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

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The NSW Codes of Practice and Standard Operating Procedures for vertebrate pests have been developed by the NSW Department of Primary Industries in collaboration with industry representatives and NSW government agencies. The documents have been endorsed by the NSW State Pest Animal Committee which comprises representatives from: Department of Primary Industries, Landcare NSW, Local Government NSW, Local Land Services, National Parks and Wildlife Service, Nature Conservation Council, NSW Farmers and RSPCA NSW.

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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 control of rabbits in NSW. The aim is for control programs to be conducted in a way that reduces the negative impacts of rabbits 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(https://www.pestsmart.org.au/) can provide general guidance for national use, but some of the content may now be out-of-date.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 Outdated information has been removed, while new information has been added to reflect the advancements and changes specific to rabbit management within NSW.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.

Contents

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 the rabbit 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 rabbit 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 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 and 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 NSW *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 they can be managed. 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 domain approach to welfare assessment as 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 shooting, 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 based on the 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

Rabbit management

Background

The key to the success of the European rabbit (*Oryctolagus cuniculus*) in Australia is their high reproductive potential, producing 15 to 40 young a year, along with the warren that provides protection from weather and predators and enables rabbits to inhabit semi-arid and arid country. Although they usually live in warrens, rabbits readily live above the ground whenever there is adequate shelter. The optimum habitat for rabbits in Australia is the intermediate rainfall zone, where parasite numbers are low, droughts are less common and breeding seasons relatively long.

Before the introduction of myxomatosis and then rabbit haemorrhagic disease (RHD), rabbits greatly reduced stock productivity and caused profound direct and indirect damage to soils and to native plants and animals. While these biological controls have greatly reduced rabbit densities nationally, damage is still significant. There may be no safe rabbit density for some tree and shrub seedlings particularly within 200 metres of rabbit warrens. As well as causing detrimental habitat change, rabbits threaten native mammals directly through grazing competition and indirectly through intensified predation by cats and foxes after rabbit numbers crash during droughts or disease outbreaks.

The extent to which rabbits reduce the carrying capacity for livestock across all industries is not well quantified, although there are numerous anecdotal accounts of increased carrying capacity for sheep following rabbit control. Competition between sheep and rabbits is likely to be most significant when pasture biomass falls below about 250 kilograms per hectare, especially during and coming out of drought.

For further information please see:

- NSW Threat Abatement Plan for Competition and Land Degradation by Rabbits: http://www.environment.gov.au/biodiversity/threatened/publications/tap/competition-and-land-degradation-rabbits-2016
- PestSmart: https://pestsmart.org.au/toolkits/european-rabbits/

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 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 rabbits, 1080 baiting would be the primary method of control and supplementary techniques are used as a follow-up e.g., warren fumigation. Regional variations can also occur within species. For example, ripping of warrens would be considered a primary technique in western NSW where access is good whereas in certain parts of eastern NSW, primary control would consist of baiting. 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 is particularly the case for highly mobile pest animals.

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 stress) when bait uptake might be maximised. Alternatively, application of control can align with the need for the commodity to be protected when it is most vulnerable.

Rabbit management methods

The most commonly used rabbit control techniques are lethal baiting, warren fumigation and destruction, shooting, trapping, exclusion fencing and biological control with rabbit haemorrhagic disease virus (RHDV). Fertility control through immunocontraception or by

other chemical means is not currently a viable broadscale control option despite considerable research into their development. Other measures, such as the use of LPG technology (i.e., the R3 Unit) to kill rabbits in small warrens, are also used in specific situations. Cost-effectiveness, humaneness and efficacy for each control technique are useful in deciding the most appropriate strategy. Warren destruction is the most long-term form of rabbit control and should be the priority wherever access makes this a cost-effective option.

A brief evaluation of the humaneness of control techniques follows:

Humaneness of control techniques

Fertility control

Fertility control is seen as a preferred method of broad-scale rabbit control as it offers a potential humane, target-specific and long-term alternative to lethal methods. However, the method is not currently available for rabbit control due to technical constraints.

Exclusion fencing

The use of exclusion fencing is generally regarded as a humane, non-lethal alternative to lethal control methods but only after lethal control measures have been employed to remove rabbits from within the protected area. However, the high costs of establishing and maintaining rabbit-proof enclosures (including removal of rabbits from within the enclosure), limits their use to the protection of valuable pasture, crops and conservation areas. Despite being expensive to establish, rabbit-proof exclosures can provide long-term environmental and production benefits to properties.

Although fencing can act as a barrier to rabbits, it can also have negative effects on non-target species that are excluded from or contained within a fenced area. Fences will prevent access to familiar sources of food, water and shelter and potentially disrupt social groups and alter natural dispersion. Entanglement in fences can also cause significant injuries and death (or electrocution with electric fences) and they can prevent the movement of animals to safer areas during bushfires or flooding.

A number of actions can be taken to prevent the impacts of fencing on non-target animals. Fences can be designed to allow movement of some species by incorporating species-specific access points (e.g. wombat gates) or to minimise entanglement (e.g. by using highly visible top wires). Fences should also be checked frequently, especially in the immediate period after construction, to allow prompt removal or euthanasia of entangled animals. If non-target animals are enclosed and their abundance needs to be reduced, they must be culled using an acceptable and humane technique (e.g., shooting). In addition, if animals congregate around a new fence and are exhibiting signs of distress (e.g., pacing, not eating or drinking) it may be necessary to euthanase them using a humane method.

Refer to the following RSPCA website for further perspectives on the humaneness of exclusion fencing:

https://kb.rspca.org.au/knowledge-base/what-are-the-risks-to-wildlife-associated-with-barrier-and-cluster-fencing/

For further information on pest exclusion fence design, please refer to sites such as:

https://www.wool.com/globalassets/wool/sheep/pest-animals/wild-dog-exclusion-fencing--australian-wool-innovation/kondinin-group-research-report---exclusion-fencing.pdf

Similar pest fence designs are also available from the websites of commercial fencing manufacturers.

Lethal baiting

Lethal baiting is an important component of integrated rabbit control programs; however, not all poisons are equally humane. Depending on the poison used, target animals can experience pain/sickness and suffering, sometimes for an extended period, before death. Non-target animals including native species, working dogs and stock can also be exposed to poisons either directly by eating baits intended for pest animals (primary poisoning) or through the scavenging of tissues from a poisoned animal (secondary poisoning). Baiting campaigns (aerial and ground) should be well designed and carefully implemented to minimise any non-target effects. Sodium monofluoroacetate (1080) and pindone are the poisons currently used for rabbit control in Australia.

1080

In rabbits, clinical signs of 1080 poisoning occur after a latent period of 20 minutes to 10 hours, and include weakness and lethargy, laboured respiration and increased sensitivity to noise/disturbance. Convulsions start suddenly, often with gasping and squealing, followed by death. It is possible that rabbits may experience pain, breathlessness and anxiety/fear if they are conscious during the convulsions or if they become conscious afterwards. In rabbits, the potential for injuries after the appearance of poisoning symptoms is low. Time to death is variable depending upon the amount 1080 absorbed but is usually around 3 to 4 hours. If rabbits ingest a sub-lethal amount of 1080 then they generally do not display obvious signs of poisoning and recovery occurs within 5–24 hours with few, if any, long-term effects. 1080 is considered to be a more humane poison than pindone.

Pindone

After ingestion of pindone, there is a lag period of 3-5 days before the onset of clinical signs, which include depression/lethargy and anorexia followed by manifestations of haemorrhage including anaemia, laboured breathing, pale mucous membranes and weakness. Bleeding may be visible around the nose, mouth, eyes and anus and animals may pass bloody faeces. Swollen tender joints are common as a result of bleeding into the confined joint space. Discomfort and pain from haemorrhages in internal organs, muscles and joints typically lasts for several days before death. In rabbits that receive multiple small doses of pindone, the time to death is around 10 to 14 days after the initial dose. Because anticoagulant poisons take several days to kill, during which time they cause distress disability and/or pain, they are considered inhumane. The use of pindone can only be justified in situations where 1080 cannot be used, i.e., in close proximity to urban areas where the risk of accidental poisoning to humans and companion animals is greatest. Lethal poisoning with pindone can occur with a large single dose, but it is more effective when given as a series of smaller doses over a period of 4 to 12 days.

Warren destruction

Destruction of warrens (usually by ripping) is an important component of effective rabbit management. Because warren destruction gives long-term management of rabbit populations, the need for repeated control operations is reduced. It is best practice to perform warren destruction when rabbit numbers are at their lowest, e.g., after poison baiting, drought or disease outbreak and when they are not breeding. The intention is that a more humane control technique is used (or natural population reduction) to reduce rabbit numbers prior to destruction of the warren. Ripping of the warren causes it to collapse and the rabbits are usually crushed or suffocated. A quick death is more likely when powerful machinery is used in loose soil and the warren is ripped deep enough to cause complete destruction. Failure to collapse deep warren systems may result in some rabbits becoming trapped in partly destroyed tunnels and then suffocating or starving over a long period of time. Direct mechanical wounding can also occur from the ripping tines but is not common. Asphyxiation is likely to be the most common means of death.

Blasting is sometimes used to destroy warrens when they cannot be ripped (e.g., when they are located among rocks or boulders, or under trees), however explosives may only be used by trained operators who hold the appropriate licenses. When explosives are used for warren destruction, rabbits may be killed or injured by the effects of the blast or by crushing and suffocation from the collapse of the warren. In most cases the time to death is thought to be quick, especially when complete destruction of the warren is achieved. If rabbits are rendered immediately insensible due to the blast-generated pressure waves and they do not regain consciousness prior to death, there will be no suffering. Failure to cause complete collapse in deep warren systems may result in some rabbits becoming trapped in partly destroyed tunnels and then asphyxiating or dying from blast-related injuries that were not immediately lethal.

Warren destruction also affects rabbits that are not inside the warren at the time by depriving them of shelter from extreme heat, cold and predators. Most rabbits that are forced to live above ground after their warren has been destroyed will have little chance of survival.

R3 Unit (formerly called the Rodenator)

The R3 Unit is a gas explosive device that pumps a calibrated mixture of propane (using liquefied petroleum gas) and oxygen into a warren and then ignites the mixture causing a high energy blast wave to travel through the warren. The animal welfare impacts of the R3 unit were assessed in a study conducted by McLeod et al. (2015)[18]. They found that the R3 Unit can be an effective tool for killing rabbits when the blast pressure is sufficient to render rabbits immediately insensible and death is rapid and occurs without recovery of sensibility. To achieve an adequate blast pressure, a number of factors must be controlled; primarily, it must only be used on small warrens with seven or fewer entrances and all entrances must be adequately sealed.

When used in larger warrens (i.e., with more than seven entrances) or when all entrances are not sealed properly, the R3 Unit does not consistently produce a blast pressure sufficient to cause a rapid death and the likelihood of injury and suffering to rabbits is high.

Warren fumigation

Phosphine

Phosphine is a systemic poison that depresses the central nervous system and respiratory function. Signs of phosphine poisoning after collapse include gasping, convulsions and paddling. Time to onset of symptoms is variable as the spread of gas through a warren relies on diffusion. However, spread is relatively rapid and can be increased by the addition of water. Time to death (from when tablets are placed in a warren) is on average 225 minutes (range 119-385 minutes). Time from the onset of symptoms to death is about 30 minutes. There may be a high risk of sublethal dosing (due to variability in concentration in warrens) but it is likely that the effects of sublethal exposure will be relatively small and affected rabbits will make a complete recovery. Phosphine is currently the preferred toxin for fumigation until more humane fumigation methods are developed.

Carbon monoxide

Carbon monoxide (CO) is a colourless, odourless gas that causes oxygen depletion leading to unconsciousness and rapid death without pain or discernible discomfort. Pressure fumigation of rabbit warrens with carbon monoxide has been investigated as a humane alternative to other fumigants. However, at this stage appropriate delivery devices are not yet available.

Chloropicrin

Chloropicrin (trichloronitromethane) is considered to be highly inhumane to rabbits and poses a considerable risk to operators. As such its use has been phased out in NSW. It causes intense irritation of the respiratory tract and profuse watering of the eyes for considerable periods before death. Exposure to chloropicrin that is not immediately lethal has been shown to cause chronic debilitation, with some rabbits taking many weeks to die. Survivors may experience prolonged periods of respiratory distress prior to recovery.

Car exhaust fumes

Exhaust from idling internal combustion engines is not acceptable as a fumigant as adequate carbon monoxide concentrations cannot be achieved (particularly with modern car engines) and exhaust contaminants such as hydrocarbons, ozone, nitrogen dioxide and nitric oxides cause severe irritation before death. Also, the exhaust gases produced may be unacceptably hot.

Carbon dioxide

Although carbon dioxide (CO2) is often used to euthanase other species, it is neither effective nor economical for rabbit warren fumigation. Wild rabbits have a high tolerance to carbon dioxide (i.e. a concentration of 45% CO2 needs to be maintained for at least one hour to kill wild rabbits). Also, CO2 disperses poorly throughout the warren.

Shooting

Shooting is a relatively humane control method 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 animal can be clearly seen and is within range;

and all wounded animals are promptly located and euthanased humanely. Head shots are the preferred shot placement although chest shots are more likely when shot from a distance.

However, dependent young will experience significant negative welfare impacts if they are not euthanased humanely after their mother is shot. There is no practical way of addressing the problem of dependent young being left in burrows after the mother has been shot. Shooting can also have negative effects on surviving animals in social groups.

Trapping

All traps have the potential to cause injury and some degree of suffering and distress so should only be used when no practical alternative exists. Traps that contain an animal (e.g. cage or box traps) cause fewer injuries than traps that restrain an animal (e.g. foot-hold traps[a]). Animals 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. Foot-hold traps on the other hand can cause serious injuries to both target and non-target animals such as swelling and lacerations to the foot from pressure of the trap jaws and dislocation of a limb if the animal struggles to escape. If foot-hold traps are used, they must have a rubber-like padding[b] on each jaw that cushions the initial impact and provides friction thus preventing the captured foot from sliding along or out of the jaws. The recommended rabbit-specific trap is the Victor Soft-Catch (VSC) trap no. 1. Toothed[c], steel-jaw traps must not be used as they cause significant injury, pain and distress. The use of toothed, steel-jaw traps is illegal in NSW.

As well as injuries, trapped animals 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. Trapped animals should be approached carefully and quietly to minimise panic, further stress and risk of injury. Rabbits must be killed quickly and humanely either by shooting (with a single shot to the brain) or cervical dislocation. Cervical dislocation alone can be used on young rabbits less than 1kg. In animals >1kg, prior stunning is recommended since the large muscle mass in the neck makes manual cervical dislocation physically more difficult. Non-target animals that are caught but not severely injured should be released at the trap site. If they are injured, but

[a] *Foot-hold* refers to a trap with two hinged jaws held open by a trigger mechanism that when stepped on, closes the jaws, by spring action, around the foot or leg, this catching and restraining the animal.

[b] *Padding* is used to refer to traps that have a non-abrasive surface and durable cushioning material firmly fixed to the jaws i.e. commercially manufactured traps and aftermarket modifications.

[c] *Toothed* includes any jaws that are not smooth i.e. have metal teeth, serrations or spikes.

may respond to veterinary treatment, such treatment should be sought. Severely injured non-target animals must be destroyed quickly and humanely.

Biological control

Rabbit haemorrhagic disease virus (RHDV1)

The mortality rate for RHDV1 usually ranges between 70 and 90% of susceptible individuals. A limited number of rabbits (5–10%) may show a chronic or subclinical form of the disease. Subclinical or chronic RHD is characterised by severe and generalised jaundice, loss of weight and lethargy. Death may occur after 1 or 2 weeks, but some rabbits survive after seroconversion. In most rabbits, death from rabbit haemorrhagic disease is sudden. The incubation period for RHDV varies from 1 to 3 days with death usually occurring 12-36 hours after the onset of fever (>40°C). However, the response of individual rabbits can be variable. In the peracute form of the disease, rabbits die suddenly without previous clinical signs within a few hours of the incubation period. In the acute form, animals die after a short period of disease (1-3 days), with convulsions and signs of suffocation. Shortly before death, opisthotonus (a condition in which the body is held in an abnormal posture with the body rigid, the head thrown backward and the back severely arched), sudden crying, and uncoordinated movements or paddling of the limbs may occur. Targeted releases of disease are produced in susceptible rabbit populations by distribution of bait (carrots or oats) coated with virus suspension.

Myxomatosis

The deliberate infection of rabbits with the myxoma virus is no longer a commonly used technique, although fleas, which act as vectors of myxomatosis have been released to enhance the spread of the disease, especially in arid areas. Infection with myxoma virus causes anorexia, subcutaneous swellings around the face and ears, and swollen eyelids and conjunctivitis leading to blindness. Time to death depends upon the strain of virus. Infection with a highly virulent strain causes death within two weeks, while rabbits infected with less virulent strains may take up to four weeks to die. The severity of symptoms and long interval between infection and death indicate that considerable suffering occurs with this disease.

Risk assessment – bait application

An authorised control officer (ACO) must conduct a risk assessment to determine if it is appropriate to *supply* certain toxic baits (i.e., 1080 baits) to any person. When issuing other vertebrate pesticides as baits, ACOs must consider if a risk assessment is relevant or required e.g., where there is zero risk which requires no further controls.

Refer to the relevant Pesticide Control Order (PCO) https://www.epa.nsw.gov.au/your-environment/pesticides/pesticides-nsw-overview/pesticide-control-orders and the NSW DPI Vertebrate Pesticide Manual https://www.dpi.nsw.gov.au/biosecurity/vertebrate-pests/publications/nsw-vertebrate-pesticide-manual for further details on performing risk assessments.

Users of baits must always refer to any risk assessment and to a specific permit, approved label and Pesticide Control Order (PCO) for up-to-date information on conditions of use

including distance restrictions, public notification and bait preparation, distribution, storage, transportation and disposal.

Table 1: Humaneness, Efficacy, Cost-effectiveness and Target Specificity of Rabbit 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
Ground baiting with 1080 *Primary*	Acceptable Score: 1D-1E	Effective	Cost-effective	Potential risk of poisoning non-target animals	Effective for reducing rabbit populations prior to warren destruction. 1080 ingestion can also kill non-target animals including native species, cats, dogs and livestock. 1080 is toxic to humans; operators need to take precautions to safeguard against exposure.
Aerial baiting with 1080 *Primary*	Acceptable Score: 1D-1E	Effective	Cost-effective	Potential risk of poisoning non-target animals	Effective for reducing rabbit populations prior to warren destruction. Useful in difficult access broadscale areas. 1080 ingestion can also kill non-target animals including native species, cats, dogs and livestock. 1080 is toxic to humans; operators need to take precautions to safeguard against exposure.
Pindone baiting *Peri-urban: Primary* *Agricultural setting: Supplementary*	**Only acceptable when there is no other alternative.** Inhumane compared to 1080 Score: 1G	Effective	Relatively expensive (compared to 1080)	Potential risk of poisoning non-target animals (esp. macropods and other native species)	Should only be used in areas where it is impractical or unsuitable to use 1080 e.g., urban / residential and semi-rural areas.

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
Biological control with myxomatosis *Supplementary*	Depends upon strain. Highly virulent strains will kill rabbits quickly. Score: N/A	Unpredictable effectiveness. Has become less effective over time	No cost	Target specific	This is a self-disseminating virus that is already widespread in the environment. It is not routinely used as a control technique though natural outbreaks should be followed up with conventional control methods to achieve more long-term control of rabbit populations
Biological control with RHDV1 K5 *Primary*	Acceptable Score: 1E-1G (bait delivery), 5E-5G (inoculation delivery)	Variable	No cost	Target specific	Effectiveness depends on habitat. RHDV outbreaks should be followed up with conventional control methods to achieve more long-term control of rabbit populations. Bait delivery of the virus is a more humane technique of producing outbreaks of RHD because it does not require live capture and handling of rabbits for inoculation.

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
Warren destruction by ripping *Open plains: Primary* *Closed country: Supplementary*	Acceptable when rabbit populations are low Score: 3F	Effective	Cost-effective	Non-target wildlife using warrens are vulnerable	Where warrens are easily located and the principal shelter for rabbits, ripping is the most cost-effective and most long-lasting method of control. Difficult to use in inaccessible, rocky or environmentally sensitive areas and may require specific equipment and careful planning.
Warren destruction using explosives *Supplementary*	Acceptable when rabbit populations are low Score: 3A-3B	Effective	Relatively expensive (compared to ripping)	Non-target wildlife using warrens are vulnerable	Provides long-term management of rabbit populations. Requires trained and licensed operators and adherence to strict OH&S requirements. Mostly used for inaccessible and rocky areas.
Pressure fumigation of warrens using chloropicrin *Not available*	Not acceptable Score: 3F			Non-target wildlife using warrens are vulnerable	Inhumane and must not be used Alternatives are available.
Diffusion fumigation of warrens using phosphine *Supplementary*	Acceptable when rabbit populations are low Score: 3D	Variable effectiveness	Expensive	Non-target wildlife using warrens are vulnerable	Labour intensive. Warren is not destroyed and can therefore easily be recolonised. Unsuitable for large areas.

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: 2A (head), 2B (chest)	Not effective	Not cost-effective	Target-specific	Shooting may be effective to control small isolated rabbit populations but is inefficient for general control. It is time consuming and labour intensive and not suitable in certain situations, e.g., where dense cover is available, inaccessible or rough terrain, near human habitation.
Exclusion fencing *Supplementary*	Acceptable Score: N/A	Limited	Expensive	Can be in certain situations	Useful where there is high-value crop/pasture (e.g., market garden/horticultural enterprises) or in conservation areas. Expensive, therefore impractical for broad-scale application.
Soft-jawed traps *Supplementary*	Acceptable Score: 5C-6C	Not effective	Not cost-effective	Risk of catching non-target animals	Occasionally used in areas with small isolated rabbit populations but are inefficient for general control.
Fertility control *Not available*	Acceptable Score: N/A	Unknown	Unknown	Depends on agent used	No products currently registered.

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
Treatment of rabbit warrens using LPG technology (R3 Unit®) *Supplementary*	Acceptable when used in small warrens that are adequately sealed Score: 2C (R3 Unit with adequate blast pressure), 5D-8H (R3 Unit without adequate blast pressure)	Effective	Cost-effective for small numbers of warrens (compared to ripping)	Non-target wildlife using warrens are vulnerable	Suitable for inaccessible, rocky, environmentally sensitive or culturally important areas. If warren is not destroyed it can easily be recolonised. Unsuitable for large warrens (>7 entrances).
Toothed, steel-jaw traps *Not available*	Not acceptable Score: N/A	Not effective	Not cost-effective	Risk of catching and causing severe injury and distress to non-target animals	Inhumane and must not be used. Alternatives are available.

* 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: https://pestsmart.org.au/toolkit-resource/rabbit-control-methods-humaneness-matrix/.
N/A = Humaneness score not available.

Control techniques also 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 1967Firearms Act 1996* *Dangerous Goods (Road and Rail Transport) Act 2008* *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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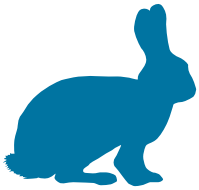
Standard Operating Procedures

- Ground baiting of rabbits with 1080 (NSWRAB SOP1)
- Aerial baiting of rabbits with 1080 (NSWRAB SOP2)
- Ground baiting of rabbits with pindone (NSWRAB SOP3)
- Diffusion fumigation of rabbit warrens (NSWRAB SOP4)
- Rabbit warren destruction by ripping (NSWRAB SOP5)
- Trapping of rabbits using padded-jaw traps (NSWRAB SOP6)
- Ground shooting of rabbits (NSWRAB SOP7)
- Bait delivery of RHDV (NSWRAB SOP8)
- Use of the R3 Unit propane-oxygen device (NSWRAB SOP9)
- Trapping of rabbits using cage traps (NSWRAB SOP10)



NSWRAB SOP1 Ground baiting of rabbits with sodium monofluoroacetate (1080)

Background

Lethal baiting with sodium monofluoroacetate (1080) is used to minimise the impact of the introduced European rabbit (*Oryctolagus cuniculus*) on agricultural production and the environment. Poisoning with 1080 is one of the most effective methods of quickly reducing rabbit numbers and is usually performed prior to harbour destruction and warren fumigation. 1080 is an odourless, tasteless, concentrated solution that has a coloured dye added for identification of the toxin. It is used for poisoning of rabbits by incorporating it into a suitable bait material. Poison bait is offered either as a concentrated trail or broadcast (scattered) in a swathe on the ground or from the air. Aerial baiting procedures are described in *NSWRAB SOP2 Aerial baiting of rabbits with 1080*. Conventional poisoning methods use free-feeding with unpoisoned bait on at least three occasions, usually three to four days apart, prior to laying poisoned baits.

Rabbits are moderately susceptible to the effects of 1080; however other species, especially some native animals and birds and domestic livestock are also vulnerable to poisoning. Good baiting technique helps to minimise the risk to non-target species and maximise the effect on targeted rabbit populations.

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 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

- 1080 baiting is subject to an authorised control officer (ACO) risk assessment.
- Baiting with 1080 should only be used in a strategic manner as part of a co-ordinated program designed to achieve sustained effective control.
- Poisoning is used as an initial control method to reduce high rabbit populations to a more manageable level. Fumigation and ripping of warrens are then used as follow-up techniques to reduce harbour and to slow re-colonisation. Poisoning is also an important management tool in areas where rabbits are mainly surface dwelling or where it is too difficult to rip warrens.

- Controlling rabbits with 1080 bait cannot be undertaken in areas where there is an unacceptably high risk to humans and/or companion animals, such as urban/residential environments.
- 1080 use is restricted in areas where there is a high risk of poisoning domestic stock and wildlife.
- Because water reduces the concentration of 1080 in bait, poisoned bait should be laid when there is a low chance of rain within several days of laying.
- Although poisoning programs can be carried out year-round, baiting is most effective when alternative food for rabbits is scarce. This can vary by season and location around the state.
- Baiting may be less effective when feed supply is abundant and also during the breeding season when juvenile rabbit movements may be limited, and they are less likely to find the bait. Kittens over 17 days old can survive even if their mother is poisoned and subsequent breeding by these survivors can cause rapid recovery of the population
- Baiting of rabbits with 1080 can only be carried out under conditions set down in a specific permit issued by the Australian Pesticides & Veterinary Medicines Authority (APVMA) under Commonwealth legislation (*Agricultural and Veterinary Chemicals Code Act 1994*).
- In NSW, 1080 must also be used in accordance with the *Pesticides Act 1999* and the relevant Pesticide Control Orders (PCO's) (which include distance restrictions, signage and notification requirements).
- 1080 is a restricted chemical product (under Regulation 45 of the Agricultural and Veterinary Chemicals Code Regulations 1995) and is listed as a Schedule 7 – Dangerous Poison under the Standard for the Uniform Scheduling of Medicines and Poisons (SUSMP). These listings require special precautions in the manufacture, handling, storage and use of 1080, along with specific regulations regarding labelling or availability.
- Handling of 1080 concentrated solution and preparation of baits can only be performed by an authorised person (ACO) who has the appropriate training.
- Prepared and manufactured 1080 baits can only be obtained through authorised government agencies.
- The 1080 user should refer to the NSW Vertebrate Pesticide Manual for all relevant legislation and its application.

Animal welfare implications

Target animals

- The toxicity of 1080 is due to the conversion of fluoroacetate to fluorocitrate, which inhibits the tricarboxylic acid cycle – a mechanism necessary for cellular energy production. In general, herbivores experience cardiac failure, whereas carnivores experience central nervous system (CNS) disturbances and convulsions and then die of respiratory failure. Some species, usually omnivores such as pigs, can be equally affected by both CNS and cardiac signs.

- After a rabbit has ingested 1080 there is a latent period ranging from around 30 minutes to 4 hours before clinical signs including lethargy, laboured respiration and increased sensitivity to noise/disturbance are observed. Convulsions start suddenly, often with gasping and squealing, followed by death. Time to death is variable depending upon the amount of 1080 absorbed but is usually around 3 to 4 hours after ingestion. The precise nature and extent of suffering after ingestion of 1080 is unknown.
- To minimise the animal welfare implications of leaving dependent young to die a slow death from starvation it is preferable not to undertake baiting programs when rabbits are known to be breeding. This is also the time when young rabbits do not travel far from their burrows and bucks vigorously defend their territorial boundaries, making it less likely that all rabbits will have access to bait. In many areas of Australia there is a peak in breeding from late winter to early summer when pastures have greened up after rain.

Non-target animals

- 1080 is toxic to a wide range of species including birds, mammals and reptiles; however, there are marked differences in sensitivity. Dogs are extremely sensitive, and most other mammalian carnivores are highly sensitive to 1080 poisoning. Herbivores are less sensitive, and birds and reptiles increasingly more tolerant.
- Poisoning of non-target species can occur either directly by eating baits intended for rabbits (primary poisoning) or through the scavenging of tissues from a poisoned animal (secondary poisoning).
- The susceptibility of non-target species to 1080 poisoning is determined by many factors including sensitivity to the poison, body weight, concentration of 1080 in the bait, bait placement, bait type and palatability, timing of baiting and level of exposure to toxic baits.
- To help reduce risks to non-target animals, the following baiting strategies are recommended:
    - *Pre-feeding with non-poisoned bait* – allows an assessment of what animals are eating the bait and the quantities of poisoned bait needed for the control program.
    - *Bait type* – use of surface coated rather than vacuum impregnated oat baits will reduce exposure of granivorous birds to the toxin. Most of these birds will only eat the kernel and discard the poisoned husk. Carrots should be diced to an optimal size favoured by rabbits (2 to 5 grams). Pieces smaller than this tend to retain and absorb a higher loading of 1080, dry out and leach 1080 more rapidly and are more likely to be eaten by birds.
    - *Colouring of baits* – baits that are dyed a specific green or blue colour may be unattractive or less obvious to birds.
    - *Placement of baits* – the laying of poisoned carrot bait in a wide swathe (i.e., broadcast or scattered; poisoned oats and pellets only to be used on trails) instead of a concentrated trail, can decrease the consumption of poisoned bait by non-target species and thus their risk of poisoning. However, uneaten broadcast bait is difficult to cover or collect and destroy after a baiting program. Laying the bait as a concentrated trail in a narrow, pre-cut furrow allows subsequent identification of the trail of pre-feed and poisoned bait, attraction of rabbits to the trail and ease of covering up any

uneaten poison bait after the program. The bait should always be placed in the prime feeding areas of rabbits.

- *Timing of baiting* – rabbits mostly feed at night, therefore bait laid in the evening will be mostly consumed overnight before diurnal non-target species such as birds will have access. However, nocturnal mammals will be at risk when bait is laid in the evening.
- *Collection of uneaten bait and rabbit carcasses* – any uneaten sections of bait trail should be covered or collected then destroyed or buried with a minimum of 500 mm of soil.
- *Collection of rabbit carcasses* – where possible, and especially in areas of risk to domestic dogs, carcasses of poisoned rabbits should be collected and destroyed and buried with a minimum of 500 mm of soil.

First aid for dogs

- 1080 baits can be attractive to carnivores such as dogs. Care must be taken to ensure that working dogs and pets do not come into contact with 1080. Dogs may eat poisoned bait or poisoned rabbit carcasses. The prognosis for poisoned dogs is extremely poor unless vomiting can be induced shortly after ingestion of 1080 and before clinical signs are evident.
- If a working dog or pet is known to have consumed a bait but is NOT yet showing signs of poisoning, induce vomiting by giving one of the following emetics by mouth:
  - washing soda crystals (sodium carbonate) – 3 to 5 crystals orally, DO NOT use laundry detergents or powders
  - table salt – 2 teaspoons of salt in 1 cup of water; more or less depending on the size of the dog
  - dilute hydrogen peroxide (3% solution) – 3 to 5ml
  - If the dog has vomited, clean it up immediately as the vomit is toxic.
- THEN SEEK VETERINARY ATTENTION IMMEDIATELY. The sooner action is taken following poisoning the better the prognosis.
- If these emetics are not immediately to hand or you are not having success in making the dog vomit it is better to seek veterinary attention immediately rather than waste time.
- If the dog has already begun to show signs of toxicosis (retching and vomiting, frenzied behaviour such as running and howling, convulsions, difficulty breathing etc.), DO NOT induce vomiting, but seek veterinary attention without delay.
- Veterinary intervention aims to decrease 1080 absorption and facilitate excretion; control seizures; and support respiration and cardiac function.

See *First Aid – 1080 and your dog* for more information: https://pestsmart.org.au/wp-content/uploads/sites/3/2020/06/1st_aid_booklet-1.pdf

Workplace health and safety considerations

- If poisoning occurs, contact a doctor or the Poisons Information Centre (Ph 13 11 26) IMMEDIATELY. Urgent hospital treatment is likely to be needed. There is no effective antidote to 1080.
- For further information refer to the Material Safety Data Sheet (MSDS), available from the supplier, the Pesticide Control (1080 Bait Products) Order, and the NSW DPI Vertebrate Pesticide Manual.

Procedures

- An ACO must conduct a risk assessment to determine if it is appropriate to supply 1080 baits to any person. Risk assessments should consider threats to non-target species particularly domestic dogs, human health and the environment.
- ACOs must conduct a risk assessment of planned group baiting programs where baiting occurs less than the prescribed minimum distances provided in the current 1080 PCO.
- Users of 1080 must always refer to any risk assessment and to specific permit, approved label and Pesticide Control (1080 Bait Products) Order for up-to-date information on conditions of use including distance restrictions, public notification and bait preparation, distribution, storage, transportation and disposal.
    - Pesticide Control (1080 Bait Products) Order: https://www.epa.nsw.gov.au/your-environment/pesticides/pesticides-nsw-overview/pesticide-control-orders
    - NSW DPI Vertebrate Pesticide Manual: https://www.dpi.nsw.gov.au/biosecurity/vertebrate-pests/publications/nsw-vertebrate-pesticide-manual

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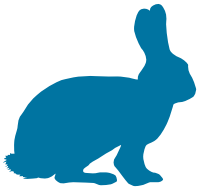

NSWRAB SOP2 Aerial baiting of rabbits with sodium monofluoroacetate (1080)

Background

Poisoning with sodium monofluoroacetate (1080) is used to minimise the impact of the introduced European rabbit (*Oryctolagus cuniculus*) on agricultural production and the environment. Poisoning with 1080 is an effective method of quickly reducing rabbit numbers and is usually performed prior to harbour destruction and warren fumigation. 1080 is an odourless, tasteless white powder that has a coloured dye added for identification of the toxin and is supplied as a concentrated solution. It is used for poisoning of rabbits by incorporating it into a suitable bait material. Poison bait is offered either as a concentrated trail or broadcast (scattered) in a swathe on the ground, or, from the air by an agricultural aircraft with a modified hopper. Ground baiting procedures are described *NSWRAB SOP1 Ground baiting of rabbits with 1080*. Free-feeding with unpoisoned bait is performed for a number of days prior to laying poisoned baits and is an essential step in a baiting program.

Rabbits are moderately susceptible to the effects of 1080; however, other species, especially some native animals and birds and domestic livestock are also vulnerable to poisoning. Good baiting technique helps to minimise the risk to non-target species and maximise the effect on targeted rabbit populations.

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 WHS) operating in the relevant jurisdiction.

Application

- Aerial baiting programs must only occur when subjected to a risk assessment and approved by an ACO and relevant authority.
- Baiting with 1080 should only be used in a strategic manner as part of a co-ordinated program designed to achieve sustained effective control.
- In NSW 1080 must also be used in accordance with the *Pesticides Act 1999* and the relevant Pesticide Control Orders (which include distance restrictions, signage and notification requirements).
- Baiting of rabbits with 1080 can only be carried out under conditions set down in a specific permit issued by the Australian Pesticides & Veterinary Medicines Authority (APVMA) under Commonwealth legislation (*Agricultural and Veterinary Chemicals Code Act 1994*).

- In NSW, aerial baiting for rabbit control should be restricted to areas where ground control is impractical or where it is necessary for the protection of threatened species. Approval for every aerial baiting program on land reserved under Part 4 of the *National Parks and Wildlife Act 1974* must be obtained from the relevant NPWS Regional Director. For all other land, approval for every aerial baiting program must be obtained from the LLS Chair of Chairs or their delegate. Aerial baiting must be organised through either LLS or NPWS or any other approved NSW public authority.
- Poisoning is used as an initial control method to reduce high rabbit populations to a more manageable level. Fumigation and ripping of warrens are then used as follow-up techniques to reduce harbour and to slow re-colonisation. Poisoning is also an important management tool in areas where rabbits are mainly surface dwelling or where it is too difficult to rip warrens.
- Controlling rabbits with 1080 bait cannot be undertaken in areas where there is an unacceptably high risk to humans and/or companion animals, such as urban/residential environments.
- Aerial baiting programs should only occur when the risk of non-target uptake is minimal.
- Aerial baiting is used to treat large areas of land. It is best suited to steep, rocky/hilly areas or inaccessible islands where ground baiting techniques cannot be employed and where impacts by rabbits are likely to be significant.
- Aerial baiting can only be applied by helicopter in the eastern division however fixed wing planes can also be used in the western division.
- Aerial baiting programs only apply to areas and situations that meet the restrictions stated in the LLS and NPWS approved task profiles and procedures for aerial baiting (available from ACOs).
- Aerial baiting is useful for broad-scale application, but it is less accurate than ground baiting. It should not be used where non-target animals occupy habitat close to the proposed treatment area.
- 1080 use is restricted in areas where there is a high risk of poisoning domestic stock and wildlife.
- Because water reduces the concentration of 1080 in bait, poisoned bait should be laid when there is a low chance of rain within several days of laying.
- Aerial baiting programs are best undertaken when alternative food for rabbits is scarce i.e., often at the end of summer or early autumn.
- Baiting may be less effective when feed supply is abundant and also during the breeding season when juvenile rabbit movements may be limited, and they are less likely to find the bait. Kittens over 17 days old can survive even if the mother is poisoned and subsequent breeding by these survivors can cause rapid recovery of the population
- 1080 is a restricted chemical product (under Regulation 45 of the Agricultural and Veterinary Chemicals Code Regulations 1995) and is listed as a Schedule 7 – Dangerous Poison under the Standard for the Uniform Scheduling of Medicines and Poisons (SUSMP). These listings require special precautions in the manufacture, handling, storage and use of 1080, along with specific regulations regarding labelling or availability.
- Handling of 1080 concentrated solution and preparation of baits must only be performed by an authorised person (ACO).

- Prepared and manufactured 1080 baits can only be obtained through authorised government agencies.
- The 1080 user should refer to the NSW Vertebrate Pesticide Manual for all relevant legislation and its application.

Animal welfare implications

Target animals

- The toxicity of 1080 is due to the conversion of fluoroacetate to fluorocitrate, which inhibits the tricarboxylic acid cycle – a mechanism necessary for cellular energy production. In general, herbivores experience cardiac failure, whereas carnivores experience central nervous system (CNS) disturbances and convulsions and then die of respiratory failure. Some species, usually omnivores, can be equally affected by both CNS and cardiac signs e.g., pigs.
- After a rabbit has ingested 1080 there is a latent period ranging from around 30 minutes to 4 hours before signs such as lethargy, laboured respiration and increased sensitivity to noise/disturbance are observed. Convulsions start suddenly, often with gasping and squealing, followed by death. Time to death is variable depending upon the amount 1080 absorbed but is usually around 3 to 4 hours. The precise nature and extent of suffering after ingestion of 1080 is unknown.
- To minimise the animal welfare implications of leaving dependant young to die a slow death from starvation it is preferable not to undertake baiting programs when rabbits are known to be breeding. This is also the time when young rabbits do not travel far from their burrows and bucks vigorously defend their territorial boundaries, making it less likely that all rabbits will have access to bait. In many areas of Australia there is a peak in breeding from late winter to early summer when pastures have greened up after rain.

Non-target animals

- 1080 is toxic to a wide range of species including birds, mammals and reptiles; however, there are marked differences in susceptibility. Dogs are extremely susceptible, and most other carnivores are highly sensitive to 1080 poisoning. Herbivores are less sensitive, and birds and reptiles increasingly resistant. Poisoning of non-target species can occur either directly by eating baits intended for rabbits (primary poisoning) or through the scavenging of tissues from a poisoned animal (secondary poisoning).
- There is a potentially greater risk to non-target species with aerial application of poisoned bait than occurs with ground baiting. Poisoned rabbit carcasses cannot usually be collected, uneaten baits cannot be covered or removed, and all bait will not necessarily be available to rabbits.
- To minimise the potential for toxic baits to be lethal to non-target animals, the following baiting strategies are recommended:
    - *Pre-feeding with non-poisoned bait* – allows an assessment of what animals are eating the bait.

- *Bait type* – surface coated rather than vacuum impregnated oat baits will reduce exposure of granivorous birds to the toxin. Most of these birds will only eat the kernel and discard the poisoned husk.
- Carrots are diced to an optimal size favoured by rabbits (2 to 5 grams). Pieces smaller than this tend to retain and absorb a higher loading of 1080 and are more likely to be eaten by birds. They will also dry out and leach 1080 more rapidly than bigger pieces.
- *Colouring of baits* – baits that are dyed a specific green or blue colour may be unattractive or less obvious to birds.
- *Placement of baits* – the bait should always be placed in the prime feeding areas of rabbits.
- *Timing of baiting* – rabbits mostly feed at night, therefore, bait laid in the evening will be mostly consumed overnight before diurnal non-target species such as birds will have access. However, nocturnal mammals will be at risk when bait is laid in the evening.

First aid for dogs

- 1080 baits are highly attractive to other carnivores such as dogs. Care must be taken to ensure that working dogs and pets do not come into contact with 1080. Dogs may eat poisoned bait (especially pellets) or poisoned rabbit carcasses. The prognosis for poisoned dogs is extremely poor unless vomiting can be induced shortly after ingestion of 1080 and before clinical signs are evident.
- If a working dog or pet is known to have consumed a bait but is NOT yet showing signs of poisoning, induce vomiting by giving one of the following emetics by mouth:
  - washing soda crystals (sodium carbonate) – 3 to 5 crystals orally, DO NOT use laundry detergents or powders
  - table salt – 2 teaspoons of salt in 1 cup of water; more or less depending on the size of the dog
  - dilute hydrogen peroxide (3% solution) – 3 to 5ml
  - If the dog has vomited, clean it up immediately as the vomit is toxic.
- THEN SEEK VETERINARY ATTENTION IMMEDIATELY. The sooner action is taken following poisoning the better the prognosis.
- If these emetics are not immediately to hand or you are not having success in making the dog vomit it is better to seek veterinary attention immediately rather than waste time.
- If the dog has already begun to show signs of toxicosis (retching and vomiting, frenzied behaviour such as running and howling, convulsions, difficulty breathing etc.), DO NOT induce vomiting, but seek veterinary attention without delay.
- Veterinary intervention aims to decrease 1080 absorption and facilitate excretion; control seizures; and support respiration and cardiac function.
- See *First Aid – 1080 and your dog* for more information: https://pestsmart.org.au/wp-content/uploads/sites/3/2020/06/1st_aid_booklet-1.pdf

Workplace health and safety considerations

- If poisoning occurs, contact a doctor or the Poisons Information Centre (Ph 13 11 26) IMMEDIATELY. Urgent hospital treatment is likely to be needed. There is no effective antidote to 1080.
- For further information refer to the Material Safety Data Sheet (MSDS), available from the supplier, the Pesticide Control (1080 Bait Products) Order, and the NSW DPI Vertebrate Pesticide Manual.

Procedures

- An ACO must conduct a risk assessment to determine if it is appropriate to supply 1080 baits to any person. Risk assessments should consider threats to non-target species particularly domestic dogs, human health and the environment.
- ACOs must conduct a risk assessment of planned group baiting programs where baiting occurs less than the prescribed minimum distances provided in the current 1080 PCO.
- Users of 1080 must always refer to any risk assessment, specific permit, approved label and Pesticide Control (1080 Bait Products) Order for up-to-date information on conditions of use including distance restrictions, public notification and bait preparation, distribution, storage, transportation and disposal.
    - Pesticide Control (1080 Bait Products) Order: https://www.epa.nsw.gov.au/your-environment/pesticides/pesticides-nsw-overview/pesticide-control-orders
    - NSW DPI Vertebrate Pesticide Manual: https://www.dpi.nsw.gov.au/biosecurity/vertebrate-pests/publications/nsw-vertebrate-pesticide-manual

Fixed-wing aircraft or helicopters

- The aircraft must be suited to the purpose and must be registered to perform the task as per agency guidelines.
- The aircraft must be equipped with a Global Positioning System (GPS).
- The location of all bait transects must be accurately recorded.
- A restrained leak–proof bait hopper and bait distribution mechanism should be used for dispensing of baits.
- The pilot must be suitably experienced and licensed to perform the task
- Aircraft operators must ensure that their flying operations comply with requirements of the Civil Aviation Safety Authority.

Planning

- Aerial baiting should not be undertaken in excessively windy conditions where accuracy of bait dispersal and ability to maintain appropriate groundspeed may be adversely affected.

- Prior to the flight, map out transects (or flight lines) at 1km apart and calculate the baiting density in kgs per square kilometre. The transect length is divided by the ground speed to give an even distribution of baits for the area.
- Enter the transect coordinates into the GPS to ensure accurate navigation and dispersal.

Dispersal of baits

- Baits must be dispersed a minimum of 500m from habitation, 100m from property boundary, 200m from domestic water supply or water draw point, and 200m from a public road, for both helicopter and fixed-wing aircrafts.
- Provisions must be in place to ensure that baits are dropped only within the target area.
- Following the pre-determined transects, drop the baits at a linear rate to achieve the desired baiting application rate. The aircraft should travel at a suitable ground speed and height that enables the baits to be safely dropped with accuracy and precision.
- Bait dispersal locations should be recorded by GPS coupled to software capable of storing these positions.

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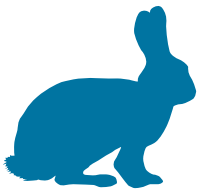

NSWRAB SOP3
Ground baiting of rabbits with pindone

Background

Poisoning with pindone is used to minimise the impact of the introduced European rabbit (*Oryctolagus cuniculus*) on agricultural production and the environment. Poisoning with pindone is used to reduce rabbit populations in areas where it is impractical or unsuitable to use 1080, e.g., urban/residential and semi-rural areas.

Pindone is a first-generation anticoagulant that acts by blocking the synthesis of vitamin K-dependant clotting factors, which causes fatal haemorrhages in susceptible animals. Poisoning with pindone can occur with a large single dose, but it is more effective when given as a series of smaller doses over a period of 4 to 12 days.

Rabbits are amongst the most susceptible species to the effects of pindone; however other animals, especially birds, cats, native rodents and macropods may be vulnerable to poisoning. Good baiting technique helps to minimise the risk to non-target species and maximise the effect on targeted rabbit populations.

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

- Subject to an authorised control officer (ACO) risk assessment (where required).
- Baiting with pindone should only be used in a strategic manner as part of a co-ordinated program designed to achieve sustained effective control.
- Pindone is mostly used for rabbit control where 1080 (sodium monofluoroacetate) cannot be used because of the risk of poisoning to humans or domestic animals. e.g., urban/residential and semi-rural areas.
- Before commencing a baiting program, an assessment of likely non-target exposure should be performed, preferably by authorised personnel with knowledge of local native fauna. If there is a significant risk of poisoning non-target animals, bait should not be laid, or measures must be taken to reduce the risk. Such measures could include:
    - use of bait stations or enclosures to restrict access by non-target animals

  - fencing to exclude larger species such as macropods
  - avoidance of baiting near areas of native vegetation that is likely to harbor smaller non-target animals such as bandicoots.
- Although poisoning programs can be carried out year-round, baiting is most effective when alternative food for rabbits is scarce, e.g., at the end of summer or early autumn. Baiting is less effective during the breeding season when rabbit movements are limited.
- There are two types of registered pindone products; ready-to-use baits and concentrates used to prepare baits:
  - Ready-to-use oat or carrot baits are available 'over-the-counter' from retail merchants or from licensed contractors and government pest control agencies.
  - Liquid (sodium salt) or powder (free acid) pindone concentrates are restricted chemical products available only to authorised control officers (ACOs). Pindone acid has low water solubility while the sodium salt is soluble in water.
- Preparation of baits for rabbits with pindone concentrate can only be carried out by ACOs, and pindone bait products (non-liquid formulations) can only be used by ACOs and persons meeting the criteria listed in the Pesticide Control (pindone products) Order.
- Pindone concentrate or bait products authorised for use in Australia must be used in accordance with the instructions on the approved label or with an APVMA permit. Persons receiving ACO-prepared bait must be supplied with the LLS pindone directions for use before being issued baits.
- In NSW pindone must also be used in accordance with the *Pesticides Act 1999* and the Pindone Pesticide Control Order (which include distance restrictions, signage and notification requirements). The pindone user should refer to the NSW Vertebrate Pesticide Manual for all relevant legislation and its application.

Animal welfare implications

Target animals

- Pindone interferes with the routine synthesis of vitamin K-dependent blood clotting factors in the liver. Without these factors, the normal daily damage to blood vessels can no longer be repaired. Poisoned animals usually die from multiple causes associated with anaemia or hypovolemic shock. A large single dose (18 mg/kg for rabbits) or repeated smaller doses (0.52 mg/kg/day over 7 days) are generally needed to induce death.
- After ingestion of anticoagulants, there is usually a lag period of 3-5 days before the onset of clinical signs. This delayed onset reflects the time required to deplete existing stores of vitamin K and blood clotting factors. Initial signs of poisoning are depression/lethargy and anorexia followed by manifestations of haemorrhage, including anaemia, laboured breathing, pale mucous membranes and weakness. Bleeding may be visible around the nose, mouth, eyes and anus and animals may pass bloody faeces. Swollen tender joints are common as a result of bleeding into the confined joint space.
- Discomfort and pain from haemorrhages in internal organs, muscles and joints typically lasts for several days before death. The time to death is around 10 to 14 days after the initial dose.

- To minimise the animal welfare implications of leaving dependent young to die a slow death from starvation it is preferable not to undertake baiting programs when rabbits are known to be breeding. This is also the time when young rabbits do not travel far from their burrows and bucks vigorously defend their territorial boundaries, making it less likely that all rabbits will have access to bait. In many areas of Australia there is a peak in breeding from late winter to early summer when pastures have greened up after rain.

Non-target animals

- Poisoning of non-target species can occur either directly by eating the carrot, oat or pellet baits intended for rabbits (primary poisoning) or through the tissues from a dead or dying poisoned animal (secondary poisoning).
- Although information on the toxicity and non-target impacts of pindone is limited, it is thought to be moderately toxic to a range of species. Whilst rabbits are extremely susceptible, sheep, possums and horses are comparatively resistant. Cattle, goats, chickens, cats and dogs are less susceptible than rabbits, but still may be at risk if exposed to large doses or smaller doses on successive days. A number of native species are likely to be as sensitive as rabbits to the effects of pindone. Macropods, bandicoots and a range of granivorous birds are susceptible to primary poisoning. Secondary poisoning can occur in species that feed on poisoned rabbits and carcasses, e.g., dasyurids and raptors.
- Rabbits dying from pindone poisoning can become lethargic and less aware of their surroundings. This can predispose these animals to predation that can in turn place predators at greater risk from secondary poisoning.
- Non-target species that accidentally receive a high enough dose of pindone will exhibit the same clinical signs as target rabbits, i.e., physical weakness and lethargy, coughing and respiratory distress, pallor, anorexia, and ventral haematomas as well as internal haemorrhages.
- Because pindone is slow acting, if accidental poisoning of stock or companion animals occurs, vitamin K_1 (phytomenadione) can be administered by a veterinarian as an effective antidote. It is usual to treat an affected animal with vitamin K_1 for at least one week after an initial loading dose. If bleeding is severe, whole blood or plasma can be given to replace clotting factors and red blood cells.
- To minimise the potential for toxic baits to be lethal to non-target animals, the following baiting strategies are recommended:
    - *Pre-feeding with non-poisoned bait* – allows an assessment of what animals are eating the bait.
    - *Bait type* – use of surface coated rather than vacuum impregnated oat baits will reduce exposure of granivorous birds to the toxin. Most of these birds will only eat the kernel and discard the poisoned husk.
    - *Colouring of baits* – baits that are dyed a green colour are unattractive or less obvious to birds.
    - *Use of bait stations* – bait can be placed under mesh canopies where it is accessible to rabbits but restricts access by non-target species such as kangaroos and wallabies.

- *Placement of baits* – the laying of poisoned bait in a wide swathe (i.e., broadcast or scattered) instead of a concentrated trail, may decrease the consumption of poisoned bait by non-target species and thus their risk of poisoning. However, uneaten broadcast bait is difficult to cover or collect and destroy after a baiting program. Laying the bait as a concentrated trail in a narrow, pre-cut furrow allows subsequent identification of the trail of pre-feed and poisoned bait, attraction of rabbits to the trail and ease of covering up any uneaten poison bait after the program. The bait should always be placed in the prime feeding areas of rabbits.
- *Timing of baiting* – rabbits mostly feed at night; therefore, bait laid in the evening will be mostly consumed overnight before diurnal non-target species such as birds will have access. However, nocturnal mammals will be at risk when bait is laid in the evening.
- *Collection of uneaten bait and rabbit carcasses* – any uneaten bait and poisoned rabbit carcasses are collected and destroyed or buried.

Workplace health and safety considerations

- Pindone is toxic to humans and should be handled with care according to the approved label. Exposure can occur from ingestion, inhalation of generated dust or skin contact/absorption. Toxic effects are produced after exposure to a high dose or repeated low doses over several days.
- If poisoning occurs, go straight to a hospital or doctor or contact the Poisons Information Centre (Ph 13 11 26) IMMEDIATELY. Urgent hospital treatment is likely to be needed. Vitamin K_1 is an effective antidote and is readily available from hospitals and veterinary practices.
- For further information refer to the Material Safety Data Sheet (MSDS), available from the supplier, the Pesticide Control (Pindone Products) Order, and the NSW DPI Vertebrate Pesticide Manual.

Procedures

- A risk assessment may be required to determine if it is appropriate to supply pindone baits to any person.
- Users of pindone must always refer to any risk assessment and to specific permit, approved label and current Pesticide Control (Pindone Products) Order (Pindone PCO) for up-to-date information on conditions of use including distance restrictions, public notification and bait preparation, distribution, storage, transportation and disposal.
  - Pindone PCO: https://www.epa.nsw.gov.au/your-environment/pesticides/pesticides-nsw-overview/pesticide-control-orders
  - NSW DPI Vertebrate Pesticide Manual: https://www.dpi.nsw.gov.au/biosecurity/vertebrate-pests/publications/nsw-vertebrate-pesticide-manual

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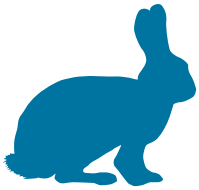

NSWRAB SOP4 Diffusion fumigation of rabbit warrens

Background

Fumigation of rabbit warrens is used to minimise the impact of the introduced European rabbit (*Oryctolagus cuniculus*) on agricultural production and the environment. Fumigation involves the introduction of toxic fumes into a warren where it is inhaled by rabbits leading to their death. There are two types of fumigation: pressure fumigation, in which the fumigant gases or vapours are generated outside the warren and forced into the warren under pressure, usually from a pump, and diffusion fumigation, where tablets are placed in active burrows and the gas generated is allowed to diffuse through the warren. Chloropicrin was the only chemical approved for pressure fumigation; however, this chemical is no longer available for use in NSW. As such, pressure fumigation is currently not an option in NSW until an alternative fumigant e.g., carbon monoxide (CO), becomes available.

Diffusion fumigation is commonly carried out using phosphine gas. Warrens are treated with aluminium phosphide tablets that liberate phosphine gas on exposure to atmospheric or soil moisture. Phosphine is a systemic poison that depresses the central nervous system and respiratory function. It is highly toxic to humans; therefore, operators performing warren fumigation must take adequate precautions to safeguard against accidental exposure.

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

- Fumigation should only be used in a strategic manner as part of a co-ordinated program designed to achieve sustained effective control. Reducing and maintaining low rabbit numbers by a combination of control methods over time is more effective than repeated (seasonal) use of a single method.
- Fumigation is labour intensive and costly. It is best used as a follow-up technique to warren ripping and poisoning, i.e., when rabbit density is low but may also be effective in the following situations:

  - where ripping cannot be done due to inaccessible location (e.g., near rocky outcrops, along fences or riverbanks, around trees) or when there is a risk of soil erosion or damage to conservation areas
  - as an alternative to poisons in situations where 1080 and pindone cannot be used, e.g., when the risk of non-target poisoning is unacceptably high, distance restrictions cannot be adhered to etc.
  - when treating small areas or isolated rabbit populations.
- Fumigation can only be used for warren dwelling rabbits. It is not effective against surface dwelling rabbits.
- Fumigation can be carried out at any time of year, but it has the greatest long-term effect if done shortly before the commencement of the rabbit breeding season.
- Fumigation with aluminium phosphide is most effective in non-porous soils through which the gas will not diffuse, e.g., compacted heavy or wet soils rather than dry sand or cracked clay.
- As phosphine gas is released from the tablets when wet, do not fumigate in weather conditions where the tablets cannot be protected from wetting prior to placement in the warren. Avoid fumigating in small sheltered gullies where the operator may be exposed to the toxic fumes. It is best to fumigate on windy days so that fumes are dispersed rather than building up in the air around the warren.
- Trained dogs can be used to drive rabbits underground prior to warren fumigation. However, it is unacceptable to set a dog onto a rabbit with the intention of catching or killing.
- Aluminium phosphide is listed as a Schedule 7 substance, a restricted chemical product that requires special precautions in manufacture, handling, storage and use, along with individual regulations regarding labelling or availability. The occupational use of certain fumigants requires a NSW EPA fumigation licence (issued by SafeWork NSW), although LLS, NPWS and landholders are exempt from this requirement for the application of aluminium phosphide. Aluminium phosphide tablets are also registered as a grain storage fumigant and as such are available 'over the counter'.
- Fumigants must be used according to instructions on approved labels, guidelines issued by NSW EPA, and the NSW DPI Vertebrate Pesticide Manual.
- Phosphine is currently the preferred toxin for diffusion fumigation until more humane methods are developed. Chloropicrin (trichloronitromethane) is considered to be highly inhumane and its use is not recommended. It causes intense irritation of the respiratory tract and profuse watering of the eyes for a considerable period before death. Exhaust from idling internal combustion engines is also not acceptable as adequate CO concentrations cannot be achieved (particularly with modern car engines) and exhaust contaminants such as hydrocarbons, ozone, nitrogen dioxide and nitric oxides cause severe irritation before death. Also, the exhaust gases produced may be unacceptably hot.

Animal welfare implications

Target animals

- The toxicity of phosphine is due to inhibition of cytochrome oxidase - an enzyme essential for the use of oxygen for energy production. Inhalation of the gas causes a reduction in the activity of the central nervous system and breathing activity. The precise nature and extent of suffering of rabbits after inhalation of phosphine is unknown. Symptoms of phosphine toxicity in humans often include nausea, abdominal pain, headache and convulsions followed by coma. It is not known whether other mammals experience similar symptoms.
- Time to death can be highly variable depending on the concentration of gas in the burrow. For example, at concentrations of 400 ppm phosphine can kill rabbits in 30 minutes whereas at 25 ppm death will take 4 hours. The time taken to reach high concentrations throughout the warren largely depends on the amount of moisture in the soil and air, or on the tablets. In low humidity, complete release of phosphine gas from the tablets may take hours or even days. Higher humidity will cause a rapid rate of diffusion and therefore result in higher concentrations of gas so that the rabbit will be exposed to a lethal dose in a shorter time and will have less chance to dig out of the burrow.
- Failure to reach lethal levels of phosphine in some parts of the warren because of inadequate diffusion will result in ineffective killing but will not necessarily cause long-term suffering. Studies in other species (i.e., cats, guinea pigs and brown rats) have produced no evidence to suggest that exposure to sub-lethal levels of phosphine gas causes sub-acute or chronic poisoning. Therefore, rabbits that escape from fumigated warrens or those that are exposed to sub-lethal concentrations in deeper parts of the warren may only experience transient illness not permanent debilitation.
- Fumigation is considered to be less humane than poisoning with 1080. Therefore, it is desirable to fumigate only after a poisoning program when the density of rabbits is low. This minimises the number of rabbits that need to be killed by a less humane technique.

Non-target animals

- Fumigation of rabbit warrens is one of the most target-specific means of rabbit destruction and will have little impact on non-target species if used correctly.
- Fumigation must only be used in active, occupied warrens. If a warren appears to be empty or possibly occupied by a non-target species (e.g., wombats, lizards, snakes), fumigation must not be performed.
- There appears to be no significant risk of secondary poisoning if carcasses of gassed animals are consumed by non-target predatory or scavenger species.
- If using dogs to work an area prior to warren fumigation, the following should be observed:
    - Dog handlers must be experienced, and the dogs well trained, i.e., they must be easily controlled by a whistle or call, obey the handlers' commands and will not chase or attack non-target animals, including livestock. Dogs that are deliberately bred or trained to attack without provocation must not be used. Suitable breeds would

include terriers, Labradors and others that are keen to chase but unlikely to catch a rabbit.

- Handlers must not encourage dogs to attack and kill rabbits. Rabbits trapped in hollow logs etc. (where they are visible, but the dogs can't access them), should be shot (refer to *NSWRAB SOP8 Ground shooting of rabbits*).
- Rabbits inadvertently caught by dogs should be killed quickly and humanely either by shooting (with a single shot to the brain) or by cervical dislocation. Rabbits should never be left to die a slow death after being maimed.
- To ensure that dogs are not exposed to phosphine gas or allowed access to treated warrens, handlers must ensure that dogs are well restrained during and after fumigation.
- For more details refer to GEN002 *The care and management of dogs used for pest animal control.*

Workplace health and safety considerations

- Operators must strictly follow the directions on the approved label when using and storing aluminium phosphide tablets. They must not be used for any other purpose than the destruction of rabbits in active warrens.
- Fumigation must always be carried out by two trained persons and must not be carried out in wet conditions when it is likely that the tablets will become wet before insertion in the burrows. Use an application aid to insert tablets rather than by hand to prevent risk of snake bite.
- Phosphine is highly toxic to humans and can kill if the tablets are swallowed or the liberated gas is inhaled. Avoid contacting the skin with aluminium phosphide or breathing phosphine gas.
- If poisoning occurs go straight to a hospital or doctor WITHOUT DELAY and contact the Poisons Information Centre (Ph 13 11 26).
- Symptoms of overexposure to phosphine gas include headache, dizziness, nausea, and difficulty breathing. Severe exposure may damage liver, kidneys, lungs, and nervous and circulatory systems, and may cause death. If a person is exposed to phosphine gas, get them to fresh air immediately. If they are experiencing breathing difficulties give oxygen. If they have ceased breathing, apply artificial respiration using a one-way mask, air-viva or oxy-viva. Do not give direct mouth-to-mouth resuscitation if aluminium phosphide tablets have been swallowed.
- Appropriate personal protective equipment should be worn when using fumigant. This includes:
  - overalls
  - eye protection (e.g., chemical goggles or safety glasses)
  - elbow length PVC or rubber gloves; and
  - full-face respirator with combined dust and gas cartridge (canister) or breathing apparatus with air supply.
- If aluminium phosphide gets on skin, immediately wash area with soap and water.

- After use and before eating drinking or smoking, wash hands, arms and face with soap and water.
- After use, wash contaminated clothing and gloves.

For further information refer to the Material Safety Data Sheet (MSDS), available from the supplier, and the NSW DPI Vertebrate Pesticide Manual: https://www.dpi.nsw.gov.au/biosecurity/vertebrate-pests/publications/nsw-vertebrate-pesticide-manual

Equipment required

Fumigation tablets

Fumigants must be stored in the closed original container in a cool, dry, well ventilated, locked area out of the reach of children and unauthorised persons and away from buildings inhabited by humans, pets or livestock. Keep away from water and liquids which may cause immediate release of phosphine gas.

- Fumigation tablets contain 560 to 570 g/kg of aluminium phosphide that produces 330 g/kg phosphine gas. Each 3-gram tablet releases 1 gram of phosphine gas when exposed to moisture in the air or soil. The evolution of gas can be increased by adding extra water when the tablets are placed in the burrow.
- Phosphine gas is slightly heavier than air, colourless, and smells slightly of garlic.
- Phosphine generating fumigation tablets are produced under several brand names (e.g., Gastion®, Pestex®, Fumitoxin®, Phostoxin®) and are available from rural merchandise suppliers.
- Where possible, consider using all tablets within a container. Tablets exposed to moisture and resealed for storage can result in an explosive reaction when next opened. Containers should be opened in a safe direction away from operators.

Other equipment

- Personal protective equipment.
- Towel, soap, dish or bucket.
- First aid kit.
- Newspaper or paper towel.
- Water for moistening paper.
- A long-handled device (at least 1 metre long) for placing fumigant down the warren.
- Shovel or mattock for digging back and sealing burrows.

Procedures

Assessment of site and estimation of rabbit numbers

- To maximise effect on rabbit populations, a careful on-site risk assessment to confirm the need for fumigation and assess the suitability of the area should be undertaken before fumigation is commenced.
- Fumigation must only be applied to active, occupied rabbit warrens to be effective and safe. Evidence of active warrens may include fresh rabbit droppings, tracks, mounds, or diggings.
- If it is suspected that native wildlife are using the warren, their presence can be determined by using sand pads - a $1m^2$ area of raked earth or sand outside of the warren entrance- to detect and identify footprints.
- The density of rabbits on the site should be estimated using spotlight counts or thermal device and warren monitoring. The location and numbers of rabbits on neighbouring properties should also be approximated.
- Contact LLS for more information and advice on site assessment and monitoring of rabbit numbers.

Fumigation procedure

Always read the product label for specific directions on use.

Do not carry fumigants inside an enclosed vehicle.

- Fumigate when the weather is hot to ensure most rabbits are underground and the survival of rabbits above ground is low. Rabbits can be driven underground before fumigation by making loud noises or using dogs to work the area, chasing the rabbits into the warrens.
- Smoke blowing devices should be used to identify all openings and to ensure the warren is completely sealed
- Work in pairs. Start fumigation at the bottom of the creek line or depression and work uphill.
- Dig back the opening of the burrow so there is a 30 cm lip between the surface and the burrow. This exposes any branching tunnels and provides a solid shelf against which to back-fill soil.
- Place two aluminium phosphide tablets at least 60 cm into the burrow. Wrap the tablets in damp newspaper or paper towel to start the release of gas. To facilitate the easy placement of the tablet into the hole, a length of wire or piece of polythene pipe containing a push-rod can be used.
- The hole should then be filled, digging back the sides of the entrance and tamping down the soil. The ground should end up relatively flat to discourage opening up from the outside.
- The entire procedure, with two tablets and backfilling, should be repeated for each hole. Always work toward the windward side of the warren.

- It is essential that all entrances to the warren are sealed. Check under nearby scrub and fallen timber for any missed burrows.
- Complete decomposition of the tablets may take up to 72 hours if the humidity in the warren is low.
- Check for re-openings around one week after fumigating and treat again as necessary.

Assessing effectiveness

- The effectiveness of a fumigation operation should be monitored by recording the number of burrow entrances treated and then recording the number of re-opened entrances that need re-treated at subsequent visits. A follow–up visit and re-treatment should not be performed until at least 48 hours after the previous treatment. Repeat the procedure until no new burrows are found.

Procedural notes

More detailed information on diffusion fumigation using phosphine can be found in the NSW DPI Vertebrate Pesticide Manual: https://www.dpi.nsw.gov.au/biosecurity/vertebrate-pests/publications/nsw-vertebrate-pesticide-manual

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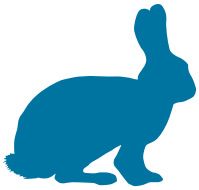

NSWRAB SOP5
Rabbit warren destruction by ripping

Background

Warren destruction by ripping is used to minimise the impact of the introduced European rabbit (*Oryctolagus cuniculus*) on agricultural production and the environment. In many areas of Australia, rabbits depend on warrens for shelter from climatic extremes, predator avoidance and also for successful breeding. Warrens are destroyed using ripping or, in rocky or inaccessible areas, explosives. Since rabbits do not readily dig new warrens, rabbit populations do not persist in areas where warrens are effectively destroyed, and re-colonisation is less likely.

Warrens are destroyed using a tractor or bulldozer fitted with single or multiple-tined rippers. The technique used will vary depending on local conditions such as soil type, position of warrens and type of equipment available. Ripping will be more humane when the number of rabbits in the warren is low and when powerful machinery is used to achieve complete disintegration of the warren, so that the rabbits are killed quickly. Because ripping gives long-term management of rabbit populations the need for repeated control operations is reduced.

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

- Warren ripping should only be used in a strategic manner as part of a co-ordinated program designed to achieve sustained effective control. Reducing and maintaining low rabbit numbers by a combination of control methods over time is more effective than repeated (seasonal) use of a single method.
- Where warrens are the principal shelter for rabbits, ripping is the most cost-effective and long-lasting method of control. It is a critical component of rabbit control programs especially in broadscale areas such as the rangelands.

- Ripping is best suited to large-scale operations. However, it may not be suitable in the following situations:
  - where locations are inaccessible to available equipment, e.g., on steep slopes, very rocky land, along fences or riverbanks, around trees
  - where rabbits inhabit scrub with few warrens
  - when there is a risk of soil erosion or damage to conservation areas.
- Ripping is most effective when rabbit numbers are already low, such as after a baiting program, drought or disease outbreak or at a time when rabbits are not usually breeding. The aim of ripping is to destroy the warren and prevent re-invasion; not to kill large numbers of rabbits.
- Sandy soils should be ripped when dry so that the collapse is more complete, and the soil will flow into the deeper tunnels. With heavier clay soils, it is best to rip when they are slightly damp. Ripping clay soils when they are too dry will result in large lumps of soil creating pockets where rabbits may survive and continue to live in the modified warren.
- Clearing surface harbour such as blackberry stands, hollow logs and rock piles may need to be performed prior to warren destruction to enhance the effectiveness of control programs and to slow re-colonisation.
- Dogs can be used to chase rabbits underground prior to warren ripping. However, it is unacceptable, and in some jurisdictions illegal, to set a dog onto a rabbit with the intention of catching or killing.
- Clearing of native vegetation or disturbance of sites with Aboriginal or archaeological significance is subject to compliance with various local, State and Commonwealth legislation. If in doubt, always check with the appropriate authority before undertaking warren and harbour destruction programs.
  - See NPWS, LLS and the Aboriginal Heritage Information Management System (AHIMS) for more information.

Animal welfare implications

Target animals

- Ripping of the warren causes it to collapse and the rabbits are usually crushed or suffocate. The weight of the soil prevents effective movement of the rabbit's diaphragm resulting in asphyxia.
- When complete destruction of the warren is achieved, time to death is thought to be quick. This is most likely in areas with fairly loose soil and where powerful machinery is used.
- Failure to cause complete collapse in deep warren systems may result in some rabbits becoming trapped in partly destroyed tunnels and then suffocating or starving over a long period of time. Some survivors may be able to dig out and re-open the warren. It is essential that the tunnel system is completely destroyed so that all rabbits die as quickly as possible and there is little chance of warrens being re-opened.

- Direct mechanical wounding can occur from the ripping tines. If rabbits are found that are injured but not killed, these must be destroyed by a shot to the brain or by cervical dislocation. Rabbits found injured above ground after ripping should not be left to die slowly.
- It is more humane to perform ripping when rabbit numbers are at their lowest, e.g., after drought, disease, warren fumigation or poison baiting or when they are not breeding. This means that lower numbers of rabbits will be killed by this relatively inhumane technique.
- Ripping also affects rabbits that are not inside the warren at the time by depriving them of shelter from extreme heat, cold and predators.

Non-target animals

- Ripping can kill animals other than rabbits if they are inside the warren at the time. If a warren appears to be vacated by rabbits and possibly occupied by non-target species (e.g., wombats and snakes), warren destruction must not be performed.
- Warren destruction may also have a negative impact on non-target species that use the warren or surrounding harbour, by removing their protection from extreme heat, cold and predators. Harbour such as native vegetation, logs and briars that are used by rabbits may also be an important habitat for native animals including amphibians, reptiles, small mammals and ground-dwelling or ground-feeding birds. The benefit of rabbit harbour removal should be assessed against the risk to native wildlife, especially in conservation areas.
- Non-target native animals that are inadvertently injured or displaced during the ripping or harbour removal procedure should be taken to a registered wildlife carer or veterinarian for assessment.
- If using dogs to work an area prior to warren destruction, the following should be observed:
    - Dog handlers must be experienced, and the dogs well trained, i.e., they must be easily controlled by a whistle or call, obey the handlers' commands and will not chase or attack non-target animals including domestic livestock. Dogs that are deliberately bred or trained to attack without provocation must not be used. Suitable breeds would include terriers, Labradors and others that are keen to chase but unlikely to catch a rabbit.
    - Handlers must not encourage dogs to attack and kill rabbits. Rabbits trapped in hollow logs etc. (where they are visible, but the dogs can't access them) should be shot (refer to *NSWRAB SOP8 Ground shooting of rabbits*).
    - Rabbits caught by dogs should be killed by a shot to the brain or by cervical dislocation. Rabbits should never be left to die slowly after being maimed.
    - Ensure that small dogs are not inside the warren before ripping takes place. They should be well restrained during ripping to prevent them from entering the warren.
    - For more details refer to *GEN002 The care and management of dogs used for pest animal control*.

Workplace health and safety considerations

- General safety precautions for using agricultural machinery must be followed. People can be killed or seriously injured falling from moving tractors, being run over by tractors, or being crushed when a tractor rolls sideways or backwards.
- Tractors must be fitted with an appropriate rollover protection structure.
- Operating heavy machinery on sloping ground can be dangerous. The maximum slope that can be ripped varies with the nature of the surface and each site must be accurately judged for safety. A measuring device should be used to assess the degree of slope if unsure of the limits. Rough ground will reduce the slope suitable for ripping. Tractors are unsuitable on steep slopes, whereas tracked machinery, such as bulldozers, are more stable.
- Further information on workplace health and safety aspects of operating heavy machinery can be obtained from SafeWork NSW.

Equipment required

Machinery

- The type of equipment used for ripping will depend on soil type, size and topography of area to be treated, cost and availability. From an animal welfare perspective, more powerful equipment is preferred as the warrens are more likely to be completely destroyed.
- Rubber-tyred conventional tractors are best suited for treating areas with low numbers of warrens on relatively flat and non-clay soils. Smaller tractors are more cost-effective for follow-up ripping and where travel time between warrens is high relative to the time spent ripping.
- Steel or rubber-tracked equipment may be more efficient for areas with large numbers of warrens on steeper slopes. Large machinery is most cost-effective for initial ripping operations.
- A ripping tine on an excavator (ripper arm) can be effective in awkward locations.
- Rippers with single, double or triple tines can be used depending on the tractor available and the soil type. If multiple tine rippers are used ripped lines should be no more than 50cm apart.

Procedures

Assessment of site and estimation of rabbit numbers

- To maximise effect on rabbit populations, a careful on-site risk assessment should be undertaken. Map the location of all warrens (include active/inactive and accessible/inaccessible warrens), note the presence of surface harbour and topographic features. For large areas, experienced spotters on motorbikes can log the location of warrens using GPS before warren destruction commences.

- The density of rabbits on the site should be estimated using spotlight or thermal counts and warren monitoring. The location and numbers of rabbits on neighbouring properties should also be approximated. If the density of rabbits is high, it is best to poison or fumigate beforehand so that few rabbits are left.
- If it is suspected that native wildlife are using the warren, their presence can be determined by using sand pads - a $1m^2$ area of raked earth or sand outside of the warren entrance- to detect and identify footprints.
- Contact LLS for more information and advice on site assessment and monitoring of rabbit numbers.

Ripping procedure

- Clear warrens of logs, rocks, woody weeds and large shrubs etc. Take care not to endanger any native wildlife that may be using the harbour.
- It is important to drive any rabbits in the area underground before ripping takes place. This can be achieved by making loud noises or using dogs to work the area, chasing the rabbits into the warrens. Most rabbits will be underground during the middle of the day especially when the weather is hot. It advisable not to use dogs following a 1080 program. If large numbers of surface rabbits are surviving, consider a second baiting program prior to ripping.
- All warrens with open entrances should be ripped even if they are not currently active. Explosives may be needed if warrens are inaccessible (refer to *NSWRAB SOP7 Rabbit warren destruction using explosives*).
- Rip the warrens to a depth of at least 900 mm and at least 4 metres beyond the edge of the warren to destroy burrows that have entrances on the edge of the warren and lead outwards. The deeper the ripping the greater is the destruction of the warren system.
- Cross-ripping may be necessary. Rip one way; then cross rip at right angles to the first rip.
- Smooth/back-blade the ripped warren to compact the soil surface and make it less attractive for rabbits to dig back in. Extensively ripped areas can be sown with pasture seed to hasten re-vegetation and prevent soil erosion on sloping ground.

Assessing effectiveness

- The effectiveness of warren ripping should be monitored by noting the presence of re-opened entrances 2-3 days after treatment. If many burrows have been re-opened you will need to rip again, but if there are only a few, then fumigation may be a more economical option.

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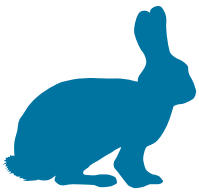

NSWRAB SOP6 Trapping of rabbits using padded-jaw traps

Background

The introduced European rabbit (*Oryctolagus cuniculus*) has a significant impact on agricultural production and the environment. Trapping is not considered an effective or efficient rabbit control technique, although it is occasionally used in areas with small, isolated rabbit populations.

Where foot-hold traps are to be used, padded-jaw traps are the more humane alternative, and hence, steel-jaw traps are prohibited in NSW.

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 is time consuming and labour intensive and is an inefficient method for large-scale rabbit control in Australia.
- Trapping is ineffective in significantly reducing rabbit populations or even maintaining them at low levels. 'Mopping-up' or maintenance control of rabbits is best done using re-ripping, baiting and fumigation.
- Traps have the potential to cause significant injuries, suffering and distress so should only be used when there is no suitable alternative.
- Humane and successful trapping requires extensive training and experience. Trapping by inexperienced operators can result in 'trap-shy' rabbits that are difficult to catch because they have previously escaped from a carelessly prepared and presented trap. Similarly, poor technique can result in greater rates of injuries and non-target captures.
- Selection of appropriate traps and trap sites will maximise the chance of capture and minimise the distress caused to target and non-target animals.
- Every effort must be made to avoid target and non-target deaths from factors such as exposure, shock, capture myopathy and predation.
- Trapping using foot-hold traps is not suitable in urban areas.

- Traps must be used in accordance with relevant state legislation (*Prevention of Cruelty to Animals Act 1979 s 23*). In NSW, padded-jaw traps are permitted and use of steel-jaw traps is prohibited.
- Once trapped, rabbits are euthanased by neck (cervical) dislocation or stunning, with a sharp blow to the back of the head, followed by neck dislocation. Neck dislocation requires training to ensure that unconsciousness is rapidly induced.

Animal welfare implications

Target animals

- Traps must be inspected at least daily to prevent suffering and possible death from exposure, thirst, starvation, predation and/or shock.
- It is preferable to set up traps at sites where vegetation can provide shade and shelter. However, sites should be avoided where there is a risk of the trapped animal becoming entangled in understorey vegetation, which could result in dislocation of the limb.
- Where possible, trapping should be avoided when adverse weather conditions threaten the welfare of trapped animals.
- Foot-hold traps cause pain and distress in three ways: pressure of the trap jaws on the captured limb; restraint of the animal; and injuries sustained in trying to escape. Padded–jaw traps cause less trauma than unpadded traps, but injuries will inevitably occur to some rabbits. These range from swelling of the foot and lacerations to dislocations and fractures. To reduce capture distress, trapped rabbits must be destroyed as quickly and humanely as possible following capture.
- Trapped rabbits may also be preyed upon by foxes, cats and wild dogs causing significant distress.
- Captured animals must be approached carefully and quietly to reduce panic, further stress and risk of injury.
- If lactating females are caught in a trap, reasonable efforts should be made to find dependent kittens and kill them quickly and humanely either by neck dislocation or manually applied concussive blow to the head.
- Trapped rabbits are euthanased by neck (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.

Non-target animals

- Traps are not target specific, so a wide range of non-target species may be caught. These can include birds (e.g., ravens, magpies, and pied currawongs), kangaroos, wallabies, hares, echidnas, goannas, wombats, possums, bandicoots and sheep.

- Different groups of non-target animals suffer different levels of injury and distress. For example:
  - wallabies often experience serious injuries e.g., dislocations, due to the morphology of their limbs and because they become very agitated when restrained.
  - goannas (e.g., lace monitors) also suffer from dislocations and can die from hyperthermia.
  - birds and other small animals may be preyed upon by foxes, cats and wild dogs while caught in traps.
- Traps must not be set near areas such as waterholes or gully crossings that are regularly frequented by non-target species.
- Live non-target animals caught in traps must be examined for injuries and signs of illness or distress and dealt with as follows:
  - Animals which are unharmed or have only received minimal injuries such as minor cuts or abrasions should be immediately released at the site of capture.
  - Animals which have more severe injuries or that 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 that have 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.*
- If a domestic pet is caught, it should be taken to the nearest veterinarian, animal shelter or council pound where it can be examined for injuries, scanned for a microchip and the owner contacted, or assessed for suitability for re-homing.
- If wild dogs or foxes are caught in the trap, they must be euthanased quickly and humanely by a shot to the brain using an appropriate firearm (refer to *NSWDOG SOP1 Trapping of wild dogs using padded-jaw traps* and *NSWFOX SOP5 Trapping of foxes using padded-jaw traps*).

Workplace health and safety considerations

- Operators should be wary of the risks of injury when placing and setting traps. Protective clothing, boots and leather gloves may help prevent injuries from shovels, hammers and trap jaws.
- Long sleeved, heavy duty overalls and long trousers should be worn to protect the operator from being scratched by rabbits during handling. Protective gloves may be used if required, although these may hinder dexterity.
- Operators must be protected by tetanus immunisation in case of infection of scratches and bites.

- Good personal hygiene is encouraged when handling wild animals. Routinely wash hands and other skin surfaces contaminated with faeces, blood and other body fluids.

Equipment Required

Traps

- Approved padded-jaw traps suitable for catching rabbits must be used, e.g., Victor Soft-Catch trap no.1. Note that it is illegal to use steel-jawed traps in NSW.
- Traps must have the following characteristics:
  - The jaws have no teeth.
  - The jaws are offset to increase the space between them when closed (i.e., a gap (minimum 6mm) remains when the jaws are closed).
  - Each jaw has a rubber-like pad to cushion the impact of the jaws on the limb and to prevent the limb sliding out.
- All traps should be checked for damage, sharp surfaces and malfunctions (e.g., loose rubber pads) before they are taken into the field.
- Traps should be handled in a way that eliminates contamination with human-related scents. Gloves should also be used when handling and setting traps.
- Traps should also have:
  - A spring placed in the anchor chain to act as a shock absorber, reducing the chance of dislocation of the captured limb. Swivels are located on both ends of the anchor chain allowing the trap to twist as the animal struggles to escape.
  - Pan tension adjusted to suit the target species so that an appropriate force is required to depress the pan and trigger the trap. This minimises the chance of non-target animals setting off the trap.

Firearms and ammunition

- Smaller calibre rifles such as a .22 rimfire, with hollow- or soft-point ammunition, are suitable for euthanasia at short range (within 5 metres)
- 12-gauge shotguns with shot sizes of BB or AAA may also be used.

Procedures

Selection of trap sites

- Traps should be set only in areas where rabbits are known to be active, e.g., near entrances to warrens and burrows, around hollow logs, dung heaps or earth mounds. Do not set traps near fences and other objects such as small trees, bushes etc. in which the trapped rabbit (or non-target) may become entangled.
- Do not set traps where non-target captures (including livestock) are likely.

- The location (GPS coordinates) of all trap sites and number of traps must be accurately recorded and marked. This information should be readily available to others in case the trapper is unable to return to check the traps.
- The recording of target and non-target captures as well as injuries can also be valuable in the constant improvement of trapping technique.
- On-line apps such as FeralScan may assist in these processes: https://www.feralscan.org.au/.
- Signage should be deployed on public lands to advise that traps are being used in the area.

Setting of traps

- Traps should be set at the end of each day and checked early each morning. If traps are left set during the day, they should be checked again in late afternoon.
- Before setting each trap ensure that it is functioning properly.
- Traps should only be anchored to stakes or fixed objects if there is a shock absorbing device such as a spring fitted to the anchor chain and a swivel attaching the chain to the trap. It is recommended to use a short length of chain (approx. 30 to 50 cm).
- Set the trap and place into position in the hole in the ground. Ensure that surrounding shrubs or debris will not interfere with the trap mechanism.
- Carefully camouflage the area around the trap with leaves, grass debris etc. but leave a slightly cleared area (10-15cm) over the area of the plate.

Euthanasia of rabbits

- Trapped live rabbits must be euthanased as soon as possible after capture. The most appropriate technique is either (1) neck dislocation (for smaller rabbits <1kg), or (2) stunning, by a sharp blow to the back of the head, followed by neck dislocation (for larger rabbits).
- Where shooting is the most appropriate means of euthanasia, smaller calibre rifles such as a .22 rimfire, with hollow- or soft-point ammunition, are suitable for use at short range (from 5-25cm away).

Neck (cervical) dislocation

- This technique should only be used on smaller rabbits (<1 kg). In larger rabbits, greater muscle mass in the neck region makes manual cervical dislocation physically more difficult; accordingly, it should be performed only by individuals who have demonstrated proficiency in euthanasing heavier animals or preferably, after the rabbit has been stunned by a blow to the head (see below).
- Hold the rabbit head downwards by grasping the hind legs in one hand; turn the palm of the other hand towards the rabbit head and take the neck between the thumb and index finger or between the index and middle fingers. Push down so that the neck is stretched, and the head moves backwards, until dislocation is felt. Although considerable kicking and other muscular movements may take place, once consciousness is lost, the animal is not sensitive to pain.

- Assisted manual cervical dislocation devices can also be used

Stunning followed by neck (cervical) dislocation

- Larger rabbits (>1 kg) will need to be stunned prior to applying neck dislocation.
- Stunning is done by holding the rabbit up by the hind legs and swinging it firmly and quickly in an arc so that the back of its head hits a hard surface such as a rock or post. Alternatively, a single, heavy, sharp blow can be delivered to the back of the skull behind the ears suing a blunt metal or heavy wooden bar.
- After stunning to render the animal insensible, dislocate the neck using the technique described above.
- Death of animals should always be confirmed by observing a combination of the following:
  - no heartbeat
  - no breathing
  - no corneal reflex (no blinking when eyeball is touched)
  - no response to a toe pinch (a firm squeeze of the pad or large toe).
- Euthanasia should be only be performed by trained operators. Acquiring (or re-acquiring) the skills to use physical methods of euthanasia may be accomplished by practising the techniques on dead animals, preferably those recently killed, and be subject to close scrutiny by those with experience in the method.

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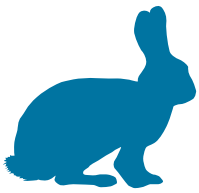


NSWRAB SOP7
Ground shooting of rabbits

Background

The introduced European rabbit (*Oryctolagus cuniculus*) has a significant impact on agricultural production and the environment. Shooting of rabbits is undertaken by government vertebrate pest control officers, landholders and professional or experienced amateur shooters. Although shooting may be useful when rabbit numbers are already low, it is labour intensive and is not effective as a general rabbit control method. Shooting is usually done at night with the aid of a spotlight but can also be conducted during the day.

Shooting is a humane method of destroying rabbits when; it is carried out by experienced, skilled and responsible shooters; the animal can be clearly seen and is within range; and, the correct firearm, ammunition and shot placement is used.

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

- Shooting should only be used in a strategic manner as part of a coordinated program designed to achieve sustained effective control.
- Shooting is sometimes used as an adjunct to other control methods. However, it is not considered to be effective for broadacre control.
- Shooting may have limited use in controlling light rabbit infestations, but it is ineffective in significantly reducing rabbit populations or even maintaining them at low levels.
- It is most suited to areas with little cover. Shooting should be concentrated in rabbit feeding areas, normally indicated by shortly cropped grass with rabbit scratchings and droppings.
- Ineffective shooting may produce rabbits that are ‘shy’ of both guns and spotlights; therefore, several months should pass before any further shooting operations are undertaken. Thermal devices can be used in place of spotlights to overcome this issue.
- Shooting in the vicinity of human habitation requires a risk assessment process and may require additional equipment such as thermal devices and silencers (when permitted).

- Shooting of rabbits should only be performed by skilled operators who have the necessary experience with firearms and who hold the appropriate licences and accreditation.
- 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

- 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 destroying rabbits. On the other hand, if inexpertly carried out, shooting can result in wounding that may cause considerable pain and suffering.
- Shooting must be conducted in a manner that aims to cause immediate insensibility and painless death. The appropriate firearms and ammunition must always be used.
- When shooting an animal, 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.
- Head (brain) or chest (heart-lung) shots must be used. Shooting at other parts of the body is unacceptable.
- The shooter must be certain that each animal is dead before another is targeted.
- Wounded rabbits must be located and dispatched as quickly and humanely as possible with a second shot, preferably directed to the head. If left, wounded animals can suffer from the disabling effects of the injury, from sickness due to infection of the wound, and from pain created by the wound.
- If lactating rabbits are shot, reasonable efforts should be made to find dependent kittens and kill them quickly and humanely.

Non-target animals

- Shooting is relatively target specific and does not usually impact on other species. However, there is a risk of injuring or killing non-target animals, including livestock, if shots are taken at movement, colour, shape, sound or, when spotlighting, eye reflection ('eye shine').
- Only shoot at the target animal once it has been positively identified. Also, never shoot over the top of hills or ridges as other animals may be out of sight beyond the hill in line with the fall of shot.
- Shooting should be used with caution around lambing paddocks as it may disturb the lambing flock and cause mismothering. Also avoid paddocks containing horses or 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 an animal is being shot. The line of fire must be chosen to prevent accidents or injury from stray bullets or ricochets.
- Shooting from a vehicle is potentially dangerous. An agreed safety procedure between the shooter and others in the vehicle must be in place to ensure that people do not enter the field of fire or disturb the taking of a shot.
- 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.
- Warm, comfortable clothing and stout footwear is recommended, especially when shooting at night.

Equipment required

Firearms and ammunition

- Centre-fire rifles are preferred since they provide the advantage of a flatter trajectory and higher projectile energy; however, the .17HMR rimfire is also suitable as it delivers enough energy at the target for smaller animals, is flat shooting and accurate out to at least 80 metres.
- The minimum firearm and ammunition requirements for the ground shooting of rabbits are:
    - calibre: .172 inches
    - bullet weight: 17 grain
    - muzzle energy: 245 ft-lbs.

- Examples of acceptable firearm and ammunition combinations with maximum shooting distances are included in the table below:

Cartridge	Bullet weight (gr)	Muzzle velocity (ft/sec)	Muzzle energy (ft-lbs)	Maximum distance (metres)
.17HMR	17	2550	245	80
.22 Hornet	45	2665	710	100
.222 Rem	50	3345	1242	200
.223	55	3240	1282	200
.22/250	55	3680	1654	200

Source: https://press.hornady.com/assets/pcthumbs/tmp/1410995911-2019-Standard-Ballistics-Chart.pdf

- Rifle ammunition must be of an expanding type designed to deform in a predictable manner, e.g., hollow point, soft-point, polymer tip.
- 12-gauge shotguns with heavy shot sizes of No. 2, SSG, BB or AAA can also be used at closer ranges, up to 20 metres from the target animal.
- The accuracy and precision of firearms should be tested against inanimate targets prior to the commencement of any shooting operation.

Other equipment

- If shooting at night, a handheld spotlight, or a helmet or headband mounted spotlight or thermal device.
- First aid kit.
- Lockable firearm box.
- Lockable ammunition box.

Procedures

Shooting at night

- Most shooting of rabbits is done at night with the aid of a spotlight to locate them while they are feeding or are away from cover. This method relies on the ability of the shooter to approach the animal until it is in shooting range.
- It is recommended that during daylight hours shooters familiarise themselves with the terrain they are to cover. Take note of potential hazards and also any landmarks that may help with navigation.
- Rabbits must NOT be shot from a moving vehicle or other moving platform as this can significantly detract from the shooters' accuracy. Ensure you are in a firm, safe and stable position before taking a shot.

- Shooting over the top of hills or ridges produces unacceptable risk. Be aware that the spotlight only illuminates a small portion of the danger zone and only a fraction of the projectile's range.
- When illuminated by the spotlight, rabbits have a pink/red eye shine.

Shooting in the day

- Rabbit activity is mainly nocturnal or crepuscular, so shooting during the day is less effective than shooting at night with a spotlight or thermal device.
- If dogs are used to flush rabbits out from warrens or vegetation, they must be adequately controlled to prevent them from attacking rabbits. Dogs should only be trained to drive rabbits from cover, not to capture or attack them. For further information on the use of dogs refer to *GEN002 The care and management of dogs used for pest animal control*.
- Daylight drives are not selective, so there is a risk of encountering other animals, including pet cats, which can be mistaken for a rabbit and shot. Capture of rabbits or non-target species by dogs is unacceptable on animal welfare grounds.

Target animal and shot placement

- 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 rabbit should only be shot at when:
  - it can be clearly seen and recognised
  - it is within the effective range of the firearm and ammunition being used
  - a humane kill is probable. If in doubt, do NOT shoot.
- The shooter must aim either at the head, to destroy the major centres at the back of the brain near the spinal cord or, at the chest, to destroy the heart, lungs and great blood vessels. This can be achieved by one of the following methods (see also Figure 1).

Head Shot (this is the preferred shot placement)

Frontal position (front view)

- The firearm is aimed at the centre of the head between the eyes.

Temporal (side view)

- The firearm is aimed at a point between the eye and the base of the ear directed towards the opposite eye.

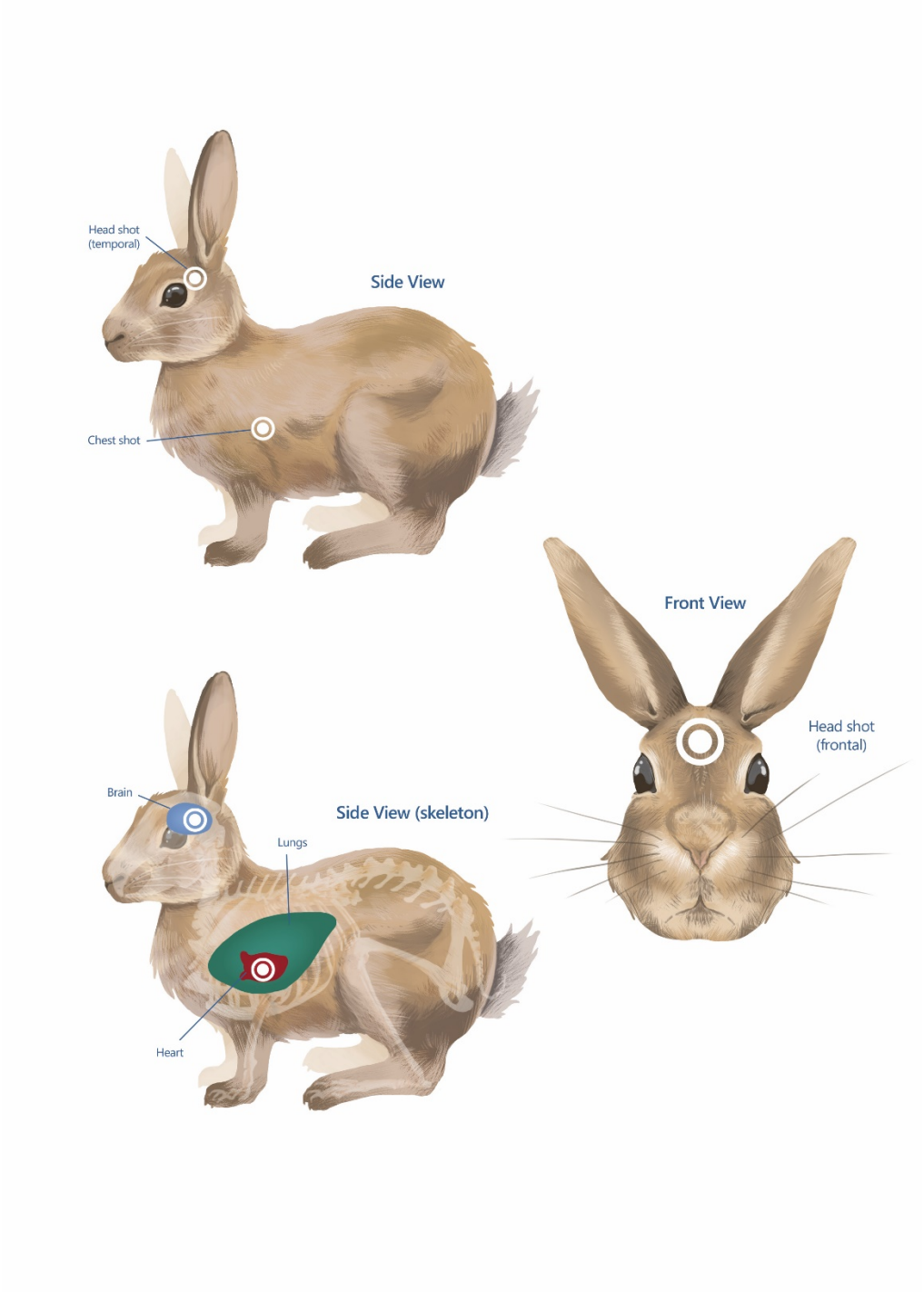
Chest Shot

Side view

- The firearm is aimed horizontally slightly to the rear of the shoulder.

- When using a rifle, the target animal must be stationary and within a range that permits accurate placement of the shot. Shots to the head are preferred over chest shots.
- When using a shotgun, the target animal may be stationary or mobile, but must be no more than 20 metres from the shooter. The pattern of shot should be centred on the head or chest. It is essential that the distance to the target animal is accurately judged. To achieve adequate penetration of shot, the animal must be in range. It is recommended that shooters practice estimating distances before a shooting operation.
- The target animal should be checked to ensure it is dead before moving on to the next animal. Death of shot animals should always be confirmed by observing the following:
  - no heartbeat
  - no breathing
  - no corneal reflex (no blinking when eyeball is touched)
  - no response to a toe pinch (a firm squeeze of the pad or large toe).
- If death cannot be verified, a second shot to the head should be taken immediately.

Figure 1: Shot placement for rabbits



Note that shooting an animal from above or below the horizontal level as depicted here will influence the direction of the bullet through the body. Adjustment to the point of aim on the external surface of the body may need to be made to ensure that the angled bullet path causes extensive (and therefore fatal) damage to the main organs in the target areas.

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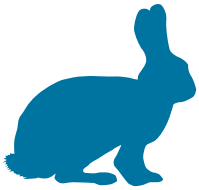

NSWRAB SOP8 Bait delivery of rabbit haemorrhagic disease virus (RHDV)

Background

Rabbit haemorrhagic disease virus (RHDV) is used to minimise the impact of the introduced European rabbit (*Oryctolagus cuniculus*) on agricultural production and the environment. RHDV causes rabbit haemorrhagic disease (RHD), an acute, highly contagious disease that infects wild and domestic rabbits. In most adult rabbits the disease progresses rapidly from fever and lethargy to sudden death within 48-72 hours of infection. The virus causes acute liver damage with resultant blood clotting abnormalities. Death occurs due to obstruction of blood supply in vital organs and/or internal haemorrhages. The virus has a high mortality rate, killing upwards of 70% of susceptible rabbits.

The deliberate release of RHDV into wild rabbit populations can be used to initiate outbreaks in an attempt to maximise the impact of the disease. There are now two RHDV virus types present in Australia. RHDV1 (Czech 351 strain) was first registered as a biological control agent in Australia in 1996. It is now registered for use as a viral suspension that can be delivered via carrot or oat bait. RHDV2 was first identified in the Australian rabbit population in May 2015 after first appearing in Europe in 2010. The epidemiology, pathology and diagnosis is the same as RHDV1; however, RHDV2 is not species specific. It infects both European rabbits and a number of hare species; although its effectiveness in the European hare (*Lepus europaeus*), Australia's only hare species, is unknown. It is not known how RHDV2 entered Australia.

RHDV1 is now prevalent in the majority of wild rabbit populations in Australia and high levels of immunity to the virus occur periodically. It is not recommended to release RHDV1 into a population of rabbits with high immunity. RHDV1 K5 (Korean strain) is a naturally occurring variant of RHDV1, registered as a biological control agent in Australia and released in March 2017. The endemic non-pathogenic rabbit calicivirus in Australia (RCV-A1) can provide some cross-protection to RHDV and reduce the likelihood of death of rabbits contracting other strains of RHDV.

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

- Introduction or 'seeding' of RHDV into rabbit populations is used as part of an integrated approach to rabbit management and is not meant to be used as a stand-alone method.
- Where RHDV is used as a control agent, follow-up control of remaining rabbits should be undertaken to ensure long-term effects.
- Release of RHDV should take into account the level of existing population immunity, rabbit breeding patterns including presence of young rabbits, natural spread of the virus and insect activity.
- Do not release RHDV into breeding populations. Younger rabbits can become infected with RHDV but are less likely to die as a result of RHD, particularly in the presence of maternal antibodies.
- As RHD is now prevalent in the majority of Australian rabbit populations, high levels of immunity to the virus is expected to occur periodically. Attempting controlled release of the virus in a population of rabbits with high immunity may have minimal impact.
- Populations of rabbits visibly affected by myxomatosis should not be baited with RHDV because they are less likely to succumb to RHD.
- Bait delivery of RHDV has been shown to be more effective in reducing rabbit numbers compared to the original inoculation technique that is no longer used in NSW. This is thought to be due to the larger numbers of rabbits that are initially exposed to the virus. Also, bait delivery is not as labour intensive or costly as inoculation and allows managers to more effectively target populations when they are most susceptible.
- Bait delivery of RHDV is also considered more humane than the inoculation method as rabbits do not need to be caught. Capture, handling and restraint are significant stressors for wild rabbits that can lead to disruption of social structure and also debilitation and sometimes death.
- Baiting of rabbits with RHDV can only be carried out under conditions set down in a specific permit issued by the Australian Pesticides & Veterinary Medicines Authority (APVMA) under Commonwealth legislation (*Agricultural and Veterinary Chemicals Code Act 1994*).
- In NSW, RHDV must also be used in accordance with the Pesticide Control (Rabbit haemorrhagic disease virus) Order
- RHDV suspension is a restricted chemical product (under Regulation 45 of the Agricultural and Veterinary Chemicals Code Regulations 1995). This listing requires special precautions in the preparation, handling, storage and use of RHDV-treated baits, along with specific regulations regarding labelling or availability.
- Handling of RHDV suspension and preparation of baits must only be performed by authorised persons who have the appropriate training as specified in the Pesticide Control (Rabbit Haemorrhagic Disease Virus) Order.
- Prepared RHDV baits can only be obtained through authorised government agencies (e.g., LLS).

Animal welfare implications

Target animals

- RHD is an acute, highly infectious usually fatal condition that affects domestic, farmed and wild rabbits of the species *Oryctolagus cuniculus*.
- In most rabbits, death from RHD is sudden. Some animals show no signs of illness prior to death whilst others will have elevated temperature, anorexia, apathy, dullness, prostration and reddened eyes. Respiratory signs (e.g., rapid respiration, bloody nasal discharge) and occasionally nervous signs (e.g., convulsions, paralysis, squealing) may be seen in the later stages. 5 to 10% of rabbits may show a chronic or subclinical course of disease. These animals may have jaundice, weight loss and lethargy for up to 1 to 2 weeks before dying or recovering.

Non-target animals

- All rabbits in Australia are derived from the European rabbit (*Oryctolagus cuniculus*) and are therefore potentially susceptible to infection. Farmed and pet rabbits should be vaccinated against RHDV. Vaccinations are available from veterinary practitioners. There is no evidence that RHDV causes infection in other species of native and domestic mammals and birds.

Workplace health and safety considerations

- Operators using RHDV must strictly follow the directions on the approved label, the Pesticide Control (Rabbit haemorrhagic disease virus) Order and the NSW DPI Vertebrate Pesticide Manual when preparing for use, using, storing, transporting or disposing of the virus.
- Currently registered RHDV products only affects European rabbits. However, due to the presence of rabbit and viral proteins in the product, it is possible that accidental administration of the product to an operator could be accompanied by an adverse allergic reaction. When mixing the virus in feed material it is advisable to wear gloves and a face shield to prevent contact of the virus with skin, eyes and mucous membranes.
- Appropriate personal protective equipment, including cotton overalls, water-impermeable gloves and a face mask or safety glasses, should be worn when preparing and handling RHDV suspension and treated baits.
- Thoroughly wash exposed skin with soap and water. Wash contaminated clothing and gloves.
- If poisoning occurs, contact a doctor or the Poisons Information Centre (Ph 13 11 26).
- For further information refer to the Material Safety Data Sheet (MSDS), available from the supplier.

Equipment required

Treated baits

- Treated bait is prepared by the application of RHDV suspension to carrots or oats in an enclosed mixing device that meets the standard requirements for 1080 bait mixing.
- Oats should be standard intact oats and carrots should be good quality and freshly diced. One vial of product is used per 15kg of freshly diced carrots OR 6kg grain.
- Prepare the viral solution as per the product label.
- Place the feed material in the mixer, add the prepared viral solution via a fine spray from the spray nozzles and then gently mix while tumbling in the sealed mixing device.
- Once mixed, transfer the treated bait material to appropriately labelled, sealable plastic containers or heavy-duty plastic bags that have significant strength to prevent damage to bait or leakage.
- Store treated baits in a cool, shaded area until ready for use.
- Treated baits should be used within 24 hours of preparation.
- Equipment used to prepare treated baits should be decontaminated after use by rinsing with 0.5% sodium hypochlorite. After rinsing, wash thoroughly with excess water and allow equipment to dry.

Other equipment

- Personal protective equipment (including water-impermeable gloves, face shield, overalls, boots etc.).
- Towel, soap, dish or bucket.
- First aid kit.
- Plastic 'sharps' disposal container for disposal of needles and other sharps.
- Appropriately labelled and leak-proof containers for storing treated bait – refer to permit for specifications.
- 0.5% sodium hypochlorite for decontamination of equipment etc. (e.g., a 1 in 20 dilution in water of household bleach solution containing 10% hypochlorite).
- Bait mixer.
- Carrot cutter (if required).

Suppliers of RHDV

Vials of RHDV are available for purchase to authorised government agencies from NSW Department of Primary Industries, Elizabeth Macarthur Agricultural Institute, Woodbridge Road, Menangle, NSW, phone 02 4640 6333.

Procedures

Always follow the directions on the approved label, the Pesticide Control (Rabbit haemorrhagic disease virus) Order and the NSW DPI Vertebrate Pesticide Manual when preparing for use, using, storing, transporting or disposing of the virus.

Assessment of site and estimation of rabbit numbers

- Warrens, rabbit harbour and scratching and feeding areas should be located to ensure accurate placement of bait.
- The density of rabbits on the site should be estimated using spotlight counts and warren monitoring. The location and numbers of rabbits on neighbouring properties should also be approximated.
- Contact your local vertebrate pest control authority for more information and advice on site assessment and monitoring of rabbit numbers.

Free-feeding

- Perform free-feeding of at least two feeds with carrots or three feeds for oats. Free-feeding of non-treated bait is an essential step to allow rabbits to become accustomed to eating bait material. It also enables an estimation of amount of treated bait required and assessment of any non-target uptake.
- The rate of bait for free-feeding should be appropriate to the local rabbit density, typically 2 to 5kg/km for oats and 15 to 20kg/km for carrots.
- Distribute free-feeds by broadcast or by trailing.

Placement of treated baits

- Broadcast the treated bait at approximately 10% of the rate applied in the final night of free-feeding.
- Lay the treated bait in or around a small number of warrens in the area targeted for a RHD outbreak.
- If treating individual warrens, select 3-4 within targeted area and apply treated feed by hand around warren entrances. Apply a maximum of 5kg treated carrot or 2kg treated oats per warren.
- Do not apply treated bait to crops or in situations where livestock may have access to the bait.
- The treated baits should be laid as soon as possible after preparation and on the day obtained. It is preferable to lay baits in the evening as rabbits are active between dusk and dawn.
- Equipment used to prepare and distribute the treated feed should be decontaminated at the end of each day use by rinsing with 0.5% sodium hypochlorite. After rinsing, wash thoroughly with excess water and allow equipment to dry.

Procedural notes

Read product label for more detailed information

Preparation and storage of RHVD inoculum

- The viral suspension should be prepared and stored according to the directions on the label.
- The contents of the vial should be used within 48 hours of initial opening.
- Unused vials of virus should be discarded into contaminated waste containers for appropriate disposal.

Disposal of contaminated waste

- Any needles /sharps should be immediately place in a designated and appropriately labelled 'sharps' container.
- Used vials and syringes should be soaked in 0.5% sodium hypochlorite prior to disposal by burial in a local authority landfill.
- All bags used for storing bait must be destroyed by deep burial.
- Sharps containers should be conveyed to a disposal facility equipped for the disposal of biomedical waste. Contact your local waste reduction and disposal services for more information.

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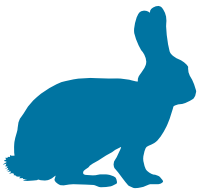

NSWRAB SOP9 Use of the R3 Unit (propane-oxygen device)

Background

The R3 Unit (formerly called the Rodenator) is a gas explosive device that pumps a calibrated mixture of propane (using liquefied petroleum gas) and oxygen into a warren and then ignites the mixture causing a high energy blast wave to travel through the warren.

The likelihood of creating a sufficient blast pressure to render rabbits immediately insensible followed by a rapid death without recovery of sensibility depends on a number of factors that must be controlled. For small warrens, that is, with seven or fewer entrances, the R3 Unit can be an effective tool for killing rabbits when all entrances have been adequately sealed. The use of the R3 Unit in warrens that have more than seven entrances or are deeper than 1.5 metres is not recommended due to the higher likelihood that rabbits will be injured and not killed immediately and will therefore suffer.

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

- Operators must be fully trained in the effective, safe and humane application of this equipment.
- This SOP is for use with the R3 unit only. It does not apply to older models or different types of gas explosive devices which may be less humane, ineffective or unsafe.
- The R3 Unit should only be used in a strategic manner as part of a coordinated program designed to achieve sustained effective control. Reducing and maintaining low rabbit numbers by a combination of control methods over time is more effective than repeated (seasonal) use of a single method.
- The R3 unit is used to kill rabbits and disrupt small warrens in areas that are inaccessible to ripping (e.g., rocky areas, under trees, along rivers and in steep sandbanks) and in areas where ripping is undesirable because of the risk of soil erosion.

- R3 unit technology uses a mix of oxygen (97%) with LPG (3 %) to create a blast that generates sufficient concussive force that will create a lethal outcome in a fully sealed warren. Due to the complex structure of warrens, the varying moisture levels underground and the different soil types across Australia, each operator needs to gain an understanding through experience of how long each blast will need to be for optimal results. Regardless of the conditions, each warren must be fully sealed in order to maximise the blast pressure. A smoker identification unit must be used to detect all openings.
- The degree of warren disruption and collapse can be variable and will depend on the size of the warren, soil type and the topography.
    - Use of the R3 Unit on warrens that have more than seven entrances and are deeper than 1.5m only results in partial collapse, with some tunnels not collapsing after blasting. Other methods of warren destruction should be considered in these cases.
    - Warrens in decomposed granite soils appear to have the greatest collapse following a blast, whereas warrens in sandy soils may only result in partial collapse.
    - If the warren is on a slope, blast pressures in the higher parts of the warren are likely to be less than lower sections.
- Some warrens will require more than a single blast to achieve the desired outcome. This can be recognised by the overall impact of the blast zone. Above-ground cracking is often observed and will track along the direction of the warren tunnels, the sealed openings will be blown out and often sink holes will appear. Depending on soil type and timing of the flow, there will often be an above-ground display of flying dirt and debris, but this is less likely in sandy soils.
- Clearing surface harbour such as blackberry stands, hollow logs and rock piles may need to be performed prior to warren destruction to enhance the effectiveness of control programs and to slow re-colonisation.
- Trained dogs can be used to chase rabbits underground prior to warren destruction. However, it is unacceptable to set a dog onto a rabbit with the intention of catching or killing it.
- Clearing of native vegetation or disturbance of sites with Aboriginal or archaeological significance is subject to compliance with various local, state and federal legislation. If in doubt, always check with the appropriate authority before undertaking warren and harbour destruction programs. Contact NSW National Parks and Wildlife Service for more information on places of significance.

Animal welfare implications

Target animals

- If rabbits are rendered immediately insensible due to the blast-generated pressure waves and they do not regain consciousness prior to death, there will be no suffering. Thus, when blast pressure is adequate it is likely that the majority of rabbits will die without significant suffering; however, there could still be some variability in the injuries received by each animal.

- The injuries experienced by rabbits are consistent with the effects of an explosion and include superficial burns to the skin, perforated eardrums and extensive haemorrhages in the lungs.
- Humane use of the R3 Unit depends on the experience and knowledge of the operator. The R3 unit must be set up and used correctly to ensure that blast pressures are sufficiently high to render rabbits immediately insensible and to cause injuries severe enough to kill them without them regaining sensibility.
- To achieve adequate blast pressure:
  - Warrens must be small, with no more than seven entrances and shallow (less than around 1-1.5 metres below ground level).
  - Burrows in the warren must be sealed prior to blasting. A 'smoker' must be used to detect all openings.
  - The duration of gas flow required will depend on the size of the warren but must be enough to achieve an adequate blast pressure throughout the entire warren (i.e., could be up to six minutes for warrens with seven entrances).
- If there is any doubt that blast pressure has not been adequate, operators must always quickly repeat the procedure, paying particular attention to resealing any new openings.
- When it is unlikely that adequate blast pressure can be achieved, it is unacceptable to use the R3 Unit as a method for killing rabbits.
- Rabbits are exposed to the propane/oxygen mixture for a short period of time prior to ignition, however the concentration of propane is not high (around 2%) so the likelihood of suffering due to hypoxia is low. Rabbits will also be exposed to the mineral oil smoke from the smoker unit for a short period of time when the entrance seals are being checked, but it is unlikely that this would cause significant irritation.
- Warren destruction also affects rabbits that are not inside the warren at the time by removing their protection from extreme heat, cold and predators. Most rabbits that are forced to live above ground after their warren has been destroyed will have little chance of survival.

Non-target animals

- Warren destruction using the R3 Unit can kill animals other than rabbits if they are inside the warren at the time. If a warren appears to be vacated by rabbits and possibly occupied by non-target species (e.g., wombats, snakes, lizards, dingoes), the R3 Unit must not be used.
- Warren destruction may also have a negative impact on non-target species that use the warren or surrounding harbour, by removing their protection from extreme heat, cold and predators. Harbour such as native vegetation, logs and briars that are used by rabbits may also be an important habitat for native animals including amphibians, reptiles, small mammals and ground-dwelling or ground-feeding birds. The benefit of rabbit harbour removal should be assessed against the risk to native wildlife especially in conservation areas.

- Non-target native animals that are inadvertently injured or displaced during the R3 unit blasting or harbour removal procedure should be taken to a registered wildlife carer or veterinarian for assessment.
- If using dogs to work an area prior to warren destruction, the following should be observed:
  - Dog handlers must be experienced and the dogs well trained, i.e., they must be easily controlled by a whistle or call, obey the handlers' commands and will not chase or attack non-target animals including domestic livestock. Dogs that are deliberately bred or trained to attack without provocation must not be used. Suitable breeds would include terriers, Labradors and others that are keen to chase but unlikely to catch a rabbit.
  - Handlers must not encourage dogs to attack and kill rabbits. Rabbits trapped in hollow logs etc. (where they are visible, but the dogs can't access them) should be shot (refer to *NSWRAB SOP8 Ground shooting of rabbits*).
  - Rabbits caught by dogs should be killed by a shot to the brain or by cervical dislocation. Rabbits should never be left to die a slow death after being maimed.
  - Ensure that small dogs are not inside the warren before blasting takes place. They should be well restrained during blasting operations to prevent them from entering the warren.
  - For more details refer to *GEN002 The care and management of dogs used for pest animal control*.

Workplace health and safety considerations

- Appropriate personal protective equipment, including long trousers, boots, helmet and a face mask or safety glasses must be worn.
- Operating in fire restriction periods poses a risk of an above-ground fire. The R3 Unit will create a small amount of flame with certain conditions. If the settings on the unit are fine tuned to use only the required percentage of LPG to ignite the oxygen then the amount of flame can almost be eliminated.
- When calibrating and using the R3 Unit, the area around the operator should be clear of other persons and there must be no naked flames, running engines or cigarettes nearby. Operators and assistants should wear appropriate hearing protection.

Equipment

- R3 Unit.
- LPG gas bottle.
- Oxygen gas bottle.
- Smoker identification unit.
- Fire prevention equipment.
- Hearing protection.
- Safety glasses.

Procedures

Assessment of site and estimation of rabbit numbers

- To maximise effect on rabbit populations, a careful on-site risk assessment should be undertaken. Map the location of all warrens, take note of surface harbour and topographic features. For large areas, experienced spotters on motorbikes can be used to log the location of warrens using GPS before warren destruction commences.
- The density of rabbits on the site should be estimated using spotlight counts and warren monitoring. The location and numbers of rabbits on neighbouring properties should also be approximated. If the density of rabbits is high, it is best to poison or fumigate beforehand so that few rabbits are left.
- If it is suspected that native wildlife are using the warren, their presence can be determined by using sand pads, i.e. a $1m^2$ area of raked earth or sand outside of the warren entrance, to detect and identify footprints. Small sticks placed over the warren entrance can also detect activity.
- Contact your local LLS for more information and advice on site assessment and monitoring of rabbit numbers.

Blasting procedure

- Clear warrens of loose logs, rocks, woody weeds and large shrubs etc. Take care not to endanger any native wildlife that may be using the harbour.
- All warrens with open entrances should be destroyed even if they are not currently active.
- It is important to drive any rabbits in the area underground before blasting takes place. This can be achieved by making loud noises or using dogs to work the area, chasing the rabbits into the warrens. Most rabbits will be underground during the middle of the day, especially when the weather is hot.
- Rabbits will often carry material into a warren to provide bedding, which is flammable once dry. Always ensure that there is no combustible material in the warren before commencing the oxygen-LPG flow for a follow-up blast. The risk of fire is low, but the R3 Unit can be damaged if it comes into contact with underground flames. This will have a blow-torch effect at the point of entry. The presence of an underground fire will be shown by smoke emitting from one or more of the blown openings.
- Refer to the current R3 Unit Operating instructions (available from Jensan Farm Services P/L) for detailed instructions on setting up, calibrating and operating the unit.
- For further information and any technical assistance contact Jensan Farm Services P/L.

Assessing effectiveness

- The effectiveness of the R3 unit should be monitored by noting the presence of re-opened entrances 2-3 days after treatment. Any re-openings can be treated further using the R3 Unit or with fumigation.

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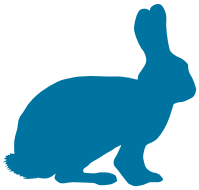


NSWRAB SOP10 Trapping of rabbits using cage traps

Background

The introduced European rabbit (*Oryctolagus cuniculus*) has a significant impact on agricultural production and the environment. Trapping is not considered an effective or efficient rabbit control technique, although it is occasionally used in areas with small, isolated rabbit populations. In urban/residential areas, cage traps are preferred over foot-hold traps as fewer injuries are sustained, non-target animals can be released unharmed and trapped rabbits can be transported away from the area for euthanasia.

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 is time consuming and labour intensive and is therefore an inefficient method for large-scale rabbit control in Australia. It can be effective in controlling small populations, particularly in urban and semi-urban areas.
- Trapping is ineffective in significantly reducing rabbit populations or even maintaining them at low levels.
- Traps have the potential to cause significant injuries, suffering and distress so should only be used when there is no suitable alternative.
- Humane and successful trapping requires extensive training and experience.
- Selection of appropriate traps and trap sites will maximise the chance of capture and minimise the distress caused to target and non-target animals.
- Every effort must be made to avoid target and non-target deaths from factors such as exposure, shock, capture myopathy and predation.
- Traps must be used in accordance with relevant state legislation (*Prevention of Cruelty to Animals Act 1979 s 23*). In NSW, cage traps and padded-jaw traps are permitted and use of steel-jaw traps is prohibited.
- Once trapped, rabbits must be euthanased in a humane manner. This can be done by neck or cervical dislocation, or stunning, with a sharp blow to the back of the head,

followed by neck dislocation. This technique requires training to ensure that unconsciousness is rapidly induced.

- Shooting of rabbits in traps should only be performed by skilled operators who have the necessary experience with firearms and who hold the appropriate licences and accreditation. Storage and transportation of firearms and ammunition must comply with relevant legislation requirements.

Animal welfare implications

Target animals

- Trapped rabbits must not be left in traps any longer than necessary. Traps must be inspected daily (preferably early morning) and left open during the day to prevent suffering and possible death from exposure, thirst, starvation, predation and/or shock.
- Adequate food (bait) such as diced carrot should be provided in the trap to sustain a captured rabbit for a number of hours.
- The number of cage traps set in the field should be limited to that which can be checked and cleared within 2-3 hours.
- Trapping must cease if there is an unusually high number of mortalities in the animals captured.
- It is preferable to set up traps at sites where vegetation can provide shade and shelter.
- Where possible, trapping should be avoided when adverse weather conditions threaten the welfare of trapped animals. Shade cloth or hessian can be for used for protection during extremes of weather.
- Trapped rabbits may also be attacked by foxes, cats and wild dogs causing significant distress. Where this becomes common, trapping should cease.
- Captured animals must be approached carefully and quietly to reduce panic, further stress and risk of injury.
- If lactating females are caught in a trap, reasonable efforts should be made to humanely destroy dependent young.
- Trapped rabbits must be killed as quickly and humanely as possible.
- Neck, or cervical, dislocation 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.

Non-target animals

- Traps are not target specific, so a wide range of non-target species may be caught. These can include birds, echidnas, goannas and possums.
- Different groups of non-target animals suffer different levels of injury and distress. For example:

  - goannas (e.g., lace monitors) can die from hyperthermia.
  - birds and other small animals may be attacked by foxes, cats and wild dogs while caught in traps.
- Traps must not be set near areas that are regularly frequented by non-target species.
- Live, non-target animals caught in traps must be examined for injuries and signs of illness or distress and dealt with as follows:
  - Animals which are unharmed or have only received minimal injuries such as minor cuts or abrasions should be immediately released at the site of capture.
  - Animals which have more severe injuries or that 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 that have 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.*
- If a domestic pet is caught, it should be taken to the nearest veterinarian, animal shelter or council pound where it can be examined for injuries, scanned for a microchip and the owner contacted, or assessed for suitability for re-homing.
- If wild dogs or foxes are caught in the trap they must be euthanased quickly and humanely by a shot to the brain using an appropriate firearm (refer to *NSWDOG SOP1 Trapping of wild dogs using padded-jaw traps* and *NSWFOX SOP5 Trapping of foxes using padded-jaw traps*).

Workplace health and safety considerations

- Operators should be wary of the risks of injury when placing and setting traps.
- Long-sleeved, heavy duty overalls and long trousers should be worn to protect the operator from being scratched by rabbits during handling. Protective gloves may be used if required, although these may hinder dexterity.
- Good personal hygiene is encouraged when handling wild animals. Routinely wash hands and other skin surfaces contaminated with faeces, blood and other body fluids.
- Firearms are hazardous. All people should stand well behind the shooter when a rabbit is being shot. The line of fire must be chosen to prevent accidents or injury from stray bullets or ricochets.

Equipment Required

Traps

- Wire mesh cage traps are used. These can be obtained from commercial suppliers and are available in a variety of sizes (e.g., 740 x 310 x 310 mm, made of 2.5 mm welded wire with a mesh size of 12.5 x 25 mm). The traps have a spring door that is activated either by a treadle plate or hook mechanism. Only traps with treadle plates are recommended for catching rabbits as the hook mechanism is only suitable for attaching meat baits to catch predators.

Firearms and ammunition

- Where shooting is the most appropriate means of euthanasia, smaller calibre rifles such as a .22 rimfire, with hollow- or soft-point ammunition, are suitable for euthanasia at short range (from 5-25cm away).

Procedures

Selection of trap sites

- Traps should be set in areas where rabbits are known to be active, e.g., around warrens or where rabbit droppings are present around pasture.
- Free feeding with bait, e.g., diced carrot, for a number of nights before setting traps will help identify likely trapping sites as well as enhancing capture rates.
- The location of all trap sites and number of traps must be accurately recorded and marked. This information should be readily available to others in case the trapper is unable to return to check the traps.
- Do not place traps in areas where they may be interfered with or damaged by large stock or humans.

Setting of traps

- It is preferable to set traps at the end of each day and check early each morning. Traps should be left open during the day.
- Before setting each trap ensure that it is functioning properly.
- Diced carrot is the preferred bait for attracting rabbits into traps. However, in some circumstances alternatives can be used such as in and around horticultural crops where rabbits are a problem, e.g., use broccoli where this is the crop being damaged.

Euthanasia of rabbits

- Trapped live rabbits must be euthanased as soon as possible after capture. The most appropriate technique is either (1) neck dislocation, or (2) stunning, by a sharp blow to the back of the head, followed by neck dislocation:

Neck (cervical) dislocation

- This technique should only be used on smaller rabbits (<1 kg). In larger rabbits, greater muscle mass in the neck region makes manual cervical dislocation physically more difficult; accordingly, it should be performed only by individuals who have demonstrated proficiency in euthanasing heavier animals or preferably, after the rabbit has been stunned by a blow to the head (see below).
    - Hold the rabbit head downwards by grasping the hind legs in one hand; turn the palm of the other hand towards the rabbit head and take the neck between the thumb and index finger or between the index and middle fingers. Push down so that the neck is stretched and the head moves backwards, until dislocation is felt. Although considerable kicking and other muscular movements may take place, once consciousness is lost, the animal is not sensitive to pain.

Stunning followed by neck (cervical) dislocation

- This technique should be used on larger rabbits (>1 kg).
- Suspend the rabbit by the hind legs, grasping around both hocks with the left hand. Deliver a single, heavy, sharp blow to the back of the skull, behind the ears, with a blunt metal or heavy wooden bar. Alternatively, if no implement is available, the rabbit can be picked up by the hind legs and swung so that the back of its head hits a hard surface such as a rock or post.
- Dislocate the neck using the technique described above.
- Death of animals should always be confirmed by observing the following:
    - no heartbeat
    - no breathing
    - no corneal reflex (no blinking when eyeball is touched)
    - no response to a toe pinch (a firm squeeze of the pad or large toe).
- Euthanasia should be only be performed by trained operators. Acquiring (or re-acquiring) the skills to use physical methods of euthanasia may be accomplished by practising the techniques on dead animals, preferably those recently killed, and be subject to close scrutiny by those with experience in the method.

Shooting

- Trapped live rabbits can be euthanased by shooting whilst still held in the cage trap.
- Unnecessary people should keep away from the area of the trap. The shooter should approach the animal in a calm and quiet manner.
- Never fire when the rabbit is moving its head, be patient and wait until it is motionless before shooting. Accuracy is important to achieve a humane death. One shot to the head should ensure instantaneous loss of consciousness and rapid death without resumption of consciousness.
- Effectiveness of shooting is dependent upon the destruction of major centres at the back of the brain near the spinal cord. This can be achieved by one of the following methods (see also Figure 2).

Frontal position (front view)

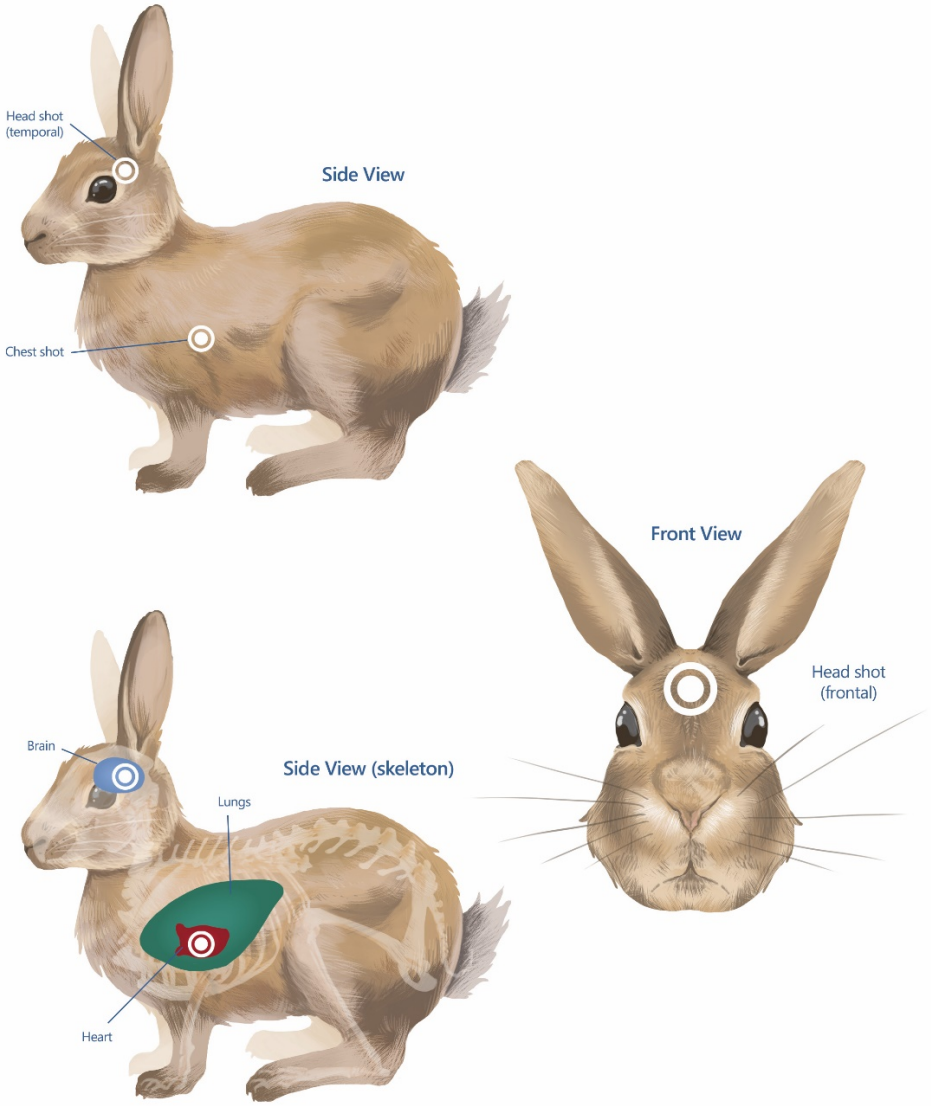
- The firearm is aimed at the centre of the head slightly below a line drawn midway between the ears.

Temporal position (side view)

- Shoot from the side aiming behind the ear so that the shot will pass through the brain towards the opposite eye.
- Death of shot animals 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 toe pinch (a firm squeeze of the pad on a toe).

If death cannot be verified, a second shot to the head should be taken immediately.

Figure 2: Shot placement for rabbits. Head shots (temporal or frontal) should be used for shooting rabbits caught in traps.



Note that shooting an animal from above or below the horizontal level as depicted here will influence the direction of the bullet through the body. Adjustment to the point of aim on the external surface of the body may need to be made to ensure that the angled bullet path causes extensive (and therefore fatal) damage to the main organs in the target areas.

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