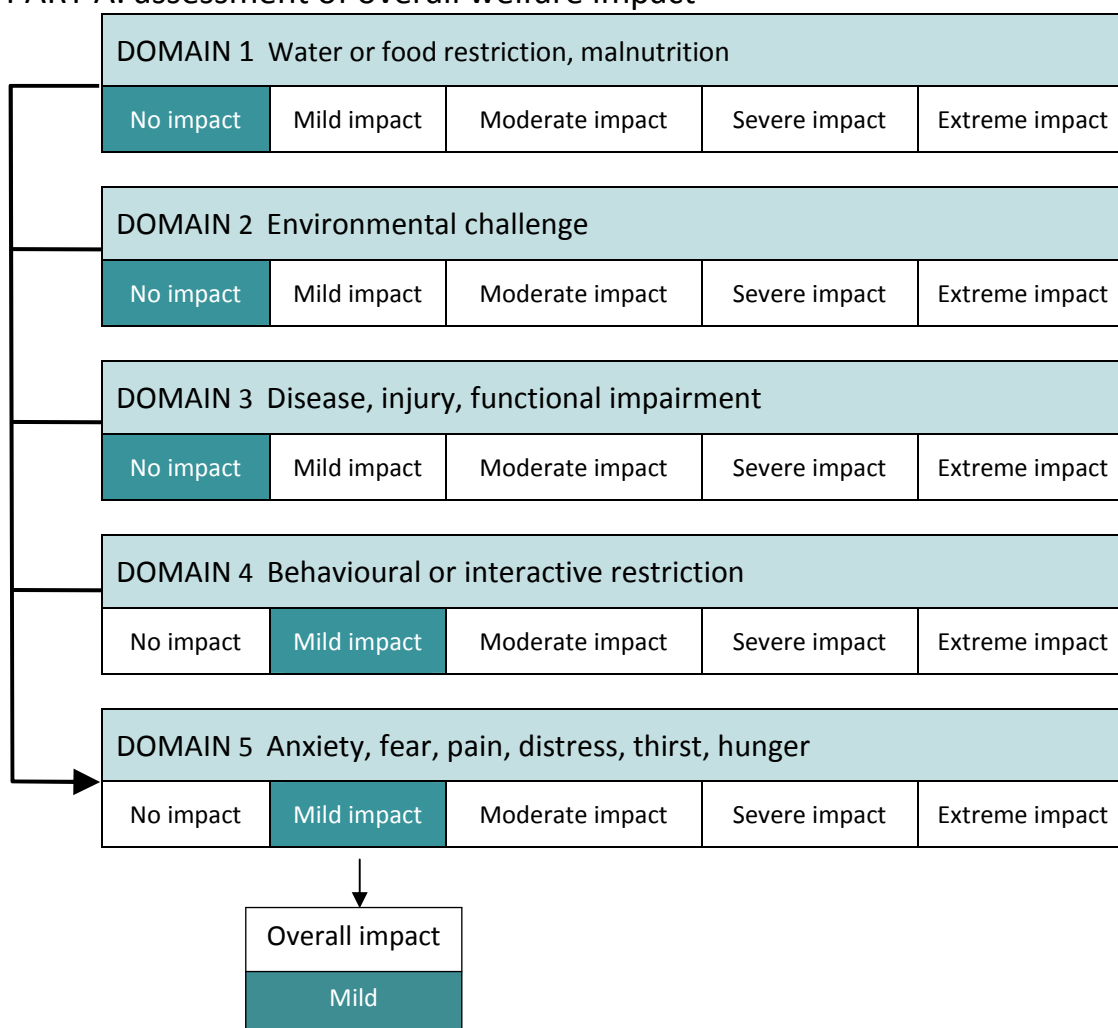


Control method: Ground shooting of rabbits

Assumptions:

- Best practice is followed in accordance with the standard operating procedure RAB009 and the shooter is competent and will make accurate decisions about whether the shot can be successfully placed.
- This method is not recommended as a primary control technique – usually used as a secondary technique.
- Wounding rates should be relatively low if best practice adhered to (and this is the basis of the assessment), however it is recognised that this method is frequently used by non-professionals because of the widespread distribution and abundance of rabbits.
- Single animals are shot on an opportunistic basis.
- Head shots are the preferred point of aim although chest shots are more likely when shot from a distance.
- The effect on dependent young is not taken into consideration with this assessment only the impact on the target animal. There is no practical way of addressing the problem of dependent young being left in burrows after the mother has been shot. In some areas rabbits can be breeding all year round (this is linked to the levels of protein available).

PART A: assessment of overall welfare impact



DURATION OF IMPACT

Immediate to seconds

Minutes

Hours

Days

Weeks

SCORE FOR PART A:

2

Summary of evidence:

Domain 1

No impact in this domain.

Domain 2

No impact in this domain.

Domain 3

No impact in this domain.

Domain 4

There is likely to be an impact on remaining adult rabbits after individuals in the group are shot. Rabbits form stable and distinct social groups where strong associations are maintained over time¹. Dependent kittens are underground and will be difficult to locate.

Domain 5

There will be some impact in this domain due to other rabbits being frightened by the noise of the gunshot.

PART B: assessment of mode of death – head shot

Time to insensibility (minus any lag time)

Very rapid

Minutes

Hours

Days

Weeks

Level of suffering (after application of the method that causes death but before insensibility)

No suffering

Mild suffering

Moderate suffering

Severe suffering

Extreme suffering

PART B: assessment of mode of death – chest shot

Time to insensibility (minus any lag time)

Very rapid

Minutes

Hours

Days

Weeks

Level of suffering (after application of the method that causes death but before insensibility)

No suffering

Mild suffering

Moderate suffering

Severe suffering

Extreme suffering

SCORE FOR PART B:

Head shot - A
Chest shot - B

Summary of evidence:

Duration –	<p>With head shots, a properly placed shot will result in immediate insensibility^{2, 3, 4}.</p> <p>With chest shots, time to insensibility can range from seconds to a few minutes. The time to loss of consciousness and the time to death will depend on which tissues are damaged and, in particular, on the rate of blood loss and hence the rate of induction of cerebral hypoxaemia⁵. Loss of consciousness and death is likely to be quick when animals have been shot in the heart. ‘Hydrostatic shock’ (see below) may also contribute to rapid incapacitation and potentially rapid loss of consciousness with shots to the chest; however this effect seems to be variable and doesn’t occur in all instances.</p>
Suffering –	<p>When animals are rendered insensible immediately with a well-placed head shot that causes adequate destruction of brain tissue there should be no suffering⁶. Studies comparing cortisol levels and a range of haematology parameters of shot rabbits and trapped rabbits demonstrate that shooting does not cause a significant stress response^{7, 8}.</p> <p>Animals that are chest shot and still conscious are likely to have a short period of suffering, though the extent of suffering will vary depending on which tissues are damaged and the rate of blood loss. During haemorrhage there is likely to be tachypnoea and hyperventilation, which, when severe, would indicate that there is a sense of breathlessness before the loss of consciousness⁵. Severe haemorrhage in humans is also associated with anxiety and confusion².</p> <p>If chest shot animals are rendered insensible by the mechanism of ‘hydrostatic shock’ and they do not regain consciousness prior to death they are unlikely to suffer.</p>

Summary

CONTROL METHOD:	Ground shooting of rabbits
OVERALL HUMANENESS SCORE:	Head shot - 2A Chest shot - 2B
Comments Wounding rates with ground shooting <p>When animals are shot at, some will be killed outright, others will be missed and some will be wounded but not killed. Of the ones that are wounded, some be killed by subsequent shots but some will escape to either die later or recover. Therefore to determine welfare impact we are interested in the extent of injury or wounding associated with ground shooting, the likelihood of it happening and the level of suffering associated with these wounds. There do not appear to be any reported wounding rates from ground shooting of rabbits but there are estimates with foxes:</p> <p>An study to estimate wounding rates for foxes with shotguns, rifles and airguns in England⁹ was reported by Baker et al. (2006)¹⁰. In this study, X-ray plates from 764 foxes admitted to wildlife hospitals and/or their veterinarians were examined for evidence of wounding by rifles and shotguns: 6 had shotgun pellets, 2 had rifle bullets and 12 had airgun pellets. Although there were a number of limitations with the data collected, the authors estimate that approximately 9% and 3% of the foxes shot at are wounded with shotguns and rifles respectively each year. They suggest that wounding with shotguns may be the result of using appropriate shot sizes but at too great a range to achieve penetration. Wounding with rifles appeared to be the result of using rimfire weapons with lower muzzle energy.</p> <p>Another study by Fox et al., (2005)¹¹ estimated wounding rates associated with shooting of foxes by using individual participants to shoot at life size paper targets of foxes. The study involved trials of</p>	

many shooting regimes with different combinations of shotguns and rifles, types of ammunition, both moving and stationary targets at a range of distances and shooters who differed in skill level. Although some consider the study to be seriously flawed¹², the authors report that the probability of wounding per shot fired, even with the best regime (i.e. using a rifle, skilled shooter, at night from 100 yards), is 10%. With other regimes (involving the use of a shotgun) the probability of wounding was as high as 50%.

What would be considered to be an acceptable wounding rate for ground shooting?

As a guide, for captive bolt stunning in abattoirs, the level of acceptability is that 95% of animals must be rendered insensible with one shot. An excellent score is 99%.¹³

Hydrostatic shock

With shooting, in addition to the damage caused by the penetrating projectile, there is scientific evidence that organs can also be damaged by the pressure wave that occurs when a projectile enters a viscous medium, a phenomenon known as 'hydrostatic shock'¹⁴. Experimental studies on pigs and dogs demonstrate that a significant ballistic pressure wave reaches the brain of animals shot in an extremity such as the thigh^{15, 16, 17}. It is hypothesised that damage to the brain occurs when the pressure wave reaches the brain from the thoracic cavity via major blood vessels but could also occur via acceleration of the head or by passage of the wave via a cranial mechanism¹⁸. It is also thought that hydrostatic shock may produce incapacitation more quickly than blood loss effects, however not all bullet impacts will produce a pressure wave strong enough to cause this rapid incapacitation¹⁹.

Anecdotal reports by hunters maintain that some species are more susceptible to this shock effect than others; however no studies were found that confirmed this. However there is some speculation that, if one of the mechanisms that contribute to the effect of hydrostatic shock and subsequent damage to the brain is caused by acceleration of the head, it is possible that some animals may be more resistant to the incapacitating effects of shooting. It is recognised that animals such as head-butting ruminants appear to be more resistant to concussion than humans and are thought to have a higher acceleration threshold which could make them more resistant to traumatic brain injury not only from externally imposed forces, accelerations and blunt force trauma but also from an internal ballistic pressure wave generated by a projectile^{20, 21}.

Bibliography

1. Marsh, M. (2009). The effects of behaviour in disease transmission: understanding RHDV dynamics in Australian rabbit populations. PhD thesis. (University of York: York, UK).
2. Zajtcuk, R. (1995). Anesthesia and Perioperative Care of the Combat Casualty. Chapter 4 - Hemorrhage, Shock and Fluid Resuscitation. (Office of The Surgeon General at TMM Publications, Borden Institute, Walter Reed Army Medical Center: Washington, DC).at <http://www.bordeninstitute.army.mil/published_volumes/anesthesia/ANfm.pdf>
3. Gregory, N. (2004). *Physiology and behaviour of animal suffering*. (Blackwell: Oxford, UK).
4. Longair, J. et al. (1991). Guidelines for euthanasia of domestic animals by firearms. *Canadian Veterinary Journal* **32**, 724-726
5. Gregory, N.G. (2005). Bowhunting deer. *Animal Welfare* **14**, 111-116
6. American Veterinary Medical Association (2001). 2000 Report of the AVMA Panel on Euthanasia. *Journal of the American Veterinary Medical Association* **218**, 669-696
7. Hamilton, G.D. & Weeks Jr, H.P. (1985). Cortisol and aldosterone comparisons of cottontail rabbits collected by shooting, trapping, and falconry. *Journal of Wildlife Diseases* **21**, 40-42
8. Jacobson, H.A., Kirkpatrick, R.L., Burkhart, H.E. & Davis, J.W. (1978). Hematologic comparisons of shot and live trapped cottontail rabbits. *Journal of Wildlife Diseases* **14**, 82-88
9. Bentley, A., Baker, P. & Harris, S. *Welfare aspects of shooting foxes (Vulpes vulpes) in Britain (unpublished data)*. (University of Bristol: Bristol, UK).
10. Baker, P., Harris, S. & White, P. (2006). *After the hunt. The future for foxes in Britain*. (International Fund for Animal Welfare (IFAW): London, UK).
11. Fox, N.C., Blay, N., Greenwood, A.G., Wise, D. & Potapov, E. (2005). Wounding rates in shooting foxes (*Vulpes vulpes*). *Animal Welfare* **14**, 93-102
12. Baker, P. & Harris, S. (2005). Shooting in the dark. *Animal Welfare (Letters)* **14**, 275-276

13. Grandin, T. (2007). Implementing effective animal welfare auditing programmes. *Animal Welfare & Meat Production* 227-242 (CABI: Cambridge).
14. Courtney, M. & Courtney, A. (2008). Scientific Evidence for Hydrostatic Shock. 0803.3051 at <<http://arxiv.org/abs/0803.3051>>
15. Suneson, A., Hansson, H.-A. & Seeman, T. (1990). Pressure Wave Injuries to the Nervous System Caused by High-energy Missile Extremity Impact: Part I. Local and Distant Effects on the Peripheral Nervous System-A Light and Electron Microscopic Study on Pigs. *The Journal of Trauma* **30**, 281-294
16. Suneson, A., Hansson, H. & Seeman, T. (1990). Pressure Wave Injuries to the Nervous System Caused by High-energy Missile Extremity Impact: Part II. Distant Effects on the Central Nervous System-A Light and Electron Microscopic Study on Pigs. *The Journal of Trauma* **30**, 295-306
17. Wang, Q., Wang, Z., Zhu, P. & Jiang, J. (2004). Alterations of Myelin Basic Protein and Ultrastructure in the Limbic System at the Early Stage of Trauma-Related Stress Disorder in Dogs. *The Journal of Trauma* **56**, 604-610
18. Courtney, A. & Courtney, M. (2009). A thoracic mechanism of mild traumatic brain injury due to blast pressure waves. *Medical Hypotheses* **72**, 76-83
19. Courtney, A. & Courtney, M. (2007). Links between traumatic brain injury and ballistic pressure waves originating in the thoracic cavity and extremities. *Brain Injury* **21**, 657-662
20. Courtney, M. & Courtney, A. (2007). Sheep Collisions: the Good, the Bad, and the TBI. 0711.3804 at <<http://arxiv.org/abs/0711.3804>>
21. Shaw, N.A. (2002). The neurophysiology of concussion. *Progress in Neurobiology* **67**, 281-344