Control method: Ground shooting of feral camels

Assumptions:

- Best practice is followed in accordance with the standard operating procedure CAM001 Ground shooting of feral camels (http://www.feral.org.au/tag/camel-sop/).
- The shooter is competent and will make accurate decisions about whether the shot can be successfully placed. Welfare outcomes are highly dependent on the skill of the shooter. If the shooter is not skilled then animal suffering is likely.
- The impacts were considered on the group of camels being targeted – the first animal to be shot and killed would be naïve but the negative impacts would increase with each subsequent animal.
- Note that camel shooting is a specialised operation. Ground shooting is only appropriate for very small mobs or individual camels and is *not* suited to rapid population reduction of high density populations.

PART A: assessment of overall welfare impact

DOMAIN 1 Water or food restriction, malnutrition				
No impact	Mild impact	Moderate impact	Severe impact	Extreme impact

DOMAIN 2 Environmental challenge				
No impact	**Mild impact**	Moderate impact	Severe impact	Extreme impact

DOMAIN 3 Disease, injury, functional impairment				
No impact	Mild impact	**Moderate impact**	Severe impact	Extreme impact

DOMAIN 4 Behavioural or interactive restriction				
No impact	Mild impact	**Moderate impact**	Severe impact	Extreme impact

DOMAIN 5 Anxiety, fear, pain, distress, thirst, hunger				
No impact	Mild impact	**Moderate impact**	Severe impact	Extreme impact

Overall impact
Moderate

DURATION OF IMPACT				
Immediate to seconds	**Minutes**	Hours	Days	Weeks

Date of assessment: 23/09/2013

Last saved: 29/10/2013 9:48 PM

SCORE FOR PART A:	4

Summary of evidence:

Domain 1	No impact in this domain.
Domain 2	If the camels are pursued prior to shooting, then running for a short period in hot ambient temperatures could result in mild but short term heat stress.
Domain 3	Ground shooting has the advantage of operators not shooting from a moving platform and the target animals being stationary rather than running, however there is still a higher risk of wounding with this method compared to aerial shooting. This is because animals are shot over a greater range and following up wounded animals is difficult because there is less opportunity to take follow-up shots quickly. Wounded animals are less visible and it is more difficult to set up the ideal orientation to the target zones when shooting from the ground. Furthermore, the operators are less likely to be trained and skilled (compared with those conducting aerial shooting). Non-target camels can also be injured as large calibre ammunition is required to bring down a camel with a chest shot and there is a risk that a bullet could pass right through the target animal and hit another animal.
Domain 4	Ground shooting will only kill individual animals or small numbers of animals out of a group therefore there will be an negative impact on the animals in a social group that are not shot. Camels are herd animals and older females have been observed leading younger animals to water. There is strong maternal bonding and lactating females stay with the mob. Removing older females from a mob could have long-term effects on that social group.
Domain 5	Camels are likely to experience a moderate degree of anxiety and distress during ground shooting due to the high risk of being wounded. If animals are injured but not euthanased they could suffer a painful and protracted death. Also individuals in a social group that are left behind have the potential to suffer considerably.

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)				
rapid	Minutes	Hours	Days	Weeks
Level of suffering (after application of the method that causes death but before insensibility)				

suffering	Mild suffering	Moderate suffering	Severe suffering	Extreme suffering

SCORE FOR PART B:	**Head shot - A** **Chest shot - D**
Summary of evidence:	
Duration –	With head shots, a properly placed shot will result in immediate insensibility[1, 2, 3]. 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 hypoxaemia[4]. Loss of consciousness and death are likely to be quick when animals have been shot in the heart. With ground shooting, single shots to the chest are often used (as opposed to 'double tap' chest shots used during aerial shooting), therefore less damage could result and the duration of suffering could potentially be minutes. There is some evidence that a phenomenon called '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 does not occur in all instances.
Suffering –	When animals are rendered insensible immediately with a well-placed head shot that causes adequate destruction of brain tissue there should be no suffering[1]. 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 consciousness[4]. Severe haemorrhage in humans is also associated with anxiety and confusion[5]. 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. With ground shooting of camels there is a higher proportion of chest shots compared with head shots due to the presentation of the animal.

Summary

CONTROL METHOD:	**Ground shooting of feral camels**
OVERALL HUMANENESS SCORE:	**Head shot – 4A** **Chest shot – 4D**
Comments **Wounding rates with ground shooting** 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 will be killed by subsequent shots but some will escape. Therefore to determine welfare impact we are interested in the extent of injury or	

wounding associated with ground shooting and the likelihood of it happening.

There are no reported observations of wounding rates during ground shooting of feral camels however there are anecdotal reports that wounding rates are high. This is mostly due to inexperienced and unskilled operators and also shooting over long ranges, poor presentation of the animal to allow a good shot to the target zone and difficulty in following up animals that are injured with a first shot. Furthermore, ground shooting of feral camels is often conducted by individual landholders who may or may not follow the standard operating procedure and are not scrutinised compared with aerial culling operations.

There have been a few studies of wounding rates associated with ground shooting in other species. For example:

Impala

A study of the night shooting of wild impala found that when the point of aim was the head, 93% of animals were killed instantaneously by the first shot[6]. Of the 6.3% of animals that were wounded and the timing of shots was recorded (n=31), the mean time between wounding and death was 30 seconds (maximum time 1 min 57s; minimum time 4.8s). Of a total of 990 shots fired, 74 (7.5%) missed animals completely and 57 (5.8%) resulted in animals being wounded (3 animals were wounded before dispatch). No animals escaped after wounding.

Deer

Estimates of wounding rates by deer stalkers have shown that 2% of deer escape wounded, 11% of deer required two or more shots to kill and 7% took 2-15 minutes to die.[7]

In a study to examine the effects of wound site and blood collection method on biochemical measures obtained from red deer, 84% of 69 deer were killed with a single shot and no deer escaped wounded[8]. Eleven of the deer were shot twice (and one deer was shot 3 times), the first shot usually being in the chest. Of the deer killed with one shot, 38% of stags and 80% of hinds were shot in the head or neck. When deer had been shot in the chest, they often ran a short distance. An estimate was made of the time between the first shot and the deer falling to the ground. The median time was 60 seconds for the multiple shot animals and 0 seconds for the single-shot.

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%.[9]

It has been proposed that a review of deer culling by shooting is warranted when, in a cull of average size (between 80 and 120 deer), 14 to 16% of the carcasses contain more than one permanent wound tract (i.e. required more than one shot).[10]

For comparison with a method that is considered to be less humane than shooting – bow hunting of deer-between 12% and 48% of shot deer may be injured and escape.[4]

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'[11,] 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[12, 13, 14]. 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 mechanism[15]. 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 incapacitation[16].

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. Some animals that engage in head butting 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[17, 18].

Bibliography

1. American Veterinary Medical Association (2001). 2000 Report of the AVMA Panel on Euthanasia. *Journal of the American Veterinary Medical Association* **218**, 669–696
2. Gregory, N. (2004). *Physiology and behaviour of animal suffering*. (Blackwell: Oxford, UK).
3. Longair, J. et al. (1991). Guidelines for euthanasia of domestic animals by firearms. *Canadian Veterinary Journal* **32**, 724–726
4. Gregory, N.G. (2005). Bowhunting deer. *Animal Welfare* **14**, 111–116
5. Zajtchuk, 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>
6. Lewis, A.R., Pinchin, A.M. & Kestin, S.C. (1997). Welfare implications of the night shooting of wild impala (Aepyceros Melampus). *Animal Welfare* **6**, 123–131
7. Bradshaw, E.L. & Bateson, P. (2000). Welfare Implications of culling Red Deer (Cervus elaphus). *Animal Welfare* **9**, 3–24
8. Bateson, P. & Bradshaw, E.L. (2000). The effects of wound site and blood collection method on biochemical measures obtained from wild, free-ranging red deer Cervus elaphus shot by rifle. *Journal of Zoology* **252**, 285–292
9. Grandin, T. (2007). Implementing effective animal welfare auditing programmes. *Animal Welfare & Meat Production* 227–242 (CABI: Cambridge).
10. Urquhart, K.A. & McKendrick, I.J. (2003). Survey of permanent wound tracts in the carcases of culled wild red deer in Scotland. *Veterinary Record* **152**, 497–501
11. Courtney, M. & Courtney, A. (2008). Scientific Evidence for Hydrostatic Shock. *0803.3051* at <http://arxiv.org/abs/0803.3051>
12. 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
13. 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
14. 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
15. Courtney, A. & Courtney, M. (2009). A thoracic mechanism of mild traumatic brain injury due to blast pressure waves. *Medical Hypotheses* **72**, 76–83
16. 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
17. Courtney, M. & Courtney, A. (2007). Sheep Collisions: the Good, the Bad, and the TBI. *0711.3804* at <http://arxiv.org/abs/0711.3804>
18. Shaw, N.A. (2002). The neurophysiology of concussion. *Progress in Neurobiology* **67**, 281–344