

Control method: Aerial shooting of feral camels

Assumptions:

- Best practice is followed in accordance with the standard operating procedure CAM002 Aerial shooting of feral camels (<http://www.feral.org.au/tag/camel-sop/>).
- The shooter is suitably trained and competent and will make accurate decisions about whether the shot can be successfully placed. Competency also applies to the pilot who is required to provide the optimum target presentation for the shooter.
- Head movement in camels is minimal during running; therefore head shots are used by some aerial shooting teams. Camels generally run in single file at consistent speed. They are considered the easiest of the largest herbivores to shoot from a helicopter.

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	
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Overall					
Mild					
DURATION OF IMPACT					
Immediate to seconds	Minutes	Hours	Days	Weeks	

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SCORE FOR PART A:	3
Summary of evidence:	
Domain 1	No impact in this domain.
Domain 2	There is less opportunity to move away from the shooter compared with ground shooting, therefore running for a short period in hot ambient temperatures during pursuit may result in a mild but very short-term heat stress.
Domain 3	<p>There is a chance that camels could be injured whilst being pursued however this is low since they do not move at a very fast pace and the terrain they are running over is usually flat.</p> <p>Wounding rates (proportion of animals shot but not killed) are also likely to be low during aerial shooting since the shooters are more skilled and the animals are at a much closer range compared with ground shooting. When animals are closer, shots can be more accurately placed in the target zones and the bullets will hit with more force resulting in more damage to target organs. When shooting from the air, there are greater opportunities to deliver follow-up shots if animals are wounded, compared with ground shooting.</p>
Domain 4	Aerial shooting forces camels to run a short distance, but their flight response tends to be a consistent loping run (not erratic, like the response of donkeys and horses) and the herd structure is maintained. Individual animals don't appear to react to other animals being shot, other than continuing with the flight response. The entire group is always killed therefore there are no long-term effects on social groups.
Domain 5	Camels are likely to experience a mild degree of fear and distress during aerial shooting due to the short period of pursuit by the helicopter. 'Chase time'—defined as the period from an animal beginning to run to escape the helicopter and the first shot being fired at that animal— has been measured in an observational study of two different shooting teams when culling 95 animals (unpublished data, J. Hampton). Duration of chase time ranged from 4 to 410 seconds with a mean 102 seconds. Chase time was greater than 1 minute for 54% of animals observed.

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)
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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 - C-D
Summary of evidence:	
Duration –	<p>With head shots, a properly placed shot will result in immediate insensibility^{1,2,3}. A follow-up shot to ensure death ('insurance shot') is required in all cases.</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 hypoxaemia⁴. Loss of consciousness and death is likely to be quick when animals have been shot in the heart.</p> <p>When 'double tap' chest shots (two quick shots in succession into the chest) are used the duration of suffering will usually be short. If only a <i>single</i> chest shot is used or a second shot is taken but does not occur immediately after the first, then the duration of suffering could potentially be minutes.</p> <p>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.</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 suffering¹.</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 consciousness⁴. Severe haemorrhage in humans is also associated with anxiety and confusion⁵. There will be less suffering when 'double tap' shots (two quick shots in succession into the chest) are used.</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

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OVERALL HUMANENESS SCORE:**Head shot – 3A
Chest shot – 3C-D****Comments****Wounding rates with aerial shooting**

In an observational study of the mode of death associated with helicopter shooting of 192 camels by two different shooting teams, mean 'time to death'—defined as the interval between the first shot being fired at an animal and the moment the animal falls and does not move— was 4 seconds (unpublished data, J. Hampton). The time to death ranged from 0 to 180 seconds. The proportion of animals that were killed instantaneously (time to death of 0 seconds) was 83% and the time to death was greater than a minute for only 1% of animals. Post-mortem observations from seven studies of aerial shooting have also recently been reported by Hampton (unpublished data, J. Hampton). In this study, 715 camels were examined. The wounding rate (proportion of animals shot but not killed) was found to be 0.4% (3 animals). The number of bullet wound tracts ranged from one to eight, the mean was 2.4, with 87% of animals shot more than once. Although the SOP states that only head and chest shots should be used, 35% of camels in this study had been shot in the cervical spine (neck shot). Seventy-five per cent had been shot at least once in the thorax (chest shot) and 63% in the cranium (head shot). Ninety eight per cent of animals had been shot at least once in the head, chest or neck. In this study shooter skill was found to have the largest impact on animal welfare outcomes.

It should be noted that shots to the neck are often used by deer hunters (so as to preserve the head and antlers) and these shots can result in a humane kill when a second shot is can be delivered quickly⁶, but they should be discouraged as a primary target area with aerial shooting of camels since there is a risk that animals can appear dead but be conscious and paralysed⁷.

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'⁸. 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^{9,10,11}. 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 mechanism¹². 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 incapacitation¹³.

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^{14,15}.

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