WELFARE IMPLICATIONS OF THE NIGHT SHOOTING OF WILD IMPALA (*AEPYCEROS MELAMPUS*)

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Abstract *Animal Welfare 1997, 6:* 123-131

The most common method of culling impala (Aepyceros melampus) *and many other antelope species in Africa was evaluated from a welfare point of view. The culling of 856 impala from 401 herds was observed and recorded in the Mkuzi Game Reserve, South Africa. Ninety-three per cent of animals were killed instantaneously by the first shot. Results indicated that herd size and composition, distance of herd from hunting vehicle and shot number all have a bearing on the number of animals wounded and missed. It is concluded that the culling of free-ranging impala by night-hunting in the manner described is a satisfactory method on welfare grounds, although a number of recommendations are made which might render the culling process more humane. It is argued that economic and welfare considerations are not necessarily in conflict, and long-term efficiency is likely to be enhanced by addressing both simultaneously.*

Keywords: *animal welfare, culling, impala, wildlife*

Introduction

Culling is an integral component of many wildlife management programmes throughout the world, increasingly so as wildlife becomes compressed in smaller areas, therefore requiring a high level of active management. In addition to culling (the killing of animals to reduce numbers, often for ecological reasons), wildlife populations may be utilized on a sustainable basis. This generally involves the cropping of animals for meat and other products (Young & Wagner 1968). Such utilization has the potential to benefit wildlife by providing the economic incentive to conserve it. This was recognized as having a major role to play in conservation, particularly in the less developed countries where wildlife is increasingly being looked upon as a valuable natural resource. Both culling and cropping are forms of wildlife management and both involve issues relevant to animal welfare (Eltringham 1988).

The impala is a medium-sized antelope common to much of eastern and southern Africa. Females live with young and juveniles in large breeding herds, adult males forming bachelor groups. Mature males hold territories during the breeding season, most of the lambing taking place between November and January in southern Africa, when culling is avoided. The impala is an economically important species, being regularly cropped for meat in many

African countries. It has a dressing percentage (weight of carcass expressed as a per cent of live body-weight) of 58 per cent (Bothma 1989) which is high compared to other antelope species and cattle, and 75 per cent of maximum body size is attained in two years (Bothma 1989). The impala is also a hardy antelope which can browse and graze and therefore survive in degraded grazing conditions (Macartney 1975). Detailed anatomical information on the impala, indicating the exact location of the brain and other vital organs, is shown in Hofmann and Schotz (1968).

A review of culling and cropping techniques for ungulates is given in Tinley (1972), the favoured method for culling impala being to shoot at night from a vehicle, with the aid of spotlights. From a conservation point of view, it is desirable to shoot representative numbers of all ages and both sexes to avoid exerting selective pressure on the population. However, when the primary objective of culling is utilization, the sex ratio of the population may be manipulated for maximum productivity (Fairall 1985). It is fortunate, from a management perspective, that the impala is sexually dimorphic (only males having horns), and it is possible to estimate the age of male impala from their horns with a high degree of accuracy (Bothma 1989). This, together with the alert and investigative postures adopted by ungulates when startled and dazzled at night, renders night shooting a feasible method for reducing the size of impala populations. Since this method relies on good visibility and a static target, which is achieved by the use of spotlights, it provides the opportunity for an observer to record data on humane killing and herd responses to shooting disturbance.

If the culling and cropping of wildlife is to be acceptable, it is important for it to be humane. Little data exists on the welfare aspects of different culling techniques, and economic rather than welfare considerations have often been paramount in the past. This study attempts to identify the key factors which limit the instantaneous killing of free-ranging impala in Africa, and to recommend shooting practices which promote this objective.

Methods

The culling of herds of impala at night was observed and recorded in the Mkuzi Game Reserve, South Africa. The study area is located in north-east Natal and covers 34,644 hectares. The impala is the dominant ungulate species in this area and has been subject to population reduction exercises for many years.

An open four-wheel drive vehicle was used for hunting, stripped to give a clear arc of fire of 180° to the front and sides of the vehicle. The marksman, equipped with a .222 calibre high velocity rifle fitted with a four-power (4x) telescopic sight, sat in the front passenger seat and was able to rest the rifle on the dash board. An observer sat between the marksman and driver. Two 100W quartz iodide spotlights were mounted on swivels at an elevated position behind the cab and controlled by two assistants. Four other assistants, equipped with torches and knives, were carried in the rear of the vehicle to recover the carcasses. Another vehicle followed the shooting vehicle to assist in carrying the carcasses.

Hunting commenced shortly after dark on moonless nights, continuing until dawn the following day. Vehicles were driven at 10–20km per hour along roads and specially opened tracks in the Reserve, each spotlight sweeping back and forth over an arc of 180° but concentrating on the area in front of the vehicle. On sighting an appropriate herd (bachelor or breeding, depending on the animals to be targeted), the vehicle was stopped, usually immediately, on the road or track. Animals were seen either directly or by the reflection of

light from their eyes. Occasionally, the vehicle left the road to approach a herd more closely, stopping just prior to shooting. At no time was shooting undertaken from a moving vehicle. During shooting, both spotlights were trained on the herd and target animals shot in the head by the marksman. Very occasionally, when a head shot was not possible, a high neck shot was taken. Shooting of individual herds stopped when the flight response of the herd limited further accurate shooting. Following shooting, the dead animals were exsanguinated (carotid arteries and jugular veins cut) as soon as possible. During shooting and subsequent carcass recovery, the observer recorded the number of animals in the herd, the incidence of shots which missed or wounded animals and, in most cases, the number and timing of each shot (including the timing between animals being wounded and death) and an estimate of herd distance from the vehicle.

Results

Records of the shooting of 856 animals from 401 herds shot over eight nights during July and August were obtained. In 308 (77%) of the herds culled, the marksman targeted only adult and subadult males. The majority of these herds consisted of male animals only (ie bachelor herds). In 62 (15%) of the herds culled, adult females were targeted in addition to adult and subadult males. In 31 (8%) of the herds culled, adult females only were selected. The overall mean time between the killing of one animal and the next, where these data were recorded (n = 305), was 28 seconds (maximum time 3min 18s; minimum time 2s).

Of the 856 animals killed during the study, 54 (6.3%) were wounded prior to being dispatched with a subsequent shot. No animals escaped after being wounded. Of those animals wounded, and where timing of the shots was recorded (n = 31), the mean time between wounding and death was 30 seconds (maximum time 1min 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 (three animals were wounded twice before dispatch), (see Table 1).

Table 1 Summary of data collected in the study.

Data recorded	
Total number of animals killed	856
Total number of shots fired	990
Number and percentage of animals killed instantaneously	802 (93.7%)
Number and percentage of animals wounded	54 (6.3%)
Average survival time for all wounded animals (s)	30
Number of wounded animals escaping	0
Total number of herds targeted	401

For further analysis, results were condensed into three groups: small herds of 1–4 animals, medium-sized herds of 5–8 animals and large herds of 9 or more animals. The percentage of selected animals in the herd shot decreased with herd size (Table 2). There did not appear to be a relationship between herd size and the proportion of shots that missed. A greater percentage of shots resulted in animals being wounded in small herds than in medium or large herds.

Table 2 **Relationship between herd size (where recorded) and shots which resulted in animals being missed or wounded.**

Observations	Herd size			Total
	Small 1–4 animals	Medium 5–8 animals	Large 9+ animals	
No of herds	316	68	17	401
Percentage of total	79	17	4	100
Total no of shots fired	644	251	63	958
No of shots missed	37	23	3	63
Shots that missed as percentage of total shots fired	6	9	5	7
No of shots that wounded	44	3	2	49
Shots that wounded as percentage of total shots fired	7	2	3	5

The percentage of shots which resulted in animals being missed or wounded was slightly higher in bachelor herds than in breeding herds (Table 3).

Table 3 **Relationship between age/sex class of animals selected for shooting, percentage of animals shot and percentage of shots which resulted in animals being missed or wounded.**

Observations	Animals selected		
	Adult/ subadult males only	Adult/subadult males and adult females	Adult females only
No of herds	308	62	31
Type of herd	bachelor	breeding	breeding
Mean herd size	3	4	5
Mean percentage of herd shot	73	66	69
Mean percentage of selected animals in herd shot	87	67	91
Percentage of total shots fired which resulted in animals being missed or wounded	9	6	4

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The percentage of animals missed (but not the percentage of animals wounded) was directly correlated to the distance of the herd from the vehicle (Table 4). The percentage of animals missed appeared to increase with sequential shot number for a given herd (Table 5). This effect was not apparent with shots which wounded animals.

Table 4 **Relationship between estimated distance of herd from hunting vehicle during shooting (where recorded) and number of shots which resulted in animals being missed or wounded.**

Observations	Distance		
	0–40m	41-80m	81 + m
No of herds encountered	66	32	13
No of shots fired	158	69	36
No of missed shots	13	9	7
Shots that missed as percentage of total shots fired	8	13	19
No of wounding shots	9	4	1
Wounding shots as percentage of total shots fired	6	4	3

Table 5 **Relationship between sequential shot number and percentage of animals missed and wounded.**

Sequential shot no	Total shots fired	Shots which missed		Shots which wounded	
	n	n	%	n	%
1	418	22	5.3	29	6.9
2	257	17	6.6	13	5.1
3	149	18	12.1	12	8.1
4	85	11	12.9	3	3.5
5	47	3	6.4	0	0
6	16	3	18.8	0	0
7-11	18	0	0	0	0

In this study, observations during daylight hours suggested that the impala herds were more likely to show an avoidance response to the hunting vehicle when it was driven through the Reserve, than to a saloon car being driven through the Reserve. Of 109 herds observed, 58 per cent showed a specific avoidance response to the hunting vehicle, whereas only 29 per cent of 83 herds observed avoided a saloon car being driven in the Reserve.

Discussion

In this study, the primary objective was to reduce the density of impala in the Reserve for ecological reasons, although the carcasses were recovered for meat. Head shots were used almost exclusively and are the most desirable on welfare grounds. Neck shots may result in paralysis of the animal without immediate insensibility. Heart shots are likely to result in a higher incidence of woundings and do not render the animals instantaneously insensible. These results are directly relevant to the culling of other antelope species, and may provide an insight into the culling of other wildlife.

A high proportion (93.7%) of animals were killed instantaneously by the first shot, with 13.2 per cent of all shots fired missing or wounding animals. Where animals were wounded and timing of shots was recorded (n = 31), mean time from wounding to death was 30 seconds. Perhaps the best documented culls of other wild species are to be found in the whaling industry as current hunting techniques are developed and refined. Currently in whaling, best practice can only achieve 50 per cent of animals killed instantaneously, with wounded animals surviving for up to one hour (Kestin 1995). Surveys of commercial farm animal stunning in UK abattoirs indicate that 94 per cent of cattle are stunned instantaneously (Daly & Whittington 1992), and that approximately 80 per cent of pigs are stunned instantaneously (Anil & McKinstry 1993). The welfare standard of impala culling as practised in this study is much better than is achieved by whalers and on a par with that achieved in commercial abattoirs.

The behaviour of the herds during shooting may partly explain why a greater percentage of shots resulting in animals being wounded was observed in the smaller herds. Smaller herds tend to be bachelor herds, and the males in this study generally exhibited a more active response to disturbance than the females in the breeding herds. This finding is supported by our data, which indicate that the percentage of shots resulting in animals being wounded is higher in bachelor herds than in breeding herds. The greater percentage of selected animals in the herd shot in breeding herds where adult females only were selected, may also indicate that females showed a less active response to disturbance. The greater percentage of selected animals shot in bachelor herds compared to breeding herds, in which both males and females were selected, may indicate that males show a more pronounced reaction to disturbance when in breeding herds than in bachelor herds. Further research is necessary in this area.

An inverse correlation between herd size and percentage of selected animals in the herd which were shot, indicates that larger herds have a greater proportion of survivors which are likely to suffer stress as a result of the shooting procedure. In the culling of elephants, for example, it is normal practice to shoot all members of a herd to avoid stress in surviving animals (Department of National Parks 1992). It may be appropriate on welfare grounds to recommend that impala herds above a certain size are not targeted for shooting. It is possible that the use of silenced rifles may reduce disturbance during shooting and therefore increase the percentage of selected animals shot per herd. However, the noise of the bullet on impact may in any case result in significant herd disturbance. Our observations of behaviour suggest that some disturbance (such as the sound of the rifle) may cause impala to adopt postures favouring head shooting, and may also hinder a co-ordinated flight response.

The relationship between distance of the herd from the hunting vehicle during shooting and percentage of animals missed suggests that it may be desirable to establish an optimum

distance for shooting. This will depend to some extent on factors such as bullet calibre and velocity, power of the telescopic sight used and experience of the marksman. Flight reaction of the impala and distance of the herd from the shooting vehicle is another important limiting factor on accurate shooting. The behavioural response of ungulates to human activity is well-documented and is comparable to an anti-predator response (Hediger 1950; Walther 1969; Leuthold 1977). The effects of disturbance persist for a long period even when hunting stops (suggesting that hunting is stressful to the survivors), and disturbance is most severe in species which live in social groups (Geist 1971). Because impala exposed to hunting disturbance have a greater flight distance (Schenkel 1966), the optimum shooting distance for impala may not necessarily be the shortest distance between the impala and the shooting vehicle.

Leuthold (1977) stressed the importance of habituation to vehicles in ungulate management, also noting that habituation occurs gradually over time and varies between species. In this study, observations of impala behavioural responses which were carried out during daylight hours, indicated that the impala had learned to associate the hunting vehicle with threat (or a threat to themselves) but did not associate the presence of saloon cars passing through the Reserve with a similar threat. Using different hunting vehicles for shooting might reduce the level of flight response of the impala, therefore improving the efficiency of culling, especially when hunting is undertaken during the day.

There did not appear to be a relationship between sequential shot number and percentage of shots which resulted in animals being wounded, but there was a direct relationship between shot number in a sequence and percentage of shots which resulted in animals being missed. It appears that the flight response of the herd limits accurate shooting by the sixth shot. This provides evidence to support the case for selecting only smaller herds for shooting.

When comparing impala with other species, each species must be considered separately in terms of its natural history and behaviour. Behaviour is a particularly important factor in the general management (including culling) of impala and other ungulate populations (Jarman 1974). Factors such as grouping, social behaviour and flight response and distance must all be considered for welfare to be optimized. Different age-sex classes of animal can vary in their behaviour during hunting, and male impala, for example, are particularly vulnerable to hunting during the rut (Child *et al* 1970). A knowledge of impala behaviour is central to an appraisal of alternative culling methods such as herding the animals into an enclosure prior to shooting and head shooting from helicopters, which is sometimes undertaken in South Africa (Bothma 1989). Because tracking wounded animals is time consuming and stress affects the meat quality of wounded animals (La Chevallerie 1971), developments which render the shooting process more humane are also likely to increase its efficiency and economic viability.

On welfare grounds, shooting at night with the aid of spotlights is a satisfactory method of culling impala populations in southern Africa. Stress to the animals is kept to a minimum prior to shooting and a high proportion of the animals are killed instantaneously.

If animal welfare is to be maximized further research is required. Because herd flight response to shooting disturbance is the key limiting factor for humane and instantaneous killing, further improvement is most likely to be made by concentrating on controlling this behavioural response and by encouraging the adoption of those static responses to

disturbance which facilitate accurate shooting. It may, for example, be productive to experiment with silenced rifles and different intensities of spotlights. Further research is also needed to monitor the longer-term effects of shooting disturbance. It is possible that the frequency of such disturbance has an effect on herd size and composition and may influence the incidence of specific avoidance responses to the hunting vehicle. Finally, it is recognized that the results of this study are based on the shooting performance of one marksman and that under ideal circumstances, the shooting performance of several marksmen would have been compared.

Conclusion and animal welfare implications

In this study, where impala were shot on moonless nights with the aid of spotlights by a skilled marksman, 93 per cent of animals shot were killed instantaneously. This is comparable with what is achieved in commercial abattoirs and is better than many other methods used for culling wild animals. Although this method causes minimal stress before death, and is thus relatively humane, further evaluation could improve the welfare of these animals.

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