

APPENDIX A: ETHICS AND TROPHY HUNTING

A.1 The ethical background to trophy hunting

The principal ethical issue we address is whether acting to influence legislation on trophy hunting (for example through a ban on imports, or stricter conditions) is the *right* thing to do. We do not propose to offer a verdict on this, but will set out what should be considered in making such a judgement. Because the action being considered is a change to legislation, it is also important to preface this discussion by noting that it does not follow from the view that an action is ‘wrong’, that legislation prohibiting it should follow. We might think that telling hurtful lies is wrong, for example, but not that it should be made illegal. Lying during legal proceedings, perjury, is on the other hand widely accepted to have consequences that are serious enough to merit illegality. Similarly, there are laws that prohibit actions that are not immoral³⁶. The correspondence between law and ethics is not expected to be that complete.

It is also possible to envisage a ban on trophy imports without a verdict that trophy hunting is wrong, as a signal of what sort of society we (in the UK) are, for example, without implying that we making a judgement on the morality of practices elsewhere. But we will assume

that our focus is on the ethical sustainability of trophy hunting, and is not limited to legislation concerning trophy imports. We consider the moral repercussions of banning trophy hunting, an action the UK government has only a very indirect influence on.

A.2 What is the moral status of animals?

The moral dilemmas concerning how animals should be treated emerge at least in part from differences in judgements on the extent to which they have intrinsic value. Sentient beings are widely agreed to have intrinsic value. And if an animal has some *intrinsic value*, value beyond the use to which we can put it (its instrumental value), it follows that it should be treated with some regard for its welfare (Vucetich et al. 2015). This view is held by most ethicists and is also widespread among the public. It transforms the question concerning trophy hunting and the use of animals in general into a question of the form: what is an adequate reason to kill animals? Our more specific question here is of course: is trophy hunting an adequate reason to kill a lion?

The question is not limited to a binary verdict on whether or not trophy hunting is permissible. If this is not the

³⁶For example, driving at 71 mph on motorways in the UK is illegal. Few would argue that it is immoral.

case (if the answer to the ‘whether’ question is ‘yes’), then the ‘how’ question arises: under what circumstances is trophy hunting permissible? It is the moral status of different outcomes that inform whether we think a ban is appropriate, and under what circumstances. These judgments depend on *values*, and values are not constants across or within cultural groups (an observation that does not lead to the relativist conclusion that no judgment on right and wrong is possible). Some hold the view that some practices are wrong in principle and can never be tolerated, while others support a limited version of utilitarianism, judging the merits of an action by its positive and negative outcomes (Macdonald et al. 2016c). Conservationists advocating this perspective will likely argue that there is a duty to conserve lions for future generations of humans. A verdict on trophy hunting is bedevilled by the incommensurability of the outcomes – economics, ecology and both human and animal welfare are involved.

Vucetich and Nelson (2014) apply the formal methodology of argument analysis to wolf hunting in the US. They highlight that a central proposition justifying the conclusion that wolf hunting should be allowed, that “*Conserving wolf populations is an adequate reason to kill individual wolves*” is not settled, and represents an unresolved conflict between

conservation ethics and animal welfare ethics. This is the core of the ethical dilemma concerning trophy hunting of lions.

Providing answers to questions of the form “*what is a good reason to kill an animal?*” requires rational assessment of the different value judgements underlying a decision. Under what conditions, for example, can the proposition that the ends justify the means, the core of the utilitarian perspective, not be defended? At one extreme, some philosophers defend the view that at least some animals merit full moral consideration, where ‘full’ implies a status equal to that of humans, and characterise the opposing view as ‘speciesism’. This school of thought has been championed by the philosopher Peter Singer (who is also explicitly utilitarian in his ethical stance³⁷). Singer’s view, based on capacity for suffering is: “*The basic principle of equality is, I shall argue, equality of consideration; and equal consideration may lead to different treatment and different rights*” (Singer 1986). This leads Singer to rule out consumptive use of animals including for hunting. Most philosophers reject this position, arguing that the difference in capabilities between humans and other species, which Singer does not dispute, merit qualitatively different moral obligations, different enough that hunting is permissible (Scruton 2000). Scru-

³⁷ *Sympathy for utilitarian ethics does not therefore necessarily lead to tolerance of, or support for, trophy hunting.*

ton's view is that our obligation to sentient beings is for proper respect to be shown. He also defends hunting as satisfying a fundamental human need for connection with nature.

Some of those who argue that the species barrier is artificial are led *in extremis* to the conclusion³⁸ that humans have an obligation to intervene in nature to improve welfare (some philosophers have argued that the death of Cecil was a good thing based on the rationale that the net effect on animal welfare may have been positive because Cecil's death spared his future prey animals a grisly death³⁹). Anyone with any awareness of nature knows that few animals die peacefully at the end of a full life span (Macdonald et al. 2006). But the idea that this lead to a human obligation to intervene and to eliminate at least some carnivores is, as one of the philosophers who advocates it (Oscar Horta) admits, "*new and strange*" (Horta, cited by (Simpson 2015)). It is based on the view than reducing animal suffering should be prioritised over the preservation of species⁴⁰. There may be sound philosophical cases to be made against this position, but the most potent argument is probably that it is difficult to visualise the circumstances

where it could be made to 'work' ecologically. One of the difficulties for this position, as admitted by one philosopher who is sympathetic to the idea, is in predicting the myriad of knock-on effects for any specific proposed intervention, and that the chance of a large net decrease in animal welfare is plausible for many scenarios. This aspiration is sufficiently challenging in practice that the rational case is not explored further here.

The Cecil event drew attention to a possible conflation of animal welfare and animal rights. The distinction centres on whether there is any physical or mental stress to the animals concerned. If an animal is rendered unconscious instantaneously by a hunter, and with no mental stress preceding the event, it can be argued there are no animal welfare issues⁴¹. If it is admitted that animal have some intrinsic value, then we again arrive at the question of whether or not the reason for the killing is an adequate one. One view, said by Oscar Horta to be 'popular', is that death is harmful because it deprives an animal of future positive experiences (LaFollette and Wiley Online Library (Online service) 2013). There is also an ethic of 'divinity' holding that "*every entity in nature enjoys its partic-*

³⁸supported by philosophers like Oscar Horta, who recently spoke in Oxford on human obligation for improving wild animal welfare (Oxford Magazine, M term 2015, 013).

³⁹<http://qz.com/497675/to-truly-end-animal-suffering-the-most-ethical-choice-is-to-kill-all-predators-especially-cecil-the-lion/>

⁴⁰http://opinionator.blogs.nytimes.com/2010/09/19/the-meat-eaters/?_r=0

⁴¹A similar issue arises where methods of animal slaughter are discussed, and if methods prescribed by religion that do not produce instantaneous unconsciousness are acceptable.

ular right to exist” (Schweder, cited by Dussault 2013).

‘Trolleyology’ experiments⁴² exploring moral decisions made when animals’ fates are compared with those of humans suggest in practice people do place higher value on human life compared with that of animals. In one scenario the subjects are told that an out of control trolley is headed down a rail towards the last surviving group of mountain gorillas, but that they can throw a switch and send it towards a young man, who will definitely die. Do they make that switch? In this and other similar dilemmas, and this is replicated in different parts of the world, almost everyone chooses people over animals – the moral rule “*save people over animals*” was dominant (Herzog 2011). There is therefore little public assent for those who argue that the distinction between humans and other sentient animals is an arbitrary one.

A.3 If trophy hunting is permissible in principle, what affects this?

Most people occupy what has been called ‘the troubled middle’ in their dealing with animals, having some sympathy for the logic of animal rights, but while eating meat and being willing to sacrifice many mice in the search for a cure

for cancer (Herzog 2011). The motive for the killing of animals is clearly influential. The impetus for a trophy ban, brought to the fore by the ‘Cecil’ event, concerned its status as a sport. Unlike the debate surrounding UK foxhunting (Macdonald and Johnson 2015b), which was also defended on its utility in pest control, but attracted disapproval for its function as at least partly for sport, trophy hunting of lions is unequivocally a sport. We know that ‘motive’ is widely perceived to affect the moral status of an action – hunting for food or protection is deemed much more acceptable than for sport. Hunting of ungulates is sometimes defended as providing meat (as well as sport), and is therefore closer to the UK foxhunting case, where motivation is not completely straightforward. The moral judgment to be made then concerns whether the meat delivered by the hunting renders the action more acceptable (economically both functions can be monetised, which contributes to a judgment based on consequentialism, depending on who benefits).

Those who might support or tolerate trophy hunting from a utilitarian perspective acknowledge that how trophy hunting is managed affects its acceptability – they argue that its practitioners have a duty to maximise conservation and welfare standards (Macdonald

⁴²In trolleyology experiments moral dilemmas are framed around a thought experiment in which a subject is asked if they would prevent an out of control rail trolley from for example killing five people by switching the tracks so that one person on a different line was killed.

et al. 2016c), and it is clear that trophy hunting is very variable in these respects. The practice known as canned hunting (see Section 1.2.2) attracts particular opprobrium on both welfare and conservation grounds. Here, lions are bred to be hunted in relatively small enclosures and the hunter is almost guaranteed a trophy. Di Minin et al. (2016) comment that “*the ethics of canned hunting are dubious*”, without setting out their objections, and call it an “*abhorrent practice*”. There is almost no evidence that canned hunting makes a meaningful contribution to conservation, and even among trophy hunters the practice is deprecated: Glen Martin writes that “*canned hunts have long been an embarrassment to the international hunting community*” (Martin 2012). Part of the ethical objection to canned hunting also lies in perceived fairness. For example, Mercer, cited in Anon (2015), describes canned hunting as a practice where “*the target is unfairly prevented from escaping the hunter*”. This resonates with Roger Scruton’s defence of hunting where proper ‘respect’ is shown to the quarry. And the questionable wild status of the quarry here further weakens a case for the hunting as fulfilling an innate human need for connection with nature. There is an

instinctive sense of ‘fair play’ at work here⁴³.

What other inputs are there to a moral judgment on the acceptability of trophy hunting? It is widely accepted that where animals are killed there is an obligation to maintain as high a level of welfare standard as possible. (Recalling that after the ‘whether’ question the ‘how’ question follows). Humanely carried out, the execution of trophy hunting need not raise welfare concern. It is arguable that at least in some cases that properly run trophy hunting can have a net welfare benefit if the targeted animals are old and poor health. Old lions may starve or incur severe injuries hunting large prey. Data on wounding rates are sparse⁴⁴, and hunting methods that are difficult to defend on welfare grounds, such as the bow hunting of Cecil, are used. Further, trophy hunting can lead to infanticide and other social disruption with negative welfare outcomes if the wrong animals are targeted. But even if trophy hunting were carried out to a high welfare standard, its opponents often invoke an argument based on the right to life of the individual animals, as well as holding the view that killing animals for sport is wrong as a moral imperative. For those with this view, the

⁴³*The ethical perspective is complicated by a tension between ‘fair play’ and ‘clean kill’ – the latter will frequently be more difficult to guarantee for conventional trophy hunting, with welfare implications. A wounded animal might linger in the bush, whereas for canned hunting the animal will be found more easily and rapidly dispatched.*

⁴⁴*In the BVC reserve Zimbabwe, lion wounding rates are said to have been 0% of over 100 hunted in the last ten years, and 4% for leopards (K. Leatham, General Manager, BVC, pers. comm.).*

intrinsic value of the animal is such that the distress at the knowledge that trophy hunting continues is a real cost. For conservationists prioritising the persistence of lion populations, the focus is on establishing the circumstances where trophy hunting makes a positive contribution.

Arriving at a verdict that trophy hunting is justified by its current impact for conservation also depends on considering what would happen if trophy hunting were removed. If other land uses, phototourism most obviously, were almost certain to be substituted and with equally good or better consequences for conservation and the local economy, support for trophy hunting does not look ethically sustainable. If on the other hand, the likely outcome is that conversion to agriculture is likely, and with devastating effects for both wildlife and local economies, then the ethical case for current toleration of trophy hunting is clearly stronger. In reality of course it will be difficult to make this ‘what if’ judgement for any specific location.

Some hunting areas, including the Buby Valley Conservancy exist in areas where agriculture has failed due to poor soils and rainfall. Trophy hunting areas are often remote and without aesthetic appeal for conventional tourism (Winterbach et al. 2015). The ethical implications may be particularly difficult where changes in land use are predicted

to have opposing effects for wildlife and people. How do we react to a thought experiment in which wildlife is removed, but a new agricultural regime has substantial economic and social benefits for the local people, who hitherto tolerated lions in their midst only because of the previous income from trophy hunting?

A.4 How does emotion affect judgements concerning trophy hunting?

Where human-animal relations are concerned, value judgements are notoriously riddled with illogicality and inconsistency⁴⁵. Andrew Rowan, president of the Humane Society of the US, has been quoted as saying “*The only consistency in the way people think about animals is inconsistency*” (Herzog 2011). The public pressure for a trophy import ban is arguably driven primarily by emotion (which was conspicuous in the reaction to the ‘Cecil’ event). Emotion may have a legitimate part to play in moral judgements, and in some cases conservationists may be guilty of neglecting the importance of emotion (Nelson et al. 2016).

That emotion is a powerful force in ethical judgements is undeniable. The primacy of emotion in any ethical judgement does not by itself tell us anything about the validity of that ethical judgement. The question to be answered is: *is that eventual judgement rational?*

⁴⁵ See e.g. Hal Herzog, *Some we Love, Some we Hate, Some we Eat* (2010)

Jonathan Haidt (Haidt 2012) has argued that instinctive emotional processes underlie a Kantian moral perspective, compared with more reflective utilitarian process (and also points out that both have been highly generative in public policy)⁴⁶. Haidt argues that emotion leads the formation of moral judgements, and that the more reflective and slower logical process kicks in later providing post hoc rational justification for those judgements⁴⁷, likening the primacy of emotion in making moral judgements to an emotional elephant being ridden by a rational rider – the former is a lot stronger. He has coined the term ‘moral dumbfounding’ to describe scenarios where someone will declare an action ‘wrong’ without subsequently being able to produce any coherent case as to why it is wrong. Hal Herzog’s experiments on people’s reactions to different hypothetical scenarios involving the use of animals in medical research (Herzog 2011) show that the balance between emotion and reasoning varies depending on the ‘yuk’ factor – experiments involving amputations much more likely to evoke an emotional rather than a reasoned response for example. A current weakness in our knowledge of emotion as it relates to trophy hunting is the narrowness of its research base. Nelson et al. (2016) consider only the emotions of a Western audience – there has been almost no

consideration of the emotional response amongst rural Africans, who bear all the costs of lion presence, and understandably, some of them are very negative towards lions (Nzou 2015).

A.5 What inconsistencies are there in value judgments concerning acceptable reason for killing animals?

The reaction to the Cecil event illustrated many inconsistencies in public attitudes to animals. These inconsistencies are well known and culturally diverse (Herzog 2011). For example, the concern for the welfare of an individual wild animal looks extravagantly disproportionate compared with the welfare implications of factory farming (many of those who reacted to Cecil’s killing will have been consumers of the products of factory farming, where mammals are daily subject to very poor welfare practices on an industrial scale). Other factors are likely to influence this judgement, for example: *if the hunted animal is consumed, how much the food was needed by its consumers?* In these and other judgements there are known to be substantial differences between men and women – men are more likely to approve of killing animals for fun and profit compared with women (Herzog p134). One of the more salient features of the trophy

⁴⁶ *There is evidence that utilitarian heuristics are held in less esteem than more instinctive judgements:* <https://theconversation.com/want-to-be-popular-you-d-better-follow-some-simple-moral-rules-57511>

⁴⁷ *The parallel with Kahneman’s type 1 and type 2 heuristic processes is striking*

hunting pictures assembled in the pages of the Safari Club International record books is the predominance of male faces.

The effect of ‘charisma’ is also influential. Mammalian charisma is a phenomenon that has been quantified (Macdonald et al. 2015b) – big cats in particular are perceived to be highly charismatic compared with antelope for example. It seems unlikely that the hunting of an antelope called ‘Cecil’ would have attracted comparable attention to Cecil the lion. And even comparing big cats, if action were to be targeted against lion hunting against, there are consequences if hunters merely substitute leopards. Further down the charisma hierarchy, rodents and other pest species are not highly valued, and welfare standards for their treatment are relaxed as a result (Baker et al. 2012). There is also an effect of size – there is more sympathy for larger animals than for small ones⁴⁸. For conservation scientists, these perceptual biases may be akin to many of those described by Daniel Kahneman in work on the psychology of judgement and heuristics (Kahneman 2011). A quest for consistency in attitudes to animals may not only be futile, but fail to acknowledge a significant element in how biodiversity is valued. The visceral public affront pro-

voked by the Cecil case draws attention to how a bias towards large charismatic predators, shared by scientists and general public alike impacts conservation priorities. Macdonald et al. (2006) point out that while it would be rational to treat animals with equal cognitive capabilities similarly, glancing acquaintance with public views makes clear that some are more equal than others. This inequality in terms of charisma is regularly utilised in conservation marketing, where charismatic species are routinely used to spearhead fundraising.

More inconsistencies concern the failure of those who oppose trophy hunting (and therefore support a trophy import ban as part of the opposition to it) to acknowledge the views of Africans living with the lions, many of whom would prefer to see fewer or no lions on their doorstep, or who tolerate lions only because of the economic benefits of trophy hunting⁴⁹. These people endure a tangible cost in the stress of living close to. At real risk of loss of livelihood or even life, for many of these the concept of animal rights is alien. Opponents of trophy hunting based in economically advantaged countries risk being perceived as cultural imperialists imposing values on other sovereign states, and against a

⁴⁸ *A bias which Shakespeare may have been acknowledging when he has the character Isabella in Measure for Measure say “and the poor beetle that we tread upon finds a pang in corporal sufferance as great as when a giant dies”*

⁴⁹ *Many of them also view trophy hunting with some suspicion for its association with the “indelible stain of colonialism” (Martin, Gamechanger p 49)*

backdrop of highly inconsistent attitudes to animals in their own countries. There is also moral hazard where corrupt trophy hunting is tolerated because it has net conservation benefits, even where money supposedly destined for conservation or local people finds its way into corrupt pockets. What if the host country tolerates ad hoc lethal force against poachers to defend its stock of wildlife? Mike Norton Griffiths describes it as inexplicable for conservationists to condone the “*slaughter of destitute peasants in the name of conservation*” (cited in Martin 2012, p 75). Can cooperation with land managers be justified in these circumstances?

A.6 Does the Cecil event highlight changing perspectives on the acceptability of trophy hunting?

The most vociferous contributors to the debate following Cecil’s killing were adherents to a pathocentric view of nature, focussing on the individual animal’s conservation rather than that of the ecosystem inhabited by it, an ecocentric perspective that conservationists tend to adopt⁵⁰. The most extreme rhetoric, from a conspicuous minority, referring to Walter Palmer as a ‘murderer’ for example implies some sympathy for the

opposition to ‘speciesism’. In this movement and more moderate voices for the interests of individual animals, which he refers to as ‘animalism’, Glen Martin (Martin 2012) identifies a transformed social landscape for conservation in Africa, and a ‘New Environmentalism’ rooted more in social trends than in science, and propelled by the animal rights movement. He argues that this drift away from dispassionate data driven science invests this movement with a power that science finds hard to combat, it being “*grounded in the heart more than the mind*” (Gamechanger p49). Also recognising shifting societal attitudes, Macdonald et al. (2016) wrote “*Insofar as global opinion might create circumstances which made lion trophy hunting unviable (or banned it outright), and insofar as such hunting might indeed currently contribute to financing conservation of lions and beyond, it would seem prudent to plan for a journey towards that outcome, rather than to jump precipitously to it. That said, our sense of the global interest in Cecil was that it suggested a prevailing moral standpoint whereby ethical consideration rendered it inappropriate to consider economic ones. We sensed that the prevailing opinion was that ethics trumped finance in this context, and that arguing against that was perceived as morally equivalent to,*

⁵⁰ *The ecocentric perspective’s focus on ecological entities does not necessarily exclude care for individuals. J. Baird Callicott’s version of ecocentrism has been criticised for its ‘ecological fascism’. But many conservationists would reject that, and argue that ecocentrism involves care for both ecological entities and individual organisms (John Vucetich, pers comm).*

for example, justifying slavery on the basis of its revenue generating capacity. Conservationists seeking the best consequentialist compromise, then, were likely to be judged harshly by history. If this is indeed the prevalent global mood, and insofar as trophy hunting does indeed give lions a value that prevents their eradication, it is obviously urgent to find an alternative means of encouraging (presumably paying) people to tolerate them.” Conservationists, particularly those concerned with large charismatic carnivores, may therefore be faced with the increasing challenge of reconciling the science underpinning proposed policy with its public approval. There may be in part a failure of science to communicate the science – the idea that killing individuals is compatible with the conservation of their species may not have been well communicated, and can be refuted. But the challenge goes beyond that, in making the case for values surrounding custodianship of species for future generations, for example in the face of increasing public preoccupation with the fate of individual animals. It is unlikely that conservationists contemplating this complex miasma of incommensurables will very often be able to identify what is clearly the ‘right’ thing to do. In a messy and dynamic system, the problem will more frequently be to make a judgement as to what course of action is the least bad⁵¹.

A.7 Summary

An ethical verdict on trophy hunting depends on how diverse values are weighed. A key unresolved conflict is that between conservation and welfare ethics. The acceptability of hunting is also affected by how it is carried out. The practice of canned hunting, where animals are bred to be shot in small enclosures, is particularly problematical. The needs of local people have to be taken into account, both for ethical reasons and because lion conservation, whether dependent on trophy hunting or not, may not be sustainable without their support. Salient questions are: *to what extent does trophy hunting currently contribute to conservation?; what are its current impacts on local people?; what land uses might be substituted were it to be banned?; and what would be the implications of a change in land use for conservation and local people?* Public disapproval of trophy hunting of lions outside of countries hosting trophy hunting seems likely to be based at least in part on the charisma of large predators, and an emotional reaction to killing such animals for sport. It is not clear that this is a sound basis, by itself, for any policy change. The ethical propriety of a ban on trophy hunting of lions depends on the implications and possibility of perverse outcomes for conservation of lions and of predators, and for local economies.

⁵¹ And as Richard Dawkins has pointed out, if someone makes a judgement that A is worse than B, it does not follow that they are ‘supporters’ of B.

B.2 Mozambique

Table 5: *Reported international imports vs exports 2006-2015: Mozambique*

Exporter	Importer	Reported By	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	Total	
Mozambique	Austria	Importer	0	0	0	0	2	0	0	0	0	0	2	
		Exporter	0	0	0	0	2	0	0	0	0	0	0	2
	Denmark	Importer	0	0	0	0	0	0	1	2	0	0	0	3
		Exporter	0	0	0	0	1	0	0	0	0	0	0	1
	France	Importer	0	0	0	0	0	0	0	0	0	0	0	0
		Exporter	0	0	0	0	0	0	0	0	1	2	3	3
	Germany	Importer	0	0	0	0	1	0	0	1	0	0	0	2
		Exporter	0	0	0	1	0	0	0	0	0	0	0	1
	Hungary	Importer	0	0	0	0	0	0	0	0	0	0	0	0
		Exporter	0	0	0	0	1	0	0	0	0	0	0	1
	Lithuania	Importer	0	0	0	0	0	0	0	0	0	0	0	0
		Exporter	0	0	0	0	0	0	0	0	1	0	0	1
	Luxembourg	Importer	0	0	0	0	0	0	0	0	0	1	0	1
		Exporter	0	0	0	0	0	0	0	0	0	0	0	0
	Mexico	Importer	0	3	1	0	0	0	0	0	0	0	0	4
		Exporter	0	0	1	0	0	0	0	0	0	0	0	1
	Namibia	Importer	0	0	0	0	0	0	0	0	0	0	0	0
		Exporter	1	0	0	0	0	0	0	0	0	0	0	1
	Norway	Importer	0	0	0	0	1	0	0	0	0	0	0	1
		Exporter	0	0	0	1	0	0	0	0	0	0	0	1
	Poland	Importer	0	0	0	0	0	0	0	0	0	0	0	0
		Exporter	1	0	0	0	0	0	0	0	0	0	0	1
	Portugal	Importer	1	2	3	6	2	0	1	4	1	0	0	20
		Exporter	2	2	2	2	1	0	0	0	1	0	0	10
	Russian Federation	Importer	0	0	0	0	0	0	0	0	0	0	0	0
		Exporter	0	0	0	0	0	0	0	0	0	1	3	4
	South Africa	Importer	1	3	3	2	1	4	24	2	1	0	0	41
		Exporter	5	3	3	10	3	2	0	0	7	3	3	36
	Spain	Importer	3	2	3	1	1	3	0	2	0	0	0	15
		Exporter	3	1	3	2	3	0	0	0	1	1	1	14
United States Of America	Importer	1	2	2	4	3	7	5	4	9	0	0	37	
	Exporter	3	5	5	8	10	2	0	2	4	5	5	44	
Unknown	Importer	0	0	0	0	0	0	0	0	0	0	0	0	
	Exporter	0	0	0	1	0	0	0	0	0	0	0	1	
Zimbabwe	Importer	0	0	0	0	2	0	0	0	0	0	0	2	
	Exporter	3	0	2	0	3	0	0	0	0	0	0	8	
Total reported by Importers			6	12	12	13	13	14	31	15	12	0	128	
Total reported by Exporters			18	11	16	25	24	4	0	3	15	14	130	

B.3 Namibia

Table 6: Reported international imports vs exports 2006-2015: Namibia

Exporter	Importer	Reported By	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	Total	
Namibia	Austria	Importer	0	1	0	0	0	0	0	0	0	0	1	
		Exporter	0	0	0	0	0	0	0	0	2	0	0	2
	Bulgaria	Importer	1	0	0	0	0	0	0	0	0	0	0	1
		Exporter	1	0	0	0	0	0	0	0	0	0	0	1
	Canada	Importer	0	0	0	0	0	0	0	0	0	0	0	0
		Exporter	0	0	0	0	0	0	0	2	0	2	0	4
	Croatia	Importer	0	0	0	0	0	0	0	0	0	0	0	0
		Exporter	1	0	0	0	0	0	0	0	0	0	0	1
	Czech Republic	Importer	0	0	0	0	0	0	0	0	0	0	0	0
		Exporter	0	0	1	0	0	0	0	0	0	0	0	1
	Finland	Importer	0	0	0	0	0	0	0	1	0	0	0	1
		Exporter	0	0	0	0	0	0	0	0	0	0	0	0
	France	Importer	0	0	0	0	0	0	0	0	0	0	0	0
		Exporter	1	0	0	0	0	0	0	0	0	0	0	1
	Germany	Importer	0	1	1	1	0	1	2	0	1	0	0	7
		Exporter	1	0	3	0	0	0	2	0	2	0	0	8
	Luxembourg	Importer	0	0	0	0	0	0	1	0	0	0	0	1
		Exporter	0	0	0	0	0	0	0	0	0	0	0	0
	Mexico	Importer	0	3	1	0	0	0	0	0	0	0	0	4
		Exporter	2	0	0	0	0	0	0	0	0	0	0	2
	Netherlands	Importer	0	0	0	0	0	0	0	0	0	0	0	0
		Exporter	1	0	0	0	0	0	0	0	0	0	0	1
	Norway	Importer	0	0	0	4	3	0	0	0	0	0	0	7
		Exporter	0	0	3	2	0	0	0	0	0	0	0	5
	Poland	Importer	3	10	0	0	0	0	0	0	0	0	0	13
		Exporter	0	0	0	0	0	0	0	0	0	0	0	0
	Portugal	Importer	0	1	0	0	0	0	0	0	0	0	0	1
		Exporter	0	0	0	0	0	0	0	0	0	0	0	0
	Romania	Importer	0	0	0	0	0	0	0	0	0	0	0	0
		Exporter	0	0	0	0	0	0	1	0	0	0	0	1
	Russian Federation	Importer	0	0	0	0	0	0	0	0	0	0	0	0
		Exporter	0	0	3	3	0	0	0	1	2	0	0	9
	South Africa	Importer	0	0	1	1	0	0	0	0	0	0	0	2
		Exporter	0	0	0	1	0	0	1	0	0	0	0	2
	Spain	Importer	0	0	0	0	1	0	0	2	0	0	0	3
		Exporter	0	0	0	0	0	0	0	2	0	0	0	2
	Sweden	Importer	0	0	0	4	0	0	0	0	0	0	0	4
		Exporter	0	0	0	1	0	0	0	0	0	0	0	1
	Turkey	Importer	0	0	0	2	0	0	0	0	0	0	0	2
		Exporter	0	0	0	0	0	0	0	0	0	0	0	0
	United States Of America	Importer	6	7	8	6	7	8	5	6	3	0	0	56
		Exporter	4	0	4	7	2	10	7	6	10	0	0	50
Total reported by Importers			10	23	11	18	11	9	11	6	4	0	103	
Total reported by Exporters			11	0	14	14	2	10	15	9	16	0	91	

B.4 Tanzania

Table 7: *Reported international imports vs exports 2006-2015: Tanzania*

Exporter	Importer	Reported By	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	Total	
Tanzania	Argentina	Importer	0	0	0	0	0	0	0	0	0	0	0	
		Exporter	1	0	0	0	1	0	0	0	0	0	0	2
	Austria	Importer	0	0	1	0	1	3	1	0	0	0	0	6
		Exporter	0	0	0	0	1	0	0	0	0	0	0	1
	Belgium	Importer	0	0	1	3	1	0	0	0	0	0	0	5
		Exporter	1	0	3	0	1	0	0	0	0	0	0	5
	Bulgaria	Importer	0	0	0	1	1	1	0	0	0	0	0	3
		Exporter	0	0	0	0	0	0	0	0	0	0	0	0
	Canada	Importer	0	0	0	0	0	0	0	0	0	0	0	0
		Exporter	2	0	0	1	0	0	0	0	0	0	0	3
	China	Importer	0	0	0	0	2	0	0	0	0	0	0	2
		Exporter	0	0	0	0	0	0	0	0	0	0	0	0
	Croatia	Importer	0	0	0	0	0	0	0	0	0	0	0	0
		Exporter	1	0	0	0	0	0	0	0	0	1	0	2
	Czech Republic	Importer	0	0	0	0	0	0	0	2	0	0	0	2
		Exporter	1	0	0	0	0	0	0	1	0	0	0	2
	Denmark	Importer	1	0	2	0	2	0	0	0	0	0	3	8
		Exporter	0	0	0	0	0	0	0	0	0	0	0	0
	Estonia	Importer	0	0	0	0	0	0	0	1	0	0	0	1
		Exporter	0	0	0	0	0	0	0	0	0	0	0	0
	Finland	Importer	0	0	0	0	0	0	0	0	0	0	0	0
		Exporter	1	0	0	0	0	0	0	0	0	0	0	1
	France	Importer	9	2	0	0	0	0	0	0	0	0	0	11
		Exporter	12	0	3	2	5	0	0	0	0	1	0	23
	Germany	Importer	7	4	3	6	2	2	3	0	2	1	1	30
		Exporter	5	0	2	0	0	0	0	0	0	1	0	8
	Hungary	Importer	0	0	0	0	0	0	0	0	0	0	0	0
		Exporter	2	0	1	0	0	1	0	0	0	0	0	4
	Italy	Importer	3	0	1	0	0	0	0	0	0	0	0	4
		Exporter	5	0	3	3	1	0	0	0	0	2	0	14
	Lithuania	Importer	0	0	0	0	1	0	0	0	0	0	0	1
		Exporter	0	0	0	0	0	0	0	0	0	0	0	0
	Luxembourg	Importer	0	2	1	0	0	0	0	0	0	0	0	3
		Exporter	0	0	1	0	0	0	0	0	0	0	0	1
	Mexico	Importer	17	12	13	10	11	5	9	7	3	0	0	87
		Exporter	5	0	2	0	0	0	1	0	2	0	0	10
	Namibia	Importer	1	0	0	0	0	0	0	0	0	0	0	1
		Exporter	1	0	0	0	0	0	0	0	0	0	0	1
	Netherlands	Importer	0	0	0	0	0	0	0	0	0	0	0	0
		Exporter	1	0	0	0	0	0	0	0	0	1	0	2
	Norway	Importer	0	0	0	0	20	0	0	0	0	0	0	20
		Exporter	0	0	0	0	0	0	0	0	0	0	0	0
	Poland	Importer	0	0	0	0	0	0	2	0	0	0	0	2
		Exporter	1	0	0	0	0	0	0	0	0	0	0	1
	Portugal	Importer	0	1	0	0	0	0	0	0	0	0	0	1
		Exporter	0	0	0	0	0	0	0	0	0	0	0	0
	Russian Federation	Importer	0	0	0	0	0	0	0	0	0	0	0	0
		Exporter	3	0	1	0	0	0	0	0	0	0	0	4
	Serbia	Importer	0	1	0	0	0	0	0	0	0	0	0	1
		Exporter	0	0	0	0	0	0	0	0	0	0	0	0
	South Africa	Importer	3	4	5	10	2	0	0	0	3	0	0	27
		Exporter	12	0	3	1	3	1	0	0	2	0	0	22
	Spain	Importer	22	18	12	8	7	1	3	1	1	1	0	73
		Exporter	14	0	1	3	2	0	0	0	1	0	0	21
	Sweden	Importer	0	0	0	0	2	0	0	0	0	0	0	2
		Exporter	0	0	0	0	0	0	0	0	0	0	0	0
	Switzerland	Importer	0	1	0	0	0	0	0	0	0	0	0	1
		Exporter	0	0	0	0	0	0	0	0	0	0	0	0
	Turkey	Importer	0	0	0	1	0	0	0	0	0	0	0	1
		Exporter	0	0	0	0	0	0	0	0	0	0	0	0
	United Kingdom	Importer	0	0	0	0	0	0	0	0	0	0	0	0
		Exporter	21	0	0	0	0	0	0	0	0	0	0	21
	United States Of America	Importer	108	61	86	91	64	37	42	3	38	0	0	530
		Exporter	91	0	36	8	7	3	8	3	27	0	0	183
	Zambia	Importer	0	0	0	0	0	0	0	0	0	0	0	0
		Exporter	0	0	0	0	0	0	0	0	1	0	0	1
	Total reported by Importers			171	106	125	130	116	51	61	11	47	4	822
	Total reported by Exporters			180	0	56	18	21	5	10	3	39	0	332

B.5 Zambia

Table 8: Reported international imports vs exports 2006-2015: Zambia

Exporter	Importer	Reported By	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	Total
Zambia	Australia	Importer	0	0	0	0	0	0	0	0	0	0	0
	Australia	Exporter	0	0	1	2	0	0	0	0	0	0	3
	Austria	Importer	0	0	0	1	1	0	0	0	0	0	2
	Austria	Exporter	0	0	0	0	1	0	0	0	0	0	1
	Belgium	Importer	0	2	0	0	0	0	0	0	1	0	3
	Belgium	Exporter	0	0	0	0	0	0	1	0	0	0	1
	Botswana	Importer	0	0	0	0	0	0	0	0	0	0	0
	Botswana	Exporter	1	0	0	0	0	0	1	0	0	0	2
	Canada	Importer	0	0	0	0	0	0	0	0	0	0	0
	Canada	Exporter	1	1	0	0	42	0	0	0	0	0	44
	Croatia	Importer	0	0	0	0	0	0	0	0	0	0	0
	Croatia	Exporter	0	0	0	0	1	0	0	0	0	0	1
	Czech Republic	Importer	0	0	0	0	0	0	1	0	0	0	1
	Czech Republic	Exporter	0	0	0	0	0	0	1	0	0	0	1
	Denmark	Importer	1	0	2	2	0	2	1	0	0	0	8
	Denmark	Exporter	1	1	3	0	1	3	3	0	0	0	12
	Finland	Importer	0	0	0	0	0	0	0	0	0	0	0
	Finland	Exporter	1	1	0	0	0	0	0	0	0	0	2
	France	Importer	1	0	0	0	0	0	0	0	0	0	1
	France	Exporter	3	1	4	4	0	2	0	0	0	0	14
	Germany	Importer	0	0	0	1	1	5	1	1	0	0	9
	Germany	Exporter	0	0	0	2	2	4	1	0	0	0	9
	Hungary	Importer	0	0	0	0	0	0	0	0	0	0	0
	Hungary	Exporter	1	1	1	1	3	0	6	0	0	0	13
	Italy	Importer	0	0	0	0	0	0	0	0	0	0	0
	Italy	Exporter	0	0	0	1	0	0	0	0	0	0	1
	Korea, Republic Of	Importer	0	0	0	0	0	0	0	0	0	0	0
	Korea, Republic Of	Exporter	0	0	0	0	0	1	0	0	0	0	1
	Latvia	Importer	3	0	0	0	0	0	0	0	0	0	3
	Latvia	Exporter	1	0	0	0	0	0	2	0	0	0	3
	Lithuania	Importer	0	0	1	0	0	0	0	0	0	0	1
	Lithuania	Exporter	0	1	0	0	0	0	0	0	0	0	1
	Mexico	Importer	0	0	2	4	2	3	7	4	0	0	22
	Mexico	Exporter	0	0	1	1	1	3	1	0	0	0	7
	Norway	Importer	2	0	0	0	0	1	0	0	0	0	3
	Norway	Exporter	1	0	0	0	2	0	0	0	0	0	3
	Portugal	Importer	0	0	1	0	0	0	0	0	0	0	1
	Portugal	Exporter	0	0	1	0	0	0	0	0	0	0	1
	Russian Federation	Importer	0	0	0	0	0	0	0	0	0	0	0
	Russian Federation	Exporter	0	2	1	3	1	0	0	0	0	0	7
	South Africa	Importer	2	2	8	3	2	0	0	2	0	0	19
	South Africa	Exporter	4	7	1	4	4	2	4	0	0	0	26
	Spain	Importer	2	2	6	2	0	2	1	1	0	0	16
	Spain	Exporter	3	4	5	3	3	1	2	0	0	0	21
	Sweden	Importer	0	2	0	0	0	0	0	0	0	0	2
	Sweden	Exporter	1	0	0	0	1	0	0	0	0	0	2
	Ukraine	Importer	0	0	0	0	0	0	0	0	0	0	0
Ukraine	Exporter	1	0	0	0	0	0	0	0	0	0	1	
United Kingdom	Importer	0	0	0	0	0	0	0	0	0	0	0	
United Kingdom	Exporter	5	0	1	0	0	1	2	0	0	0	9	
United States Of America	Importer	33	39	32	31	19	16	32	17	0	0	219	
United States Of America	Exporter	41	36	30	19	26	17	50	0	0	0	219	
Unknown	Importer	0	0	0	0	0	0	0	0	0	0	0	
Unknown	Exporter	0	1	0	0	0	2	0	0	0	0	3	
Zimbabwe	Importer	0	0	0	0	0	0	0	0	0	0	0	
Zimbabwe	Exporter	0	0	1	0	1	0	0	0	0	0	2	
Total reported by Importers			44	47	52	44	25	30	42	26	0	0	310
Total reported by Exporters			65	56	50	40	89	37	73	0	0	0	410

B.6 Zimbabwe

Table 9: Reported international imports vs exports 2006-2015: Zimbabwe

Exporter	Importer	Reported By	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	Total	
Zimbabwe	Argentina	Importer	0	0	0	0	0	0	2	0	0	0	2	
		Exporter	0	0	0	0	0	0	0	0	0	0	0	0
	Australia	Importer	0	0	0	0	0	0	0	0	0	0	0	0
		Exporter	0	2	1	0	0	0	0	0	0	0	0	3
	Austria	Importer	1	0	1	0	0	1	0	0	2	0	0	5
		Exporter	1	0	1	0	0	0	0	0	0	0	0	2
	Belgium	Importer	0	0	0	0	0	1	0	0	0	0	0	1
		Exporter	0	0	0	0	0	0	0	1	0	0	0	1
	Bulgaria	Importer	0	1	0	0	0	0	0	0	1	1	1	3
		Exporter	1	1	0	0	1	0	0	0	0	1	0	4
	Canada	Importer	0	0	0	0	0	0	0	0	0	0	0	0
		Exporter	1	0	0	0	1	0	0	0	0	0	0	2
	Denmark	Importer	0	0	0	1	1	1	0	0	0	0	0	3
		Exporter	0	0	0	0	1	0	0	0	0	0	0	1
	Finland	Importer	0	0	1	0	1	0	1	0	0	0	0	3
		Exporter	0	0	1	0	0	0	0	0	0	0	0	1
	France	Importer	0	0	0	0	0	0	0	0	0	0	0	0
		Exporter	3	1	1	2	1	0	0	0	2	0	0	10
	Germany	Importer	4	0	0	2	1	2	1	1	1	3	0	14
		Exporter	3	0	3	1	0	0	0	1	0	0	0	8
	Italy	Importer	0	0	0	0	0	0	0	0	0	0	0	0
		Exporter	1	1	0	2	1	0	0	0	1	0	0	6
	Lithuania	Importer	2	1	1	0	0	0	0	0	0	0	0	4
		Exporter	1	0	1	0	0	0	0	0	0	0	0	2
	Mexico	Importer	1	0	2	2	0	0	1	4	0	0	0	10
		Exporter	1	0	0	0	0	0	0	0	0	0	0	1
	Namibia	Importer	0	0	0	0	0	0	0	0	0	0	0	0
		Exporter	1	0	0	0	0	0	0	0	0	0	0	1
	Poland	Importer	1	0	0	1	0	0	0	0	0	0	0	2
		Exporter	1	0	0	1	0	0	0	0	0	0	0	2
	Russian Federation	Importer	0	0	0	0	0	0	0	0	0	0	0	0
		Exporter	0	0	0	0	0	0	0	1	0	0	0	1
	Slovakia	Importer	0	0	0	0	0	0	0	0	0	0	1	1
		Exporter	0	0	1	0	1	0	0	0	0	0	0	2
	Slovenia	Importer	0	0	0	0	0	1	0	0	0	0	0	1
		Exporter	0	0	0	0	0	0	0	0	0	0	0	0
	South Africa	Importer	4	5	5	2	1	2	4	4	4	3	0	30
		Exporter	3	2	3	1	0	0	0	0	0	0	0	9
	Spain	Importer	0	2	1	2	0	3	2	0	0	0	0	10
		Exporter	1	3	0	2	1	0	1	0	0	0	0	8
	Sweden	Importer	0	0	0	0	0	0	0	0	0	0	0	0
		Exporter	0	0	0	0	0	0	1	0	0	0	0	1
	Switzerland	Importer	0	0	0	0	0	0	0	0	0	0	0	0
Exporter		0	0	0	0	0	0	0	0	1	0	0	1	
United Kingdom	Importer	0	0	0	0	0	0	0	0	0	0	0	0	
	Exporter	0	2	0	0	0	0	1	0	0	0	0	3	
United States Of America	Importer	40	30	24	46	38	33	48	44	40	0	0	343	
	Exporter	31	14	21	17	25	3	2	0	24	0	0	137	
Zambia	Importer	0	0	0	0	0	0	1	0	0	0	0	1	
	Exporter	0	0	0	0	0	0	0	0	0	0	0	0	
Total reported by Importers			53	39	35	56	42	44	60	53	49	2	433	
Total reported by Exporters			49	26	33	26	32	3	7	1	29	0	206	

APPENDIX C: CASE STUDY OF A SUCCESSFUL HUNTING AREA: THE BUBYE VALLEY CONSERVANCY

There are multiple examples of poorly run hunting areas, which have been linked to population declines of lions and other species (Packer et al. 2009; Packer 2015), as well as other concerns such as poor animal welfare practices (e.g. Green Mile Safaris, see Section 2.1.2.4). However, it is possible to have a well-managed trophy hunting area that leads to an increasing lion population despite being harvested, and one such model, Zimbabwe's Buby Valley Conservancy (BVC), is described below.

C.1 Background to Buby Valley Conservancy

At the end of the nineteenth century, the Liebig's Extract of Meat Company (LEMCO) founded a large cattle ranch in the Zimbabwean lowveld – indigenous wildlife was deliberately eliminated due to competition for grazing and the risk of disease transmission to the livestock. As their natural prey base became depleted, the predators were subsequently persecuted when they resorted to livestock predation. Some wildlife persisted in small pockets of remote habitat within the ranch, however lion, elephant (*Loxodonta africana*), buffalo, black rhino and white rhino (*Ceratotherium simum*) were all completely eradicated. A monoculture of cattle dominated the landscape for the better part of a century.

In 1992 Zimbabwe suffered one of the worst droughts on record, which effectively destroyed the economic viability of cattle ranching in the area, and the pri-

vately owned Buby Valley Conservancy was subsequently founded in 1994 with the realisation that endemic wildlife, which are better adapted than livestock to cope with the local climate, could be successfully commercialised (Child 1988; Bond 1993).

C.2 Lions in Buby Valley Conservancy

After originally being eradicated by the cattle ranchers, 13 lions were reintroduced to the Buby Valley Conservancy in 1999, and 4 young males broke into the Conservancy that same year. From the original 17 animals present in 1999, ten years later in 2009 the Buby Valley Conservancy lion population was estimated at approximately 280 when a WildCRU research team initiated robust population surveys in the area. This lion population has continued to grow, and today it is estimated at over 500 individuals (du Preez et al. 2015).

With boreholes artificially augmenting the water availability, herbivore populations are able to increase in excess of what they probably naturally occurred at historically. Overpopulation can lead to overgrazing and excessive hoof pressure, soil erosion, weed encroachment and desertification. Dense prey populations may also allow predator populations to rapidly expand to unsustainable levels that could result in outcompetition of subordinate carnivores (du Preez et al. 2016a) and an eventual crash in the prey base. These anthropogenically

derived ecological problems are exacerbated in fenced areas, and often present the dilemma of further interference management.

The exponentially increasing Buby Valley Conservancy lion population currently exists at one of the highest densities in Africa (~ 0.187 lions km^{-2} : du Preez et al. 2015), greater than that of the Serengeti, Tanzania (0.100 lions km^{-2} : Pusey and Packer 1987; Spong 2002), Selous, Tanzania (0.080 – 0.130 lions km^{-2} : Creel and Creel 1996; Creel and Creel 1997), Kruger National Park, South Africa (0.096 – 0.112 lions km^{-2} : Mills 1995), and Hwange National Park, Zimbabwe (0.027 lions km^{-2} : Loveridge et al. 2007a), which equates to one of the largest contiguous lion populations in Zimbabwe.

The Buby Valley Conservancy offsets the cost of lion predation on its other wildlife via sport-hunting of the species, which began in 2002. Despite being hunted the lion population continued to grow, while the management facilitated the protection and enhancement of the lion prey base via anti-poaching efforts and stable water provision, as well as the purchasing of additional land. Lion offtake at less than 3% of the total population is responsible for more than a third of the annual revenue generated by the Conservancy, without which it would be unviable to continue as a wildlife area (B. du Preez, pers. comm.).

C.3 Revenue generated from lion hunting in Buby Valley Conservancy

In 2015, the lion trophy fee in BVC was US\$42,000, with a lion hunt daily rate of US\$2,950 day^{-1} (with a minimum lion hunt duration of 18 days, so that equated to US\$53,100). There are also additional costs that averaged US\$6,500 per lion hunt in 2015 (scout, observers, bait used, other trophy species taken during the lion hunt), so each hunt generates around US\$101,600. In 2015, there were 12 lion hunts, so that generated a total of US\$1,219,200. Lion trophy hunting represents approximately 33.9% of the Buby Valley Conservancy's total annual revenue generation (which includes post-hunt meat and hide sales). All of the revenue generated from lion sport-hunting on the Buby Valley Conservancy has gone back into the running costs of the Conservancy, which is all part of conservation, and which includes: anti-poaching and fence monitoring and maintenance (approximately US\$506,000 year^{-1}), research (approximately US\$34,700 year^{-1} not including client and sponsor donations), and community support assistance (approximately US\$210,000 year^{-1}). With a lack of attractive scenery, and an unsaturated photographic tourism industry throughout the rest of the country, sustainable sport-hunting provides the sole economic incentive to continue operating the Buby Valley Conservancy as a wildlife conservation area (B. du Preez, pers. comm.).

APPENDIX D: EXAMPLE OF AN ADAPTIVE AGE BASED QUOTA SYSTEM

Under this system, each hunting block has a starting quota, which may be a conservative quota (e.g. 0.5 lions 1,000 km²) or set some other way (e.g. the quota that block has traditionally been allocated if there is no evidence of detriment). Even if the initial quota is too high, the system is self-regulating and means that in blocks where there are not enough huntable older lions, the quota would drop quickly during each

successive year to reflect this.

The disadvantage of this system, which makes it less advantageous than the ones above, means that the adjustment is retrospective and only occurs after younger males have already been harvested. However, these costs may be balanced by the incentive to improve management while keeping the land in the lion estate. One potential example of an adaptive system is shown in Table 10:

Table 10: *Zimbabwe's adaptive quota points system*

	≥7 years old	No hunt	6 years old	5 years old	<5 years old	Failure to submit return/ incomplete hunt returns
For quotas of ≥3	4	3	2	1	-3	0
For quotas of 2	5	3	2	1	0	0
For quotas of 1	6	3	2	1	0	0
Quota setting process	<i>These points are added up and divided by 3 to yield the quota for next year</i>					

As a worked example of the system, if a hunting block initially has a quota of two male lions in year 1, and during that year it shoots them both, but the post-mortem inspection reveals that one is 8 years old and one is 6 years old, then the operator would receive 4 points for the 8-year old lion, and 2 points for the 6-year old lion. This would give it 6 points, so the quota for the next year

would be 6 points divided by 3, so the quota would remain at two animals. If, however, in the following year, the operator shot two 6 year-olds, he would receive only 4 points, so his quota would be 1.3 (rounded down to one animal). In this way, the younger the animals he shoots, the more his quota is reduced, and vice versa. Some worked examples are provided in Table 11:

Table 11: *Worked examples of an adaptive quota points system*

Initial quota	Total shot	No. lions on										Total no. points this year	Quota for next year (rounded to whole animal)	Difference in annual quota
		quota not shot		≥7 yr old lions		6 yr old lions		5 yr old lions		<5 yr old lions				
		No.	(Points)	No.	(Points)	No.	(Points)	No.	(Points)	No.	(Points)			
5	5	0	(0)	3	(12)	1	(3)	1	(2)	0	(0)	17	6	1
4	3	1	(3)	1	(4)	1	(3)	1	(2)	0	(0)	12	4	0
3	3	0	(0)	2	(8)	0	(0)	1	(2)	0	(0)	10	3	0
2	2	0	(0)	1	(4)	0	(0)	0	(0)	1	(0)	4	1	-1
1	1	0	(0)	0	(0)	0	(0)	1	(2)	0	(0)	2	1	0

This system focuses attention on the balance between punishment and incentivisation. The ingenuity of the points system is that the loss of a younger male (even if undisclosed, see paragraph below) would lead subsequently to a dearth of older males (because there are fewer younger males to mature) and thus dwindling opportunities for the operator to secure quota – the operator, rather than the hunter, would feel the loss and thereby be incentivised strongly to enforce the rules upon the hunters, encouraging self-regulation and positive peer-pressure.

A possible issue with this system is that it allows, counter-intuitively, the import of under age animals, when so much effort has been expended by conservationists in disallowing the hunting of any except the oldest animals. Indeed, Tanzania already bans the export of hunted lions younger than 4 years old, and Packer et al. (2011) recommended banning the importation of any under-

age lions. However, the reason for not banning the import of those young lions is to try to reduce the risk of ‘double hunting’, which is otherwise extremely difficult to police. ‘Double hunting’ is where a hunter shoots an animal, realises it is too young to export, and illegitimately discards that animal and shoots an older one, so clearly the population suffers a double loss. The goal of this nuanced system is to create a balance between punishing poor behaviour and rewarding good behaviour, against the ultimate yardstick of maintaining the greatest area of land within the lion estate and wider wildlife economy.

There are variations in the points-based systems currently in place – for example, in Tanzania, the quota is *increased by 1 when all the lions harvested were 6 years of age and above; is decreased by 1 for each lion harvested with an age of 4 or 5 years; and is decreased by 2 for each lion harvested at under 4 years.* If strictly enforced, the Tanzanian sys-

tem would be much more punitive than the system above (or the ones currently implemented with positive outcomes for lion conservation in Zimbabwe and the Niassa region of Mozambique).

Regardless of the exact details of the adaptive age-based quota system implemented, the Creel et al. (2016) models suggest that any ‘rewards’ (in terms of points counting towards increased quotas) be awarded only for males aged 7 or over, and these should be coupled with strong penalties for taking males below 5 years of age. The operation of this sort of age-based system should be inde-

pendently and transparently monitored. This can be achieved in stakeholder workshops where quotas and offtakes per area (as well as photos of the lions) are presented to the audience in justification of subsequent quotas.

Again, to emphasise, the objective of this system would be to ensure that trophy hunting was not detrimental to lion conservation, that it was conducted within a framework that incentivised benefits to conservation and thereby increased the probability of land remaining in the lion estate that might otherwise be lost from it.

LITERATURE CITED

- Anon. 2015. The Economics of Poaching, Trophy and Canned Hunting.
- Baker, S. E., S. A. Ellwood, V. Tagarielli, and D. W. Macdonald. 2012. Mechanical Performance of Rat, Mouse and Mole Spring Traps, and Possible Implications for Welfare Performance. *Plos One* 7: e39334.
- Balmford, A., J. M. Green, M. Anderson, J. Beresford, C. Huang, R. Naidoo, M. Walpole, and A. Manica. 2015. Walk on the wild side: estimating the global magnitude of visits to protected areas. *PLoS Biol* 13: e1002074.
- Barnes, J. 2001. Economic returns and allocation of resources in the wildlife sector of Botswana. *South African Journal of Wildlife Research* 31: 141-153.
- Barthold, J., A. J. Loveridge, D. W. Macdonald, C. Packer, and F. Colchero. 2016. Bayesian estimates of male and female African lion mortality for future use in population management. *Journal of Applied Ecology* 53: 295-304.
- Barthold, J., C. Packer, A. J. Loveridge, D. W. Macdonald, and F. Colchero. 2016. Dead or gone? Bayesian inference on mortality for the dispersing sex. *Ecology and Evolution* 6(14): 4910-4923.
- Bauer, H., G. Chapron, K. Nowell, P. Henschel, P. Funston, L. T. Hunter, D. W. Macdonald, and C. Packer. 2015. Lion (*Panthera leo*) populations are declining rapidly across Africa, except in intensively managed areas. *Proceedings of the National Academy of Sciences* 112: 14894-14899.
- Bauer, H., C. Packer, P. F. Funston, P. Henschel, and K. Nowell. 2016. *Panthera leo*. The IUCN Red List of Threatened Species 2016.
- Becker, M., R. McRobb, F. Watson, E. Droge, B. Kanyembo, J. Murdoch, and C. Kakumbi. 2013. Evaluating wire-snare poaching trends and the impacts of by-catch on elephants and large carnivores. *Biological Conservation* 158: 26-36.
- Bond, I. 1993. The Economics of Wildlife and Land Use in Zimbabwe: An Examination of the Current Knowledge and Issues. WWF, Harare, Zimbabwe.
- Booth, V. 2002. Analysis of wildlife markets (sport hunting and tourism). WWF-SARPO Report, Harare.
- Booth, V. R. 2010. The contributions of hunting tourism: how significant is this to national economies? In Contribution of wildlife to national economies. Joint publication of FAO and CIC. Budapest.

- Bouché, P., W. Crosmary, P. Kafando, B. Doamba, F. C. Kidjo, C. Vermeulen, and P. Chardonnet. 2016. Embargo on Lion Hunting Trophies from West Africa: An Effective Measure or a Threat to Lion Conservation? PloS one 11: e0155763.
- Burns Inquiry. 2002. Report of the Committee of Inquiry into Hunting with Dogs in England and Wales. Command Paper 4763.
- Caro, T., C. Young, A. Cauldwell, and D. Brown. 2009. Animal breeding systems and big game hunting: models and application. Biological Conservation 142: 909-929.
- Chardonnet, P. 2002. Conservation of the African lion: contribution to a status survey. International Foundation for the Conservation of Wildlife, France & Conservation Force, USA.
- Child, B. 1988. The role of wildlife utilization in the sustainable economic development of semi-arid rangelands in Zimbabwe. D.Phil. University of Oxford, Oxford, U.K.
- CITES. 2014. CITES Periodic review of the status of African Lion across its range: Report of Kenya and Namibia.in Twenty-seventh meeting of the Animals Committee. Convention on International Trade in Endangered Species of Wild Fauna and Flora, Veracruz, Mexico.
- CITES. 2016. CoP17 Com I. 29: Draft decisions on the African Lion. In: Seventeenth meeting of the Conference of the Parties, Johannesburg, South Africa.
- Creel, S. and N. Creel. 1997. Lion density and population structure in the Selous Game Reserve: evaluation of hunting quotas and offtake. African Journal of Ecology 35: 83-93.
- Creel, S. and N. M. Creel. 1996. Limitation of African wild dogs by competition with larger carnivores. Conservation Biology 10: 526-538.
- Creel, S., J. M'soka, E. Dröge, E. Rosenblatt, M. Becker, W. Matandiko, and T. Simpamba. 2016. Assessing the sustainability of African lion trophy hunting, with recommendations for policy. Ecological Applications.
- Croes, B., P. Funston, G. Rasmussen, R. Buij, A. Saleh, P. Tumenta, and H. De Iongh. 2011. The impact of trophy hunting on lions (*Panthera leo*) and other large carnivores in the Bénoué Complex, northern Cameroon. Biological Conservation 144: 3064-3072.
- Cumming, D. 2004. Performance of parks in a century of change. Parks in transition. UK: Earthscan: 105-124.
- Cusack, J. J., A. Swanson, T. Coulson, C. Packer, C. Carbone, A. J. Dickman, M. Kosmala, C. Lintott, and J. M. Rowcliffe. 2015. Applying a random encounter model to estimate lion density from camera traps in Serengeti National Park, Tanzania. The Journal of Wildlife Management 79: 1014-1021.

- Damm, G. R. 2005. Hunting in South Africa: facts, risks and opportunities. *African Indaba* 3: 1-23.
- Davidson, Z., M. Valeix, A. J. Loveridge, H. Madzikanda, and D. W. Macdonald. 2011. Socio-spatial behaviour of an African lion population following perturbation by sport hunting. *Biological Conservation* 144: 114-121.
- Di Minin, E., N. Leader-Williams, and C. J. Bradshaw. 2016. Banning Trophy Hunting Will Exacerbate Biodiversity Loss. *Trends in Ecology & Evolution* 31: 99-102.
- Dickman, A. J. 2015. Large carnivores and conflict in Tanzania's Ruaha landscape. Pages 30-32 in S. M. Redpath, R. J. Gutierrez, K. A. Wood, and J. C. Young, editors. *Conflicts in Conservation: Navigating Towards Solutions*. Cambridge University Press, Cambridge, U.K.
- Dickman, A. J., A. E. Hinks, E. A. Macdonald, D. Burnham, and D. W. Macdonald. 2015. Global Priorities for Felid Conservation. *Conservation Biology* 29: 854-864.
- Dickman, A. J., E. A. Macdonald, and D. W. Macdonald. 2011. A review of financial instruments to pay for predator conservation and encourage human-carnivore coexistence. *Proceedings of the National Academy of Science of the United States of America* 108: 13937-13944.
- Dickson, B., J. Hutton, and W. A. Adams. 2009. *Recreational hunting, conservation and rural livelihoods: science and practice*. John Wiley & Sons.
- du Preez, B., T. Hart, A. J. Loveridge, and D. W. Macdonald. 2015. Impact of risk on animal behaviour and habitat transition probabilities. *Animal Behaviour* 100: 22-37.
- du Preez, B., T. Hart, A. J. Loveridge, and D. W. Macdonald. 2016a. Experimentally testing an intraguild hostility hypothesis: the impact of lions *Panthera leo* on leopards *Panthera pardus*.
- du Preez, B., R. Groom, O. Mufute, R. Mandisodza-Chikerema, and V. Booth. 2016b. *Sport-Hunting and Lion Panthera leo Conservation in Zimbabwe. A report on practical lion conservation to the USFWS*.
- Durant, S. M., N. Mitchell, R. Groom, N. Pettorelli. submitted. Disappearing spots: The global decline of cheetah and what it means for conservation. *Proceedings of the National Academy of Sciences*.
- Dussault, A. C. 2013. In search of ecocentric sentiments: Insights from the CAD model in moral psychology. *Environmental ethics* 35: 419-437.
- East, R. 1984. Rainfall, soil nutrient status and biomass of large African savanna mammals. *African Journal of Ecology* 22: 245-270.

- Economists at Large. 2013. The \$200 million question: how much does trophy hunting really contribute to African communities? A report for the African Lion Coalition, prepared by Economists at Large. Melbourne, Australia.
- Edwards, C. T. T., N. Bunnefeld, G. A. Balme, and E. J. Milner-Gulland. 2014. Data-poor management of African lion hunting using a relative index of abundance. *Proceedings of the National Academy of Sciences* 111: 539-543.
- Elliot, N. B., M. Valeix, D. W. Macdonald, and A. J. Loveridge. 2014. Social relationships affect dispersal timing revealing a delayed infanticide in African lions. *Oikos* 123: 1049-1056.
- Estes, R. 2015. Hunting helps conserve African wildlife habitat. *African Indaba* 13: 4.
- European Commission. 2015. Larger than Elephants: Inputs for an EU strategic approach to wildlife conservation in Africa – Synthesis. Directorate-General for International Cooperation and Development, Brussels, Belgium.
- Ferreira, S. M. and P. J. Funston. 2010. Estimating lion population variables: prey and disease effects in Kruger National Park, South Africa. *Wildlife Research* 37: 194-206.
- Fields, S. 2005. Continental Divide: Why Africa's climate change burden is greater. *Environmental Health Perspectives* 113: A534.
- Funston, P., L. Frank, T. Stephens, Z. Davidson, A. Loveridge, D. Macdonald, S. Durant, C. Packer, A. Mosser, and S. Ferreira. 2010. Substrate and species constraints on the use of track incidences to estimate African large carnivore abundance. *Journal of Zoology* 281: 56-65.
- Funston, P. J., R. J. Groom, and P. A. Lindsey. 2013. Insights into the management of large carnivores for profitable wildlife-based land uses in African savannas. *PloS one* 8: e59044.
- Fusari, A., R. Cumbi, P. Chardonnet, and C. Begg. 2010. Conservation Strategy and Action Plan for the African Lion (*Panthera l. leo*) in Mozambique. Ministry of Tourism and Ministry of Agriculture, Maputo, Mozambique.
- Greene, C. and M. Mangel. 1998. Animal Breeding Systems, Hunter Selectivity, and Consumptive Use. *Behavioral ecology and conservation biology*: 271.
- Groom, R. J. and J. P. Watermeyer. 2015. Carnivore densities in the Savé Valley Conservancy: 2015. Report for the Savé Valley Conservancy.
- Haidt, J. 2012. *The righteous mind: why good people are divided by politics and religion*. Allen Lane, London.

- Hann, E. C. 2015. From calibers to cameras: Botswana's ban on trophy hunting and consequences for the socioecological landscape of Ngamiland District. Pennsylvania State University.
- Hazzah, L., M. Borgerhoff Mulder, and L. Frank. 2009. Lions and Warriors: Social factors underlying declining African lion populations and the effect of incentive-based management in Kenya. *Biological Conservation* 142: 2428-2437.
- Henschel, P., D. Azani, C. Burton, G. Malanda, Y. Saidu, M. Sam, and L. Hunter. 2010. Lion status updates from five range countries in West and Central Africa. *Cat News* 52: 34-39.
- Henschel, P., L. Coad, C. Burton, B. Chataigner, A. Dunn, D. MacDonald, Y. Saidu, and L. T. Hunter. 2014. The Lion in West Africa Is Critically Endangered. *PloS one* 9: e83500.
- Herzog, H. 2011. *Some we love, some we hate, some we eat*. Harper Collins, New York.
- Humavindu, M. N. and J. I. Barnes. 2003. Trophy hunting in the Namibian economy: an assessment. *South African Journal of Wildlife Research* 33: 65-70.
- Hunter, L., P. Lindsey, G. Balme, M. Becker, C. Begg, H. Brink, P. Chardonnet, A. Dickman, C. Edwards, L. Frank, P. Funston, P. Henschel, D. Ikanda, B. Kissui, A. Loveridge, P. Mesochina, N. Midlane, P. White, and K. Whitman-Gelatt. 2013. Urgent and comprehensive reform of trophy hunting of lions is a better option than an endangered listing; a science-based consensus. Panthera, unpublished policy document. Available at: http://www.panthera.org/sites/default/files/PFunston_PLOS_Biology_1.13.pdf.
- IUCN. 2006a. Conservation strategy for the lion in West and Central Africa. IUCN – The World Conservation Union, Gland, Switzerland.
- IUCN. 2006b. Regional conservation strategy for the lion *Panthera leo* in Eastern and Southern Africa. IUCN SSC Cat Specialist Group, Gland, Switzerland.
- IUCN. 2016. Informing decision on trophy hunting. Gland, Switzerland.
- Kahneman, D. 2011. *Thinking, fast and slow*. Allen Lane, London.
- Kays, R. W. and B. D. Patterson. 2002. Mane variation in African lions and its social correlates. *Canadian Journal of Zoology* 80: 471-478.
- Kiffner, C., B. Meyer, M. Mühlenberg, and M. Waltert. 2009. Plenty of prey, few predators: what limits lions *Panthera leo* in Katavi National Park, western Tanzania? *Oryx* 43: 52-59.
- LaFollette, H. and Wiley Online Library (Online service). 2013. The international encyclopedia of ethics. Page 1 online resource. Wiley-Blackwell, Malden, MA.

- Lewis, D. M. and P. Alpert. 1997. Trophy hunting and wildlife conservation in Zambia. *Conservation Biology* 11: 59-68.
- Lindsey, P., R. Alexander, G. Balme, N. Midlane, and J. Craig. 2012a. Possible relationships between the South African captive-bred lion hunting industry and the hunting and conservation of lions elsewhere in Africa. *South African Journal of Wildlife Research* 42: 11-22.
- Lindsey, P., P. Roulet, and S. Romanach. 2007. Economic and conservation significance of the trophy hunting industry in sub-Saharan Africa. *Biological Conservation* 134: 455-469.
- Lindsey, P. A., R. Alexander, L. Frank, A. Mathieson, and S. Romanach. 2006. Potential of trophy hunting to create incentives for wildlife conservation in Africa where alternative wildlife-based land uses may not be viable. *Animal Conservation* 9: 283-291.
- Lindsey, P. A., G. A. Balme, V. R. Booth, and N. Midlane. 2012b. The Significance of African Lions for the Financial Viability of Trophy Hunting and the Maintenance of Wild Land. *PloS one* 7: e29332.
- Lindsey, P. A., G. A. Balme, P. Funston, P. Henschel, L. Hunter, H. Madzikanda, N. Midlane, and V. Nyirenda. 2013. The trophy hunting of African lions: scale, current management practices and factors undermining sustainability. *PloS one* 8: e73808.
- Loveridge, A., G. Hemson, Z. Davidson, and D. Macdonald. 2010. African lions on the edge: reserve boundaries as 'attractive sinks'. *Biology and conservation of wild felids*: 283-304.
- Loveridge, A., A. Searle, F. Murindagomo, and D. Macdonald. 2007a. The impact of sport-hunting on the population dynamics of an African lion population in a protected area. *Biological Conservation* 134: 548-558.
- Loveridge, A. J., C. Packer, and A. Dutton. 2009. Science and the recreational hunting of lions. Pages 108-124 in J. Dickson, J. Hutton, and W. M. Adams, editors. *Recreational hunting, conservation and rural livelihoods*. Wiley-Blackwell, Oxford, U.K.
- Loveridge, A. J., J. C. Reynolds, and E. Milner-Gulland. 2007b. Does sport hunting benefit conservation? Pages 224-240 in D. W. Macdonald and K. Service, editors. *Key Topics in Conservation Biology*. Blackwell Publishing, Oxford, U.K.
- Loveridge, A. J., M. Valeix, Z. Davidson, G. Mtare, and D. W. Macdonald. 2016a. Conservation of large predator populations: demographic and spatial responses of African lions to the intensity of trophy hunting. *Biological Conservation*.
- Loveridge, A. J., M. Valeix, N. Elliott, and D. W. Macdonald. 2016b. The landscape of anthropogenic mortality: how African lions respond to spatial variation in risk. *Journal of Applied Ecology*, doi: 10.1111/1365-2664.12794.

- Macdonald, D. W., N. M. Collins, and R. Wrangham. 2006. Principles, practice and priorities: the quest for 'alignment'. Pages 273-292 in D. W. Macdonald and K. Service, editors. Key Topics in Conservation Biology. Blackwell Publishing, Oxford.
- Macdonald, D. W., K. S. Jacobsen, D. Burnham, P. J. Johnson, and A. J. Loveridge. 2016a. Cecil: A Moment or a Movement? Analysis of Media Coverage of the Death of a Lion, *Panthera leo*. *Animals* 6: 26.
- Macdonald, D. W. and P. J. Johnson. 2015a. Foxes in the landscape: hunting, control, and economics. Pages 47-64 in D. W. Macdonald and R. E. Feber, editors. *Wildlife Conservation on Farmland Volume 2: Conflict in the Countryside*. Oxford University Press, Oxford.
- Macdonald, D. W. and P. J. Johnson. 2015b. Foxes in the landscape: hunting, control, and economics. Pages 47-64 in D. W. Macdonald and R. E. Feber, editors. *Wildlife Conservation on Farmland Volume 2: Conflict in the countryside*. Oxford University Press, Oxford.
- Macdonald, D. W., P. J. Johnson, A. J. Loveridge, D. Burnham, and A. J. Dickman. 2016c. Conservation or the Moral High Ground: Siding with Bentham or Kant. *Conservation Letters* 9: 307-308.
- Macdonald, E. A., D. Burnham, A. Hinks, A. J. Dickman, M. Yadvinder, and D. W. Macdonald. 2015a. Conservation inequality and the charismatic cat: *Felis felix*. *Global Ecology and Conservation* 3: 851-866.
- Martin, G. 2012. *Game changer: animal rights and the fate of Africa's wildlife*. University of California Press, Berkeley, Calif.
- McNeely, J. 2000. Practical approaches for including mammals in biodiversity conservation. *CONSERVATION BIOLOGY SERIES-CAMBRIDGE*: 355-368.
- MET. 2008. *Draft Conservation Strategy for the Lion in Namibia*. Ministry of Environment and Tourism.
- Miller, J. R., G. Balme, P. A. Lindsey, A. J. Loveridge, M. S. Becker, C. Begg, H. Brink, S. Dolrenry, J. E. Hunt, and I. Jansson. 2016. Aging traits and sustainable trophy hunting of African lions. *Biological Conservation* 201: 160-168.
- Miller, S. M., C. J. Tambling, and P. J. Funston. 2015. GrowLS: Lion (*Panthera leo*) population growth simulation for small reserve management planning. *South African Journal of Wildlife Research* 45: 169-177.
- Mills, M. 1995. Notes on wild dog *Lycaon pictus* and lion *Panthera leo* population trends during a drought in the Kruger National Park. *Koedoe* 38: 95-99.

- NACSO. 2011. Living with wildlife – the story of Namibia’s communal conservancies. The Namibian Association of CBNRM Support Organisations, Windhoek, Namibia.
- NACSO. 2015. Namibian Association of CBNRM Support Organisations.
- Naidoo, R., L. C. Weaver, R. W. Diggle, G. Matongo, G. Stuart-Hill, and C. Thouless. 2016a. Complementary benefits of tourism and hunting to communal conservancies in Namibia. *Conservation Biology*.
- Naidoo, R., L. C. Weaver, R. W. Diggle, G. Matongo, G. Stuart-Hill, and C. Thouless. 2016b. Importance of local values to successful conservation: response to Jacquet and Delon. *Conservation Biology*.
- Nelson, M. P., J. T. Bruskotter, J. A. Vucetich, and G. Chapron. 2016. Emotions and the Ethics of Consequence in Conservation Decisions: Lessons from Cecil the Lion. *Conservation Letters* 9: 302-307.
- Nzou, G. 2015. In Zimbabwe, We Don’t Cry for Lions. Page A19 *New York Times*, New York.
- Packer, C. 2015. *Lions in the Balance: Man-Eaters, Manes, and Men with Guns*. University of Chicago Press.
- Packer, C., H. Brink, B. Kissui, H. Maliti, H. Kushnir, and T. Caro. 2011. Effects of trophy hunting on lion and leopard populations in Tanzania. *Conservation Biology* 25: 142-153.
- Packer, C., L. Herbst, A. E. Pusey, J. D. Bygott, J. P. Hanby, S. J. Cairns, and M. Borgerhoff Mulder. 1988. Reproductive success of lions. Pages 363-383 in T. H. Clutton-Brock, editor. *Reproductive success*. University of Chicago Press, Chicago.
- Packer, C., M. Kosmala, H. S. Cooley, H. Brink, L. Pintea, D. Garshelis, G. Purchase, M. Strauss, A. Swanson, G. Balme, L. Hunter, and K. Nowell. 2009. Sport hunting, predator control and conservation of large carnivores. *PloS one* 4:e5941.
- Packer, C., A. Loveridge, S. Canney, T. Caro, S. Garnett, M. Pfeifer, K. Zander, A. Swanson, D. Macnulty, and G. Balme. 2013a. Conserving large carnivores: dollars and fence. *Ecology Letters* 16: 635-641.
- Packer, C., A. Loveridge, S. Canney, T. Caro, S. Garnett, M. Pfeifer, K. Zander, A. Swanson, D. Macnulty, and G. Balme. 2013b. Large carnivore conservation: dollars and fence. *Ecol. Lett* 16: 635-641.
- Packer, C., A. E. Pusey, and L. E. Eberly. 2001. Egalitarianism in female African lions. *Science* 293: 690-693.

- Packer, C., K. Whitman, A. Loveridge, J. Jackson, and P. Funston. 2006. Impacts of trophy hunting on lions in East and Southern Africa: Recent offtake and future recommendations. in Background paper for the Eastern and Southern African lion conservation workshop, Johannesburg, South Africa.
- Panthera, WildAid, and WildCRU. 2016. Beyond Cecil: Africa's Lions in Crisis.
- Patterson, B. D. 2007. On the Nature and Significance of Variability in Lions (*Panthera leo*). *Evolutionary Biology* 34: 55-60.
- Pusey, A. E. and C. Packer. 1987. The evolution of sex-biased dispersal in lions. *Behaviour* 101: 275-310.
- Radder, L. 2005. Motives of international trophy hunters. *Annals of Tourism Research* 32: 1141-1144.
- Riggio, J., A. Jacobson, L. Dollar, H. Bauer, M. Becker, A. Dickman, P. Funston, R. Groom, P. Henschel, H. de Iongh, L. Lichtenfeld, and S. Pimm. 2013. The size of savannah Africa: a lion's (*Panthera leo*) view. *Biodiversity and Conservation* 22: 17-35.
- Ripple, W. J., J. A. Estes, R. L. Beschta, C. C. Wilmers, E. G. Ritchie, M. Hebblewhite, J. Berger, B. Elmhagen, M. Letnic, and M. P. Nelson. 2014. Status and ecological effects of the world's largest carnivores. *Science* 343: 1241-1244.
- Rosenblatt, E., M. S. Becker, S. Creel, E. Droge, T. Mweetwa, P. A. Schuette, F. Watson, J. Merkle, and H. Mwape. 2014. Detecting declines of apex carnivores and evaluating their causes: An example with Zambian lions. *Biological Conservation* 180: 176-186.
- Safari Club International. 2005. *SCI Record Book of Trophy Animals: Africa Field Edition* Safari Club International, Tucson, Arizona .
- Samuelsson, E. and J. Stage. 2007. The size and distribution of the economic impacts of Namibian hunting tourism. *South African Journal of Wildlife Research* 37: 41-52.
- Scruton, R. 2000. *Animal rights and wrongs*. 3rd edition. Metro i.e. Continuum, London.
- Sharp, R. and K.-U. Wollscheid. 2009. An overview of recreational hunting in North America, Europe and Australia. *Recreational hunting, conservation and rural livelihoods*: 25-38.
- Simasiku, P., H. I. Simwanza, G. Tembo, S. Bandyopadhyay, and J.-M. Pavy. 2008. MESSAGE TO POLICY MAKERS.
- Simpson, M. 2015. Oscar Horta, C.S. Lewis and the fall of nature. Pages 13-15, *Oxford Magazine*, Oxford.

- Singer, P. 1986. Applied ethics. Oxford University Press, Oxford.
- Southwicks Associates. 2015. The economic contributions of hunting-related tourism in eastern and southern Africa. <http://safariclubfoundation.org/conservation-equation>
- Spong, G. 2002. Space use in lions, *Panthera leo*, in the Selous Game Reserve: social and ecological factors. Behavioral Ecology and Sociobiology 52: 303-307.
- Sutherland, W. J. 2008. The conservation handbook: research, management and policy. John Wiley & Sons.
- TAWIRI. 2007. Proceedings of the First Tanzania Lion and Leopard Conservation Action Plan Workshop. Tanzania Wildlife Research Institute, Arusha, Tanzania.
- Toulmin, C. 2009. Climate change in Africa. Zed Books.
- UICN/PACO. 2009. La grande chasse en Afrique de l'Ouest: quelle contribution à la conservation? (Big Game Hunting in West Africa. What is its contribution to conservation?). UICN – Programme Afrique Centrale et Occidentale, Ouagadougou, Burkina Faso.
- United Nations Environment Programme – World Conservation Monitoring Centre. 2006. CITES Trade Database, UNEP-World Conservation Monitoring Centre, Cambridge, UK.
- UNPD. 2015. World Population Prospects, the 2015 Revision. United Nations Department of Economic and Social Affairs Population Division.
- U.S. Fish and Wildlife Service. 2015. Endangered and Threatened Wildlife and Plants; Listing Two Lion Subspecies. Federal Register 80: 80000-80056.
- Vucetich, J. A., J. T. Bruskotter, and M. P. Nelson. 2015. Evaluating whether nature's intrinsic value is an axiom or anathema to conservation. Conservation Biology 29: 321-332.
- Vucetich, J. A. and M. P. Nelson. 2012. A Handbook of Conservation and Sustainability Ethics. CEG Occasional Paper Series.
- Vucetich, J. A. and M. P. Nelson. 2014. Wolf Hunting and the Ethics of Predator Control. The Oxford handbook of animal studies. www.oxfordhadbooks.com, Oxford.
- West, P. M. and C. Packer. 2002. Sexual selection, temperature, and the lion's mane. Science 297: 1339-1343.
- West, P. M. and C. Packer. 2013. *Panthera leo* .in J. Kingdon and M. Hoffmann, editors. The Mammals of Africa. Volume V: Carnivores, Pangolins, Equids and Rhinoceroses. Bloomsbury Publishing, London.

- White, P. A., D. Ikanda, L. Ferrante, P. Chardonnet, P. Mesochina, and R. Cameriere. 2016. Age Estimation of African Lions *Panthera leo* by Ratio of Tooth Areas. PloS one 11: e0153648.
- Whitman, K., A. M. Starfield, H. S. Quadling, and C. Packer. 2004. Sustainable trophy hunting of African lions. Nature 428: 175-178.
- Whitman, K. L. and C. Packer. 2007. A hunter's guide to aging lions in eastern and southern Africa. Safari Press.
- Whitman, K. L., A. M. Starfield, H. Quadling, and C. Packer. 2007. Modeling the effects of trophy selection and environmental disturbance on a simulated population of African lions. Conservation Biology 21: 591-601.
- Williams, S. T., K. S. Williams, C. J. Joubert, and R. A. Hill. 2016. The impact of land reform on the status of large carnivores in Zimbabwe. PeerJ 4: e1537.
- Williams, V. L., D. J. Newton, A. J. Loveridge, and D. W. Macdonald. 2015. Bones of Contention: An Assessment of the South African Trade in African Lion *Panthera leo* Bones and Other Body Parts. TRAFFIC and WildCRU, Cambridge, UK.
- Winterbach, C. W., C. Whitesell, and M. J. Somers. 2015. Wildlife abundance and diversity as indicators of tourism potential in northern Botswana. PloS one 10: e0135595.
- Zambia Wildlife Authority. 2009. Zambia's Conservation Strategy and Action Plan for the African Lion. Chilanga, Zambia.
- ZPWMA. 2015. Age restrictions on lion trophies and adaptive management of lion quotas in Zimbabwe. Zimbabwe Parks and Wildlife Management Harare, Zimbabwe.

