Control method: Ground shooting of feral cats

Assumptions:	▪ Best practice is followed in accordance with CAT001 and the shooter is competent and will make accurate decisions about whether the shot can be successfully placed. ▪ Single animals are shot on an opportunistic basis. ▪ Head shots are the preferred point of aim. ▪ Shooting is conducted during daylight hours or at night with the aid of a spotlight. ▪ The welfare impact on dependent young is significant when lactating females are killed however this aspect is not considered with this assessment. It is assumed that any kittens are dealt with according to the standard operating procedure.

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
No impact

DURATION OF IMPACT				
Immediate to seconds	Minutes	Hours	Days	Weeks

SCORE FOR PART A:	1
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	No impact in this domain.
Domain 5	No impact in this domain.

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 - C**
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. '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 immediately insensible 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.

Summary

CONTROL METHOD:	**Ground shooting of feral cats**
OVERALL HUMANENESS SCORE:	**Head shot – 1A** **Chest shot – 1C**

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 may 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 feral cats but there are estimates with foxes:

An study to estimate wounding rates for foxes with shotguns, rifles and airguns in England[6] was reported by Baker et al. (2006)[7]. In this study, X-ray plates from 764 foxes admitted to wildlife hospitals and/or 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.

Another study by Fox et al., (2005)[8] 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 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 flawed[9], 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%.[10]

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. 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[17, 18].

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