LIONS, TROPHY HUNTING AND BEYOND, KNOWN UNKNOWNS AND WHY THEY MATTER

Abstract

What does trophy hunting contribute to wild lion conservation? What constitutes best practice? D.W. Macdonald (2016) summarises what we know. However, in the much, but perhaps unfairly, mocked words of Donald Rumsfeld, there are knowns, known unknowns and unknown unknowns. We identified gaps in knowledge inhibiting conservation planning in several areas: these areas included the causes of lion mortality, the amount of land used for lion trophy hunting, the extent to which trophy hunting depends on lions for financial viability, and the vulnerability of areas currently used for trophy hunting to conversion to non wildlife-based land uses if it were to cease.

Key Words: Lions, trophy hunting, economics, ethics

Running head: Unknowns in trophy hunting

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Background

Lions, the iconic symbol of the African wilderness, are in trouble. The latest IUCN estimates suggest a population of 23,000 – 39,000 (probably closer to the lower estimate), a decline of at least 43% between 1993 and 2014, approximately three lion generations (Bauer et al. 2015). Lions have been extirpated from at least 92% of their historic range. According to the 2016 Red List Assessment, in Africa, lions are almost certainly extinct in 15 countries, possibly extinct in another seven, and now occur in only 25 countries (Bauer et al. 2016). Lion decline may be even more severe than estimated by the IUCN (IUCN 2006a, 2006b), whose assessment is based on well-known populations which tend to be in a better state. Only six populations have

more than 1000 lions (Selous-Niassa, Serengeti-Mara, Kavango-Zambezi, Greater Limpopo, Katavi-Ruaha and Kgalagadi). About half of the remaining wild populations comprise fewer than 100 individuals (Dickman et al. submitted). Lion populations are in crisis, due primarily to the loss and degradation of habitat, loss of prey, and conflict with people (Panthera et al. 2016), pressures exacerbated when they are small, isolated and poorly managed (IUCN 2006a, 2006b; Henschel et al. 2014).

Public interest in lion conservation was stimulated in July 2015 with the killing of a well-known lion nicknamed 'Cecil' (D. W. Macdonald et al. 2016a). Fierce debate has since raged over whether trophy hunting is good or bad for lion conservation. To be clear, trophy hunting *"generally involves the payment of a fee by a foreign or local hunter for a hunting experience, usually guided, for one or more individuals of a particular species with specific desired characteristics (such as large size or antlers). The trophy is usually retained by the hunter and taken home*" (IUCN 2016).

This debate would be informed by identifying the conditions where trophy hunting contributes to lion conservation, if indeed such conditions prevail anywhere. Whether trophy hunting lions is ethically acceptable is a distinct debate, which we enlarge on below. Some hold trophy hunting in such moral repugnance that *any* benefit to conservation is insufficient to justify it. This view may come to prevail, and perhaps a majority of the Western public already holds it (although the balance of opinion probably varies from place to place, notably between the West and range states). Until the part played by trophy hunting is known and, as necessary, alternative means of financing lion conservation are in place, we have defended a more utilitarian population-based perspective, arguing that the cost of implementing such a moral imperative may be too high if no better alternative for lion conservation is available (David W. Macdonald et al. 2016b). We support the cessation of trophy hunting where it is clearly inimical to conservation, and its reform where it is better for conservation than any viable alternative land use. While lion hunting exists, it should, at least, be sustainable. An account of the evidence base for assessing its sustainability is presented in Macdonald (2016, available at https://www.wildcru.org/wp-

content/uploads/2016/12/Report_on_lion_conservation.pdf). In compiling that evidence base, we were, however, thwarted by a surprising lack of information on several important issues.

We identified a conspicuous knowledge gap concerning the causes of lion mortality. At both national and regional scales trophy hunting of wild lions has been ranked relatively low as a threat (IUCN 2006a, 2006b). (We do not consider "canned" hunting where captive-bred lions are hunted, which has little relevance to wild lion conservation). However, there is evidence that over-hunting has reduced lion numbers at national scales - such an effect was particularly clear in Tanzania (Packer et al. 2011). In unfenced reserves, large-scale population growth rates were lower in the presence of trophy hunting (Packer et al. 2013). It is also clear that badly regulated hunting can be locally damaging (Caro et al. 2009; Packer 2015; Creel et al. 2016).

Trophy hunting is not the only reason lions are killed. How the number of lions killed by trophy hunting compares with those killed by snaring or human-lion conflict is known only for a few localities (eg Loveridge et al.(2016)), and conventional ecological methods for estimating mortality have been found to underestimate rates of illegal killings, such as poaching, relative to legal killings, for example trophy hunting (Treves et al. 2017). Mortality due to conflict with local people may be orders of magnitude greater than that due to international trophy hunters: in Tanzania's Ruaha landscape, at least 37 lions were killed in 2011 due to conflict, in an area of less than 500km^2, making the offtake over 100 times higher than the recommended maximum offtake for a trophy hunting area (Dickman in prep). Recently, concern over lions being poisoned as an incidental outcome of attempts to disguise elephant poaching has gained prominence (Sandhu 2016). There are other places (e.g. Hwange, (Loveridge et al. 2016)) where trophy hunting is the main cause of mortality for adult male lions. However, in many places the balance of these factors is unknown , although it is suspected that across Africa many more lions die due to conflict than are killed by trophy hunters (Panthera et al. 2016).

Where trophy hunting occurs, its mortality is probably additive. In addition, it can lead to a cascade of indirect mortality through social perturbation (the perturbation effects of other sources of mortality have not been studied). But even where other sources of mortality predominate, it is theoretically possible for a small amount of additive mortality to tip the balance from a scenario where a population is stable or increasing to one where the population growth rate is negative. Creel et al. (2016) concluded that for trophy hunting to be sustainable under the conditions most lions experience, total mortality needs to be reduced. Where other sources of mortality dominate, tackling them is likely to be the priority. It is clear that there will be many places where focussing on a single threat to lions, whether trophy hunting or any other cause, will be inadequate for effective conservation. A holistic approach, considering all the threats and their interconnections, is most likely to succeed.

As with photo-tourism, trophy hunting can protect wildlife by providing an economic reason for land being maintained under a wildlife-based land use. Income from trophy hunting can be a significant source of income for government bodies responsible for managing wildlife – the Wildlife Division in Tanzania for example makes 60% of its income from trophy hunting licence fees (Estes 2015). Major unknowns therefore include the likely, but inconclusively demonstrated, positive roles of trophy hunting in creating economic incentives for wildlife-based land use, whether on private, state or communal land. It may also provide anti-poaching presence in wildlife areas together with general management such as maintenance of boreholes. How widely land managed for hunting is well managed for non-hunted species is also poorly understood.

The continued availability of land for lions is clearly crucial for their conservation. Our review of the evidence led to the conclusion that trophy hunting's greatest contribution to lion (and wider) conservation lay in providing an incentive to retain wildlife habitat that might otherwise be lost to agriculture or pastoralism (D.W. Macdonald 2016). It is vital therefore to know how much lion habitat there is, where it is, how many lions it supports and how it is managed. Large areas of wilderness

are used for lion hunting, but there are few recent estimates of precisely how much. Lindsey et al. (2013) estimated that lions were hunted across around 558,000km^2, which comprised 27-32% of the lion range in countries which hunted them. There have been no published updates since Botswana banned lion hunting in 2008 (and all hunting in public areas in 2014) or since Zambia imposed a lion hunting moratorium between 2013 and 2016. Also, since Lindsey et al.'s estimate, human encroachment has caused losses of hunting land: Packer (2015) estimates that 40% of hunting blocks in Tanzania have been abandoned in the last decade. Hunting blocks elsewhere have also been abandoned after becoming depleted and unviable (P. A. Lindsey et al. 2016). If not used for hunting, a lot of that land would be likely to be lost to wildlife, by for example being converted to agriculture or livestock grazing. In some areas, where economic forces did not prompt conversion, lions and their prey might recover when hunting stopped, leading to restoration of hunting at some point.

We make two interim conclusions: first, trophy hunting should be strictly regulated to ensure that it does contribute to lion conservation, including by the maintenance of habitat (our report makes clear how this can be achieved). Second, where lion hunting is disallowed by national law or rendered financially unviable (by import bans for example), alternatives must be found to ensure that its contribution to habitat preservation is replaced – this is the difficult bit, and the one worst bedeviled by unknowns. The substituted institutions will need to effect more than habitat protection, by preventing poaching for example. It is crucial to distinguish between scenarios where trophy hunting of lions alone is stopped compared to a general cessation of trophy hunting. Many hunting areas may not be financially dependent on lions, but a further unknown is whether a cessation on lion hunting would be followed by extended restrictions on the hunting of other charismatic and threatened species. Lindsey at al.(2017) demonstrate that, with or without hunting, many areas have insufficient funds for effective management.

How Hunting Affects Lion Populations

An understanding of the mechanisms whereby trophy hunting affects lion populations requires monitoring, and knowledge not just of population size, but the density of individuals eligible for hunting. Appropriate methodologies are available (eg, Funston et al. (2010); Broekhuis and Gopalaswamy (2016); Elliot and Gopalaswamy (2016)). D.W. Macdonald (2016) shows how an adaptive management system can ensure that departures from sustainable offtakes can be rectified. Thus while there is scope for refining methods of counting carnivores (Gopalaswamy et al. 2015), useful methods exist – the dangerous unknown is ignorance of the numbers of lions, largely due to the practicalities of who is going to pay for such monitoring.

In principle, calculating the mortality lion populations can withstand, from trophy hunting or any other source, is straightforward. There are area- and density-based harvesting models of sustainable offtake. These could be refined to account for intra-specific variation in lion density, and other threats. For example, the figure recommended by Packer et al. (2011) for offtake of 0.5 lions 1000 km^{-2}, while intended to be precautionary, does not account for variation in lion population density. Furthermore, it would be useful to quantify the interactions between mortality factors (e.g. trophy hunting, snaring, conflict etc) some of which (e.g. snaring) are non-specific. Perturbation effects (Tuyttens & Macdonald 2000) on lion demography resulting from trophy hunting are well documented (Loveridge et al. 2007), and there is evidence that such effects exacerbate human-lion conflict (Loveridge et al. in prep.).

What Would Happen to Hunted Lion Populations if they were no Longer Hunted for Trophies?

It is difficult to predict what would happen to hunted lion populations if hunting was stopped. Would photo-tourism substitute, or some other non-wildlife friendly

192 regime? Hunting may, in general, be less beneficial than photo-tourism for lion
193 populations, but may nonetheless be better than nothing (P.A. Lindsey et al. in
194 press). There are crucial unknowns from the viewpoints of both land-managers and
195 governments. These include the extent to which photo-tourism (itself vulnerable to
196 insecurity and global economic forces), or other non-consumptive uses can
197 substitute for trophy hunting, and crucially, how lion populations would fare
198 following conversion. How much current trophy hunting land is suitable for
199 conversion to photo-tourism is uncertain. Lindsey et al. (2006) argue that certainly
200 not all of it is, and question whether there is sufficient demand to supply visitors to
201 these areas.
202
203 Under what conditions is trophy hunting land converted to less wildlife-friendly uses
204 such as agriculture, settlement, mining or pastoralism? The regulation and
205 enforcement of land ownership and land-use zoning are likely to be influential. The
206 key unknown here is how important lions are for the profitability of trophy hunting
207 operations relative to their value under different land uses. It is also important to
208 whom the different values of lions accrue under different land-use systems. Progress
209 is hampered by inadequate political, legal and governance instruments such that
210 local people have no incentive to value wildlife (Muposhi et al. 2016).
211
212 Amongst the most serious unknowns, then, are the extents to which trophy hunting
213 (and photo-tourism) does or could provide sufficient financial incentive to retain
214 land under wildlife compared to alternative uses, and what factors influence this
215 (and how the answers are likely to change in the rapidly changing socio-economic
216 landscape of Africa and beyond). From the viewpoint of governments, the associated
217 expenditure and value-added estimates of the economic contribution of trophy
218 hunting and the alternative land-uses should be compared, not just the economic
219 revenue directly attributable to each activity, which is most commonly the practice
220 in both the academic literature and advocacy documents. Questions of land-use
221 transitions will also be affected by unknowns such as the likely sequence in which
222 measures against lion hunting would be extended to other species, most obviously
223 elephants to whom, de facto, it has already extended through the ban of imports in

important consumer countries, while the process of up-listing leopards has already begun under the US ESA (Anonymous 2016).

In 2012, before the restrictions on elephant hunting and reduced lion quotas, P. A. Lindsey et al. (2012) made a tentative prediction that a lion hunting ban would make trophy hunting financially unviable across substantial areas of lion range with potential wider negative impacts. Banning the hunting of species like leopards would be likely to reduce viability across a wider area. Those authors did not account for the cost of conservation in their perspective on sustainability. The proportion of park and wildlife management budgets provided by trophy hunting operators are generally unanswered (and might usefully be posed of photo-tourist operators too). Most National Parks in Africa would not be financially viable without support from government, which often comes at least in part from hunting revenues. It would also be helpful to know how important trophy hunting is for the financial viability of wildlife authorities. Considering that in most African countries conservation is underfunded (P. A. Lindsey et al. 2017), it would be useful to know more about the comparative economics of trophy hunting and photo-tourism.

A linked unknown is how lions would be tolerated if they could not be hunted, but land was managed for other wildlife uses, such as trophy hunting of their prey. Lions could then impose a substantial cost – it has been said that 'game farming is incompatible with predators' (Schneider 1990). The fate of lion populations even under non-consumptive land uses is also uncertain, although insights may soon be gleaned from Botswana where hunting was banned in 2015 (D.W. Macdonald 2016); there may also be lessons, although certainly not simple cause and effect, to be gleaned from Kenya, where trophy hunting was banned in 1977 and where wildlife numbers declined on average by 68% between 1977 and 2016, alongside increases in human and livestock numbers that further confound simple interpretations (D.W. Macdonald 2016; Ogutu et al. 2016). Banning trophy hunting does not necessarily lead to less killing of lions: Richard Leakey observes that : "*Carnivores are being decimated .....hunting has never been stopped in Kenya, and there is more hunting*

in Kenya today than at any time since independence. (Thousands) of animals are being killed annually with no control….." (Martin 2015) .

Of 38 lion populations in non-hunting areas examined under the latest IUCN Red List assessment, 58% were declining, while of the 7 populations examined in hunting areas, potentially self selecting and mainly fenced, one (14%) was declining (Bauer et al. 2015). Comparing trends is not straightforward. For example, hunted populations are likely to be depleted already, whereas well-protected populations are generally closer to carrying capacity and therefore more likely to decline if protection wavers.

The current Status of Trophy Hunting

It is clear that evaluating how trophy hunting contributes to lion conservation is compromised by lack of data. Here we turn to the current state of lion trophy hunting. Macdonald (2016) sets out criteria under which lion hunting could be deemed sustainable. How many hunted populations meet these criteria is unknown, as are the conditions where trophy hunting is a conservation tool. Although we know which populations are currently hunted, we do not know how many of these depend on lion hunting for their viability (the only estimate, from 2012 and before heavy quota reductions in Tanzania and several other countries, is about 11% (P. A. Lindsey et al. 2012)). Indeed, for many management units, how many lions are hunted annually is unknown. Monitoring of both populations and hunting offtake is often poor; Macdonald (2016) concludes that under these circumstances precaution demands the use of conservative age and area-based criteria when allocating quotas.

Amongst the gaps that impair a comprehensive analysis of lion trophy hunting is the inadequacy of statistics on exports. Improving the collection and organisation of CITES data was amongst several recommendations made by Macdonald (2016).

Others included a move to open auctions for concession leases and to longer leases to discourage short-termist mining of the natural resources (Brink et al. 2016).

Ethics and Hindsight

Thus far we have focused on empirical data. However, the evidence of these disciplines will be judged within a wider set of societal ethics. There is no consensus, even among conservationists, that a utilitarian perspective on trophy hunting is the right one. Even the concept of 'sustainability', used above as a criterion of good management, would be viewed by some as ethically questionable when applied to lion hunting (or to any killing of animals for 'sport'). Also, we are mindful that while emotional responses affect moral judgements (Nelson et al. 2016), policies based principally on emotion could have perverse consequences. Where an intention to improve lion conservation worsens it, perhaps even those implacably opposed to lion hunting on ethical grounds might favour a 'journey' to its cessation rather than a 'jump'. As Macdonald (2016) concluded "if society judged trophy hunting lions unacceptable, but also concluded that it benefited lion conservation, then this dilemma might be approached via a journey to find ways of replacing the benefits of hunting before jumping to end them".

The day may not be far off, if it is not here already, when much of society (at least outside lion range countries) regards lion hunting as being as unacceptable as, for example, bear baiting or child labour (D. W. Macdonald et al. 2016a). However, views widely held in the wealthy West are often at odds with views within range countries, where lions often impose severe costs (including man-eating) on the people who live alongside them. Who has the right to make decisions about trophy hunting – how should the weight of opinions held on lion hunting in countries without lions, such as the USA (which has a thriving domestic hunting market) be ranked against the opinions held in African countries where lions occur (and where the financial consequences of a cessation of trophy hunting might bite hardest)? These are all difficult issues. It is clear though that if lion hunters aspire to be tolerated, they must demonstrate radical reform (and that may not be enough). It is

also clear that those who seek to eliminate trophy hunting have either to acknowledge the possible subsequent loss of lions is a cost they are prepared to pay, or to demonstrate an economically valid alternative wildlife-based land use.

Conclusion

Trophy hunting, like almost everything else affecting conservation, is a moving target (and moving, like all aspects of African conservation, heavily at the mercy of external factors). Having reviewed the knowns (D.W. Macdonald 2016), we thought it helpful to highlight the unknowns here and why they matter. Firstly, trophy hunting's potential global significance for the species is obviously compromised by not knowing over how much of the species range it occurs. And where trophy hunting does occur, the implications for lion conservation of any change to the current system will vary from place to place. Where lion trophy hunting is run with sustainable quotas, and where no viable wildlife friendly alternative exists, its removal seems likely to be negative for lion conservation. But there are extensive areas where the implications of its removal for lion conservation are uncertain because we do not know the answer to questions like how much the industry's viability depends on lions, or if lions could persist after an alternative land use was substituted.

Unknown threats to lions will surely change. The next clutch will be spawned by changing societal, global economic, demographic and environmental factors. Trophy hunting, and the prudence of relying on tourism to support conservation in Africa, might be considered minor issues compared to the others jeopardising biodiversity. The money needed to reverse biodiversity loss dwarfs that likely to flow from any variant of tourism, including hunting, so new financial models to encourage coexistence with nature must be found. Dickman et al. (2011) speculate that mechanisms for converting global value to local benefits are one promising option. Beyond that, we cannot predict how emerging markets and economies such as Russia and China will influence the status quo. The most perilous unknowns of all

include the consequences of an estimated tripling by the year 2100 of the human population of Africa. Whatever plan is put in place for the conservation of lions and the rest of Africa's wildlife, it must accommodate the reality of nature living alongside two billion people.

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