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Literature review on humaneness and effectiveness of aerial shooting of feral horses

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Overview

Aerial shooting, particularly from helicopters, is an effective tool for reducing wildlife abundance in inaccessible areas or on landscape scales. Public acceptability remains low, and relates to welfare concerns, exacerbated by a lack of information on animal welfare outcomes. The humaneness of aerial shooting was considered by the Independent Technical Reference Group in 2015, although at this stage aerial shooting was not considered one of the options. The goal of this review is to determine if the 2015 humaneness assessment is supported by any subsequent research.

The literature supports that the keys to successful aerial operations depend on using highly skilled and experienced shooters and pilots, ensuring multiple shots ('overkill'), and shooting in relatively open areas. When skilled operators work in open areas with multiple shots to each animal, the outcomes for animals are humane, with very short time to insensibility (<1 minute), with more than half insensible on the first shot and very low percentages of wounding (<1%). Aerial shooting therefore results in welfare outcomes that are equivalent to and better than all other control operations. Furthermore, aerial shooting involves a single procedure, so cumulative impacts do not need to be considered, but do need to be considered in other control methods. Lastly, aerial shooting can reduce numbers to an extent that research suggests is required to have positive impacts on conservation.

Due to the public concerns, the practices should be openly audited and made publicly available to ensure best practice is employed, and that there is continual improvement, with animal welfare outcomes prioritised in every management action. However, the decision of technique should be based on the achievement of the management objective and the welfare outcomes. Community perception of welfare outcomes should not drive the decisions, but should be considered where there could be a reputational risk effecting the licence to operate.

In summary, both desktop and published field humaneness assessments conclude that best practice aerial shooting results in humaneness that are comparable or better than other forms of control, with ground shooting having similar outcomes. Furthermore, aerial shooting is a technique that has the potential to remove sufficient numbers to impact the desired conservation outcomes on the National Park. The literature therefore supports the conclusion that aerial shooting could be a humane and effective management tool.

Background

Any management action has implications for animal welfare, and requires a humaneness assessment. Sharp and Saunders (2011) developed a tool for assessing relative humaneness of pest control methods. The tool has been used to assess pest control methods across a range of techniques and species globally (e.g. Beausoleil et al. 2016, Allen et al. 2019, Harvey et al. 2020, De Ruyver et al 2023).

Humaneness assessment aims to evaluate the impact of control on individual animals which then enables comparison between methods. The goal is to create a comparison between methods rather than an absolute assessment of humaneness. The assessment can then be used to inform decisions about management actions through a welfare lens, by considering comparative humaneness of methods (and doing nothing, which also has humaneness implications).

The assessment of welfare impact is based on five domains:

1. Thirst/hunger/malnutrition
2. Environmental challenge
3. Injury/disease/functional impairment
4. Restriction on behaviour/interaction
5. Anxiety/fear/pain/distress

The five domains are evaluated across a matrix that evaluates the impact and the duration to give a pre-determined score (Table 1). For lethal control techniques, there are two parts to the assessment: Part A examines the impact on overall welfare, and the duration of the impact (and is also assessed in non-lethal control), and Part B examines the effects of the killing method on welfare by evaluating intensity and duration of suffering leading to death (Table 2). Thus, we can compare welfare implications of all control across Part A, but only lethal control methods will include a Part B, and are used cumulatively to assess lethal control methods.

Table 1. Scoring matrix for Part A: overall welfare impact (from Sharp & Saunders 2011)

Overall impact on welfare	Duration of impact			
	Immediate to seconds	Minutes	Hours	Days
EXTREME	5	6	7	
SEVERE	4	5		
MODERATE	3			
MILD				
NO IMPACT				

Table 2. Scoring matrix for Part B: assessment of mode of death (from Sharp & Saunders 2011)

Level of suffering*	Time to insensibility (minus any lag time)				
	Immediate to seconds	Minutes	Hours	Days	Weeks
EXTREME	E	F	G	H	H
SEVERE	D	E	F	G	H
MODERATE	C	D	E	F	G
MILD	B	C	D	E	F
NO IMPACT	A	A	A	A	A

In 2015, the Independent Technical Reference Group undertook a humaneness assessment based on these parameters. Due to the lack of research, this was based on advice and expert opinion of a range of practitioners (ITRG 2015), including the author of this review. This resulted in a range of scores for different control methods, including aerial shooting. The

assessment resulted in scores ranging from 4-7 in Part A, and A-D in Part B, with Aerial shooting in scores that were comparable to other forms of control (and with less impact than some; summarised in Table 3). Note that given the paucity of information on aerial shooting, two scenarios were considered: Best case (1) where the chase is <1 minute and insensible on first shot, and (2) chase >5 minutes, requiring >1 shot to insensible.

Table 3. Summary of assessment scores from the ITRG (2015) report on humaneness of wild horse management methods.

Method	Part A score	Part B score
Passive trapping	5	
Mustering (small groups)	5	
Mustering (large groups)	6	
Roping	6	
Onsite humane killing		A
Loading and transport (short)	5	
Loading and transport (long)	7	
Lairage and holding	5	
Slaughter	4	A
Ground shooting (head)	5	A
Ground shooting (chest)	5	D
Aerial shooting (best case, scenario 1)	4	A
Aerial shooting (scenario 2)	5	D

Humaneness assessments are based on expert advice rigorously conducted but should be tested using evidence of the animal's experience of management actions (Hampton et al. 2016c). The purpose of this review is therefore to determine if subsequent research supports the conclusions of the desktop assessment.

Aerial shooting assessment

Aerial shooting involves a qualified shooter using a high calibre semi-automatic weapon from a helicopter, with shooting including deliberate repeat shooting. There is a standard operating procedure in Australia (Sharp 2011). Generally, helicopter-based shooting is effective for population reduction (Bengsen et al. 2022). While aerial shooting has been used on a large number of species and is efficient for reducing population size (e.g. feral donkeys Carrion et al. 2007; feral pigs Parkes et al. 2010; red deer Forsyth et al. 2013; sika deer Forsyth et al. 2013, Latham et al. 2018, fallow deer Bengsen et al. 2022; chital Bengsen et al. 2022), fewer studies have assessed welfare outcomes.

To assess welfare, all the different sections of the procedure need to be considered, including the helicopter pursuit, the mode of death, time to death and rate of non-lethal

injury and associated suffering. Furthermore, logistic challenges also need to be considered, as aerial shooting is inherently imprecise, since a moving platform is used to shoot a moving target (Hampton et al. 2014), such that these logistic considerations can have welfare implications. Some logistic techniques may both enhance efficacy and welfare outcomes, such as thermal camera assisted aerial shooting (Pulsford et al. 2022, Cox et al. 2023). Vegetation is an important consideration, as closed canopy makes both detection and follow-up shots more difficult and time consuming, potentially increasing the time from detection to insensibility. Initial studies had an outcome focus. For example, English (2000) assessed the welfare outcomes of the 606 horses shot in an operation in Guy Fawkes National Park, which led to widespread claims of inhumane treatment, but found no evidence of negative welfare outcomes.

A growing number of studies have performed a welfare assessment on aerial shooting operations, including both pre-mortem and post-mortem inspections, which are required for a full assessment of welfare outcomes (Hampton et al 2016b). The overall conclusion from these initial studies is that the time to death or insensibility (because death can be hard to judge from a helicopter, Hampton et al. 2022), is short, including if the chase is included in the calculation. For horses specifically there has been one study, but it assessed the welfare outcomes across three control operations and almost 1000 horses (Hampton et al. 2017). The welfare outcomes are very similar to another open country species, the dromedary camel (Hampton et al. 2014). While some parameters were sub-optimal (37% were not rendered immediately insensible; 3% of horses were shot outside of preferred anatomical target zones), this was explained by shooter skill which is emphasised as an important consideration. However, the time to insensibility was quick, and the non-fatal wounding rate was <1%. High shooter skill and experience is associated with better welfare outcomes in horses (Hampton et al. 2017) and other species (Hampton et al. 2014). Other shot related factors, such as projectile energy, shot type and vegetation cover can also affect outcomes (Table 4).

Table 4. Results of studies that have assessed welfare outcomes of aerial shooting

Species	Assessment	Average time to insensible	Instant insensible	Wounding	Influencing factors	Reference
Feral horses	937 ante-mortem, 630 post-mortem	Medians: Chase 42s, kill 15s, total 52	63%	1%	Shooter skill	Hampton et al. 2017
Feral dromedary camels	715 post-mortem, 192 ante-mortem	Kill: 4s	83%	0.4%	Shooter skill Vegetation	Hampton et al. 2014
Chital deer Fallow deer	632 ante-mortem 225 post-mortem	Chase 7s-11min, 13s Kill 1s-7 mins 6s Total 11s to 11 mins 22s (average 57sec)	<20%	1%	Fly-back with multiple shots enhances outcome	Hampton et al. 2022
Fallow deer	104 deer	Total 49.5s (max 159s)	Not measured	Not measured	Shotgun enhanced outcomes	Bradshaw et al. 2023
Pigs	138 detected 122 culled	Total: 94.5 Kill: 11.5s	15%	0%	Thermal camera enhanced efficiency and welfare outcomes	Cox et al. 2023
Fallow deer	246 detected 188 culled	Total: 98s Kill: 11s	7%	0%	Thermal camera enhanced efficiency and welfare outcomes	Cox et al. 2023
Rabbits	Low vs high energy projectile 482 post-mortem 500 ante-mortem	Kill: 10s vs 4s	66% vs 92%	6% vs 2%	High projectile energy enhances welfare	Hampton et al. 2016a

Based on literature currently available, aerial shooting in horses has involved chases of <1 minute, and time to insensibility averaging 15s, with 63% rendered insensible instantly. Thus, the evidence to date in horses suggests that the welfare impact approximates Scenario 1 (best practice, chase <1minute, first shot cranium, rendered almost instantly insensible), rather than Scenario 2 (extended chase >5 minutes, wounding, regaining consciousness before death). However, for a minority of individuals, chase time was ~10 minutes, so closer to Scenario 2 (Hampton et al. 2017). Evidence from other species supports the conclusion that welfare outcomes more closely match Scenario A in open country species like camels. Outcomes for most other species are also closer to Scenario A, even in woody country – provided best practice is applied (such as fly-back with multiple shots, high projectile energy, or thermal cameras in bush), although there is a growing probability that some individuals have welfare outcomes closer to Scenario B.

Overall, therefore, there is evidence that welfare outcomes are moderate with a duration of minutes, resulting in a score of 4 for Part A (i.e. less impact than most other management techniques for Part A), and an A score for Part B, representing a very rapid time to insensibility from first shot, and low impact (equivalent to the low-impact lethal techniques, like humane on-site killing, and best practice ground shooting). Therefore, the evidence to date suggests that best practice aerial shooting would lead to equivalent welfare outcomes to other forms of lethal control, and better outcomes than several of the current techniques.

When assessing welfare outcomes, the goals of the operation must also be considered. The goal of removing horses is to reduce impact on the land and the remaining species. If the horses removed do not have the desired positive outcome for the land values and other species, then the welfare impacts are not justified. For example, if the number of horses removed is equivalent to annual recruitment, then the population size and associated impacts on the natural values will remain constant, and the goals of the operation will not have been met. One could therefore argue that the welfare impacts on the horses removed was poorly justified if there is no positive impact on the land values and remaining species, which provided the justification for the management action. Thus, aerial shooting can remove sufficient numbers to positively impact conservation, providing better justification for the welfare impacts. While public acceptability of aerial shooting remains problematic, the choice of management techniques should be based on actual (not perceived) animal welfare outcomes and the effectiveness of the technique to reach the desired conservation outcome (Hampton et al. 2016b).

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