

## Control method: Aerial shooting of feral goats

Assumptions:	<ul style="list-style-type: none"> <li>▪ Best practice is followed in accordance with the standard operating procedure GOA002.</li> <li>▪ The shooter is 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.</li> <li>▪ For aerial shooting of goats, chest shots are preferred over head shots (because they are easier to achieve with a moving animal), however there is a provision for an initial head shot if presentation of the animal and other conditions are ideal.</li> </ul>
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### 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	

<b>SCORE FOR PART A:</b>	<b>4</b>
Summary of evidence:	
Domain 1	No impact in this domain
Domain 2	No impact in this domain
Domain 3	<p>There may be mild impact due to the probability of injuries from shooting occurring. Goats were considered to be less flighty than other species (e.g. horses, deer) so this unlikely to be a cause of increased injury<sup>1</sup>.</p> <p>The wounding rate may be higher with aerial shooting (compared with ground shooting) because animals are shot whilst they are moving, however the range is likely to be much shorter and any wounded animals can be followed up quickly.</p>
Domain 4	<p>There will be a short-term restriction of behaviour since the animal will be in a heightened state of alertness due to the presence of the helicopter.</p> <p>The SOP recommends that aerial culling is not performed when females are kidding. Females leave the group to give birth in isolated and/or sheltered locations and are therefore less likely to be seen. Also, if females are targeted, it may be difficult to find their young – approximately half of mothers tend to stay in the vicinity of the newborn kid, while others leave them alone to forage (stayers and leavers)<sup>2</sup>. If kids are bigger, they will be with the mother.</p>
Domain 5	<p>The presence of the helicopter will cause increased alertness and fear with a subsequent escape response that includes running and changing the size and composition of groups<sup>3,1</sup>.</p> <p>With aerial shooting it is more likely that all animals in a group will be shot, however, if individuals are left behind they will be isolated from their usual social group, and are likely to experience distress until they find another group to associate with<sup>4</sup>.</p>

## PART B: assessment of mode of death - chest shot

Time to insensibility (minus any lag time)				
Immediate to seconds	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

<b>SCORE FOR PART B:</b>	<b>C</b>
Summary of evidence:	

**Duration –**

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<sup>5</sup>. 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. 'Double tap' shots (two quick shots in succession) are always used with chest shots.

With head shots, a properly placed shot will result in immediate insensibility<sup>6,7,8</sup>. A follow-up shot to ensure death ('insurance shot') is required in all cases.

**Suffering –**

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<sup>5</sup>. Severe haemorrhage in humans is also associated with anxiety and confusion<sup>9</sup>.

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.

When animals are rendered insensible immediately with a well-placed head shot that causes adequate destruction of brain tissue there should be no suffering<sup>6</sup>.

## Summary

<b>CONTROL METHOD:</b>	<b>Aerial shooting of feral goats</b>
<b>OVERALL HUMANENESS SCORE:</b>	<b>4C</b>
<b>Comments</b>	
<b>Hydrostatic shock</b>	
<p>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'<sup>10</sup>. 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<sup>11,12,13</sup>. 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<sup>14</sup>. 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<sup>15</sup>.</p> <p>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<sup>16,17</sup>.</p>	

### Wounding rates with aerial shooting

Statistics on wounding rates for aerial culling of animals are not readily available. Information provided by Tim Fraser, Team Leader of the SA DEH aerial shooting team states that "Animals killed instantly by my team would be better than 90 % and wounded animals less than 5 %". He also explained that "In most cases an experienced shooter knows as he/she touches off the shot whether it is perfectly placed or not, and if there is any doubt, second or even third shots are on there way instantly".

One published account of wounding rates during an aerial shooting cull of feral horses was found. This was in a report on the cull of feral horses in Guy Fawkes River National Park in 2000 prepared by English<sup>18</sup>. The cull occurred between 22 and 24 October 2000, during which time 606 horses were shot. One horse was found alive on 1st November despite having 2 bullet wounds in the killing zone. The report author states that 'many horses received 4 or more shots, but the great majority were killed by the first or second shot' (the actual numbers are not given in the report). Thirty-nine horses were examined after the cull on 2 and 10 November, and also 67 horses were examined by a veterinarian, and 'no evidence of indiscriminate killing away from the target zone was found'.

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