/minimise_files/Myna_Mitigation_PhaseI.pdf. The design is a large (0.8 W x 0.8 L x 1.9m H) mesh trap with two compartments. The lower compartment has two walk-in funnel entrances (First stage); the upper compartment has a one-way entrance leading upwards (Second stage) and is also where the lure

birds are housed. This trap has provision for housing so may only need to be checked every 2 days.

- *Mist nets* are fine nylon or polyester nets which are suspended between two upright poles. Birds fly into the net and remain caught until released. They are mostly used by researchers and are commonly used for small to medium-sized birds. Mist nets require continual monitoring, expert handling of caught birds and result in an increased likelihood of non-target capture. Users of mist nests must hold an authority from the Australian Bird and Bat Banding Scheme and a separate permit from the relevant State fauna agency (NPWS).

- Details of trap specifications and construction can be obtained from commercial manufacturers or groups such as: http://www.indianmynaaction.org.au/

Bait material

- Bait material suitable to the species being trapped should be used. For example:
  - *Mynas and starlings* - chick starter pellets, bread, sultanas, fruit, pet food
  - *Corvids* - offal, meat, animal carcasses.
  - *Galahs, cockatoos, long-billed corellas* – wheat or other grain.

Carbon dioxide equipment

- Source - compressed CO_2 in cylinders.
- Gas regulator/s.
- Large canvas or heavy-duty plastic bags for enclosing traps.
- Chamber/container for birds that are gassed outside the trap.

Carbon dioxide equipment

- Source - cooled and scrubbed exhaust from non-vehicular petrol engines without a catalytic converter.
- Large canvas or heavy-duty plastic bags for enclosing traps.
- Chamber/container for birds that are gassed outside the trap.

Other equipment

- Hand-held nets.
- Calico bird-bags.
- First aid kit.
- Gloves.
- Face masks.

Procedures

Trapping of birds

- An ideal trap site is where the birds are already feeding, but traps can also be placed near roosts and along the route from the roosting area to the feeding ground.
- Traps may need to be tied down in the event of windy weather.
- A period of free feeding using bait appropriate for the target species is recommended prior to the commencement of trapping, to both limit non-target captures and to improve trap success.
- Regular checking of traps ensures provision of clean food, water and shade. Some traps will need to be checked more regularly than others i.e., traps that hold only small numbers of birds need to be checked daily. The frequency of trap monitoring will depend on a number factors including trap success, presence of predators, number of lure birds, or if lure birds are observed not to be eating, or appear unwell or stressed e.g., through feather loss, lethargy etc. Initially, all large traps should be checked daily, then gradually less often if birds and the enclosure remain in good condition. The frequency should increase when many birds are being captured.
- Remain quiet when checking traps so as not to frighten birds that are in or near the trap.
- To reduce panic and injury to birds, always approach the traps slowly, particularly when there are birds inside. When free feeding, ensure that birds inside the trap are able to leave it without panic.
- When removing non-target birds from the trap, always remove the larger birds first as their movements can injure the smaller ones.
- Non-essential personnel and animals such as dogs and cats and must be kept away from the area whilst the trap is in operation.

Euthanasia of trapped birds and disposal of carcasses

Acceptable methods of euthanasia for trapped pest birds are:

Neck (cervical) dislocation

- This technique requires mastering of technical skills to ensure that loss of consciousness is rapidly induced.
- Carefully remove birds from the trap by hand or using a handheld net.
- Dislocate the neck by taking the birds legs in the left hand (if right-handed) and the head between the first two fingers of the right hand with the thumb under the beak. A sharp jerk with each hand, pulling the head backward over the neck will break the spinal cord and carotid arteries.
- Cervical dislocation is not suitable for birds larger than 3 kg as it is difficult to pull the neck quickly. Most pest birds will be below 3 kg in weight. For example, average weights for some species are:
  - starlings – 50 to 80g
  - sulphur crested cockatoos -1kg

- corellas – 565g
- galahs – 330g
- ibis - 2.5kg
- ducks - 1 to 2 kg.

Inhalation of carbon dioxide (CO_2) gas

- Compressed CO_2 gas in cylinders should be used so the inflow to the chamber can be regulated precisely.
- Birds can either be: (1) removed from the trap and placed into a container pre-filled with CO_2, or (2) remain in holding cages, which will be enclosed within a material or plastic sack.
- A continuous inflow of CO_2 should then be allowed to flow into the sack. A constant level of CO_2 should be maintained for at least 3 minutes and anaesthesia will occur within 60 seconds.
- With birds inside the chamber, an optimal flow rate should displace at least 20% of the chamber volume per minute.
- Carbon dioxide used in a sealed environment is suitable for animals up to 3 kg.
- Carbon dioxide is heavier than air so incomplete filling of a chamber may permit some birds to fly up to avoid exposure to the gas.
- Care must be taken to limit the number of birds in a chamber at any one time to maintain a constant CO_2 concentration.
- Each bird must be verified as dead before removing it from the chamber. If the bird is not dead CO_2 narcosis must be followed with cervical dislocation.

Inhalation of carbon monoxide (CO) gas

- Note that personnel using CO gas must be instructed thoroughly in its use and must understand its safety hazards and limitations. There is a substantial risk to operators if safety precautions are not observed.
- Carbon monoxide sourced from the *cooled exhaust of non-vehicular petrol engines <u>without</u> a catalytic converter* (*e.g.,* lawn mower, whipper snipper engine or purpose-built carbon monoxide generator) can be an acceptable method of euthanasia when the conditions for humane, effective and safe use can be met. See Appendix for further information on sources of carbon monoxide.
- The CO source and chamber must be located out-of-doors.
- The CO flow rate should be adequate to achieve a uniform CO concentration (of at least 4-6%) after birds are placed in the chamber. If birds lose consciousness quickly (in less than 60 seconds) and die without recovering consciousness or showing signs of distress, this is an indicator that the concentration of CO is adequate.
- A continuous inflow of CO should then be allowed to flow into the chamber. A constant level of CO should be maintained for at least 5 minutes and death will occur from around 1 to 3 minutes depending on engine and chamber size.
- Care must be taken to limit the number of birds in a chamber at any one time to maintain a constant CO concentration.

- Each bird must be verified as dead before removing it from the chamber. If the bird is not dead, gassing must be followed with cervical dislocation.
- Note that young chicks are more tolerant of CO poisoning than adult birds therefore alternative methods such as cervical dislocation are more suitable (see Euthanasia of nestlings and destruction of eggs below).

Overdose of barbiturate

- Usually given by the intraperitoneal route in smaller birds. For larger birds such as cockatoos, the intravenous route is preferred.
- Barbiturates should only be administered by an appropriately qualified person, e.g., a veterinarian.
- Birds killed by this method may contain potentially harmful residues and should be disposed in a manner that will prevent them from being consumed by predatory/scavenger animal species.
- Death of euthanased birds should always be confirmed by observing a combination of the following:
  - no heartbeat
  - no breathing
  - no corneal reflex (no blinking when the eyeball is touched)
  - no response to a painful stimulus (e.g., a toe pinch).
- If death cannot be verified, a second method should immediately be used to kill the bird. Carcasses should only be discarded once death has been established.
- Bird carcasses should be collected and disposed of in an appropriate manner in accordance with acceptable practices as required by local councils and applicable federal and state regulations.

Euthanasia of nestlings and destruction of eggs

- The most suitable methods of euthanasia for chicks and nestlings are:
  - *Inhalation of carbon dioxide* – may need a longer time for death (at least 10 minutes), increase CO_2 concentration to 100%.
  - *Cervical dislocation* – effective and humane
  - *Decapitation* – the instrument used must be sharp and well maintained. In larger chicks the method should be performed after a blow to the head to render the bird unconscious.
  - *Concussion (stunning)* – a blow on the head will usually be sufficient to render the bird insensible. To ensure death stunning must be followed by another method, e.g., decapitation or exsanguination (bleeding-out).
- It is believed that in avian embryos greater than half of the way to hatching, the neural tube has developed sufficiently to allow perception of pain. Therefore, it is preferable that eggs are destroyed by cooling or freezing them to <4°C for at least 4 hours. However, under field conditions quickly breaking the eggs and decapitation or crushing of the embryo may be a humane and more practical alternative.

Further information on the use of carbon monoxide for the euthanasia of trapped birds

The humaneness and efficacy of carbon monoxide as a gaseous euthanasia agent is highly dependent on the *source* of the gas. There are four ways of delivering carbon monoxide:

- Carbon monoxide sourced from the cooled exhaust of non-vehicular petrol engines without a catalytic converter (e.g., lawn mower, whipper snipper engine or purpose-built carbon monoxide generator) appears to be acceptable since the level of carbon monoxide remains high and results in a rapid death. However, the literature suggests that contaminants such as hydrocarbons in the fumes can be irritating to the eyes and airways which makes the efficiency of delivery important.
- Carbon monoxide sourced from the cooled exhaust of vehicular petrol engines with a catalytic converter i.e., from newer cars less than approximately 10 years old is not acceptable on the basis of all current information. For example, research has shown that the levels of carbon monoxide drop off very quickly after the engine has started, leaving only a small window where concentration is adequate for a rapid death (i.e., for up to approx. 60 seconds after a car has been cold started). It is also likely that the level of potential irritants, e.g., carbon, are highest during this short time.
- Carbon monoxide from a commercially compressed cylinder is acceptable because it induces loss of consciousness without pain or discernible discomfort and death occurs rapidly if the right concentration is achieved. However, carbon monoxide cylinders are NOT readily available for such use due to WHS issues.
- Carbon monoxide sourced from the cooled exhaust of older vehicles without catalytic converters could potentially be acceptable but there are still welfare concerns due to a high variability in the age and condition of engines and presence of irritating contaminants.

For more information see:

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NSWBIR SOP3
Exclusion of pest birds using netting

Background

Exclusion netting is often used over large areas of horticultural and viticultural crops and over fish farms. It is also placed in areas in and around buildings to prevent access by pigeons and other birds. If applied and maintained correctly, exclusion netting can be effective and humane however, it can be expensive and impractical and needs to be checked regularly to prevent injuries and death of wildlife due to entanglement.

This standard operating procedure (SOP) is a guide only; it does not replace or override the relevant legislation that applies in NSW. The SOP should only be used subject to the applicable legal requirements (including WHS) operating in the relevant jurisdiction.

Individual SOPs should be read in conjunction with the overarching Code of Practice for that species to help ensure that the most appropriate control techniques are selected and that they are deployed in a strategic way, usually in combination with other control techniques, to achieve rapid and sustained reduction of pest animal populations and impacts.

Application

- Exclusion netting should only be used in a strategic manner as part of a co-ordinated program designed to achieve sustained effective control.
- A management plan that specifically targets the main pest species should be developed. Birds differ greatly in their ecology and behaviour, and this influences the way in which they respond to different forms of control.
- Netting may not be an economic solution for all situations, but it can be justified when the increase in returns exceeds the cost of the netting.
- Control of pest birds must be implemented in accordance with any relevant State and Commonwealth legislation. Permits may be required for the control of some species. Contact the relevant State agency (LLS, NPWS) for further details.

Animal welfare implications

Target and non-target animals

- Humaneness of exclusion netting as a control technique depends on the type and size of the netting used, how it is applied and maintained and also how often it is checked.

- Older types of netting (such as black or green monofilament netting) and netting that is not used in the correct manner can pose a serious risk to wildlife such as birds, possums, flying foxes. Factors that make the mesh less visible are more likely to increase the risk of wildlife becoming entangled.
- Animals that become entangled can potentially sustain severe injuries including broken bones, lacerations to wings and also mouth injuries caused by trying to escape. If injuries are severe, they can die from strangulation, blood loss, shock, or dehydration. Entangled animals are also vulnerable to predation from both mammalian (e.g., dogs, cats) and avian (e.g., kookaburras, corvids, currawongs, raptors) predators and sometimes ants and reptiles if the birds are in contact with ground.
- Wildlife can also become distressed or injured if they go underneath the netting and then cannot get back out.
- Animals that are entangled or trapped underneath the netting, but not severely injured should be released at the site.
- Animals that have injuries which are untreatable, or which would compromise their survival in the wild should be humanely euthanased using an appropriate method. For further information refer to NSWGEN SOP1 *Methods of euthanasia* and for birds also NSWBIR SOP2 *Trapping of pest birds*.

Workplace health and safety considerations

- Care must be taken when handling live animals and carcasses as they may carry diseases that can affect humans and other animals, e.g., psittacosis (chlamydiosis), aspergillosis, erysipelas, salmonellosis, leptospirosis, Q fever, etc. Routinely wash hands after handling all animals and carcasses.
- Australian bat lyssavirus (ABL) and rabies vaccination is recommended for people who come into regular contact with bats (both flying foxes and microbats). Operators should avoid bites and scratches and use protective equipment when handling all bats. All wounds inflicted by bats or flying foxes should be washed thoroughly with soap and water as soon as possible. Operators should always seek medical advice regarding post-exposure treatment whenever a bite, scratch or mucous membrane exposure to saliva from any Australian bat has occurred. Where the bat is available it should test for the presence of ABL.

Equipment

Netting

- The use of strong, durable, UV stabilised plastic nets or densely woven net (with a mesh size less than 1cm square) is recommended. The more conspicuous the netting the better to prevent entanglements. Although darker netting (e.g., black, tan or dark green) may be more aesthetically acceptable, birds are more likely to become entangled in it.
- Netting thickness and mesh diameter may also influence visibility by birds and therefore the likelihood that they may become entangled in the netting. Small mesh netting is more visible. If the mesh is small, birds will not attempt to get through it.

- Monofilament bird netting (thin nylon type) should be avoided wherever possible to prevent entanglement. If used, it should be installed tightly over a frame and not draped over trees.
- White netting poses more of a visual barrier that birds can avoid as it stands out against the foliage of the fruit trees and produce.

Refer to guidelines for choosing the right netting and application: e.g., http://www.wildlifefriendlyfencing.com/WFF/Netting.html, https://www.greenharvest.com.au/DownLoads/WildlifeFriendlyNettingBrochure.pdf

https://agriculture.vic.gov.au/livestock-and-animals/animal-welfare-victoria/pocta-act-1986/protecting-fruit-trees-and-wildlife

Equipment to cut entangled birds out of nets when necessary

- Scissors or seam-rippers are suitable for cutting nets to release entangled or trapped birds.

Other equipment:

- First aid kit.
- Gloves.
- Face mask.

Procedures

Application of netting

- Nets are either permanently installed supported on a pole and cable or wire structure or used as throw-over cover supported by crop foliage and only applied for a relatively short time each year.
- The netting must be pulled tight with no loose or flapping ends to minimise entanglements.
- Where nets are used in horticulture, the nets must be applied carefully to ensure that there are no gaps between the netting and the ground. This will reduce the number of birds that are able to get under the net.
- Full canopy netting should be installed by contractors or under their advice to ensure that it meets standards for safety and efficacy.
- Skilled application of netting and good net maintenance will ensure longer netting life and also better animal welfare outcomes.
- For some applications of temporary netting (e.g., in vineyards), net application machinery or various frames and poles are available to assist in applying and removing the net.

Checking of netting

- It is important to check netting regularly, preferably no less than twice daily.

- The netting should also be well maintained to prevent entanglement or trapping of wildlife.
- Unharmed wildlife found inside the netting should be released as soon as possible.

Extraction of entangled and trapped animals

- If the entangled animal is considered dangerous to safely handle (e.g., flying foxes, bats, owls, hawks, eagles, possums, snakes, goannas), call a registered wildlife carer or rescue organisation for help and advice.
- If an animal is found entangled in netting, it needs to be carefully restrained while the netting is cut away with scissors or an unpicking tool so that it does not escape with some netting material still attached.
- Thick gloves may need be worn to protect against bites and scratches while restraining the animal, or a pillowcase (or similar) may be used to cover and hold the animal if it is small enough.
- If the entangling material is embedded in the animal's skin or wrapped tightly, do not attempt to remove it yourself as this may cause more damage. Cut away enough material to detach the animal from the netting.
- Entangled or trapped animals must be examined for injuries and signs of illness or distress and dealt with as follows:
    - Animals that are unharmed or have only received minimal injuries such as minor cuts or abrasions should be immediately released at the site of capture.
    - Animals that have more severe injuries or are suffering from thermal stress should receive appropriate attention. An animal suffering from thermal stress can initially be placed in a suitable quiet holding area that provides warmth or shade to allow recovery before release.
    - Animals with treatable injuries that cannot be immediately released or those failing to recover from thermal stress should be presented to a veterinarian or a registered wildlife carer for treatment.
    - Animals with injuries that are untreatable or that would compromise their survival in the wild should be euthanased using a technique that is suitable for the species. For more information on euthanasia techniques refer to *GEN001 Methods of Euthanasia* and for birds also NSWBIR SOP2 *Trapping of pest birds*.

Disposal of netting

- Ensure that netting is discarded appropriately so that is not a hazard to wildlife. Animals such as snakes and lizards can easily become entangled when discarded netting is left lying on the ground.

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