

Welfare aspects of vertebrate pest control and culling: ranking control techniques for humaneness

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Summary

The management of vertebrate pests depends on the use of traps, pesticides, repellents and other methods, each of which can cause varying levels of pain and other negative experiences to animals. Vertebrate pest control is essential for managing the impacts of unwanted or over-abundant animals on human and animal health, ecological balance and economic interests. As the need for this management is unlikely to diminish over time, a framework has been developed for assessing the humaneness of each technique by considering their negative impacts on animal welfare so that these can be included in decision-making about the selection of techniques for a specific control operation. This information can also support evidence-based regulations directed at managing such animal welfare impacts. In this paper, the authors discuss this assessment framework, briefly review two assessments conducted using the framework and discuss ways in which Competent Authorities and others can use it and other means to improve animal welfare in vertebrate pest management.

Keywords

Animal welfare – Humane vertebrate pest control – Pesticide – Rodent control – Trap – Vertebrate pest control – Vertebrate pest management.

Introduction

The management of vertebrate pests is essential for protecting native flora and fauna, animal- and crop-based industries, and the health and well-being of animals and humans. Rather than declining over time, it is predicted that the adverse effects of pest animals will continue to increase. Many factors are responsible for this, including climate change, the expanding human population encroaching on areas that were previously wilderness, intentional and unintentional introductions of invasive species into new ranges by humans, and the favourable living conditions that people create for animals that eat food waste and find shelter around their homes.

Vertebrate pest control and culling carry inherent risks to animal welfare (1), both to the animals that are the intended target of the control and to 'non-target' animals. The welfare risks occur when target animals are killed, or are not killed but otherwise adversely affected (e.g. through injury or sub-lethal exposure to pesticides), and when 'non-target' animals are unintentionally exposed, directly or indirectly, to a control technique. Animals that are not exposed to the control technique can also be indirectly affected, positively or negatively, by the technique's impacts on their environment and on the other animals with which they interact or on which they depend.

'Pest' is a broad term applied to animals that are unwanted for some reason – they may be too numerous, or in the wrong place or have particular negative effects. Animals

may be considered a pest or a resource, and animals that are pests in one place or at one time may not be pests elsewhere. Indeed, animals that are highly valued in one place may be considered pests in another. Thus, human attitudes towards pests are complex. Nevertheless, when people are asked whether they care if an animal pest experiences pain when it is killed, they are likely to say 'yes' (e.g. 2, 3, 4, 5). This accords with similar concerns expressed about other interactions that we have with wildlife, such as fishing (6), conservation research and practices (e.g. 7, 8, 9), and the control of wildlife for disease management (10, 11). How far this extends to attitudes in developing countries has not yet been explored, to the authors' knowledge, although there has been some work on attitudes in situations of conflict between humans and wildlife (12), and, more generally, on rodents and rodent control (e.g. see 13).

Regardless of whether or not there is public concern, it can be argued that we have an ethical duty to minimise animal suffering, particularly when we have caused that suffering (14). This includes cases when the cause is vertebrate pest management (1, 15). In practical terms, animal suffering can be minimised by using the control techniques that have the lowest negative impact on animal welfare while remaining effective, following best practice in the manufacturing and use of control products, seeking to improve the humaneness of current methods, and continuing to search for alternatives that are more humane (1, 15).

Using the most humane techniques for vertebrate pest control – a model for assessing and comparing animal welfare impacts

In order to use the most humane control methods, we need to be able to evaluate the negative impacts of the available methods on animal welfare. The impacts can then be compared against each other, or against a set standard of acceptable impacts. At a workshop held in 2003, it was recognised that an objective, risk-based assessment model was needed to assess and compare pest control methods in a consistent way (16). Such a model would need to facilitate comparison across a range of techniques from traps, through repellents, hunting and trap-and-release, to vertebrate pesticides (poisons).

Globally, there are various frameworks for assessing and/or comparing the animal welfare impacts of techniques used for vertebrate pest control, but these have some disadvantages

(see 17, 18). In particular, some frameworks focus on specific animal welfare risks, such as pain or the likelihood of injury; some are suitable for one type of control method but not for others, e.g. pesticides versus traps; other approaches are useful for assessing lethal techniques but not non-lethal ones; and, sometimes, different frameworks are used for assessing the same method, e.g. traps. There have been useful assessments conducted using these other frameworks (e.g. 19, 20, and see 17, 18 and 21). Essentially, however, there has been no single, agreed framework that systematically examines all risks to animal welfare, or that can be used to compare the relative impacts of the many different lethal and non-lethal techniques.

These problems are circumvented by an alternative framework, first published in 2008 and since updated (18), based on the 'Five Domains' model for assessing animal welfare compromises (22, 23, 24). The framework has since been applied to the main pest control techniques in Australia and New Zealand (see below), with some suggestions made for refinement (18, 21).

While not strictly following a formal risk assessment approach, the model aligns with the risk assessment principles applied by the World Organisation for Animal Health (OIE) (25, 26) and the European Food Safety Authority (EFSA) (27), in which hazards, exposure (although this is not addressed in detail) and consequences are considered to determine risk. For animal welfare risk assessment, these variables have been described as 'welfare challenges', 'adverse welfare outcomes' and 'welfare impacts', and together, they determine the animal welfare risk (28).

The assessment process

The framework outlined here uses published scientific information and informed judgement to examine the negative impacts that a pest control or culling method has on an animal's welfare and, if it is a lethal method, the impacts of the method of killing. A score is generated so that the relative humaneness of different methods can be compared (18).

Specific information is used about the mode of action and welfare impacts of each technique. Where possible, the welfare impacts are taken from research that has been planned and executed for this purpose. A 2002 review (17) considered that the following information is essential for an accurate evaluation of welfare impacts, and that it should be collected using a combination of behavioural, physiological and pathological indicators:

- the time of onset of the first signs that the animal is affected

- the time of onset and duration of each sign or effect, plus an indication of the degree of impact (e.g. mild, moderate or severe breathlessness or injury)
- the time to loss of consciousness using an agreed indicator
- other impacts of the technique that may influence (increase or decrease) the degree or duration of negative impacts experienced by the animal; for example, neurological impairment, sedation, analgesia or fear.

Before initiating research to collect this information, impacts should be predicted as much as possible on the basis of a review of the relevant human and animal literature, so that an appropriate sampling regime can be set up (17).

Reports of the impacts on humans and other animals can be used instead of species-specific data, if these are not available. However, note that when data are substituted in this way, the reporting of the results needs to reflect the degree of uncertainty around each assessment (see 21 for an example).

A recent draft EFSA scientific opinion (29) gives good guidance for assessing pain, distress and the level of consciousness in an animal before it completely loses consciousness. Whilst this guidance relates to animals killed for human consumption, the parameters and responses suggested are appropriate for the intentional killing of animals in other contexts, including vertebrate pest management and culling. In particular, the opinion suggests a range of behavioural, physiological and neurological responses that should be monitored for any study attempting to collect data on the animal welfare impacts of a pest control technique.

The present model uses a Delphi approach for the informed judgement required for the assessments. This is where a panel of experts in animal welfare assessment and in vertebrate pest management score the techniques by consensus, based on the information available. The composition of the expert panel is important to the success and robustness of the assessments.

There are two parts to the assessment. Part A considers the impact of a technique on overall welfare and the duration of this impact. If a method involves killing, then Part B is applied to consider the intensity and duration of suffering caused by the killing technique. In this way, these two parts of the model can be applied separately or together to evaluate all components of a pest management technique. This allows comparison of techniques that involve capture followed by other possible outcomes (e.g. trap and release), and techniques that are intended to cause death (e.g. killing traps and pesticides).

In Part A, overall welfare impact is assessed by systematically considering impacts in each of five domains (18, 21, 24):

- **nutrition:** water and food deprivation and malnutrition
- **environment:** challenges including exposure to adverse effects such as heat or cold
- **health:** injury, disease and impaired functioning
- **behaviour:** restriction of behaviour and social interaction
- **mental state:** the contributions of the above, plus other features of the technique, to a range of negative affective experiences, such as thirst, hunger, breathlessness, nausea, dizziness, pain, debility, sickness, weakness, anxiety, fear and other forms of distress.

The degree of impact in each domain is rated as ‘no impact’, or as ‘mild’, ‘moderate’, ‘severe’ or ‘extreme’. The first four domains are rated in terms of impacts on strictly physical/functional states (e.g. dehydration). The associated affective impacts (e.g. thirst) are accumulated and rated within the fifth, mental domain (21). Descriptions and examples for each degree of impact in each domain are provided in the published model (18). The degree of impact is then combined with its estimated duration, i.e. immediate to seconds, minutes, hours, days or weeks, to give a numerical score for Part A (Fig. 1).

Part B is applied only to lethal control methods and assesses the killing technique on the level and duration of suffering until the animal becomes insensible (Fig. 2). Again, descriptions and examples are provided in the published model for each category of impact (18).

The overall score of the animal welfare impact is expressed as a combination of the scores in parts A and B. This is illustrated by the example given in Table I for rodent control methods from the Australian assessment (18).

Overall impact on welfare	Duration of impact				
	Immediate/seconds	Minutes	Hours	Days	Weeks
Extreme	5	6	7	8	8
Severe	4	5	6	7	8
Moderate	3	4	5	6	7
Mild	2	3	4	5	6
No impact	1	1	1	1	1

Fig. 1
Scoring matrix for Part A: overall welfare impact
 From a model described by Sharp & Saunders (18)

Level of suffering	Time until insensibility				
	Immediate/seconds	Minutes	Hours	Days	Weeks
Extreme	E	F	G	H	H
Severe	D	E	F	G	H
Moderate	C	D	E	F	G
Mild	B	C	D	E	F
No impact	A	A	A	A	A

Fig. 2
Scoring matrix for Part B: assessment of mode of death
 From a model described by Sharp and Saunders (18)

Applying the model – assessments of the relative animal welfare impacts of some common control techniques

To date, more than 100 assessments have been conducted in Australia (18) and New Zealand (21) on a range of introduced wild animals: birds, brushtail possums, cats, camels, wild deer, dogs, donkeys, ferrets, fish, foxes, goats, horses, pigs, rabbits, rodents (rats and mice), stoats and wallabies. The techniques covered differ among species and include ground shooting; aerial shooting; live trapping followed by release, transport or killing; pesticides; mustering (herding) followed by various procedures; and warren (burrow) destruction and the introduction of a disease agent for rabbits. The following summary is from both studies.

Of the pesticides assessed using this model, anticoagulant poisoning was consistently determined to have the worst impact on welfare for all species in both studies (18, 21). Encapsulated cyanide had the lowest relative animal welfare impact. Of the other commonly used pesticides, 1080 and zinc phosphide were ranked better across a range of species than white and yellow phosphorus and cholecalciferol. The negative impact of two newer pesticides, para-aminopropiophenone (PAPP) and sodium nitrite, was considered to be less than these commonly used pesticides, although, in one assessment, a lack of usable data precluded a firm decision (21). Of the fumigants used for rabbits, chloropicrin ranked poorly in comparison to phosphine-releasing fumigant techniques. Two avicides were also assessed. Of these, DRC-1339 ranked very poorly while alpha-chloralose was considered to have a less severe impact over a shorter period of time and ranked similarly to the intermediate mammalian pesticides. Rotenone for

controlling pest fish was considered in one assessment (21) and given an intermediate score.

For live capture traps, assessments are based on the outcome for the animal after trapping, in addition to the impact while in the trap. Thus, methods that require the handling of trapped animals, for example, cause more of a problem for animal welfare than methods where animals are killed while in the cage (such as shooting). Nevertheless, in general, cage traps were ranked as better than padded leg-hold or foot-hold traps, when both methods were used on the same species, and net traps were preferable to cage traps for birds. Kill traps (snap traps or 'break-back' traps) have only been ranked for rodents, but they were rated as better than poisoning with anticoagulants or zinc phosphide, glueboard traps followed by blunt trauma to cause death, and live capture traps followed by blunt trauma to cause death (18).

Of the other physical control methods, ground shooting (using head shots) was considered to be relatively more humane than aerial shooting (shooting from an aircraft), since animals are not shot from a moving platform and are not pursued. However, aerial shooting allows any wounded animals to be followed up quickly. Rabbit warren destruction by blasting (when rabbit numbers are low, as prescribed by best practice in a standard operating procedure) was ranked better than the use of fumigants in the Australian assessment (18).

Benefits of the model

Practical improvements in pest management

The model outlined here can lead to improvements in best practice because it allows animal welfare impacts to be considered together with other features, such as efficacy, cost-effectiveness, practicality, public acceptability, environmental impacts, target specificity and operator safety. The assessments can also be used by regulators to develop best practice guidelines for appropriate control techniques or to set limits of acceptability in legislation. For instance, the assessment in Australia recommends amendments to National Codes of Practice and banning the use of some of the least humane techniques, including strychnine and chloropicrin (18). Also, because the model is systematic, its use identifies gaps in current knowledge, allowing us to prioritise research that will improve our understanding of welfare impacts (24).

Addressing public concerns about humaneness

Importantly, the results can also inform debate on the acceptability of techniques when their humaneness

Table I
An assessment of the animal welfare impacts of rodent control, using the model described by Sharp and Saunders (18)

Assessment criteria	Rodent control method				
	Baiting with anticoagulants	Baiting with zinc phosphide	Trapping with snap-back traps	Trapping with glue boards*	Live trapping
Part A – Welfare impact before death					
Domain 1: nutrition	No impact	No impact	No impact	Mild	Mild
Domain 2: environment	No impact	No impact	No impact	Mild	Mild
Domain 3: health	No impact	No impact	No impact	Moderate/severe	No impact
Domain 4: behaviour	No impact	No impact	No impact	Severe	Mild
Domain 5: mental state	No impact	No impact	No impact	Severe	Mild
Overall impact	n/a	n/a	n/a	Severe	Mild
Duration	n/a	n/a	n/a	Hours	Hours
Score	n/a	n/a	n/a	6	4
Part B – Welfare impact of the method of killing/death	Baiting with anticoagulants	Baiting with zinc phosphide	Trapping with snap-back traps	Blunt trauma	Blunt trauma with handling
Duration	Days	Hours	Immediate/seconds	Immediate/seconds	Immediate/seconds
Suffering	Moderate/severe	Moderate/severe	Mild	Mild	Mild/moderate
Score	F–G	E–F	B	B	B–C
Overall score	F–G	E–F	B	6B	4B–C

*Checked twice daily

is questioned. In particular, a consistent assessment framework is useful when one pest control method has a disproportionately high and negative profile in some communities, compared to other methods used to control the same pest species. An example of this is opposition to use of the pesticide sodium fluoroacetate (1080) for vertebrate pest management, based in part on perceptions of it being inhumane. However, if we apply the model to all vertebrate pesticides used for managing brushtail possums (*Trichosurus vulpecula*), an introduced invasive species in New Zealand (Fig. 3), it becomes evident that 1080 has moderate welfare impacts within the full range assigned and that other pesticides with greater welfare impacts are also used.

Setting limits on acceptable versus unacceptable levels of impact on animal welfare

There are contexts in which the ability to set a threshold level for acceptable welfare is necessary or useful. For instance, commercial welfare assurance schemes delineate acceptable or unacceptable farming practices. Likewise, regulators set limits on which techniques may be used to control

vertebrate pests and other unwanted animals. These include Australia’s Model Codes of Practice and Standard Operating Procedures for Humane Pest Animal Control (30) and the OIE’s standard on stray dog population management (31). The model discussed here is not proposed primarily as a way of setting a threshold for ‘acceptable’ versus ‘unacceptable’ levels of negative impact on animal welfare. Instead, it is intended to allow comparison among techniques, rather than passing judgement on what is, or is not, ‘humane’ in absolute terms. Nonetheless, the model does generate a score which could be used to set a level of acceptable animal welfare impact.

Moving beyond the model: other ways to promote humane pest management

As indicated above, selecting the most humane technique is only one way in which animal welfare concerns can be addressed in pest management. Other aspects relating to the design, manufacture and use of techniques are

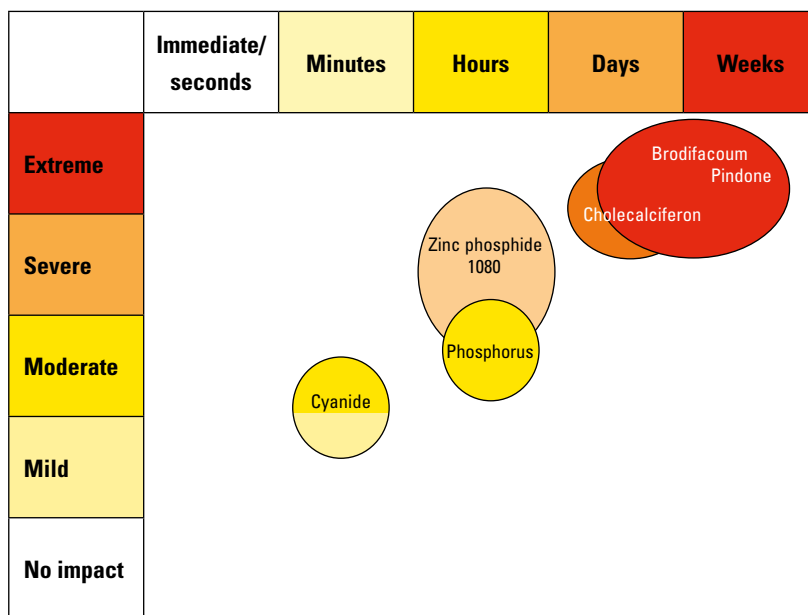


Fig. 3

Relative animal welfare impacts of pesticides used for the control of brushtail possums (*Trichosurus vulpecula*)

An introduced invasive species in New Zealand, assessed according to Sharp and Saunders (18)

also important (see 1). For example, animal welfare is improved in control operations by following best practice when applying a technique, along with any directions on the label, so as to limit escapes from traps, sub-lethal consumption of or exposure to poisons, and impacts on non-target animals. In addition, in the case of poisons, bait formulation, structure and toxin concentration, and mode of presentation are key to minimising negative animal welfare impacts.

Other frameworks have been proposed to support operational decisions that minimise unnecessary suffering in pest animals (15, 16, 32). Such considerations accord with recent thinking on ethical principles for all interactions with wildlife (33), including the notion of 'compassionate conservation' (34), and can contribute to the development of best practice to meet these ethical principles.

In addition to the above measures, which largely rely on pest control practitioners taking appropriate action, there are many ways in which governments and other organisations can support best practice approaches that maximise the humaneness of pest management. Littin (35) considered a range of these. Appropriate regulation, practitioner training, public education and involvement in decision-making, the incorporation of pest management into national animal welfare strategies, and funding for the development of more humane alternatives are all examples of how Competent Authorities and wider government can support improved animal welfare in pest management. Intergovernmental organisations can also demonstrate their support for improvement, as shown by the OIE's adoption of standards for humane stray dog population control (31).

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La lutte contre les espèces de vertébrés nuisibles et leur élimination : classification des techniques en fonction de leur prise en compte du bien-être animal

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Résumé

La gestion des espèces de vertébrés classés nuisibles repose, entre autres méthodes, sur l'utilisation de pièges, de pesticides et de répulsifs qui peuvent provoquer des douleurs ou d'autres affects négatifs chez les animaux, à des degrés divers. La gestion des vertébrés nuisibles est essentielle pour maîtriser l'impact des animaux indésirables ou en sureffectifs sur la santé humaine et animale, sur l'équilibre écologique et sur l'activité économique. Ces questions vont certainement continuer à se poser à l'avenir, ce qui a incité les auteurs à développer un cadre permettant d'évaluer les effets négatifs de chaque technique sur le bien-être animal de sorte que cet aspect puisse être pris en compte lors des décisions sur le choix des techniques à utiliser pour chaque opération de contrôle particulière. Cette information sera également utile pour élaborer une réglementation bien documentée afin de maîtriser l'impact sur le bien-être animal des stratégies mises en œuvre. Les auteurs présentent ce modèle d'évaluation, exposent brièvement deux évaluations concrètes basées sur celui-ci et examinent les possibilités futures d'utilisation du modèle (notamment par les Autorités compétentes) et d'autres outils afin d'améliorer le bien-être animal dans le cadre de la gestion des vertébrés nuisibles.

Mots-clés

Bien-être animal – Contrôle des rongeurs – Contrôle des vertébrés nuisibles – Gestion des vertébrés nuisibles – Lutte contre les nuisibles dans des conditions décentes – Pesticide – Piège.



La dimensión del bienestar en el control de plagas y el sacrificio de vertebrados: clasificación de las técnicas según su grado de «humanidad»

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Resumen

La lucha contra los vertebrados considerados como plagas reposa en el uso de trampas, pesticidas, repelentes y otros métodos, cada uno de los cuales puede generar un grado variable de dolor u otras experiencias negativas en los animales. El control de las plagas vertebradas es esencial para gestionar los efectos derivados de una presencia indeseada o excesiva de animales sobre la salud humana y animal, el equilibrio ecológico y los intereses económicos. Dado que es poco probable que la necesidad de este tipo de métodos disminuya con el tiempo, se ha elaborado un marco de referencia para evaluar las repercusiones negativas de cada técnica por lo que respecta al bienestar animal, de forma que sea posible tenerlas en cuenta a la hora de elegir entre una u otra técnica

para determinada operación de lucha. Esta información, además, puede ser útil para elaborar reglamentos científicamente sólidos destinados a gestionar esas repercusiones sobre el bienestar animal. Los autores describen dicho marco de evaluación, exponen brevemente dos evaluaciones realizadas con él y explican de qué manera las Autoridades Competentes (u otras instancias) pueden utilizar el modelo y otros procedimientos para mejorar los niveles de bienestar animal en la lucha contra las plagas vertebradas.

Palabras clave

Bienestar animal – Control incruento de plagas – Control de plagas vertebradas – Control de roedores – Lucha contra las plagas vertebradas – Pesticida – Trampa.



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