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CONVENTION ON INTERNATIONAL TRADE IN ENDANGERED SPECIES
OF WILD FAUNA AND FLORA

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REPORT ON LION CONSERVATION WITH PARTICULAR RESPECT TO THE ISSUE OF TROPHY HUNTING

This document is submitted by the United Kingdom of Great Britain and Northern Ireland with respect to agenda item 29.*

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Report on Lion Conservation with Particular Respect to the Issue of Trophy Hunting

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at the request of Rory Stewart OBE

Under Secretary of State for the Environment

28 November 2016

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Born Free
LionAid
Safari Club International Foundation (SCIF)
The British Association for Shooting and Conservation (BASC)
The European Federation of Associations for Hunting and Conservation (FACE)
The International Union for Conservation of Nature (IUCN)
The Wildlife Conservation Society (WCS)
The World Wide Fund for Nature (WWF)

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Abbreviations Used in the Text

ALWG	African Lion Working Group
CITES	Convention on International Trade in Endangered Species of Wild Fauna and Flora
CMS	Convention on the Conservation of Migratory Species of Wild Animals
DAFF	Department of Agriculture, Forestry and Fisheries
DEA	Department of Environmental Affairs
DEFRA	Department for Environment, Food and Rural Affairs
FSC	Forest Stewardship Council
ISO	International Organisation for Standardisation
IUCN	International Union for Conservation of Nature
PAC	Problem Animal Control
SCI	Safari Club International
SCIF	Safari Club International Foundation
TAWIRI	Tanzania Wildlife Research Institute
UNPD	United Nations Population Division
USFWS	US Fish and Wildlife Service
WWF	World Wide Fund for Nature
ZPWMA	Zimbabwe Parks and Wildlife Management Authority

Preface

This is a scientific report about one aspect of the conservation of wildlife and, specifically, of lions in Africa. That aspect is the trophy hunting of wild lions, and the remit is to evaluate evidence that trophy hunting has, or could, impact on the distribution and abundance of lions for better or worse in terms of their conservation. Other considerations beyond this, most obviously ethics (Macdonald et al. 2016b), are relevant to society's decisions on whether hunting lions for trophies is an acceptable activity. These other considerations are very important, and potentially decisive, but they are not the remit of this report. Indeed, those who have contributed to this report have done so strictly from a position of professional neutrality that is neither pro- nor anti-hunting, although they are united in being pro good evidence and anti bad management of lion populations.

The question of whether trophy hunting of lions harms or benefits lion conservation has become important and topical because lion numbers are declining fast and because the allegedly illegal hunting in Zimbabwe in 2015 of a lion nicknamed Cecil has focused unprecedented international attention on the issue (Macdonald et al. 2016a). It has also revealed that, at least in many of the countries into which lion trophies are currently imported, large sections of society regard hunting lions for sport as an ethically inappropriate activity for the twenty-first century (Macdonald et al. 2016a). Others take the opposite view, most notably often amongst people who actually have to live with lions in their range countries (Nzou 2015). Crucially relevant to the consequences of this disagreement is the proposition that rather than being a threat, hunting lions contributes significantly to their conservation, primarily through the maintenance of wild habitat, and that its cessation would worsen the species' already deteriorating status (Lindsey et al. 2012b; Di Minin et al. 2016). These ethical and pragmatic views may be irreconcilable, but before deciding what to do about it, individuals and nations need to know the facts, and indeed the gaps in

knowledge. Providing these facts, and identifying important gaps, is one function of this report, and it is particularly important insofar as policies applied impulsively could have perverse consequences if the intention to improve lion conservation resulted in worsening it. In that case, even those implacably opposed to lion hunting on ethical grounds might favour a *journey* rather than a *jump*. For example, 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.

It was against this background that the then Minister for the Environment, Rory Stewart, invited this review of existing lion trophy hunting practice with the aim of:

1. providing recommendations for criteria for best practice in the industry to inform assessments of whether trophy hunting is well managed and sustainable;
2. providing recommendations for what the UK, working with the our partners in the EU and also internationally, could do to assist implementation of best practice; and
3. framing these recommendations within the wider context, and overall goal, of supporting lion conservation.

As will become clear, the topic is vast, its ramifications endless, and the knowledge gaps numerous. Plugging those gaps could take a substantial inter-disciplinary research programme, and compiling even what is known now might usefully take a team of scholars a year. In reality, only a few months have been available, and so amongst the things this report is not, is entirely comprehensive or complete. Nonetheless, it aspires to set the scene and offer recommendations that are evidence-based, precautionary and workable.

Having stated that this report is concerned with trophy hunting in terms only of its impact on lion, and other wildlife, conservation, it is worth being clear on the meaning of conservation as used in this report. It is a highly inter-disciplinary blend of natural and social sciences that together provide the evidence from which

to understand, and thereby to provide the basis for conserving, species and their diversity. That evidence is necessary, but not sufficient, to make decisions on policy, because like other political matters good decisions rest upon wise judgement beyond the facts. Conservation is often characterised as being focused on populations, but insofar as the behaviour of populations emerges from the behaviour of the individuals that comprise them, conservation is also concerned with the fates and well-being of individuals. Conservation is sometimes characterised as being disinterested in animal welfare, but that is an error: for example, welfare is one of the factors that would be considered in evaluating different conservation policies. Furthermore, there was a time when conservation was thought to prioritise wildlife over people, but this too is a simplification to the point of error. Modern wildlife conservation strives to find mutual advantage between the well-being of wildlife and the people who live, often with difficulty and in poverty, alongside it.

In this report, the 'lion estate' refers to the area of land occupied by wild lions (more technically, their geographical range) and relevant to the species' conservation in the wild. Due to ecological factors (principally linked to variation in rainfall, vegetation and prey abundance) lion abundance varies across their geographical range (East 1984). But over and above that natural intra-specific variation in population density (e.g. between <1 and 40 lions 100 km^{-2}; Packer et al. 2013a), their numbers are frequently below carrying capacity due to human factors. For example, lions are often poisoned in reprisal for stock-raiding, or killed by snares set by poachers for bushmeat, or they may be hunted unsustainably for trophies. This report is concerned with lion conservation in terms of impacts on the extent of the lion estate and the abundance of lions occupying it. Any human action that diminishes the extent of that estate is considered here as inimical to lion conservation; any action that maintains or increases the lion estate is a benefit to lion conservation. In terms of the abundance of lions, while in the face of their widespread decline increasing the numbers of lions is generally considered a benefit to conservation, maximising their numbers is not necessarily the goal of conservation. This is because, in the context of natural communities, a greater abundance of lions can lead, through competition, to smaller numbers of other wild carnivores (e.g. leopards, cheetahs, African wild dogs) or, through predation, to fewer of their prey. Notwithstanding these nuances, the

primary aim of this report is to evaluate how trophy hunting impacts lion conservation, where the goal is to maintain or increase the lion estate and the eventual abundance of lions thereon.

The original Ministerial request to prepare this report had the intention of informing the British government delegation to the 17th meeting of the Conference of the Parties to CITES (CoP17), at which a proposal by Niger and eight other countries to up-list lions to Appendix I was anticipated to have implications that could have added further restrictions to the trophy hunting of wild lions, and thus had consequences, some of them perhaps unintended, for lion conservation. As Bauer and Breittenmoser (2016) report, the proposal was not adopted and so trophy hunting of wild lions was not directly affected. However, the mood of the meeting, and perhaps also of a wider global community, was that if trophy hunting had on this occasion avoided strictures it was nonetheless the moment for that industry to take decisive steps to ensure forcefully not only that it caused no detriment to lion conservation but actively enhanced it. Thus an additional and timely role emerges for this report: to address the question of how, for so long as it continues, trophy hunting can be managed to maximise its contribution to lion conservation.

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28th November 2016

Executive Summary and Recommendations

Value and Status: Lions are charismatic, widely valued and have the potential to act as conservation 'ambassadors' for biodiversity. As a species, they are not doing well: lions have disappeared from 92% of their historic range and their numbers have declined drastically to approximately just 20,000 individuals.

Grasping the moment to create the movement: Given this rapid decline of one of the world's most iconic species, action to conserve lions is urgently needed. Considering this urgency, and from the perspective of conservation, it is unacceptable to tolerate factors worsening the lion's status where options exist for mitigating them. With the world's attention galvanised by the killing of 'Cecil' the lion, there is an opportunity to convert that *Cecil Moment* into the *Cecil Movement* for global conservation. From the perspective of conservation, there is a global responsibility to grasp that opportunity.

Threats to lions: The primary threats to lions (which vary regionally), are habitat loss and degradation, loss of prey base and conflict with people over livestock. These threats are likely to intensify with climate change and rapidly increasing human population, predicted to double in Africa by the year 2050. Trophy hunting of lions can be a threat to some populations.

Extent of lion trophy hunting: Trophy hunting of lions was legal in 18 African countries in 2014, is currently practised at a significant level in at least 12 countries, and is an extensive form of land use therein. 'Canned' hunting of captive animals is legal in some countries but these are not considered wild lions and so are considered only in passing in this report.

Ethical considerations: The ethics of trophy hunting are much debated. This report focuses on trophy hunting's consequences for lion conservation, while recognising that ethics, particularly relating to animal and human welfare, will influence policy decisions.

Numbers of lions hunted for trophies: Most trophy-hunted lions are bred in captivity. The number of wild lions trophy-hunted is hard to establish with precision due to inconsistencies in the data. Between 2006 and 2015, CITES recorded 4,474 'wild'-sourced lion trophies (which include parts of lions so may not reflect numbers of individuals) as imported world-wide, with only 2,429 reported as exported. Between 1991 and 2013, CITES records 80 wild lion trophies (not individual lions) exported to the UK; the UK importation records show 4 trophies.

Effects of trophy hunting on lion populations: Trophy hunting, particularly of females and pride males, can be a significant (and in some cases even primary) threat to lion populations at a local level, especially when additive to other effects. The damaging effects of unsustainable trophy hunting can extend beyond hunting areas into adjacent protected areas. However, there is little evidence that trophy hunting has substantial negative effects at a national or regional level. Where trophy hunting is well-regulated, transparent and devolves sufficient authority to the land managers, it has the potential to contribute to lion conservation, but in many countries, poor governance and weak regulation can lead to unsustainable trophy hunting.

Impact of trophy hunting on lion populations: There is little evidence that trophy hunting has substantial negative effects at a national or regional level. Where trophy hunting is well-regulated, transparent and devolves sufficient authority to the land managers, it has the potential to contribute to lion conservation, but in many countries, poor governance and weak regulation can lead to unsustainable trophy hunting.

Trophy hunting as a contributor to lion conservation: The most fundamental benefit of trophy hunting to lion conservation is that it provides a financial incentive to maintain lion habitat that might otherwise be converted to non-wildlife land uses. It has been estimated that trophy hunting areas cover 1.4 million km^2 – 22% more land than National Parks – in Africa. How much of that area could viably be converted to phototourism is unknown, but this certainly could not be accomplished everywhere.

Revenue generated from trophy hunting: The revenue generated by trophy hunting is debated, with estimates of >US$200 million in gross revenue annually across sub-Saharan Africa. Lion hunting probably accounts for 5-17% of that income, depending on the country. Overall, the trophy hunting industry is not heavily

dependent on lions for its financial viability, but if lion hunting was ruled out, trophy hunting could, according to the only peer-reviewed published estimate (Lindsey et al. 2012), become unviable across approximately 60,000 km^2.

Approaches to reducing the risk of over-harvesting: Two main proposals have been made for reducing the risk of unsustainable trophy hunting – the first is area-based, with removal level ideally capped at 0.5 lions 1,000 km^{-2} (unless there is evidence it can withstand a higher level), and the second is age-based, where it is recommended that only males of 7 years or above are taken. In areas where other threats are present then combining the age- and area-based methods would be the safest policy (if other risk factors are not increasing, this should have a $<$10% risk of population extirpation within 25 years).

Trophy hunting in perspective: Over and above the issue of trophy hunting, international attention should be focused on generating new financial mechanisms to secure lion populations across their range. In this context lions are a metaphor, and an ambassador, for wider biodiversity conservation. Given that there are probably 60 remaining wild lion populations, a priority, and a call to arms, is to secure the six remaining ones of those which have substantial lion numbers and to safeguard all 60 remaining wild lion populations.

Recommended criteria for importing trophies to the UK: The criteria for whether a lion trophy could be imported into the UK should be that the hunting (a) was unlikely to cause detriment to the lion population from which it was taken, and (b) contributes to lion conservation. Therefore, we recommend that the following essential criteria should be applied to the consideration of lion trophy imports to the UK:

i. That the UK should import trophies only from areas that are sufficiently large to offer conservation benefit to lions (we suggest 500 km^2 or more), and where the lion population is demonstrably well-managed.

ii. Good management requires either adequate monitoring, which allows scientific quota-setting and shows a stable or increasing population, or age-based harvesting. Age-based harvesting could include either the precautionary approach (0.5 male lions of $\geqslant$7 years per 1,000 km^2, with rest periods, unless there are good data showing it can withstand a higher level), or adaptive age-based quotas.

iii. Areas that fail to qualify under the foregoing criteria could possibly receive a 'grace period' of up to 3 years under very strict criteria and annual review in order to allow

them to reach the required standards. During any such period, hunting should be heavily limited, e.g. to a maximum of 0.5 lions 1,000 km^{-2} aged $\geqslant$7 years. Failure to meet the required conditions after the grace period would result in a moratorium on UK imports from the area until they are in place.

iv. In areas where lion populations are declining unsustainably under any of the permitted harvesting systems, hunting should be stopped or, if there is a significant risk of losing that habitat from the wildlife estate, the area should be examined on a case-by-case basis and any lion hunting kept only at a very minimal level until the situation can be improved.

v. These criteria should ideally be applied at the level of the hunting area not the country, and exports should be managed by an independent committee of stakeholders in each country. That committee should audit hunting practices, set and monitor quotas, encourage certification of hunters, ensure adequate training of professional hunters, ensure transparency and compliance, and verify the age of hunted lions based on hunt reports, photos and tooth X-rays. The costs of operating these national committees would normally be met by stakeholders such as the hunting industry, relevant NGOs, international and local governments.

In addition, the likelihood of trophy hunting contributing to lion conservation would be increased if regulations were designed to maximise the revenue procured that was, at least partly, available to conservation. Therefore, this report recommends that the following desirable elements should be in place:

i. Short leases, and the short-termism and incentive for over-harvesting that they encourage, should not be issued to hunting blocks. A suitable minimum would be ten years, with option for extension by the current tenant (assuming conservation requirements have been met).

ii. Hunting blocks should be allocated according to an open auction system.

iii. Trophy hunting fees should only be applied following successful hunts, thereby reducing the incentive to kill inappropriate individuals.

Because trophy hunting involves killing a wild animal that, if not killed cleanly, has the potential to suffer, and because human safety is also at risk with the use of firearms, this report recommends reviewing the evidence and codes of practice that would ensure:

- that professional hunters are strictly accredited as evidenced by membership of internationally recognised associations that put standards first and foremost (including those

of marksmanship and animal welfare), and will conduct investigations into reports of misconduct and expel guilty members (national governments should support such expulsions by refusing disciplined PHs permission to hunt). Membership with such an association would be necessary to market hunts (e.g. at the large international conventions where an estimated >75% of the hunts are booked).

Finally, broader scale analysis of imports and exports of lion trophies is an essential element of monitoring the industry and its impact on conservation. The CITES database is a potentially incomparable resource for doing so. However, ambiguities over the muddling of entire lions and parts of lions, and some lack of clarity between exports and re-exports, currently confound the data, and lamentably diminish the value of the database. Therefore, this report also recommends that:

- CITES procedures are adjusted so that it is possible to assign various body parts to a single trophy lion (thereby avoiding the double-counting of, say, the pelt and skull of a single animal), and to track successive re-exports of that individual.

These recommendations, based on an impartial review of the scientific evidence, represent feasible steps for minimising risk of adverse effects of trophy hunting on lion populations, while ensuring that where trophy hunting occurs it contributes significantly to the benefit of lion conservation. This is important, but the UK government, and its partners and collaborators in this grand vision, will also need to invest heavily in tackling even greater issues beyond trophy hunting to secure the long-term future of this globally iconic species.

Wider implications for the governance of lion trophy hunting to ensure it is not detrimental to lion conservation and has the potential to enhance it: Although this report was commissioned by the then Under Secretary of State to inform decisions on the conditions that might apply to the import of lion trophies to the UK, the recommendations set out in that context in the foregoing section apply equally to the wider question of how the lion trophy hunting industry might be regulated to ensure that it is not detrimental to lion conservation and is best placed to enhance it.

1. Reasons for examining the issue of trophy hunting with respect to lion conservation

1.1 Reasons for being concerned about lion conservation

1.1.1 What value do lions have?

The African lion is one of the world's most iconic species, and has played a rich role in the symbolism and culture of the United Kingdom. At a wider scale, at least a large part of the global public assign great existence value to lions (Dickman et al. 2011), and there is vast international interest in lion welfare and conservation (Macdonald et al. 2016a). Lions and other big cats are viewed as particularly charismatic species amongst people likely to engage with conservation campaigns, making them powerful ambassadors for conservation (Macdonald et al. 2015a).

As apex predators, lions also have great ecological value, and the removal of top carnivores from ecosystems can have long-lasting negative ecological impacts (Ripple et al. 2014). In addition to their cultural and ecological significance, lions undoubtedly have very high economic value, and are one of the top draws for both photographic tourists and trophy hunters to the countries where they remain, generating large amounts of revenue (McNeely 2000; Lindsey et al. 2012b). Lions are a regular part of the trophy hunting industry in at least 10 African countries and more information on the specific economic revenue of lion trophy hunting is provided in Section 2.2.2.

1.1.2 To what extent have lions declined, in terms of numbers and geographic range?

The urgency and importance of lion conservation arises from the fact that lions have experienced a dramatic decline in both numbers and geographic range over recent decades. The latest IUCN estimates suggest a population of 23,000 – 39,000 African lions (probably closer to the lower estimate), representing a decline of at least 43% between 1993 and 2014 (approximately three lion generations) (Bauer et al. 2016). Most alarmingly, lions are now considered to have been extirpated from at least 92% of their historic range[1] (Bauer et al. 2016).

[1] *Lions occur in 24 African countries (Bauer et al. 2016). Since 1977, 20 of these countries have exported lion trophies (CITES: http://trade.cites.org/en/cites_trade/ [accessed 2016-07-12])*

According to the 2016 Red List Assessment, in Africa, lions are now extinct in 15 countries (including Western Sahara, which is technically a disputed territory), are possibly extinct in another seven and now occur in only 24 countries (Bauer et al. 2016). Lion decline may be even more severe than currently estimated by the IUCN, due to the assessment being based on data from relatively well-known populations. This is a common practice, but well-monitored populations are also those which are likely to have relatively high levels of attention, investment and protection, so a possible bias is that they are likely to be less threatened than many other subpopulations (Durant et al. submitted).

1.1.3 What is the current threat status of lions?

The lion is classed as 'Vulnerable' by the IUCN (Bauer et al. 2016) based on its declining population size, so is thought to be facing a high risk of extinction in the wild. However, across the majority of its range, the lion meets the IUCN criteria for 'Endangered' status, with an inferred rate of decline of over 50% across three lion generations, but the positive trends from southern Africa reduce that average decline at a range-wide level (Bauer et al. 2015). Only two African countries (Namibia and Zimbabwe) had substantially increased lion populations between 1993 and 2014, and it is of note (given the purpose of this report) that both those countries are ones which trophy-hunt lions. Similarly, while lions in most parts of Mozambique are declining, in Niassa Game Reserve where hunting was tightly regulated, lion populations increased locally between 1993 and 2014. However, trophy hunting is clearly not a guarantee of increasing lion populations, as other key trophy hunting countries such as Tanzania showed declines (Bauer et al. 2016), with previous data from Packer et al. (2009) showing highest declines in countries with highest trophy hunting rates.

1.1.4 What are the major current threats to lions?

The 2016 IUCN Red Listing for the lion states that "*Among the causes of decline, the most important are indiscriminate killing in defence of human life and livestock, habitat loss, and prey base depletion. Prey base depletion is partly linked to habitat loss, but more importantly to poaching and bushmeat trade (Becker et al. 2013). An emerging threat is trade in bones and other body parts for traditional medicine, both within Africa and in Asia (IUCN 2006a, b; Riggio et al. 2013). Furthermore, although trophy hunting contributes positively to Lion conservation, improvements in management practices have been recommended (Hunter et al. 2013; Lindsey et al. 2013; Edwards et al. 2014), as when poorly regulated, it also contributes to population declines (Packer et al. 2009; Croes et al. 2011;*

Packer et al. 2011; Rosenblatt et al. 2014). While attention is currently focused on Lion hunting reforms to ensure sustainability, the leading causes of population decline are more difficult to address and are likely to continue" (Bauer et al. 2016).

The CITES/CMS meeting of all lion range states in May 2016 summarised that: "*...the main threats (listed in no particular order) for lions in Africa are: (1) Unfavourable policies, practices and political factors (in some countries); (2) Ineffective lion population management; (3) Habitat degradation and reduction of prey base; (4) Human-lion conflict, (5) Adverse socio-economic factors; (6) Institutional weakness; and (7) Increasing trade in lion bones.*" The two 2006 IUCN regional reports for lions noted that the major factors affecting lion viability were availability of wild prey, indiscriminate killing of lions, size and extent of the lion population, and loss, degradation and fragmentation of lion habitat, with increasing human populations and poverty acting as key underlying root causes of decline, as well as institutional weakness and poor management (IUCN 2006a, b). A 2016 report by Panthera, WildAid and WildCRU named human-lion conflict and bushmeat poaching as critical threats to lions, while human encroachment was a high threat and trophy hunting and lion poaching were deemed medium threats (Panthera et al. 2016). In short, experts agree that the primary threats to lions (which vary to some extent by region; see Section 2.1.4) are habitat loss and degradation, loss of prey base and conflict with people over livestock depredation.

1.1.5 Future considerations for lion conservation

There are significant global challenges facing lions and other biodiversity, particularly the impacts of human population growth and climate change. Human populations are set to swell over the 21st century, as is their demand for resources including land. Africa, with a current population size of ∼1.2 billion (UNPD 2015), has the fastest population growth rate in the world, with projections estimating a population tripling across 27 African states by 2100, leading to a continental estimate of ∼4 billion. Eight lion range states[2] (as well as Mali, where lions are possibly extinct, and Burundi, where they are extinct) are estimated to have a five-fold increase in human population by 2100 (UNPD 2015). At current rates of population growth, by the end of the century the population of Tanzania will be two-thirds that of the United States of America (USA) but in an area ten times smaller. Worse still, Nigeria, also with a surface area roughly one-tenth that of the USA, is projected

[2] *Angola, Democratic Republic of the Congo, Malawi, Niger, Somalia, Uganda, Tanzania and Zambia*

to have a population that will be double that of the USA (European Commission 2015). The impact of this human population growth on the lion estate depends on many variables, but even supposing favourable economic development and land-use transitions were to occur (which seems unlikely in many places), it is expected that pressure on lion habitat and prey will increase substantially. Livestock numbers are expected to grow concomitantly, leading to intensified human-lion conflict. Changes in human populations may also be associated with changes in patterns of tourism, which might affect both photographic and hunting revenues for lion range states.

Regarding climate change, under moderate emissions scenarios, global mean temperature is expected to reach 2° above pre-industrial levels by 2050. More likely, and given the reticence or incompetence with which governments have faced climate change, these temperature scenarios will be exceeded. A more likely prediction is 2.5–3° warming by 2050[3]. Climate changes are likely to have pervasive effects such as reduced and more erratic rainfall (Fields 2005; Toulmin 2009). Although lions have broad habitat tolerance within the savannah biome, the predicted drying trend is likely to affect lions through declines and changes in prey species communities. The implications of changing climate for lions are not limited to direct effects: it could also feasibly alter the potential human land-uses. There is uncertainty about how increasing aridity may affect land conversion and the implications for the lion estate. However, there is likely to be increasing pressure on water-rich regions from growing human populations, increasing demand for land and increasing pressure on currently protected areas.

1.1.6 Summary of reasons for being concerned about lion conservation

Lions have great value at national and international scales, including significant existence, ecological and economic value. Furthermore, lions hold both symbolic meaning and widespread affection in the UK, making their conservation important for the British populace. Rural populations in many African countries often take a different view of animals that can and do kill their stock and even members of their families, and to them, lion killing can be not only ethical but often desirable (Hazzah et al. 2009; Dickman 2015). Furthermore, governments in lion range countries, often affected by poverty and all the attendant pressures, will have different priorities from West-

[3] *IPCC, 2014: Climate Change 2014: Synthesis Report. Contribution of Working Groups I, II and III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Core Writing Team, R.K. Pachauri and L.A. Meyer (eds.)]. IPCC, Geneva, Switzerland, 151 pp.*

ern audiences. Over only a few decades, the lion estate has shrunk strikingly, as have numbers of lions occupying parts of it, so to those who value it, the conservation of this iconic species is now more urgent than ever. With perhaps not many more than 20,000 free-ranging lions remaining, and in the light of increasing pressure on lion populations, there is a pressing requirement for effective conservation, and anything that might imperil it necessitates careful scrutiny. There have been vociferous arguments that trophy hunting is one of the factors that imperils lions, while others state equally vigorously that restricting trophy hunting would be a larger danger factor for lion conservation. Therefore, it is urgent that this issue is examined impartially, in order to develop suggestions for policy that would minimise negative impacts for lion conservation.

1.2 Background to lion trophy hunting

1.2.1 What is lion trophy hunting?

According to the IUCN, "*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). Trophy hunting is also known as 'safari hunting' and is often referred to as a type of 'sport' or 'recreational' hunting (and justifications are clearly distinct from those when hunting is primarily for pest control or subsistence; Loveridge et al. 2007b). Regarding lions, the trophy is normally the animal's skull and skin (and clavicle, hyoid bone and claws). The mane is the prominent feature of the skin, with longer, thicker and darker hairs signifying a better quality of trophy, although ultimately Safari Club International (SCI) define trophy quality by skull size (Safari Club International 2005). Trophies are usually mounted for display and associated kudos and nostalgia.

Although an important part of the pursuit, trophies themselves are not usually the sole motivation for hunting. Motivations may include engagement in outdoor pursuits, an enthusiasm for collection, social status and owning 'bigger' trophies (as evidenced by the emphasis on trophy size in SCI Awards and record book). Surveys of over 600 international trophy hunters who had hunted in South Africa between 1999 and 2003 revealed that spiritual or emotional motives (particularly the enjoyment of being in nature), were the most commonly mentioned reasons for hunting, followed by 'emotional' aspects such as enjoying the challenge of the hunt, although col-

lection of the trophy was an important theme for many people (Radder 2005).

In Africa, government or wildlife management agencies make hunting concessions available, usually on leasehold, and normally issue trophy hunting licences that are available to the hunting client through hunting outfitters, also known as safari operators[4], for a fee. The overall cost to the hunting client covers the direct costs of the hunt (e.g. trophy fees, per diem rates [which differ between species and are significantly larger for dangerous species], concession fees, accommodation, subsistence, staff and travel costs). It also usually covers a levy that goes to the Government, part of which may be used by the Government to provide funds for wildlife areas and local communities (see Section 2.2.2.3). The motivation of the lion range states for permitting trophy hunting is, as for other forms of tourism, to generate revenue and jobs; this has the consequence of financing a wildlife economy on land where in some cases alternative forms of land-use are less profitable or practical.

The hunting operations are usually run by outfitters (although sub-leasing and external marketing complicates the system and the task of regulating it); outfitters are responsible for all hunting requirements in-country, such as obtaining the correct licences, permits, liaising with landowners, and organising all other logistics. Outfitters also provide access to a professional hunter (which may be the outfitter themselves), whose responsibility it is to accompany the client and ensure that the hunt is conducted to the required standard. Professional hunters are variously accredited by national hunting bodies or wildlife management authorities. The exact mechanisms of lion trophy hunting vary by country, but once the lion has been killed, the outfitter or professional hunter is responsible for the field preparation and care of the trophy, and ensuring that all the relevant permits are in place for the client to export the trophy to its final destination.

1.2.2 Legality of lion trophy hunting

The global outcry over the trophy hunting[5] of Cecil the lion in July 2015 (Macdonald et al. 2016a) revealed widespread surprise amongst the public, particularly in more developed countries, that trophy hunting remains a legal practice

[4] *Hunting outfitters or safari operators have the legal rights to hunt on a defined piece of land (either private land, government concession, or community land) for which they may be issued a hunting quota for particular species. Professional hunters are contracted by the safari operators to guide paying tourist hunters in their pursuit of quarry; doubling up as instructors, first aiders, bodyguards etc.*

[5] *All legal charges relating to the hunting of Cecil were dropped in November 2016. A Zimbabwe court ruled that they were too vague for a proper defence to be mounted (http://www.bbc.co.uk/news/world-africa-37948866). Most trophy hunting is legally practiced.*

(and an expansive land use) in many African countries. Trophy hunting (of certain wildlife species, not just lions) is currently practiced at a significant level in approximately 12 African countries (historically at least 33 African countries permitted trophy hunting; CITES data: http://trade.cites.org/en/cites_trade/ [accessed 2016-07-12]). A summary of which African countries historically hunted and currently hunt lions, according to CITES data, is shown in Table 1.

As of December 2015, trophy hunting was banned in six African lion range countries that are still thought to have lions – Angola, Botswana, Kenya, Malawi, Niger and Nigeria (U.S. Fish and Wildlife Service 2015). While some of these bans are long-standing (e.g. Kenya banned all trophy hunting in 1977), some are recent bans – for example Botswana enforced a ban on all trophy hunting in public areas from the start of 2014 (following a moratorium on lion hunting between 2001 and 2004, and successive restrictions thereafter). Trophy hunting is also banned in Congo, Gabon and Mauritania, where the lion is regionally extinct, in Ghana where they are possibly extinct, and in Rwanda where a small number of lions were reintroduced in 2015[6] (U.S. Fish and Wildlife Service 2015; Bauer et al. 2016).

The US Fish and Wildlife Service found that as of May 2014, 18 African countries in Africa legally permitted lion hunting: Benin, Burkina Faso, Central African Republic, Democratic Republic of the Congo, Ethiopia, Côte d'Ivoire, Mali, Mozambique, Namibia, Senegal, Somalia, South Africa, Sudan, Tanzania, Togo, Uganda, Zambia and Zimbabwe (U.S. Fish and Wildlife Service 2015). However, lions are thought to be extinct in three of those countries (Côte d'Ivoire, Mali and Togo), and in Ethiopia and Uganda, trophy hunting is restricted to problem or dangerous animals (U.S. Fish and Wildlife Service 2015), with some similar restrictions in places in Namibia. However, they also found that as of 2013, lion trophy hunting was only documented to occur in eight countries, namely Benin, Burkina Faso, Central African Republic, Mozambique, Namibia, Senegal, Somalia, South Africa, Tanzania and Zimbabwe – Zambia imposed a moratorium on the trophy hunting of big cats in 2013, but lifted it for the 2015/16 hunting season for leopards, and announced the lifting of the ban on lions for the following year (U.S. Fish and Wildlife Service 2015). Swaziland has no legal protection for lions (similar to Guinea Bissau, where lions are possibly extinct, and Burundi and Lesotho where they are regionally extinct) (U.S. Fish and Wildlife Service 2015; Bauer et al. 2016). There have

[6] *Rwanda is amongst the 7 countries we cite on a list of those from which lions have probably become recently extinct according to the IUCN Redlist. This situation may be retrieved by the 2015 reintroduction.*

also been some restrictions on lion hunting within countries – for example, Zimbabwe imposed a regional moratorium on lion hunting between 2004 and 2008 (Loveridge et al. 2010).

As with any other form of wildlife management, permitted trophy hunting activities are legislated by the relevant national government and wildlife authorities, and the specifics of that legislation (as well as how well it is enforced) vary considerably. In some countries (most notably South Africa) lions can be shot within very small enclosures, a practice known as 'canned', 'captive' or 'put-and-take' hunting. As long as the landowner complies with the relevant national and provincial legislation regarding minimum standards for fencing and enclosure sizes, it is legal to breed lions and hunt them within those small fenced areas (although trophies from these captive lions from South Africa can no longer be imported into the US as a result of the October 2016 evaluation by the USFWS). Most lion hunting in South Africa is from captive animals: Lindsey et al. (2012a) reported that South African hunting operators estimated that only 0.9% – 1.1% of lions hunted in 2009 and 2010 were wild. The CITES Scientific Authority for South Africa have given a slightly higher estimate, with wild lions accounting for 5% of total successful lion hunts, but the vast majority of hunting in South Africa is clearly from captive animals (Williams et al. 2015). There is widespread opposition to the practice of canned or captive hunting on ethical and animal welfare grounds (IUCN 2016) and it has been condemned by the IUCN, which states: "*Canned hunting...raises very different issues from trophy hunting of free-ranging animals, and is condemned by existing IUCN policy*" (IUCN Recommendation 3.093, 'Application of the IUCN Sustainable Use Policy to sustainable consumptive use of wildlife and recreational hunting in southern Africa', 2004; IUCN 2016).

Table 1: *Summary of the historic extent of trophy hunting practice across Africa, including information on the recent export of trophies from that country. The current lion conservation status for each country is summarised as per Bauer et al. (2015). The relative scales as a proportion of 1 for both general trophy hunting and lion hunting are provided for the decade 2006 and 2015. Data were extracted from the CITES database* (http://trade.cites.org/en/cites_trade/ [accessed 2016-07-12]) *for the years 1975 to 2015 and for the purpose of* 'H – Hunting trophy'*. The data were then subset by* 'W' *(wild) source and term* 'trophies'*. As there may be a lag in exporting trophies and updating the records, the* 'Recently exported' *columns consider data from 2014 to 2015.*

Country	Historically hunt *Trophies*	Recent export *Trophies*	Relative scale *Trophies*	Lion status	Historically hunt *Lions*	Recent export *Lions*	Relative scale *Lions*
Algeria	no	no	-	Extinct	no	no	-
Angola	no	no	-	EXTANT	no	no	-
Benin	YES	YES	0.002	EXTANT	YES	YES	0.004
* Botswana	YES	YES	0.044	EXTANT	YES	no	0.025
Burkina Faso	YES	YES	0.007	EXTANT	YES	YES	0.050
Burundi	no	no	-	Extinct	no	no	-
Cameroon	YES	YES	0.028	EXTANT	YES	YES	0.026
Cape Verde	no	no	-	absent	no	no	-
Central African Republic	YES	YES	0.010	EXTANT	YES	no	0.007
Chad	YES	no	0.001	EXTANT	YES	no	0.001
Comoros	no	no	-	absent	no	no	-
Congo	YES	YES	0.000	Extinct	no	no	-
Congo	YES	no	0.000	EXTANT	YES	no	0.000
Cote D'ivoire	YES	no	0.000	*Unsure*	no	no	-
Djibouti	no	no	-	Extinct	no	no	-
Egypt	no	no	-	Extinct	no	no	-
Equatorial Guinea	no	no	-	absent	no	no	-
Eritrea	no	no	-	Extinct	no	no	-
Ethiopia	YES	YES	0.004	EXTANT	YES	YES	0.001
Gabon	YES	no	0.000	Extinct	YES	no	0.000
Gambia	no	no	-	Extinct	no	no	-
Ghana	YES	no	0.000	*Unsure*	no	no	-
Guinea	YES	no	0.000	*Unsure*	no	no	-
Guinea-bissau	no	no	-	*Unsure*	no	no	-
Kenya	no	no	-	EXTANT	no	no	-
Lesotho	YES	no	0.000	Extinct	no	no	-
Liberia	YES	no	0.000	absent	no	no	-
Libya	no	no	-	Extinct	no	no	-
Madagascar	YES	no	0.000	absent	no	no	-
Malawi	YES	no	0.000	EXTANT	no	no	-
Mali	YES	no	0.000	*Unsure*	no	no	-
Mauritania	no	no	-	Extinct	no	no	-
Mauritius	YES	YES	0.000	absent	no	no	-
Mayotte	no	no	-	absent	no	no	-
Morocco	YES	no	0.000	Extinct	no	no	-
Mozambique	YES	YES	0.035	EXTANT	YES	YES	0.040
Namibia	YES	YES	0.186	EXTANT	YES	YES	0.024
Niger	YES	YES	0.000	EXTANT	no	no	-
Nigeria	YES	no	0.000	EXTANT	no	no	-
Reunion	no	no	-	absent	no	no	-
Rwanda	no	no	-	*Unsure*	no	no	-
Sao Tome And Principe	no	no	-	absent	no	no	-
Senegal	YES	no	0.000	EXTANT	YES	no	0.000
Sierra Leone	no	no	-	Extinct	no	no	-
Somalia	no	no	-	EXTANT	no	no	-
South Africa	YES	YES	0.436	EXTANT	YES	YES	0.269
South Sudan	no	no	-	EXTANT	no	no	-
Sudan	YES	no	0.001	EXTANT	no	no	-
Swaziland	YES	no	0.000	EXTANT	no	no	-
Tanzania	YES	YES	0.118	EXTANT	YES	YES	0.424
Togo	YES	no	0.000	*Unsure*	YES	no	0.000
Tunisia	no	no	-	Extinct	no	no	-
Uganda	YES	YES	0.000	EXTANT	no	no	-
Western Sahara	no	no	-	Extinct	no	no	-
§ Zambia	YES	YES	0.060	EXTANT	YES	no	0.079
Zimbabwe	YES	YES	0.069	EXTANT	YES	YES	0.047

∗ *Botswana banned lion trophy hunting in 2008, and all trophy hunting in public arenas in 2014.*

§ *Zambia implemented a lion and leopard hunting moratorium in 2013, which was reversed in 2015 for leopards and 2016 for lions.*

Across Africa, there is also a bias towards hunting captive lions rather than wild ones[7]: CITES export records document more than twice as many captive lion trophies as wild ones, with a ratio of 2.35 to 1 (5,715 'captive' versus 2,429 'wild'), although the importers record a slightly different ratio, of 1.89 captive trophies for every wild one (4,474 'captive' versus 2,367 'wild').

In South Africa at least, captive lions are bred for the purpose of supplying the demand for lion trophies, with this industry regulated by the Department of Environmental Affairs (DEA) and the Department of Agriculture, Forestry and Fisheries (DAFF)[8]; however these lions are generally neither considered as wild or contributing to lion conservation[9].

The African Lion Working Group (ALWG) in 2016 stated that "*the sport hunting of lions that are captive bred and reared expressly for sport hunting, and/or sport hunting of lions that occur in fenced enclosures and are not self-sustaining, does not provide any demonstrated positive benefit to wild lion conservation efforts and, therefore, cannot be claimed to be conservation... The estimated 8,000 lions in South Africa currently being maintained and bred on game farms as part of this industry should not be included in any assessments of the current status of wild lions.*"

As this report is focused on wild lion conservation, canned or captive hunting does not fall within its remit, and will therefore not be considered further, except insofar as it might indirectly affect lion conservation.

1.2.3 Ethical acceptability of lion trophy hunting

There has been more than a century of concern over the ethics of hunting (e.g. fox hunting in the UK: Burns Inquiry 2002; Macdonald and Johnson 2015a), against which background the killing of Cecil the lion triggered widespread outrage over the perceived ethical unacceptability of trophy hunting (Macdonald et al. 2016a). The motivation for that outrage varied, but tended to centre around the unacceptability of killing an animal purely for sport, particularly when that animal is a threatened species.

However, views regarding trophy hunting (and indeed the killing of animals in general) vary markedly across

[7] *Similar systems of put-and-take hunting are familiar in the West, for example, in the UK the shooting of reared game birds or angling in stocked trout lakes*

[8] https://www.environment.gov.za/sites/default/files/docs/lionmanagementinSA_questions_answers2015

[9] http://www.repository.up.ac.za/dspace/bitstream/handle/2263/19272/Lindsey_Possible(2012).pdf

the world (Macdonald et al. 2016b). In many African communities, the killing of a lion is often something to be celebrated (Hazzah et al. 2009; Dickman 2015), and there is a commonly-held view that it was unethical for foreigners to care so much about the killing of one lion (or indeed lions in general), particularly when lions themselves kill people and endanger their livelihoods (Nzou 2015). It was also noted that much of the demand for banning trophy hunting in Africa came from the United States, which has one of the largest domestic trophy hunting markets in the world (Sharp and Wollscheid 2009). The ethical debates around trophy hunting are important and merit consideration (Macdonald et al. 2016b), but they are beyond the scope of this report, which is focused specifically on the role of trophy hunting with regard to conservation. Conservation action does not of course take place in an ethical vacuum – Vucetich and Nelson (2012) provide an accessible account of applied conservation ethics. An exploration of the specific issues raised by trophy hunting is provided in Appendix A. Some people find any form of lion hunting morally unjustifiable, regardless of the sustainability question, particularly if it is done in ways that involve animal suffering. This report focuses on conservation. But welfare and other ethical issues (which dominated the much of the public discourse following Cecil's death) are inextricably part of the process that shapes conservation policy.

1.2.4 Extent of lion trophy hunting and its markets

It is surprisingly hard to determine exactly how many lions are trophy hunted across Africa each year, because the CITES database (which records imports and exports of such trophies) records the number of trophies (i.e. individual parts moved) and not the number of animals killed. One trophy-hunted lion could result in multiple trophies, for example if the skin, skull and claws were counted separately. This is an issue which is clearly highlighted by CITES itself, which states that "*Because 'specimens' include parts and derivatives, the numbers of specimens do not reflect numbers of individual animals*" (CITES 2014). In addition, the records of exported trophies often do not match the number imported, partly because of delays in the system and partly because of inconsistencies in the ways different countries record their data. Despite this, many reports publish the number of trophies as if it was the number of lions hunted, which is misleading. Bearing in mind these caveats, the CITES database gives an overall idea of trends and comparative numbers, and a summary of the number of wild-sourced lion trophies

(using data from the CITES database, http://trade.cites.org/) is given in Table 2, with more information on the international extent of trade in lion trophies by country is given in Appendix B.

Table 2: *Summary of the total number of wild-sourced lion trophies (not necessarily the number of lions) recorded as exported or imported by CITES.*

Country	Reported exports *Lion trophies*	Reported imports *Lion trophies*	Total destinations *Lions*
Benin	25	18	6
Botswana	168	151	20
Burkina Faso	333	78	12
Cameroon	176	78	15
Central African Republic	48	49	12
Chad	10	6	2
Congo, Democratic Republic Of	0	1	1
Ethiopia	10	13	3
Gabon	2	0	1
Mozambique	268	197	19
Namibia	163	168	28
Senegal	3	0	2
South Africa	1801	3572	69
Tanzania, United Republic Of	2842	2305	49
Togo	1	0	1
Zambia	530	562	33
Zimbabwe	317	1117	34
Total	**6697**	**8315**	**-**

The UK was recorded as having 80 wild lion trophies exported to it (from 9 source countries) during the 22 years from 1991–2013, with the importation records showing 4 trophies[10]. Figure 1 provides an overview of the movements of lion trophy across the globe, and highlights the significance of the US and European markets for such trophies.

1.2.5 Reason for the UK Government examining this issue now

Wildlife conservation has been a concern in Britain for centuries, and remains a strong interest of the UK public (Sutherland 2008).

[10] *These numbers have to be interpreted bearing in mind the problems of inferring number of lions from number of trophies.*

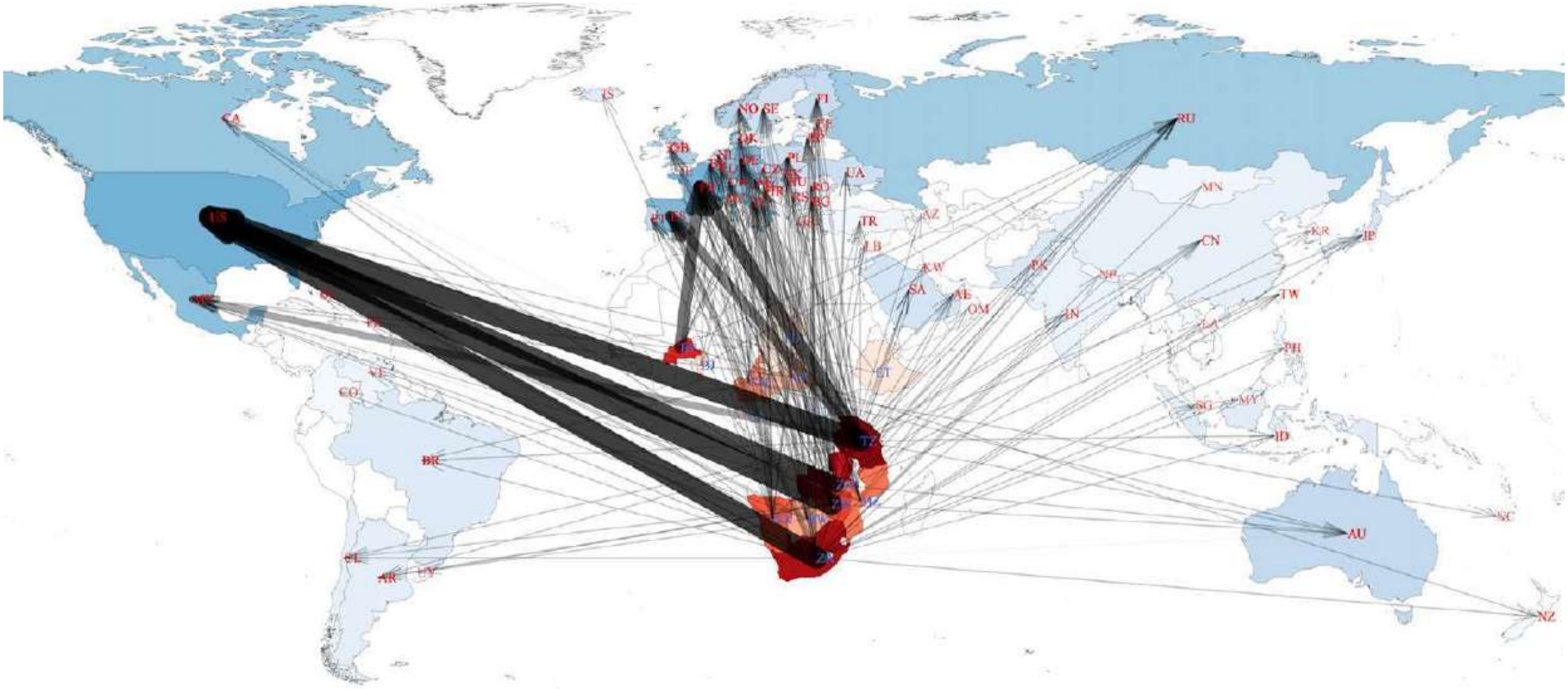

Figure 1: *Overview of international movements in lion trophies, showing source (red) and destination (blue) countries for lion trophies linked by directional arrows. Arrow width indicates the scale of trade from one country to another. Tone of colour per country indicates the relative scale of either export or import relative to all other exporters or importers respectively. ISO2 country codes of exporter and importer countries are indicated on the map. Lion hunting data was obtained from CITES and considered for the decade between 1996 and 2015. The data was subset to include only* 'lion' 'trophies' *from a* 'wild' *source and that were* 'hunted'. (CITES data: http://trade.cites.org/en/cites_trade/ [accessed 2016-07-12])

For the roots of modern conservation some might look to 1066 when King William I set aside forests, such as New Forest, Sherwood and Forest of Dean as royal hunting reserves (others trace the roots of conservation to concerns over UK forests in the 1660s). John Muir, a Scotsman, inspired the movement to preserve wilderness in the USA, including Yosemite National Park. In 1892, he founded the Sierra Club, one of the first organisations devoted to environmental conservation.

The roots of conservation in Europe and the USA are inextricably bound to hunting, initially by protecting wild animals for it and latterly more often protecting them from it. In 1903, British naturalists helped found another pioneering conservation society (the Society for the Preservation of the Wild Fauna of the Empire, which has evolved today into Fauna and Flora International) (Loveridge et al. 2007b). As a group they were known as 'The Penitent Butchers' because all were former sportsmen or trophy hunters who became concerned by the wide-scale decimation of wildlife through unregulated hunting particularly in Africa (Loveridge et al. 2007b). Their aim was to safeguard Africa's large mammals from over-hunting and habitat encroachment. The Society worked with Governments, land-owners and hunters to pass legislation which restricted hunting across large swathes of East and southern Africa, and which ultimately led to the creation of some of Africa's most iconic parks, such as the Serengeti National Park.

In short, hunting and conservation has long been a preoccupation within British society. There has long been a demand to examine and reform trophy hunting, but public awareness of the issue reached a peak in July 2015 over the killing of Cecil the lion (Macdonald et al. 2016a). Much of the reaction to Cecil's killing focused on pressing for bans on trophy hunting, or at least of the carriage and import of trophies to countries such as the USA and the UK. As of August 2016, 32 airlines, including British Airways, have instigated complete bans on carrying trophies. Seven more refuse to carry 'Big Five' trophies, and a further five have implemented specific embargoes, from a ban on CITES Appendix I species by Emirates to a much broader ban on dead/processed/research animals by Turkish Airlines. In total, 44 airlines now refuse to carry lion trophies[11], with pressure on other carriers to do the same[12].

As a measure of feeling (although it floundered), in January 2016 a group of members in the European Parliament

[11] http://www.hsi.org/news/news/2015/08/airlines-shipping-hunting-trophies
[12] http://www.ifaw.org/united-states/news/trophies-back-board-south-african-airways-cans-its-ban
[13] http://www.europarl.europa.eu/sides/getDoc

called for the signing of a declaration restricting trophy imports[13], while the UK Government is actively considering its position on the importation of lion trophies, including asking for this report to be produced to inform its thinking.

As of August 2016, several countries have already banned lion trophy imports, including the Netherlands, France, Australia and Costa Rica. Whilst the USA has refrained from an outright ban, lion trophies had been made illegal in Washington State and New Jersey[14], although in late August 2016, the New Jersey ban was deemed illegal by US authorities[15].

Moreover, in December 2015 the US Fish and Wildlife Service (USFWS) listed the lion in southern and eastern Africa, *Panthera leo melanochaita*, as threatened under the Endangered Species Act (the lion in west, central, northern Africa and India, *P. l. leo*, was listed as endangered). Although this threatened listing comes with an addendum permitting the import of sport-hunted trophies, the conditions under which a permit may be granted are rigorous, perhaps prohibitively so, requiring that exporting countries address concerns over "*evaluating population levels and trends; the biological needs of the species; quotas; management practices; legal protection; local community involvement; and use of hunting fees for conservation*" (Federal Wildlife Service, 2016[16]). This evaluation has now taken place for South Africa[17] (with the conclusion that only trophies from wild or wild-managed lions could be imported to the US); evaluations will follow for other relevant countries.

A proposal (CoP17 Prop 4) for consideration at the 2016 Conference of the Parties (CoP) to CITES was made by nine countries (Chad, Côte d'Ivoire, Gabon, Guinea, Mali, Mauritania, Niger, Nigeria and Togo) for all African populations of *Panthera leo* to be transferred from Appendix II to Appendix I. However, it should be noted that only three of those countries (Chad, Niger and Nigeria) are still thought by the IUCN to have any extant lions (Bauer et al. 2016), and the proposed listing was met with significant opposition by many of the key lion range countries, particularly the southern African lion hunting countries where lion populations are stable.

In fact, the first CITES/CMS (Convention on International Trade in Endangered Species of Wild Fauna and Flora / Convention on the Conservation of Migratory Species of Wild Animals) meeting of all lion range states, which

[14] http://www.nj.com/politics/index.ssf/2016/06/christie_signs_law_banning_trophy_animals_in_nj
[15] http://www.africahunting.com/threads/victory-for-new-jersey-hunters-in-the-anti-trophy-law.30930/
[16] https://www.fws.gov/endangered/what-we-do/pdf/Lion_FL_FAQs_Final.pdf
[17] http://www.huffingtonpost.com/entry/a-major-step-forward-for-lion-conservation-in-africa_us_5808f6ffe4b099c434319294

took place in 2016, highlighted the importance of trophy hunting under certain conditions, stating: "[*We*] *Highlight the benefits that trophy hunting, where it is based on scientifically established quotas, taking into account the social position, age and sex of an animal, have, in some countries, contributed to the conservation of lion populations and highlight the potentially hampering effects that import bans on trophies could have for currently stable lion populations*".

Regarding the 2016 proposal to list lions on CITES Appendix I, the CITES/CMS report states that "*Lion Range States have different views on the inclusion of all African populations of* Panthera leo *in Appendix I, with some arguing that the populations in West and Central Africa are fragmented and highly threatened; and others arguing that the species does not meet the listing criteria and is threatened by factors other than those CITES can address*".

The 2016 CITES CoP (CoP17) eventually decided not to list lions on Appendix I, but did state they would work towards lion conservation in a more active way, including helping to develop and support the implementation of joint lion conservation plans and strategies (CITES 2016). CoP17 did add an amendment which prohibited the export of bones, bone pieces, bone products, claws, skeletons, skulls and teeth from wild lions for commercial purposes, although it remained possible for these parts to be exported from captive-bred lions in South Africa (CITES 2016).

This decision, and the subsequent October 2016 evaluation by the USFWS which banned the import to USA of trophies from 'canned' lions, interact to raise two new questions of relevance to the conservation of wild lions. First, insofar as the majority of farmed lion trophies would hitherto have been imported to the USA, will this prohibition cause a proportion of the American hunters who might formerly have hunted farmed lions to turn to wild lions, thereby affecting the demand on the wild sector? Second, and considering the report by Williams et al. (2015) on the export from South Africa of farmed lion products aside from trophies, with the loss of their income from trophies destined for America, will the farmers flood the market with lion body parts with the possible result, through predatory pricing, of increasing the subsequent demand?

In terms of lion conservation, banning the importation of trophies to the UK would have little significant direct effect because the numbers of lions involved are so few (<4 lions yr^{-1} between 1991 and 2013 exported from Africa to Britain; CITES data; see Section 1.2.4). However, the cascading indirect effects of UK policy are difficult to predict and possibly wide-reaching. The UK may have impact beyond its borders through the influence of the evidence it is able to present (e.g. this report) and through ad-

vocating for greater alignment of North American and European positions.

Even if the UK doesn't change policy, the status quo will not be maintained, as international policy developments will bring about change. For example, it has been proposed that lions should be uplisted to CITES Appendix I, most recently in 2016 and previously by Kenya to the CoP in 2004 (although that was subsequently withdrawn) – such uplisting has not been passed but similar proposals could be submitted again in the future. It is very likely that any such listing would lead to increased regulation and/or limitation of trophy exports to all Parties, including the UK. Although strictly tangential to the issue of trophy hunting, the UK's influence on the classification of lions under CITES is likely to be influenced by lobbying motivated by opposition to hunting. Listing lions on CITES Appendix I would prevent commercial trade in wild specimens but hunting trophies are currently considered personal effects. It is not necessary to have specific Resolutions (cf black rhinos and leopards) to permit future trade.

Although the CITES uplisting has not passed to date, there has been a significant recent change in international policy regarding lions, when in 2015 the US listed them as Endangered in West and Central Africa and as Threatened in East and southern Africa on the annexes of the Endangered Species Act. As a consequence, imports of lion trophies into the large and lucrative American market are no longer allowed from West and Central Africa, and the industry in other regions is forced to demonstrate that trophy hunting is of net benefit to lion conservation. Many trophy hunting areas are now setting up monitoring systems to be able to demonstrate net positive effect in order to maintain access to the US market, and the US is currently considering whether those areas do provide enhancements for the species. The USFWS announced their first finding, for South Africa, in October 2016, stating that it would not permit the importation of trophies from captive-bred lions as they did not meet the criteria for conservation enhancement, but would permit the import of trophies from wild and wild-managed lions on a case-by-case basis[18]. Some possible consequences for wild lions of this prohibition on the import to the USA of farmed lion trophies are mentioned above.

In another policy development, many Parties to the Convention on Migratory Species are arguing that the lion should be listed under that Convention[19] – the implications would depend on which Appendix they were added to, but this

[18] http://www.huffingtonpost.com/entry/a-major-step-forward-for-lion-conservation-in-africa_us_5808f6ffe4b099c434319294

[19] https://cites.org/eng/news/sg/Lion_Range_State_Meeting_Joint_statement_by_CITES_CMS_300516

could facilitate management of transboundary lion populations. The UK plays an active role in these international developments, but that doesn't preclude further domestic policy development.

Given the intensity of global interest in this subject, and the wide range of views and stakeholders involved, the UK government has recognised the need for comprehensive and impartial advice on how possible trophy hunting might affect lion conservation, as well as how the UK Government can best support lion conservation in a wider context.

1.3 Summary of reasons for examining trophy hunting with regard to lion conservation

Lions are one of the world's most iconic species, and are under increasing threat. The degree to which trophy hunting plays either a negative or positive role in lion conservation is hotly debated and will be covered in more detail below, but it is clear that there is a long history of polarised views over trophy hunting. Recently – and particularly notably since the killing of Cecil the lion – a large section of the global public appears to have concluded that lion trophy hunting in particular, is unethical. However, this contrasts strikingly with the views of many people in the African countries where lions occur, and it is important to consider how any actions taken by the UK and its partners would affect those range countries with regard to wild lion conservation.

2. Threats and impacts associated with lion trophy hunting

2.1 The significance of trophy hunting as a threat to lions

2.1.1 Significance of trophy hunting as a threat to lions at a population scale

Trophy hunting can have marked impacts at a population scale, particularly when harvest rates are high (Loveridge et al. 2007a; Caro et al. 2009; Creel et al. 2016). Trophy hunting tends to be particularly negative when it is additive to other threats – and the magnitude of those other threats also depends strongly on how well the hunting area is managed. For example, lion populations are declining across the Benoue complex in Cameroon, thought to be due to a combination of high poaching pressure and excessively high lion trophy off-takes (Croes et al. 2011). However, there are strong underlying pressures in Cameroon – large mammal populations have declined steeply since the 1970s due to habitat destruction and poaching, and are particularly precarious due to the small size and fragmentation of protected areas, as well as poor management of those areas (Croes et al. 2011). Modelling by Creel et al. (2016) suggested that in the presence of additional (and stable) threats such as human encroachment, poaching and prey depletion, the addition of any hunting produced some degree of population decline and an increased probability of local extirpation, although conservative limits on hunting (see Section 3.2), resulted in situations with relatively stable dynamics and low probability of extirpation over a 25 year period.

In some populations, hunting alone explains lion declines – Packer et al. (2009) found that within Tanzania's Selous Game Reserve (the largest lion trophy hunting landscape in the world), the hunting blocks with the highest lion offtakes per 1,000 km^2 had the steepest declines in lion populations, unrelated to the impact of habitat loss. In western Zimbabwe lion populations rebounded by 50% when lion hunting was suspended, suggesting that previously high quotas were a cause of population decline (Loveridge et al. 2010; Loveridge et al. 2016). In Zambia, trophy hunting was the major factor behind declining lion populations (Rosenblatt et al. 2014). Poorly calculated and/or enforced quotas are thus perilous for lion populations (Caro et al. 2009; Packer 2015). The severity of impacts at a population level depends upon both the number and de-

mography of the animals removed, and this is covered in more detail below (see Section 3.2).

2.1.1.1 Negative population effects associated with the removal of females

Currently, only male lions are now hunted in most countries, but females were hunted in Zimbabwe until 2004 (Packer et al. 2006) and are still hunted in Namibia (Lindsey et al. 2013), as well as South Africa[20] (although many of those lionesses are in canned hunting operations). The number of females in a pride has a strong effect on per capita reproductive success, with the lowest cub production in prides with fewer females (Packer et al. 1988).

Larger prides have greater survival of all cub age-classes, benefitting from collective defence and possibly from synchronous breeding and communal nursing (Packer et al. 2001; Loveridge et al. 2010). Therefore, the removal of adult females is particularly damaging to populations of lions and other long-lived species.

2.1.1.2 Negative population effects associated with the removal of pride males

Loss of male lions from a pride facilitates pride takeover by other males, and infanticide of dependent cubs (Loveridge et al. 2007a; Loveridge et al. 2010). Rapid turnover of males also results in premature eviction and subsequent death of sub-adults (Elliot et al. 2014). The difference in male turnover between hunting/non-hunting periods was evident from cub survival rate, with only 66% of cubs surviving to 1 year of age during the trophy hunting period, which increased to 80% in the absence of hunting (Loveridge et al. 2010). Similarly, cubs in protected core areas experienced >40% greater survival than did cubs in edge prides, presumed as a result of reduced male turnover (Loveridge et al. 2010).

Moreover, the consequences for hunted populations are not limited to those individuals on hunting concessions: there can be knock-on effects even across core protected areas, as a result of the vacation of territories. In Hwange, removal of territorial males from the adjoining hunting zone resulted in a 'vacuum effect' where the availability of territory and lack of competition drew individuals from the safe area into hunting zones (Loveridge et al. 2010). Thus, removal of males within hunting areas adjacent to protected areas can have pervasive effects at a population scale when hunting offtake is high (Whitman et al. 2004; Loveridge et al. 2007a; Loveridge et al.

[20] https://www.discountafricanhunts.com/hunts/south-africa-spot-stalk-lioness-hunting-safari.html

2010). That excessive levels of trophy hunting can negatively impact lion populations is illustrated by Hwange National Park. Sport hunting of lions over the period 1999–2004 greatly reduced the number of males in the population, resulting in sex ratios heavily skewed towards females. However male densities and sex ratios recovered quickly once trophy hunting levels were reduced (Barthold et al. 2016a; 2016b; Loveridge et al. 2016a). Similarly, the number of male coalitions across the population was lower and the average coalition size smaller than in the absence of hunting (Loveridge et al. 2010). The number of adult females also increased when hunting was absent or light, probably as a response to increased adult and cub survival (Loveridge et al. 2016b). In the absence of hunting, there was an average reduction in male lion territory size of 421 km^2 in Hwange, which was probably due to a resultant increase in lion density from the lack of harvest offtake (Davidson et al. 2011).

Trophy hunting was the primary cause of death in Zambia's South Luangwa landscape between 2008 and 2012, with 46 males harvested (Rosenblatt et al. 2014). This was linked to a declining population, low recruitment, low survival of sub-adult and adult males, depletion of adult males and an ageing population of adult females (Rosenblatt et al. 2014). Similarly, Loveridge et al. 2016b show that trophy hunting areas form 'attractive sinks' for male lions, in that they represent areas with intact habitat and available prey and thus attractive to lions. The risk of mortality in these areas is however very high with few cues available to the lions to facilitate avoidance.

These strong negative impacts associated with the removal of pride males forms the biological basis for stipulating a minimum age limit where only older (and ideally post-reproductive) males can be hunted, as this should theoretically limit these 'cascading effects' of pride male removal. The principle behind restricting trophies to older males is that their tenure in the pride should have overseen the raising of at least one generation of cubs to adulthood. Following early models setting the minimum age at 5 years or older (Whitman et al. 2004), age limits set within countries have traditionally been set at $\geqslant$6 years. However, more recent modelling (Creel et al. 2016) has suggested that it would be prudent to raise this to $\geqslant$7 years (see Section 3.2 for more detail), while Packer et al. (2006) suggest that because the '6-year rule' was developed in Tanzania and male lions seem to mature later in southern Africa, it might be prudent to use a 7 year minimum in southern Africa. Nonetheless, it has been evident that in some populations, e.g. in Hwange National Park, almost all trophy males, even very old ones such as Cecil, were reproductively active in a pride when hunted. Old males evicted from prides in Hwange National Park rarely survive long enough to be hunted,

and even elderly males in prides seem to be reproductive, meaning that their deaths are followed by perturbation in the same way as those of younger pride males.

2.1.1.3 Threat to lion populations of trophy hunting relative to other threats

It is important to view trophy hunting within the context of all threats facing lion populations. Trophy hunting is usually only one of several threats facing lions, and the relative magnitude of those threats varies between sites. In South Luangwa, Zambia, trophy hunting was indeed the major threat at the population scale – although snaring was a significant concern, 87% of known snared lions were immobilised and successfully treated for their injuries, so this had little impact on lion dynamics (Rosenblatt et al. 2014). The snaring of prey is likely to contribute to the declining lion population as well, but the magnitude of this threat had not been quantified, and trophy hunting was the only obvious cause of the severe male depletion seen in the population (Rosenblatt et al. 2014).

In western Zimbabwe, trophy hunting was the primary source of recorded mortality for adult lions (mostly males), followed by snaring bycatch and retaliatory killing. Natural annual mortality rates were only 0.11 for males and 0.30 for females, compared with trophy hunting mortality rates of 0.65 and 0.30 for males and females respectively, which underlines the profound effect that anthropogenic factors can have on population dynamics (Loveridge et al. 2016b). In Tanzania's Selous Game Reserve, trophy hunting is thought to also pose one of the largest threats to lions (Creel and Creel 1997), but this is Africa's largest protected area, where other anthropogenic threats are likely to be relatively small.

In some other populations, trophy hunting is an additional (and often important) factor but not the major reason for any lion decline. In Tanzania's Ruaha landscape, another major trophy hunting landscape, there is an extremely high level of lion killing to protect livestock or to fulfil cultural roles (Dickman 2015), and it is likely that the impact of trophy hunting is dwarfed by these other threats. In that landscape, 37 lions were documented as killed through conflict with pastoralists in an area of less than 500 km^2 in one year – which equates to over 100 times the recommended maximum offtake if that was a hunting area (Dickman pers. comm.). That level of lion killing across just a few rural villages (which is likely to be an underestimate of the real level of killing), exceeds the number of lions imported as trophies into the US (the major importer) in 2013 from Botswana, Mozambique, Namibia, Zambia and Tanzania combined (U.S. Fish and Wildlife Service 2015). Similarly, in the Niassa National Reserve, 12 lions

were trophy hunted in 2014–15, while at least 42 lions were killed by local people. Across Africa, the number of lions killed illegally has been estimated as perhaps 5 times as many as those killed by trophy hunters, with the level of illegal killing being up to 10 times higher in some populations (Panthera et al. 2016).

We are not aware of any documented case of trophy hunting being the primary driver of lion population extirpation – Tanzania's Katavi National Park is one case where lions have apparently been extirpated, according to the latest IUCN listing (Bauer et al. 2016) and anthropogenic mortality is a likely driver of that decline, but that includes both unsustainable trophy hunting and traditional killing (Kiffner et al. 2009).

However, it should be noted that there is considerable debate about whether lions have truly been extirpated from Katavi – in communication with the EU CITES Scientific Authorities, Tanzanian authorities maintain that "*there are substantial numbers of lions remaining in Katavi ecosystem and a significant proportion of prime age males are still present, suggesting a balanced age pyramid and population structure (despite trophy hunting in the area)*" (Sigsworth pers. comm.).

2.1.2 Significance of trophy hunting as a threat to lions at a national scale

There are several guidelines for the percentage of a hunted lion population that can be sustainably harvested. Creel and Creel (1997) and Greene and Mangel (1998) suggest sustainable offtakes of 5% and 10% of adult males respectively. Caro et al. (2009) recommend harvests of 5% of total population, which if only males are hunted (as is the norm) would result in a higher proportion of males in the population being hunted than Creel and Creel (1997) or Greene and Mangel (1998) recommend. But few lion populations are adequately surveyed at the population level, so using a percentage harvest to determine sustainable offtakes is generally unworkable. If the above guidelines are accepted then at the current scale, trophy hunting offtake in most of the countries where it currently occurs is relatively conservative with no more that 2–4% of lions hunted annually (Loveridge et al. 2009)[21].

However, in the past, offtakes have often been considerably higher (e.g. in Zambia, offtakes occasionally reached 8–9% of the population per year, while in Zimbabwe historically offtakes reached 20–30% (Packer et al. 2006). Although, in a review for the Eastern and Southern

[21] *Given that there is a large degree of uncertainty surrounding lion population size and status across much of the species range these figures should be treated with some caution. The utility of defining sustainable offtakes as a percentage of a population is limited when population sizes is unknown.*

African regional lion plan, Packer and colleagues concluded that "*quota sizes have probably been too small in almost every country to contribute to any decline in lion numbers in the past 20–30 yrs...[with] one exceptional country, Zimbabwe, there is some evidence that trophy hunting can have a significant effect at a national scale, as over the past 25 years the steepest declines in lion harvests occurred in countries with the highest hunting intensities*" (Packer et al. 2009).

Next, we examine the potential significance of trophy hunting as a threat to lions in the six most significant countries for lion conservation (including Botswana as the ban is very recent, and excluding South Africa as the vast majority of its hunting involves captive lions).

2.1.2.1 Significance of trophy hunting as a threat to lions in Botswana

Our latest data suggest that Botswana holds approximately 2,800 free-ranging lions[22] in an estimated lion range of 237,000 km^2 (Dickman in prep.). The latest Red List assessments compiled data from three populations in Botswana (none of which were hunting areas), and found they had undergone an overall decline of 26% between 1993 and 2014, although this was heavily biased by the 46% decline in the Okavango, while Kwando/Chobe had an increase of 84% and Magkadikgadi had an increase of 121% (Bauer et al. 2016). Di Minin et al. (2016) estimated that 37.2% of the country was in terrestrial protected areas, while 23.0% was in hunting areas, although Botswana has banned all lion trophy hunting since 2008 and all trophy hunting in public areas since 2014. Botswana does not have a national action plan for the lion, but did adopt a 6-year minimum for trophy males in March 2005. Botswana has imposed various temporary bans on trophy hunting – after the ban of 2001–2004 there was an expectation of high quality trophy lions, which pushed the price per lion hunt from US$25,000–US$30,000 pre-ban, to US$85,000–US$115,000, and meant that the country was able to generate more income with half the quota (Winterbach pers. comm.). Before the most recent cessation of lion trophy hunting the country had an annual quota of 30 lions, of which 13–18 trophies were exported (Winterbach et al. in prep.). Due to this low offtake, lion trophy hunting in the recent past may have been sustainable in Botswana.

2.1.2.2 Significance of trophy hunting as a threat to lions in Mozambique

[22] *Defined, for this and all countries in this section, as lions which are either completely free-ranging, in areas of at least 500 km^2 if the population is partially fenced, or in areas of at least 1,000 km^2 if the population is partially fenced.*

Our latest data suggest that Mozambique holds approximately 1,500 free-ranging lions in an estimated lion range of 247,000 km^2 (Dickman in prep.). Di Minin et al. (2016) estimates that 17.6% of the country is in protected areas, while 10.5% is covered by hunting areas. Lions have declined substantially across Mozambique (with some areas, such as the Niassa National Reserve, apparently showing population increases; Bauer et al. 2016), and the key causes for the reduction in lion distribution and are thought to be declining prey numbers and conflict with livestock-rearing pastoralists (Fusari et al. 2010). The IUCN Red List obtained population trend data from only one population (Niassa National Reserve, where hunting occurs), which showed a 246% increase between 1993 and 2014 (Bauer et al. 2016). Although Niassa might not be representative of the whole country, as it has had relatively high conservation investment, it does hold perhaps two-thirds of Mozambique's lions (Dickman et al. in prep.), so this trend is significant for the country's overall population.

The lion trophy hunting quotas in Mozambique have been criticised as being too high, as well as being issued without any scientific basis (Fusari et al. 2010). The annual quota was 50 animals in 2007, 111 in 2008 and 60 in 2009 (Fusari et al. 2010), but the actual offtake appears to be significantly lower than that. Many wildlife areas have been depleted in Mozambique, due to factors including government culling of wildlife (including lions) during the 1960s and 1970s, and extensive poaching for meat during and after the civil war (Fusari et al. 2010). Due to this wildlife depletion, most hunting areas currently generate negative returns on investment, with hunting operators investing in unprofitable concessions on the assumption that wildlife populations will recover. Age-based export regulations have now been developed and enforced in Niassa National Reserve, with a 6-year minimum implemented in September 2006, limiting the negative impacts of trophy hunting (and leading the EU to conclude a positive opinion for lion trophies from Niassa only rather than the whole of Mozambique; Sigsworth pers. comm.). The small number of lions trophy hunted per year in Mozambique relative to its population size suggests that trophy hunting unlikely to have a significant negative impact at a national scale, with bushmeat pressure, growing human populations and pastoralist-lion conflict more significant threats.

2.1.2.3 Significance of trophy hunting as a threat to lions in Namibia

The 2008 draft Namibian national lion conservation strategy suggested that, based on data collected within the two previous years, Namibia had fewer than 1,000 lions, including between 615 and

799 free-ranging lions (as termed in the report) and an additional 100 to 125 animals on private land (MET 2008). Our latest data suggest that Namibia holds approximately 750 free-ranging lions in an estimated lion range of 170,000 km^2 (Dickman in prep.).

The draft national lion conservation strategy states that lions are subject to extreme human pressure, with nearly 900 lions destroyed over the past 20 years, mainly due to conflict with livestock keepers (MET 2008). Di Minin et al. (2016) estimated that 43.2% of Namibia was covered by protected areas, with 11.4% covered by game ranches. As well as state protected areas and private game ranches, by the end of 2014, Namibia had 82 communal conservancies (including 36 in Kunene region, mentioned below), which covered over 17% of the country and encompassed 184,000 people, around 8% of the national population and around one in four rural Namibians (NACSO 2011, 2015). Sustainable use of wildlife (including trophy hunting), with devolved power and benefits to local communities, are a cornerstone of the conservancies – about half the conservancies benefit solely from hunting, and the revenues from trophy hunting totalled US$1.6 million in 2013 (NACSO 2015). This community-based conservation model is thought to be one of the key factors behind Namibia's expanding population of free-roaming lions (NACSO 2011, 2015). The latest Red List assessment of Namibian lion populations, based on three areas (one of which had hunting) showed an overall increase of 41% between 1993 and 2014. However, this was strongly influenced by the huge increase in lions in Kunene (the area where trophy hunting occurred), which had an increase of 3,933%, going from an estimated 6 lions in 1993 to 242 lions in 2014 (Bauer et al. 2016).

At least as of 2008, Namibia had no annual national-level lion quota. Trophy hunting permits are allocated to kill problem lions (males only) on conservancy land. 38 lions were hunted this way between 1998 and 2008, with an average offtake of less than 4 a year. In addition, trophy hunting is permitted on free-roaming lion populations in hunting concessions, which may be conservancies or protected areas (excluding Etosha National Park) (MET 2008). Most lions shot as trophies in Namibia are from hunting concessions, mostly in the Kunene and Caprivi regions (MET 2008).

The draft national lion conservation strategy revealed that some illegal trophy hunting was occurring along the southern boundary of Etosha National Park, making the allocation of quotas and maintenance of trust with landowners very difficult (MET 2008). The draft national lion conservation strategy set out some key activities for improving trophy hunting in Namibia, specifically that efforts should be made to:

- Develop and implement an approved

quota setting methodology rigorously and consistently across all hunting areas

- Review and analyse annual quotas and offtakes to ensure these are adaptive and responsive to population changes, trophy quality and levels of PAC over time
- Allocate quotas at a scale reflective of lion ecological and biological functionality which invariably acts across different and/or smaller land units or uses
- Develop and implement standardised hunt return forms and trophy hunting databases and review annually thereafter
- Ensure centralised database and cost-effective system for data collection from hunting areas and subsequent collation, entry, analysis, reporting and feedback to key stakeholders in the wildlife industry (MET, NAPHA, NAU, NNFU, Conservancies, conservation NGOs and researchers etc. as appropriate)
- Provide training to MET, Conservancy and NAPHA personnel and other relevant field staff in the approved quota setting methodology
- Review trophy fees to maximise benefit and generate additional revenue

Overall, trophy hunting does not seem to pose a threat to lions in Namibia, and is in fact (particularly in the conservancy areas) thought to be one of the reasons why Namibia's lion population has increased over recent years (NACSO 2011, 2015). However, Namibia is an unusual case in having relatively good governance and very low human population density, so it is unlikely that the successes seen here could easily be replicated across many other African countries. More generally, governance and infra-structural capacity, of which corruption is a factor, are relevant to the delivery of felid conservation as documented by (Dickman et al. 2015), and governance has been highlighted as a key issue with regard to the sustainability or otherwise of trophy hunting operations (Packer 2015).

2.1.2.4 Significance of trophy hunting as a threat to lions in Tanzania

Our latest data suggest that Tanzania holds approximately 9,900 free-ranging lions in an estimated lion range of 380,000 km^2 (Dickman in prep.). Tanzania has around 32.2% of its land covered by protected areas, and 26.4% in game reserves (Di Minin et al. 2016). Tanzania contains about half of the continent's remaining lion population (Riggio et al. 2013), but the IUCN found significant declines, based on an analysis of five populations, one of which had trophy hunting (Bauer et al. 2016). There was

an overall decline of 66% in the lion populations between 1993 and 2014 – only one population (the Serengeti) increased, while the population with trophy hunting (Katavi) was apparently extirpated during that period, according to the IUCN data (Bauer et al. 2016; although this is disputed – see Section 2.1.1.3).

Tanzania has long hosted the largest lion trophy hunting industry, with 100–300 lions hunted per annum (Packer et al. 2010). The Selous Game Reserve is the largest uninhabited protected area in Africa (55,000 km^2) and is a premier destination for lion trophy hunters. Lions are considered to be declining in a significant proportion of Tanzanian hunting areas, with trophy hunting considered to be the primary driver of this decline outside (and inside some) protected areas (Packer et al. 2011). Lion harvests declined by 50% across Tanzania between 1996 and 2008, and hunting areas with the highest initial harvests suffered the steepest declines; the intensity of trophy hunting was the only significant factor in a statistical analysis of lion harvest trends (Packer et al. 2009).

Tanzania introduced a 6-year age minimum for lion trophies in 2012 (based on the recommendations of Whitman et al. 2004); lion offtakes have further declined in the past few years, with only 40 lions exported in 2014; it is not clear if this recent drop has resulted from hunting clients restricting their offtakes to lions aged 6yrs or older or from a continuation of the trend reported by Packer et al. (2009). Leader-Williams et al. (2009) and Packer (2015) note that Tanzania has a poor record of hunting governance, and the recent scandal over Green Mile Safaris (whose clients posted evidence of multiple trophy hunting and animal welfare infractions online, but who nevertheless were apparently permitted to continue hunting in Tanzania[23]) is one clear example of very poor management of the country's trophy hunting industry. Similarly, a recent report from East Africa has raised concerns that corrupt officials in Tanzania and Kenya in particular, have been compromised through bribes to allow the killings of wildlife and the illegal export of trophies[24].

While there is evidence that trophy hunting has had negative impacts on Tanzania's lion populations (Packer et al. 2011), other threats are more significant. Tanzania's National Action Plan for lions and leopards concluded that prey availability, land use and land cover change, anthropogenic killing, inadequate management and disease may

[23] http://www.huffingtonpost.com/entry/abusive-safari-company-tanzania_us_57769240e4b04164640fbba8
[24] http://allafrica.com/stories/201608291000.html

pose threats to those species, with retaliatory killing, land use change and problems arising from inadequate management the most important factors (TAWIRI 2007).

2.1.2.5 Significance of trophy hunting as a threat to lions in Zambia

Our latest data suggest that Zambia holds approximately 1,200 free-ranging lions in an estimated lion range of 135,000 km^2 (Dickman in prep.). The IUCN examined only one population in Zambia (Luangwa) for the IUCN Red Listing – this population was hunted for trophies and had declined by 28% between 1993 and 2014 (Bauer et al. 2016).

Di Minin et al. (2016) estimated that 37.8% of Zambia was covered by terrestrial protected areas, with 21.3% in hunting ranches. However, it is notable that despite this extensive coverage of hunting areas, which is second only to Tanzania and Botswana (before the ban), Zambia generates very little revenue from trophy hunting (see Table 3 for comparison of estimates). This concurs with the findings of Lindsey et al. (2012b), who stated that most Zambian trophy hunting concessions appear to be running at a loss, probably as a result of the depletion of prey populations due to human settlement and the bushmeat trade in Game Management Areas (Lewis and Alpert 1997; Simasiku et al. 2008). Quotas of lions have been excessive, are established arbitrarily and there is a lack of monitoring of wildlife populations or of trophies. Per annum, 39 lions are hunted, while 13–18 trophies are exported (Lindsey et al. 2007). This level of hunting is approximately 3.4% of the estimated population, so is a relatively high level compared to many other countries.

Zambia's national authorities appeared to consider trophy hunting as a significant threat to lions (hence the ban on big cat trophy hunting implemented in 2013) but later reversed the decision (with some adjustments to quotas and regulations), mainly because of concerns over a lack of revenue[25].

The Zambian lion management strategy highlights poor management of the trophy hunting process, and states that there is inconsistency in the collection of data at temporal scale and in terms of measurable variables making it difficult to assess trophy quality trends in the country. The management plan states that it is focusing on the "*promotion of age-based harvesting of lions and setting of hunting quotas based on empiri-*

[25] http://www.bbc.co.uk/news/world-africa-32815508

cal biological data in addition to the ongoing collection of trophy measurements" (Zambia Wildlife Authority 2009). The national lion management strategy also highlights the following issues relevant to improving trophy hunting within the country:

- Standardization of lion survey methods and conducting baseline survey of lion numbers
- Setting of sustainable lion off take quotas
- Monitoring and evaluation of the lion population in the context of existing conservation and tourism programmes
- Preparation and implementation of field age determination techniques
- Development of area-specific lion management strategies especially for Game Management Areas (GMAs)

However, that strategy was developed in 2009 and it is unclear how much progress, if any, has been made since then towards improving the management of lion trophy hunting in Zambia. Therefore, it is still possible that poorly-managed trophy hunting could be a threat to Zambia's lion populations.

2.1.2.6 Significance of trophy hunting as a threat to lions in Zimbabwe

Our latest data suggest that Zimbabwe holds approximately 1,500 free-ranging lions in an estimated lion range of 57,000 km^2 (Dickman in prep.). The IUCN Red Listing used data from five populations in Zimbabwe, four of which had trophy hunting. All populations showed a significant increase (the lowest level was in Hwange, but even that was 86%) so overall, there was a very impressive 1,252% increase in lion numbers across those areas between 1993 and 2014, mainly due to increases in relatively small populations (Bauer et al. 2016). The largest increase was in Gonarezhou, the non-hunted population, which had a 7,900% increase (from 1 lion to 80), and this was closely followed by Savé Valley Conservancy, with a 6,967% increase (3 lions to 212) (Bauer et al. 2016).

Di Minin et al. (2016) estimated that 27.2% of the country was covered by terrestrial protected areas, with game ranches covering 16.6%. From the 1970s lion trophy hunting harvests in Zimbabwe were some of the highest in relation to population size in Africa, with annual offtakes of between 90 and 141 lions between 1992 and 2002 (Loveridge et al. 2009; Packer et al. 2009), but quotas were reduced to 75 individuals in 2015 (ZPWMA 2015) and lion numbers are now increasing in several populations (Bauer et al. 2016). Since the elephant trophy import ban in the US, there is

anecdotal evidence that lion have become relatively more important to the national hunting industry economically.

Zimbabwe introduced a 5-year age limit on hunted lions in January 2006, and has used an adaptive age-based quota system with evidence of success. This calculates a fluid quota per area based on the previous season's performance in terms of hunting only older males. The Zimbabwean adaptive system has been associated with a rising age of hunted lions, a desirable outcome illustrating the role of quotas and age-based restrictions in influencing population demographics (ZPWMA 2015). The goal of the Zimbabwean system of inbuilt feedbacks is to discourage outfitters from hunting lions that are too young, thereby minimising negative impacts on the lion population whilst maximising the sustainable yield, and therefore the economic incentive to conserve lions. With these lowered quotas and age-based systems, there is little evidence that trophy hunting is negatively affecting Zimbabwe's lion population at a national scale.

2.1.3 Factors mediating the threat posed by trophy hunting

Despite the threats posed by trophy hunting to individual populations, trophy hunting has never (to our knowledge) been implicated as a significant factor in the extirpation of lions from a country. While Chardonnet's (2002) estimate that 32 African countries supported wild lions may have been optimistic, by 2015 seven of them no longer did so (Bauer et al. 2016); however, none of these countries had exported a lion trophy over that period [CITES trade database: http://trade.cites.org/en/cites_trade/ (Accessed 11 July 2016)].

It seems as if where trophy hunting is well-regulated, transparent and has a significant amount of power devolved to the landowners (for example in Namibia; Naidoo et al. 2016a), it has the potential to deliver significant conservation benefits in terms of protecting habitat and allowing lion populations to persist (NACSO 2011, 2015; Naidoo et al. 2016a). However, in many countries, poor governance[26] and weak enforcement of hunting regulations increases the threat posed by trophy hunting; indeed, Packer (2015) argues that corruption within the hunting industry

[26] *Lion hunting countries rank poorly in governance scores from Transparency International (www.transparency.org)*

and wider frameworks is the reason why lion hunting often fails to deliver the benefits to lion conservation that might be expected in principle, and Dickman et al. (2015) consider corruption as a limiting factor in delivering felid conservation in some countries.

According to the IUCN in 2009, good governance was absent from almost the entire trophy hunting sector in many countries, with those currently in control of the system not prepared to share power and undertake adjustments that would mean relinquishing control; a position that IUCN (2009) concludes serves individual interests, but not those of conservation, local communities or good governance (UICN/PACO 2009). However, even poor national governance does not always preclude relatively well-managed trophy hunting: Zimbabwe has recently implemented an age-based adaptive quota strategy (see Section 2.1.2.6), which has resulted in the reduction of hunting under-age animals (ZPWMA 2015).

Similarly, despite weak governance across much of Mozambique, age-based adaptive management of trophy hunting (and work to address other threats to lions) has been implemented effectively in the Niassa National Reserve, and lion populations are increasing there despite hunting (Bauer et al. 2016).

2.1.4 Significance of trophy hunting as a threat to lions at a regional scale

The IUCN 2006 regional conservation Strategies for lions (in West and Central Africa, and in Eastern and Southern Africa), considered possible threats to lions, and ranked them using a points-based system (IUCN 2006a, b).

The top five threats (i. *prey depletion*, ii. *conflict with humans*, iii. *small population size*, iv. *livestock encroachment* and v. *habitat loss*) were the same in each region, albeit in slightly different orders (see Figures 2a and 2b).

Trophy hunting was not ranked by experts as one of the top three threats to any lion populations across West and Central Africa (IUCN 2006a). Trophy hunting emerged as a higher threat across Eastern and Southern Africa than in West and Central Africa, but was not ranked as a high level threat.

2.1.5 Summary of the significance of trophy hunting as a threat to lions

Poor quota management and unregulated hunting of lions, in particular that of dominant males and pride females, can result in significant negative impacts at a population scale (e.g. Loveridge et al.

2007a; Packer et al. 2009; Croes et al. 2011; Packer et al. 2011; Becker et al. 2013). These negative impacts could be ameliorated (either in whole or in part, depending on the population) by restricting offtake to males of ⩾7 years, which should have reproduced, and in some areas by combining this with an area-based hunting quota. However, when assessed at either a national or a regional level, the negative impacts on lions from trophy hunting are deemed by experts to be substantially smaller than other threats, particularly those of human-lion conflict and loss of prey (IUCN 2006a, b).

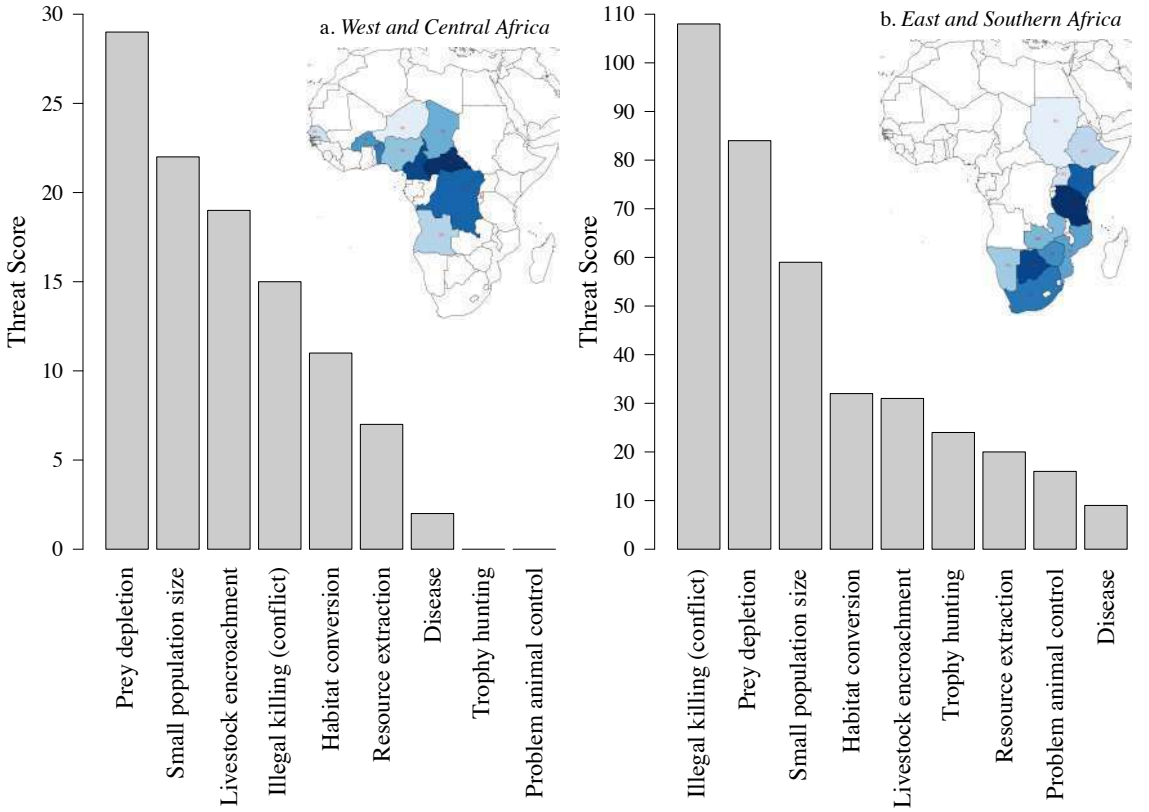

Figure 2: *Threat ranking for lions in (a) West and Central Africa, and (b) East and Southern Africa, as assessed by experts at the 2006 IUCN Lion Conservation Strategy meetings (note that the y-axes are different scales as the magnitude of threats was considered higher in East and Southern Africa). The maps show the countries assessed in the strategies, with the colour showing the relative lion population in the range country, with darker colour showing a larger population.*

2.2 Impacts associated with lion trophy hunting [27]

2.2.1 Ecological impacts

2.2.1.1 Habitat protection

The protection of wildlife habitat is the primary benefit associated with trophy hunting, as it reduces the major threat of habitat loss – conversion to other forms of land use such as agriculture is often irreversible. In 2007, Lindsey et al. estimated that a total area of at least 1,394,000 km^2 was conserved for trophy hunting in sub-Saharan Africa, which exceeded the area of national parks in those countries by 22%. In 2013, it was estimated that lions were hunted across at least 558,000 km^2, which comprised 27–32% of the lion range in countries where trophy hunting of lions was permitted (Lindsey et al. 2013), and at least 16% of the total lion distribution in Africa (Riggio et al. 2013). Given the dates of those studies, the extent of this hunting range will now have declined slightly since Botswana imposed its lion trophy hunting ban in 2014.

Many of the areas that are (or recently were) hunting zones are not currently suitable for photographic tourism (e.g. even in Botswana, which is one of Africa's premier destinations for photographic tourists, over three-quarters of hunting land in the Northern Conservation Zone had low potential for phototourism; Winterbach et al. 2015), so hunting enables this land to be maintained under a wildlife-based land use. This maintenance of habitat (even if lions themselves are negatively affected at some level) is by far the most significant benefit provided by trophy hunting of lions, particularly given the fact that habitat loss and degradation is such a significant threat to lions at all scales (IUCN 2006a, b; Fusari et al. 2010; Henschel et al. 2010; Henschel et al. 2014). Particularly in West and Central Africa, trophy hunting maintains lion habitat in areas where photographic tourism and philanthropy are absent – and those land uses are much less developed than in other regions. This is evident from the fact that lions have been extirpated from most protected areas in the region (Henschel et al. 2014) whereas the last two remaining substantial populations (>250 lions) are both within large complexes of National Parks interconnected and buffered by hunting zones that appear to be at least partially effective at reducing livestock encroachment, with hunting not

[27] *Throughout, we try to provide as much specific data as possible with regard to lion trophy hunting, but in some cases information is only available for trophy hunting in general.*

appearing to significantly affect the last remaining lion stronghold in West Africa, the W-Arly-Pendjari (WAP) ecosystem (Bouché et al. 2016).

Although lions are one of the main draws of trophy hunting areas and increase their financial viability, these areas are also very important for many other species, including some highly threatened ones. For example, in the case of the critically endangered black rhino (*Diceros bicornis*), only 10 'IUCN Key 1' populations remain (i.e. populations that are crucial to the survival of the species), and three of those occur on private hunting conservancies in Zimbabwe where lions are also key hunted species (N. Anderson, International Rhino Foundation, pers. comm.).

However, not all the ecological impacts of trophy hunting are positive. In areas managed predominantly for lions, high densities have negative impacts on the populations of smaller competitors, such as cheetahs (*Acinonyx jubatus*) and African wild dogs (*Lycaon pictus*). Where provided with adequate resources and protection (even where they are hunted), lion populations can achieve very rapid growth rates (e.g. Groom and Watermeyer 2015; Miller et al. 2015; du Preez et al. 2016a). High lion densities (particularly within fenced reserves, including non-consumptive photographic areas) can lead to significant ecological and social problems such as severe reductions in prey populations and intra-specific lion killing (Ferreira and Funston 2010; du Preez et al. 2015). The associated management issues (overpopulation and overpredation) may necessitate lethal control of the lions (Miller et al. 2015), or intensive management strategies such as contraception or translocation.

2.2.1.2 Reduction of other threats to lions and other wildlife

At least within well-managed trophy hunting areas, it is common to have significant anti-poaching patrols, which would reduce threats of human encroachment, such as the loss of lion prey through bushmeat hunting. For example, in Cameroon, where bushmeat poaching is a major conservation issue, observations between 2005 and 2010 suggested that anti-poaching efforts were higher in the hunting zones than National Parks, due to economic incentives to reduce poaching in hunting areas, and a lack of government funding to conduct similar anti-poaching efforts in Parks (Croes et al. 2011). Even in poorly-managed areas, funds from hunting can still play a major role in funding anti-poaching operations. For example, in Tanzania's Selous Game Reserve (which is allegedly beset by high levels of corruption), the 'Selous Retention Scheme' has recently been re-established, where 50% of hunting revenues from the Reserve are re-invested into conservation and anti-poaching (IUCN 2016). The Re-

serve's chief warden from 1994–2008 and 2012–2015 has raised serious concerns about the impacts of trophy import bans on the capacity of the reserve to successfully conduct anti-poaching efforts (IUCN 2016). However, anti-poaching efforts run by hunting operators vary considerably between countries and operators, and they tend to be seasonal rather than year-round.

2.2.2 Impacts of economic benefits generated from trophy hunting

There are several reasons for considering the economic contributions of trophy hunting, not least because of its possible role in the economic development of African nations and as a source of income to local people (though the significance of trophy hunting revenue is debated for both those factors). However, within the remit of this report, we focus on the connection between the economic impact of trophy hunting and conservation outcomes.

2.2.2.1 Level of trophy hunting revenue generated

There are a range of estimates of the degree of economic revenue generated by trophy hunting, but there is a lack of rigorous, independent data on the economics of trophy hunting. A report commissioned by Safari Club international, an organisation that is explicitly in favour of hunting, concluded that across eastern and southern Africa (Botswana, Ethiopia, Mozambique, Namibia, South Africa, Tanzania, Zambia and Zimbabwe) hunters spend US$326.5 million annually when accounting for all in-country expenditure, including not only the cost of the hunt and associated fees but also other costs such as transportation, food and souvenirs (Southwickes Associates 2015). They found the value-added contribution to GDP (using multipliers derived from World Travel and Tourism Council) to be US$426 million (Southwickes Associates 2015). They also found that trophy hunting supports 53,400 jobs, when including supporting sectors. However, in 2009 the IUCN criticised the low proportion of jobs created by the hunting industry in comparison to the proportional area of land it occupies – it cited figures of 15,000 salaried jobs across Africa, compared to a human population of 150 million in the eight main trophy hunting countries, where trophy hunting takes up 16% of their land (UICN/PACO 2009). However, this must be considered in the context of naturally low human density in wildlife areas, and the general incompatibility of (or inverse relationship between) large human populations and maintenance of wildlife populations.

There is variation in estimates given in the peer-reviewed literature regarding the level of trophy hunting revenue,

and those estimates usually do not provide value-added estimates or account for revenue to supporting sectors etc. Lindsey et al. (2007) estimated that trophy hunting generated gross revenues of at least US$201 million per year in sub-Saharan Africa, although this estimate has been criticised in a report prepared for The African Lion Coalition, which is composed of animal welfare groups, for relying on unreliable sources of data (Economists at Large 2013). Booth (2010) estimated gross revenues of at least US$190 million for South Africa, Namibia, Botswana (the paper was published prior to Botswana's trophy hunting ban that entered into effect in 2014), Zambia, Mozambique, Zimbabwe and Tanzania. Di Minin et al. (2016) estimated total annual hunting revenue to be approximately US$217.2 million in those same countries (see Table 3 for a summary of estimates of the revenue generated by trophy hunting per country). However, the report prepared for the African Lion Coalition argues that that the contribution of trophy hunting to national economies is insignificant because it constitutes only a small percentage of Gross Domestic Product (GDP) (Economists at Large 2013). The IUCN estimated trophy hunting revenue to contribute 0.19% of GDP in Botswana, 0.03% in Mozambique, 0.45% in Namibia, 0.04% in South Africa, 0.22% in Tanzania, 0.05% in Zambia and 0.29% in Zimbabwe (UICN/PACO 2009). Though small on a national scale, income from trophy hunting can be a significant source of income for the government bodies responsible for managing wildlife. For example, the Wildlife Division in Tanzania makes 60% of its income from trophy hunting licence fees (Estes 2015). The IUCN stated that a definite positive aspect of trophy hunting is that conservation results are financed completely by the hunters, without drawing from donors or requiring government commitment (UICN/PACO 2009).

Most of the figures discussed above concern trophy hunting as a whole, and only part of these are generated by trophy hunting of lions specifically. Lindsey et al. (2012b) estimated that lions generate 5–17% of gross trophy hunting income on national levels among Mozambique, Namibia, Tanzania, Zambia and Zimbabwe, but lions were not the species that generated the largest proportion of trophy hunting income in any of these countries.

2.2.2.2 The economic contribution of lion hunting and its impact on land-use

From a conservation perspective, the overriding concern is how the economic profitability of trophy hunting of lions affects land-use.

Table 3: *Estimates of revenue generated by trophy hunting per country.*

Country	Revenue year^{-1} (US$ m)	Source
Botswana	20	*Lindsey et al. 2007*
	40	*Di Minin et al. 2016*
	12.5	*Northumbrian 2001*
	40	*Booth 2010*
Burkina Faso	0.6	*Lindsey et al. 2007*
Cameroon	2	*Lindsey et al. 2007*
CAR	1.4	*Lindsey et al. 2007*
Ethiopia	1.3	*Lindsey et al. 2007*
Mozambique	5	*Di Minin et al. 2016*
Namibia	28.5	*Lindsey et al. 2007*
	28.5	*Di Minin et al. 2016*
	9.6	*Booth 2010*
South Africa	100	*Lindsey et al. 2007*
	68	*Di Minin et al. 2016*
	68.3	*Booth 2010*
Tanzania	27.6	*Lindsey et al. 2007*
	56.3	*Di Minin et al. 2016*
	6-7 *	*Mésochina et al. 2010*
Zambia	5	*Lindsey et al. 2007*
	3.6	*Di Minin et al. 2016*
Zimbabwe	16	*Lindsey et al. 2007*
	15.8	*Di Minin et al. 2016*
	18.5	*Booth 2002*

∗ *Figure for revenue from lion hunting only*

If a ban on the import of lion trophies (or other policies) impacted the profitability of trophy hunting operations to the extent that it becomes less profitable than alternative land-uses due to reduced demand, then it is likely that there will be a transition to more profitable land-uses. The type of the land-use that replaces trophy hunting is important to predict the effect on the conservation of lions and wildlife in general. Transition to agriculture or livestock grazing is a serious threat to the survival of the lion populations (Loveridge et al. 2007b) and is the likely alternative to trophy hunting across much of Africa, because it is profitable for land-owners, or in the case of government-owned land, because there is strong political pressure to turn these areas over to livestock production

(Loveridge et al. 2007b).

To consider the effect of curtailment of hunting of lions on land-use, information on the specific contribution of lions to the viability of trophy hunting operations is required. There is a paucity of information on this, but Lindsey et al. (2012b) estimated the significance of lions for the financial viability of trophy hunting in Mozambique, Namibia, Tanzania, Zambia and Zimbabwe. They found that the trophy hunting industry is not dependent on lions to remain viable in most areas, and that other species are more important in financial terms. However, they conclude that if lion hunting was precluded, trophy hunting could still become unviable across at least 59,538 km^2, which constitutes 11.5% of the area lions are hunted in the countries included in the analysis. Lion hunting was found to be important for financial viability of trophy hunting in Mozambique, Tanzania and Zambia, but of minor importance in Namibia and Zimbabwe. Lindsey et al. (2012b) further noted that had Benin, Burkina Faso and the Central African Republic been included in the analysis, the estimated size of the area where trophy hunting will be lost is likely to increase significantly as these countries have low numbers and diversity of other key trophy species. Crucially, trophy hunting becomes unfavourable as a land-use option not only if a trophy hunting business becomes unprofitable, but also if it becomes less profitable than the alternative land-use from the perspective of the owners/custodians of a piece of land, so the extent of habitat loss could be greater than 59,538 km^2. In some areas, the net returns from livestock is similar to those from trophy hunting (Lindsey et al. 2012b)so there might be a transition to livestock production even with only relatively small decreases in profitability of trophy hunting. Estimates of the profitability of trophy hunting per hectare differ. IUCN (2009) reported US$1.1 ha^{-1}, Lindsey et al. (2012b) estimated net earnings to be between US$0.24 to US$1.64 ha^{-1} year^{-1} depending on the country, and du Preez et al. (2016b) calculated that hunting in Zimbabwe's lowveld was worth approximately US$16.4 per hectare per year for all species and US$5.57 for lion hunting alone. Net returns from livestock in semi-arid African rangelands (US$0.1–US$0.3 per hectare per year in areas with 400–800 ml of annual rainfall (Cumming 2004) are similar to those from trophy hunting in some areas, so these areas are at risk of conversion (Lindsey et al. 2012b).

In the most attractive and accessible areas, land-use could shift from trophy hunting to non-consumptive wildlife use, e.g. photo-tourism, such that habitat is maintained without lions being killed. This could be the ideal outcome from conservation and welfare perspectives, as lion populations would be secured without the damaging ethical, ecological and welfare impacts of trophy hunting. Indeed, Barnes (2001) concluded that pho-

tographic tourism has greater benefits than consumptive use over about one-third of the wildlife estate in Botswana, finding that "*consumptive wildlife uses are relatively unimportant in terms of economic contribution*", whilst consumptive wildlife use is the only possibility across the "*less well-endowed two-thirds of the wildlife estate*".

However, only a subset of the areas that are currently used for trophy hunting are likely to be suitable for photographic tourism (Lindsey et al. 2006). For example, they might contain limited numbers of charismatic species, lack photogenic scenery, or be located in areas with high risk of tropical disease, poor infrastructure or political instability (IUCN 2016). Trophy hunters are less discouraged by these conditions than most tourists: during the first year of land-seizures in Zimbabwe, the tourism sector was reduced by 75% while profits from trophy hunting only dropped 12% (Booth 2002). Also, it is unknown whether there exists enough unsatisfied demand for photographic tourism to supply clients if current trophy hunting areas are converted to photographic tourism, or whether this would simply divert visitors from current protected areas. Across Africa, a large number of protected areas with high levels of biodiversity receive very few visitors (Balmford et al. 2015). This is not consistent with there being significant unsatisfied demand for photographic tourism opportunities, which suggests that the creation of new photographic tourism areas might divert visitors from existing protected areas, some of which are already operating at a loss.

Even where photographic tourism is financially viable, there is evidence for interdependence between this form of tourism and trophy hunting. In Namibia, trophy hunting was shown to be important for the establishment of conservancies because it generates benefits sooner than photographic tourism after establishment of a conservancy, so it can allow conservancies to remain financially viable while its photographic tourism is developing (Naidoo et al. 2016a). Furthermore, simulations show that a significant number of community-led Namibian conservancies would not be able to meet their operational costs if there was a ban on trophy hunting, which would remove both the incentive to maintain these protected areas and the financial means to manage them (Naidoo et al. 2016a).

However, where the land-owners value wildlife beyond their economic value they might be willing to tolerate low returns from their land in order to maintain wildlife habitat, if they have sufficient wealth to do so. In these cases, reductions in profitability of lion trophy hunting may not affect the conservation of lion habitat. It is uncertain to what extent land-owners perceive intrinsic value of wildlife, and considering that the host countries of lion hunting are developing

nations, the ability to absorb financial losses or reduced returns is likely to be low.

Although there is anecdotal evidence from such countries as Botswana and Zambia after recent trophy hunting bans (see text box below), there is no published literature on the specific impacts of the ban in terms of protecting lions, and very little information on actual land use changes. At present, we are limited to inference: Williams et al. (2016) documented substantial decreases in the density of lion, leopard, cheetah, African wild dog, spotted hyaena (*Crocuta crocuta*) and brown hyaena (*Hyaena brunnea*) as land was converted from hunting conservancies to agriculture, following land reform in Zimbabwe. Direct evidence demonstrates that local people are often unsupportive of a ban, and that significant loss of revenue to hunting zones occurs when lions can no longer be utilised (Hann 2015). Hann (2015) highlights the huge knowledge gaps regarding hunting and its association with wildlife declines. The IUCN notes that "*Revenues from trophy hunting are also important for conserving threatened species that are not hunted. Populations of Black Rhino and White Rhino and of the African Wild Dog on the Savé and Bubye Conservancies in Zimbabwe are not hunted, but proceeds from trophy hunting support their conservation*" (IUCN 2016).

2.2.2.3 Trophy hunting and economic incentives for lion conservation

Another way that the economic impact of lion trophy hunting is connected to conservation outcomes is through the revenue generated by trophy hunting that goes towards implementing conservation efforts and incentivises tolerance for lions and the maintenance of habitat for wildlife – reductions in the income generated from lion hunting could reduce these incentives among governments, local communities and private land-owners.

Governments require funds for wildlife management and income to justify the maintenance of land as game reserves/wildlife management areas in the face of increasing human populations and demand for land. Some of the funds generated by trophy hunting accrue to governments. For example, in Tanzania, direct and indirect tax flows to the government is approximately 44% of the estimated gross income of the trophy hunting industry (Booth 2010), and, based on data from 2008, 22% of the gross revenue generated by hunting is allocated to the Wildlife Division (Di Minin 2016). However, much of the income generated by the industry never enters the country, accruing instead to external parties (Booth 2010). In Namibia, 21% of the income generated is captured by the government through fees and taxes (Humavindu and Barnes 2003). Lewis

and Alpert (1997) report that in Zambia: ADMADE (Administrative Design from Game Management Areas) receives around 67% of all revenue generated by sport hunting activities in Zambia's Game Management Areas. Over half (53%) of ADMADE revenue is allocated directly to local wildlife management and the remainder to community development. However, is usually unclear how much of the revenue captured by governments across lion range countries is channelled into conservation efforts, especially in the context of high levels of corruption.

From the viewpoint of lion conservation, generating benefits for local communities from trophy hunting of lions is important because it incentivises local communities to tolerate lions despite the threat they can pose to livestock and human lives (Loveridge et al. 2007b) and the opportunity costs that they can often impose by restricting resource use. These benefits can be in the form of financial/material contributions to community development, employment or income for local producers and service providers. Before Botswana's ban on trophy hunting, 75% of the gross income generated by hunting tourism remained in the country, and of this 49% remained at the district level. This equated to approximately US$5 head^{-1} when translated to an income per capita at the national level but when attributed to the main hunting districts, the per capita income was US$48.5 head^{-1}. In Tanzania, 3.1% of estimated gross expenditure by hunting companies is spent on community development and fees paid to the community and 11.9% on wages and welfare (Booth 2010). In Namibia, agreements between conservancies and operators specify the portion of income the conservancy receives, typically 8–12% of total lodge revenue and 30–75% of trophy price (Naidoo et al. 2016a). Humavindu and Barnes (2003) found that in Namibia, 24% of the income accrues to poor segments of society in the form of wages and rentals/royalties, while Samuelsson and Stage (2007) estimated that 40% went to local communities and low income wage earners.

If trophy hunting became unviable, thousands of Zimbabwean households that benefit from the CAMPFIRE programme would lose a combined US$1.7 million per annum, and the programme's revenue has already been significantly reduced following the US ban on elephant trophy imports from Zimbabwe (C. Jonga, quoted in IUCN 2016)[28]. However, despite some successes and good examples of benefit-sharing, local communities rarely benefit from trophy hunting activities (Lindsey et al. 2006) and trophy hunting frequently occurs without meaningful community involvement or consultation, which in many countries is further complicated by corruption, lack of transparency and weak rule of law (IUCN 2009).

[28] http://www.newzimbabwe.com/news-21699-US+embargo+hits+Campfire+revenues/news.aspx

Case study: Botswana after the hunting ban in 2014

Since trophy hunting was banned in Botswana in 2014, there has been minimal uptake of hunting blocks for photographic tourism (Winterbach pers. comm.). Winterbach et al. (2015) conclude that only 22% (17,142 km^2) of the Northern Conservation Zone has intermediate to high potential for phototourism, while 78% has low phototourism potential (61,769 km^2). Ten concessions (out of 32) in the Northern Conservation Zone did not include high potential phototourism areas and only one of those ten was conducting photographic safaris (although the economic viability of this concession was reliant on access to the nearby Moremi Game Reserve). Although these ten concessions have been offered to public tender four times since the hunting ban in 2014, as of June 2016 still only one was operating phototourism, the other nine being without concessionaires or not operational. In terms of habitat connectivity between protected areas, those ten concessions are critical for ecosystem health and form a vital link between Moremi Game Reserve, Nxai/Makgadigadi Pans National Park, Chobe National Park in Botswana and Hwange National Park in Zimbabwe and surrounding concessions. While hosting what is possibly the geographically largest intact lion population in Africa, this is also a key wet season range for buffalo and elephant and hosts two long-range migration routes of zebra. Some blocks that are part of the Western corridor in southern Botswana have already been changed to agricultural use (livestock farming), disrupting the link between the Central Kalahari Game Reserve and the Kgalagadi Transfrontier Park and probably fragmenting the lion population of the Southern Conservation Zone. Although the Government of Botswana has a good conservation track record and there is no immediate threat to these areas, pressure from Botswana's livestock industry for access to areas with limited tourism potential is only likely to increase (Winterbach et al. 2015). Initial reports from some communities in Botswana suggest significantly reduced conservation incentives (including meat, jobs and pensions) and hardening negative attitudes toward wildlife since the ban was implemented (Naidoo et al. 2016b).

Furthermore, lions generate only part of the total trophy hunting revenue considered in the above figures. However, if there was no income generated by lions, communities could potentially wish to eradicate them from trophy hunting areas because they pose a threat to livestock in surrounding areas, and private land-owners might want to remove lions from their trophy hunting concessions because they predate other valuable trophy species (Funston et al. 2013).

2.3 Summary of the impacts associated with trophy hunting

Trophy hunting can have marked negative impacts on the ecology of lions at a population scale, and can also have negative impacts on other species when an area is managed primarily for lions. However, these impacts are generally small in comparison to other threats at a national and regional scale, and perhaps counter-intuitively, trophy hunting could in some areas be reducing some of the primary threats to lions, namely habitat loss and loss of prey. For example, across Africa, approximately ∼1.4 million km^2 has been estimated to be conserved for trophy hunting purposes. It is likely that without trophy hunting, parts of this vast area of land would become economically unviable if maintained as ecologically intact wildlife areas, and could well be converted to agricultural use with strong negative impacts on lions and other wildlife. Governments require incentives to justify the maintenance of wildlife habitat, local communities and private landowners require incentives to maintain wildlife habitat instead of converting the land to other uses, such as agriculture, and to tolerate the presence of lions, which can pose a threat to livestock and human life. Some revenue from trophy hunting accrues to governments and to local communities, but information is lacking for most areas and in many places benefit-sharing with communities is inadequate. Furthermore, only a small portion of total trophy hunting income is attributable to lions. However, without the income from lion hunting, trophy hunting is estimated to become unviable across 59,538 km^2 in five sub-Saharan countries alone, and a transition to alternative land-uses is likely. Photographic tourism is an alternative land-use that would allow lion populations to remain, but is likely only to be viable in a subset of current trophy hunting areas. The likely outcome for many areas would be conversion to agriculture or livestock grazing, which would seriously threaten the survival of the lion populations in those areas.

3. Current and recommended lion trophy hunting practices

Many of the detrimental effects on lion conservation associated with trophy hunting are to do with failure to establish and enforce regulatory systems based on now well-established scientific principles, and within those regulatory systems, failure to follow a good code of conduct. The UK can only affect a few of these issues directly, for example potentially through specific import regulations, but it would be good to put pressure on the hunting industry to ensure that best practices are met, with strict regulations both imposed and effectively implemented.

3.1 Lease length, allocation and fixed quotas

Short leases on hunting concessions are not conducive to conservation goals (Damm 2005). The argument is that when short leases are issued with no guarantee of a long-term stake, then there is no incentive to invest in conservation, and the maximum quota is always taken so as to maximise return on the cost of lease, even if this means that wildlife are over-exploited as a result. With greater security in the future of a concession comes greater incentive to invest in the resource, and thus conservation goals are more likely to be achieved.

As an illustration, multiple use concessions in Botswana were awarded on 15-year leases. Evaluation of tender documents included a Technical Management Plan, financial plan and financial bid, which all contributed to a total point score, which determine the winner of the tender. This provided the opportunity to have wildlife monitoring, corporate social responsibility, environmentally responsible camp management etc., and the management plan became part of the lease agreement. Biannual site visits by Department of Tourism, Department of Environmental Affairs and Department of Wildlife and National Parks were conducted to ensure compliance, and operational licences could be revoked if people were not adhering to the lease agreement. This carefully regulated system contrasts with the shortcomings of patronage, and associated over-harvesting, documented by (Packer 2015) as a major impediment to hunting delivering conservation benefits to lions.

Hunting blocks should also be allocated according to an open auction system (Dickson et al. 2009) that recognizes

the extent of past investments in each block while encouraging access by well-capitalized businesses or individuals and allows options for long-term leases in the case of well-managed tenure. In some countries (e.g. Tanzania), the outfitter has to pay a mandatory fee for the lions they are allocated to hunt, even if they are not shot. Packer et al. (2006) noted that that 'fixed' quotas do not provide any incentive for hunting operators to reject lions that are too young, leading to reduced trophy quality and unsustainable harvesting. In 2013, Lindsey et al. reported that Mozambique, Benin, Burkina Faso and Cameroon had no fixed quotas, with hunters only paying for the animals they shot, but other countries did have some mandatory fees regardless of the actual offtake (Lindsey et al. 2013). This fee (regardless of actual offtake) was apparently set at 30% of the quota in Zimbabwe, 40% in Tanzania, 50% in the Central African Republic, 60% in Zambia and 100% in Namibia, where concession rights are based on the sale of the quota rather than lease of the land (Lindsey et al. 2013). Best practice would be to have no fixed quotas, with hunters only paying trophy fees for the animals that are actually shot.

3.2 Restrictions on lions able to be hunted

The negative consequences of removing females from a population have been detailed above (see Section 2.1.1.1), so best practice would be to import only male lions.

To ensure that the benefit to lion conservation from trophy hunting (through habitat protection) outweighs the costs that may be imposed, it is important to estimate how many lions can be hunted from a particular management unit without imperilling the population, and in order to import any lions, national regulators should have some confidence that the country concerned is making their calculations based on good science. Calculations of 'safe' harvests would be difficult for most species because of the practical challenges of counting animal numbers and working out their population dynamics, but in the case of lions it is made much more difficult because their social system is such that the death of a pride male can trigger a perturbation effect with cascading consequences reducing recruitment (Loveridge et al. 2007a). To avoid the hazard of overharvest, two broad approaches have been proposed by experts on lion populations, one area-based and the other age-based. Both these approaches involve hunting only adult males and there is now an emerging case for, in some circumstances, combining them (Creel et al. 2016).

The area-based approach recommends capping the number of hunted male lions at a sufficiently low number that there is minimal risk that this offtake causes a decline in the population. In most populations, the offtake has been recommended as no more than 0.5 lions 1,000 km^{-2} (Packer et al. 2011), although there might be local variation – high-density populations such as the Selous could probably sustain an offtake of 1 lion 1,000 km^{-2} (Packer et al. 2011), as could well-managed and increasing populations such as those in Bubye Valley Conservancy (ZPWMA 2015), while in particularly low-density populations, the cap may have to be adjusted downwards. Lindsey et al. (2012b) present data showing that the introduction of a recommended quota of lion offtakes of 0.5 lions 1,000 km^{-2} would allow lion hunting to be sustainable, while retaining conservation incentives from trophy hunting. They conclude such a policy would result in only 7,005 km^2 of existing hunting estate potentially become financially unviable (representing ∼1% of the 516,738 km^2 where lions are currently hunted in the main lion hunting countries), and argue sustainability would be enhanced further if age-based regulations were also implemented.

The age-based approach recommends harvesting only older males that have had the opportunity to reproduce successfully and whose deaths will therefore have fewer repercussions for recruitment of cubs into the population. The assumption behind this approach is that the harvest of those males can be sustainable irrespective of population size or numbers taken, and has no deleterious effect on population genetic diversity (Whitman et al. 2007).

However, these general rules involve complications. The original computer models by Whitman et al. (2004 & 2007) indicated that so long as only males older than $\geqslant$5 years were hunted, the numbers taken had little impact on the viability of the remaining lion population. However, as Whitman et al. (2004) cautioned, this model was based on data from a well-protected and growing lion population with an increasing prey base: conditions that may not apply to the majority of lion populations in hunting areas. Furthermore, a practical difficulty is aging the candidate trophy lions accurately under challenging field conditions, although new guidelines (and an associated training website) published by Miller et al. (2016) help with this, as well as the field guide produced by Whitman and Packer (2007). Revisiting Whitman et al.'s (2007) pioneering work, Creel et al. (2016) offer more precautionary guidelines to minimise the risk of a hunted population being extirpated, and advocated the hunting of only males aged 7 years or more (along with other measures such as recovery periods from hunting and area-based quotas). Indeed, these recent models conclude that even this strengthened age-based criterion does not necessarily en-

sure that the hunted population will not decline if other threats such as bushmeat poaching are present. However, the models show that the contribution of trophy hunting to population decline, within the suite of all the threats facing lions, will be minimised if only males of 7 years or older are removed. This is at least partly because setting the age limit higher reduces the impact of misjudging age in the field by a year or so (Creel et al. 2016). Individual lion age characteristics may vary regionally (Kays and Patterson 2002; West and Packer 2002; Patterson 2007; West and Packer 2013), and lion aging techniques differ pre- and post-mortem, with pre-mortem aging being less accurate and precise (Miller et al. 2016), and thus enforcing minimum age requirements in the field is often difficult. However, Miller et al. (2016) have shown that a suite of lion age traits, in combination with training workshops, may be used to improve significantly field assessment of lion age, and could thus be used to improve sustainability of harvest by reducing levels of underage offtake. Post mortem monitoring of age is possible (Winterbach et al. in review) but not without problems (White et al. 2016).

Therefore, and as a failsafe regulation under conditions (which often prevail) where threats such as human encroachment, poaching and prey depletion are present (but not increasing) Creel et al. (2016) suggested that a combined age- and area-based method be used. They determined that an age limit of $\geqslant$7 years AND a maximum offtake of $\sim$0.5 lion 1,000 km^{-2} AND interspersing fallow periods of recovery, in combination reduced the risk of population extirpation within 25 years to less than 10% (Creel et al. 2016). Although some people may view any risk of population extirpation as unacceptable, this level of risk is low compared to the risk implied by recent declines in lion populations (43% decline in 21 years), and should be weighed against the benefit of protecting lion habitat, the degradation of which has been a primary cause of rapid lion decline at a continental scale (Bauer et al. 2016). However, Creel et al. (2016) recognise that for some responsible operators this stringency could reduce current offtakes tenfold; they suggest a compensatory rise in trophy fees to maintain the same levels of economic return from the land (Creel et al. 2016), which would only be feasible in certain areas or markets. How the demand for lion trophies would be affected by the price is a significant gap in current knowledge.

We suggest that in order to be eligible to export trophies, countries should be able to demonstrate that they are effectively implementing a quota system based on this best available science, with hunting restricted to older males, possibly with an additional area-based component. More information on how this might feed into conditions for any imports is provided in Section 4.3.2.

4. Options to improve the conservation impact of trophy hunting

Regarding the importation of lions into the UK, an option for the UK Government is to maintain the status quo, which is conditional import, with those from some countries banned and others subject to assessment against strict criteria. Options are thus to make the judgment that trophy hunting has no part in conservation, which might lead to a ban on all imports, or whether to enhance existing criteria to give greater confidence of conservation benefit (and by working with other countries have a greater impact). When considering the impacts of banning trophy imports, we acknowledge that if the decisions made by the UK Government are only adopted by them, then the impacts will be negligible, but we are assuming that the approach decided on by the UK Government could influence the development of policies more widely.

4.1 Possible impacts of maintaining the status quo

Maintaining the status quo would probably anger elements of the UK public, who have been vociferous in their demand for the Government to take action to restrict the importation of trophies from lions (as well as from other species[29]), and would put the UK at odds with the US and two EU countries, Netherlands and France (as well as Australia and Costa Rica) with regard to their positions on trophy hunting. It would also miss the opportunity to incentivise for the trophy hunting industry to improve its performance, as is clearly needed, in delivering benefits to conservation and reducing its negative impacts on threatened lion populations. This is therefore probably the least desirable option for the UK Government.

4.2 Possible impacts of a total import ban

Another option would be for the UK to impose a total ban on all lion trophy imports, and this would please a vocal section of the British public. If such a ban was done in partnership with other countries then it would reduce the eco-

[29] http://www.express.co.uk/news/nature/600874/CECIL-S-LAW-Brian-May-demands-law-to-stop-hunters-importing-trophies-back-to-UK

nomic viability of trophy hunting, which might encourage land-owners to switch to non-consumptive forms of wildlife use. This would be more ethically acceptable to large numbers of people, although the degree to which this would or could happen is uncertain. The degree to which trophy hunting can be substituted by photographic tourism is debatable (see Section 2.2.2.2), and in many areas such a substitution seems unlikely, particularly in countries that are less appealing to photographic tourists such as Cameroon and the Central African Republic, and even large sections of well-visited countries such as Tanzania or Botswana.

The major risk of a total import ban would be the removal of economic incentives to maintain the land in lion hunting areas under a wildlife-based land use, and this could have significant detrimental impacts on lions. In 2012, Lindsey et al. judged that in Mozambique, Namibia, Tanzania, Zambia and Zimbabwe, trophy hunting was not dependent on lions for viability, with other species being financially more important. They also judged that trophy hunting could nonetheless become unviable across at least 59,538 km^2 in these 5 countries, representing 11.5% of the 516,738 km^2 where lions are currently hunted in these countries. Even where a safari area remained viable despite the loss of lion hunting this could affect the overall profitability of trophy hunting and thus reduce its competitiveness relative to alternative land uses that diminished the lion estate.

To predict the impact of a ban on the import of lion trophies it is also necessary to consider what further policies it is likely to give rise to. It is possible that a ban on lion hunting will precipitate pressure for restrictions on leopard hunting as well, and other charismatic threatened species, such as the elephant. There are already calls for such bans[30], and as these species are some of the most sought-after for hunters, their collective removal would certainly reduce the economic viability of trophy hunting areas quite significantly. This is particularly true regarding potential restrictions on leopard and elephant hunting; the leopard appeared as one of the top three most-hunted species in Tanzania, Botswana, Namibia, Zambia and Zimbabwe, while the elephant was amongst the top three in Tanzania, Botswana, Mozambique and Zimbabwe (Di Minin et al. 2016). Unless an alternative wildlife-based land use was implemented at the same time as hunting was stopped, or the land was managed under conservation philanthropy, there is a significant risk that a considerable area of current hunting land could be converted to non-wildlife based land uses, with the con-

[30] https://www.theguardian.com/environment/2016/jul/25/leopards-animal-welfare-groups-endangered-us

comitant increases in lion habitat loss associated with that.

Popular disdain for lion trophy hunting appears widespread in North America and Europe, but this mood is not universal. If adopted more widely, one speculation is that a ban on imports to North America and Europe could increase uptake of trophies by hunters from other countries instead, for example the Middle East and Asia, with possible unintended consequences for conservation and animal welfare. Similar shifts in the market have been seen with other import bans, such as with Asian giant tortoises (*Manouria emys*), where an import ban was well implemented by the EU and was associated with a two-year decrease in global imports before new markets were found – however, four years after the import ban, global imports approached twice the volume of the year of ban (Hann 2015). There is also a risk that if countries feel that external views are being continually imposed on them (for example through trade restrictions) then they may decide to opt out of agreements such as CITES, which would be extremely damaging for the future validity and operation of such international agreements. There were some calls in the African media for African nations to withdraw from CITES in the run-up to CoP 17 and "*reject the power of rich elites in Europe or America to dictate how they manage their affairs*"[31], although no countries actually did so.

4.3 Possible impacts of stricter controls on the import of lion trophies to the UK

4.3.1 Reasons for considering stricter controls

It is clear that poorly managed trophy hunting of lions can have serious negative impacts at a population scale (see Section 2.1.1), and potentially some impacts at a national or regional scale (IUCN 2006b). Where they occur, allowing these negative consequences to continue is unacceptable from the viewpoint of lion conservation, particularly considering the species' deteriorating status (Bauer et al. 2016). However, it is also clear that trophy hunting is currently the reason for a large percentage of the lion estate being maintained as land for wildlife – it has been estimated that four times as much of that estate is in hunting areas than Parks (Packer 2015). A central dilemma is that imposing total import bans on lion trophies would, in the absence of alternative in-

[31] http://www.dailymaverick.co.za/opinionista/2016-08-23-african-nations-should-withdraw-from-cites/

centives to conserve lions, risk perverse consequences that may worsen the conservation of lions (as well as everything covered under their conservation umbrella). Principally, this might occur by reducing the economic incentives for wildlife-based land uses, which increases the likelihood of land conversion out of the lion estate and exacerbates the main threats to lions (namely the degradation of habitat, poaching of prey and conflict with people; IUCN 2006a, b).

With the intention of creating the strongest possible incentive for the trophy hunting industry to take responsibility for improving its practices and regulations in ways that maximise the benefits to lion conservation, one solution to this dilemma would be to impose stricter conditions linked to conservation gain for the issuance of any lion trophy import permits to the UK. There are, of course, already strict conditions in CITES as implemented by the EU CITES Scientific Authorities through the Scientific Review Group (SRG). CITES conditions require that the trophy lion had been hunted according to regulations that avoided a significant detrimental impact on the lion population from which it came, so evidence of this, and encouragement to enhance conservation, could be strengthened. These dual goals, recommended to the UK government, align with those of the US Fish and Wildlife Service, which deem that, amongst other conditions, the import of any lion trophy to the USA should be contingent upon the management of lions benefiting the species in the wild (US Fish and Wildlife Service 2015). Under this scenario, the UK acts directly by permitting the importation of lion trophies only if stringent conditions that benefit lion conservation are met, and acts indirectly by convincing other nations to adopt those same conditions.

The main positive conservation enhancement associated with trophy hunting is securing habitat for both lions and other wildlife; that benefit is likely to be significant to lion conservation only in larger areas. Therefore, this report recommends setting a minimum size for areas from which trophy imports can even be considered; as a practical threshold, we suggest 500 km^2 to ensure that it is delivering conservation enhancements[32].

4.3.2 Possible options for stricter conditions

Current CITES requirements are that trophies can be approved for import where, at a minimum, it is demonstrated that hunting has no detrimental impact on the sustainability of the lion popula-

[32] *500 km^2 is not a firm cut-off for all scenarios, but is a necessarily somewhat arbitrary judgment on the smallest area usually likely to enable lions to be self-sustaining and ecologically functional, and deliver meaningful conservation benefits for lions (and other wildlife) at the landscape scale.*

tion; however, insofar as trophy hunting has been associated with over-harvesting, and declines in lion numbers, it is clear either that these requirements are not always properly applied, or the evidence to meet them has been inadequate. A second requirement could be added, namely that trophy hunting delivers conservation enhancement. A fundamental element of that enhancement is the maintenance of ecologically functional areas of lion habitat.

Although not necessarily prerequisites for trophy importation, UK government should also encourage additional benefits to conservation, e.g. anti-poaching patrols and/or wider co-benefits such as contributions to community wellbeing. This responsible custodianship of the wildlife estate might be considered appropriate requirements of any responsible business that relies upon wildlife use, whether that is consumptive (such as trophy hunting) or non-consumptive (such as eco-tourism).

The criteria for whether a lion trophy could be imported into the UK should be that its hunting (a) was unlikely to cause detriment to the lion population from which it was taken and (b) contributes to lion conservation. Although in CITES terms the burden of proof rests with the CITES exporting authority, there is a strong case that the requirement should be made of the industry to prove that lion trophies are from populations where (a) lion offtake is strictly regulated to levels that minimise the risk of extirpation and (b) 500 km ^{2} or more of wildlife habitat is maintained within the hunting zone. These conditions should sit alongside other requirements of a high code of professional practice, ensuring for example that robust animal welfare standards are met.

However, lions are hunted from populations with different conservation status, and under widely different conditions, in countries facing variously punishing poverty and infrastructural challenges, so these general principles need to be tuned accordingly. We propose categorising hunting operations into three categories, with varying import conditions. We propose that the UK takes the lead in an international effort to categorise hunting operations according to the sustainability of their practice as set out below, and applies concomitant import regimes with an effective import ban from the least sustainable operations.

We strongly recommend a best-practice approach based on robust and on-going surveys of lion populations and long-term population trends and threats, to obtain precise data from which a safe offtake can be calculated, and on the consequences of trophy hunting and other threats. However, due to constraints such as funding, there is a need to consider other methods, at least in the short-term, for ensuring that offtake is not detrimental.

It is incumbent upon the hunting area management to demonstrate that its lion hunting operations are sustainably managed. We would recommend accepting these methods of demonstrating appropriate levels of sustainability:

- Monitoring data to show that lion populations are sustainably managed (this would be considered best practice)
- Data to show that the population is managed using age-restricted hunting, aiming for an ideal threshold of ⩾7 year old males

4.3.2.1 Best-practice: Lion populations are sustainably managed, as determined by professional-standard science-based monitoring

In order to establish directly that trophy hunting of lions is sustainable, a prerequisite is that reliable, standardised, and independently verifiable surveys are conducted in the hunting area. Possible methods could include spoor counts (Funston et al. 2010), camera-trapping (Cusack et al. 2015) or by individual lion recognition depending on local circumstances. Once the lion population has been surveyed the information can be fed into a harvest rate model, such as that proposed by Caro et al. (2009), to calculate an appropriate, scientifically-based quota. Assuming the population is well managed and no external factors are jeopardising it, the harvest model should ensure that the hunted population increases or remains stable.

Within an appropriate monitoring system, successive surveys will reveal trends in the lion population, and should demonstrate sustainability. If it is increasing or stable within the hunting area (without causing negative impacts on any adjacent area), then there should be no grounds for significant concern that hunting is detrimental. Hunting areas that have achieved these 'ideal' conditions of an independently stable or increasing lion population would be eligible for best-practice hunting status, and could be advertised as such to responsible hunters.

4.3.2.2 Age-based harvesting

Two methods have been proposed for implementing age-based lion trophy hunting. One model would be to limit hunting to Creel et al.'s (2016) conservative prescription (i.e. only harvesting ⩾7 year old males at a level not exceeding 0.5 males per 1,000 km^2 – unless there is clear scientific evidence that the population can sustain a higher offtake without supplementation – with resting periods. As described above, this should carry a low risk of population extirpation and

still keep land in the lion estate[33]).

Alternatively, an option would be the implementation and enforcement of an adaptive age-based quota system. Such systems have been trialled in Mozambique's Niassa National Reserve and adopted in Zimbabwe, with apparent benefits to lion conservation. Each hunted lion results in points being awarded to (or taken away from) the outfitter based on the age of the lion, with the aim of rewarding hunters for hunting older males (ideally of $\geqslant$7 years) and penalising them for hunting younger males.

An example of a possible points-based system (which may have to be adapted depending on the lion population) is shown in Appendix D.

4.3.2.3 Interim scenario

If a hunting block failed to qualify under the suggested criteria above, then the area would not be considered suitable for importing trophies into the UK until it qualified for one of them. Mindful of the risk of such land being lost from the lion estate, this disqualification might, at the discretion of the UK importing authorities, be postponed for a grace period of up to 3 years under very strict criteria and annual review by the national committee. For continuation of the grace period within those 3 years, the managers should demonstrate at each annual review that significant progress has been made towards implementing the necessary criteria. While it takes time for changes to take full effect, Zimbabwe has seen marked improvements with benefits for lion conservation within three years so that should be a sufficient period for change. During any grace period, lion trophy hunting should be limited to a minimum area and age-based quota, such as a maximum of 0.5 lions 1,000 km^{-2} aged $\geqslant$7 years, or similar precautionary figure calculated to be locally appropriate. Failure to meet the required conditions after the grace period would result in a moratorium on UK imports from the area until they are in place. In these circumstances, every effort should be made to ensure that the land was not lost from the lion estate. This scenario is intended to ensure minimal detrimental impact on the lion population during the grace period, while incentivising improved management that will benefit lion conservation.

[33] *When considering a precautionary off-take that will be sustainable we have followed Creel et al.'s (2016) simulation as a safe starting point. However, the number of male lions that can be hunted sustainably will obviously vary with their population density and this will certainly vary between populations and may vary in any one population at different times.*

4.3.2.4 Dealing with areas which do not meet the desired conditions

Trophy hunting areas whose management does not meet the conditions set out in the three systems described above would not usually be able to import their trophies into the UK. In the highly undesirable event that a hunted lion population is declining unsustainably, under any of these systems, and thus that hunting further lions would risk additive mortality and worsening the conservation of lions, then no import permit would normally be issued. Indeed, under circumstances where a hunted population is declining unsustainably best hunting practice would normally not countenance further hunting until the population was stable, and the strongest pressure should be applied to the operator to remedy the situation. However, we are mindful of a scenario that, although perhaps uncommon, could perversely damage lion conservation. That is, if the cessation of lion hunting caused the financial viability of the hunting operation to collapse and thereby the land to be converted to agriculture and lost, effectively irretrievably, from the wildlife estate. Where the risk of this outcome was imminent, the local auditing committee should look assiduously, on a case-by-case basis, for any interim steps to forestall the loss of land from the wildlife estate – this being the ultimate disbenefit to conservation. A judgement would have to be made, with lion conservation as the criterion, on whether a short, interim period of grace, perhaps involving a very low quota, was justifiable on the grounds of providing sufficient respite to enable the situation to be remedied and the lion population returned to a sustainable state and the area retained for wildlife.

4.3.3 Notes on scale and conditions of import

4.3.3.1 Recommended scale at which criteria are applied

The foregoing criteria should ideally be applied at ***the scale of the hunting area and not the national level***. This is because, while exports and imports are legally conducted at a national scale, allowing imports only from a country where all operators have implemented best-practice hunting would disincentivise good operators within a poorly-regulated country and would therefore risk damage to lion conservation. There is already precedent for this scale of operation – for example, the EU approved trophy imports from Niassa due its good management rather than the whole of Mozambique (Sigsworth, pers. comm.). The exporting country should, via an independent panel

of stakeholders, transparently assess its hunting areas and report (with requisite proof) which ones fulfil the criteria above, and the UK Government could determine the scale of imports depending on the extent of compliance.

4.3.3.2 Verification of hunting practices

Each lion-hunting country should have an independent, competent and inclusive committee that is tasked with regulating and enforcing hunting practices. Ideally committees of this sort would be overseen by an independent international organization such as International Organisation for Standardisation (ISO). Their remit should involve the following components, some of which have also been recommended by Di Minin et al. (2016):

i. Auditing to ensure that lion monitoring practices (where they are in place; e.g. for the gold standard scenario) meet the required standards

ii. Setting quotas where necessary, i.e. based on the results of the population monitoring (for the gold-standard blocks) or based on the adaptive points system

iii. Ensuring that minimal quotas (e.g. of 0.5 lions 1,000 km^{-2} or less for low-density areas) are adhered to, unless there is clear scientific evidence that the population can sustain a higher level

iv. Encouraging certification of hunting-block operators modelled after a well-defined system such as FSC, etc., and which should ideally require considerable investments by the operator in anti-poaching, community benefit programmes etc.

v. Facilitating training of Professional Hunters regarding field assessment of lion age (e.g. Miller et al. 2016) and helping set formal appropriate standards for lion hunts, particularly with regard to welfare concerns (e.g. demonstrating adequate evidence of competence in shooting and other necessary skills, rapid dispatch of wounded animals, using large-bore rifles, no night-hunting, etc.)

vi. Ensuring transparency of the process: there should be full disclosure to the public of results and reasons for block allocations (which should be allocated in order to maximise the funds available for conservation), results of lion surveys, results of trophy age verification trophy inspection, offtake levels and other relevant information, and all records (e.g. of samples for lion ageing) must be kept for any later inspection

vii. Ensuring compliance, so that the same criteria are imposed on all block holders, enabling independent observers to be placed without advance warning on

trophy hunts, and ensuring that trophies and permits are confiscated if illegal practices are discovered, and that operators who break the laws are barred from future hunting

viii. Verifying the age of trophy hunted animals before export. This should be based on the following information:

- *Hunt report forms confirming information such as the date and location of the hunt.* These forms are also required to be completed for blocks even if no successful lion hunt is completed in that area that year in order to encourage complete information and discourage underreporting.
- *Photos of the lion immediately postmortem*, to allow inspection of a range of indicators of age, e.g. mane development, facial markings and scars, nose and teeth colour. The photos must be stamped with the date and time or they would be considered ineligible.
- *X-rays of the upper premolar PM2 and examination the degree of pulp closure in that tooth*, as this has been shown to be a very accurate measure of lion age (White et al. 2016). Both the upper premolars should be presented to the inspection team to reduce the chance of fraud. Presentation of the skull will also allow wear on the premolars and canines to be easily judged – this could be an alternative method of age estimation if an X-ray is not possible, but all efforts should be made to obtain the X-rays. It would also be desirable to take and bank DNA from all hunted lions.

5. An overview: Framing trophy hunting in the context of wider lion conservation

Although many of the topics covered in this report are hotly debated – such as the amount of revenue generated by trophy hunting, or its replaceability with photo-tourism – some points are beyond debate. Key amongst those is that the lion – one of the world's most iconic species – has undergone severe declines in numbers and range over the past few decades. Lions now remain in only 8% of their historic range, with fewer wild lions now thought to exist in Africa than rhinos (Bauer et al. 2016). Nobody knows how many lions there were in Africa a century ago, but the widely quoted speculation that there were about 200,000 is a tenfold contrast with current estimates closer to 20,000 (Bauer et al. 2016).

African lion populations are likely to be to be declining everywhere, except in four southern countries (Botswana, Namibia, South Africa, and Zimbabwe; Bauer et al. 2015). The contrast between countries in southern Africa and the rest of the continent is related to their lower human population densities, better management budgets and the less damaging impacts on prey abundance and lion by-catch of unsustainable and increasingly commercialized bushmeat trade. Furthermore, Packer et al. (2013b) showed that presence of wildlife-proof fencing, which is more common in southern Africa, was an important determinant of short-term population trends. Awkwardly, the populations that seem to be declining fastest are also those that are least well-monitored (and probably have the least conservation effort), so inadequate data may be shrouding an even worse situation. However, Bauer et al.'s (2015) population models suggest that the chance of populations declining by half over the next two decades is 67% in West and Central Africa and 37% in East Africa. So it is indisputable that effective, range-wide lion conservation strategies are urgently needed to halt this precipitous decline.

The overarching priority is to secure and better manage existing populations of lions – although there is a pressing need for more surveys of lion populations to assess numbers and trends. Dickman et al. (in prep.) used the latest available data and concluded that there are only six remaining populations (Selous-Niassa, Serengeti-Mara, Kavango-Zambezi, Greater Limpopo, Katavi-Ruaha and Kgalagadi) with more than 1,000 lions. These 6 are amongst 60 priority areas where lions are far from secure, over half of them with fewer than 100 lions left. An apt conservation slogan, and call to arms, would therefore

be: *secure the six, and save the sixty.*

Rising to this challenge will require us to secure and better manage existing protected areas (which form the core of lion populations), establish and monitor lion presence and population trends across lion range, improve the economic security of local people to reduce the intensity of bushmeat poaching, and ensure that people have some power over wildlife on their land and receive sufficient economic benefits from their presence to outweigh any costs and incentivise their protection.

These steps cannot be taken by conservationists alone – they will require effective collaboration across a huge diversity of stakeholders, including protected area managers, development experts, economists, national and local governments, and those people who live with lions on their land every day. Most importantly, enacting real change at a range-wide scale will require a level of funding that is orders of magnitude higher than that allocated to wildlife conservation today. For example, Panthera et al. (2016) estimate that just effectively managing all protected areas within current lion range would require an annual budget of at least US$1.25 billion – and many lions live outside those protected areas, very many of them on trophy hunting concessions.

Especially because constellations of threats may interact, and because the impacts of each threat may often be difficult to measure, it is hard to be precise when ranking them, and the ranking anyway varies from place to place. Nonetheless, overall the major threats to lions are the loss and degradation of habitat, the loss of prey, and conflict with people over livestock, and those pressures are exacerbated when the lion populations being affected are small, isolated and poorly managed, as is often the case (IUCN 2006a, b; Henschel et al. 2014). Experts agree that – certainly at a national and regional scale – trophy hunting ranks low amongst the threats to lion populations (IUCN 2006a, b), and that it can, perhaps counter-intuitively, have positive impacts through habitat protection and funding national wildlife agencies (Di Minin et al. 2016; IUCN 2016). The fact that trophy hunting occurs in an area does not necessarily make it a threat to the lion population there, although it can be.

So, trophy hunting can be a locally important threat to lion conservation, and should be fiercely regulated to avoid this. A broader perspective, however, ranks trophy hunting generally not in the first division of threats to lion conservation. Scanning the horizon, the greatest threats over the next few decades are likely to descend from the increasing footprint of a human population set to double, or more, by 2050. With this perspective, the real challenge for the UK Government, and the community of those concerned for this iconic species

(and all the species for which it is an ambassador), is to develop holistic conservation strategies likely to require long-term partnerships with stakeholders across the world, chiefly the Governments and local people in countries that still manage lions.

5.1 Summary of lion trophy hunting in the context of conservation

So, finally to take stock, why is trophy hunting of lions a topic of concern to conservation? Because lions are charismatic top predators, already classified as threatened or endangered (depending on the area) by the IUCN and demonstrably declining fast in parts of their range, and trophy hunting is an obvious concern because it involves killing them. There are two categories of reasons why this may attract the attention of conservationists and wider society. First, the killing of individuals of a threatened species for sport may be ethically unacceptable to some people and for those that hold this as a moral absolute, trophy hunting of wild lions (and, obviously, farmed lions) will be ruled out. Second, for those who could countenance sport hunting of a threatened species, perhaps on utilitarian grounds of securing a greater good to conservation such as habitat protection (Macdonald et al. 2016b), the killing of lions nonetheless raises two obvious fears of over-harvest and thus unsustainability. First, lions are difficult to count and therefore harvests may be miscalculated and, anyway, there is an incentive to over-harvest for short-term profit, and documented evidence shows that this happens (sometimes with dire consequences that have drawn a comparison with strip-mining; Packer 2015). Trophy hunting is most straightforwardly[34] acceptable to conservation if it is demonstrably sustainable (it should also adhere to high standards of animal welfare), and demonstrating

[34] *The adverb 'straightforwardly' acceptable is not a descent into weasel words, but a caveat necessary to take account of argument in extremis with respect to the priority of retaining land in the lion estate and under wildlife use. The straightforward case is that trophy hunting is demonstrably sustainable, and that demonstration necessitates monitoring data, and therefore for trophy hunting to be acceptable there must be monitoring data and they must demonstrate sustainability. This should be the driving logic behind the regulation of trophy hunting as a potential contributor to lion conservation. However, and without relenting on the drive to demand high standards of trophy hunting, or other uses of wildlife, the logical possibility of an extreme possibility requires mention: even undesirably unsustainable trophy hunting may, in the short term, 'buy time' in keeping land in the lion estate and, irreversibly, out of agriculture, and this situation, while infuriating and lamentable, may be more tolerable than losing the land to wildlife.*

its sustainability requires adequate data on lion numbers and their ages, ergo trophy hunting is straightforwardly acceptable only where lion numbers are monitored – and there are direct and indirect methods of doing this.

The most strongly evidenced benefit of trophy hunting to lion conservation is that it gives lions monetary value, which can provide a marginal economic advantage to keeping some land under wildlife use that would otherwise more profitably be converted to other uses and thereby lost from the lion estate (at a time when this is already shrinking perilously). All else being equal, there might be no difference in the conservation outcome if lions are given the necessary monetary value by trophy hunting or by some other means (for example, some form of international payment to encourage coexistence; Dickman et al. 2011). However, all else is often not equal; killing animals that are members of complex societies where they will be survived by sentient companions capable of behavioural and psychological perturbation, may contribute to a mood in at least some sections of society that, even if sustainable and a benefit to conservation, hunting lions for sport is a recreation that is not compatible with 21st-century civilization. A plausible speculation is that this opinion will soon prevail (notwithstanding clear cultural differences between East and West, North and South). Insofar as this creates pressure for a ban on trophy hunting it also risks unintended consequences for lion conservation if it causes the marginal value of land previously retained under wildlife use for hunting to fall below that for non-wildlife uses (such as farming), and thus the lion estate to be diminished. Anticipating that possibility, there is an urgent imperative to find alternative means of giving those threatened parts of the lion estate sufficient monetary value to prevent their degradation. Indeed, the report strongly re-emphasises Bauer et al.'s (2015) conclusion that unless political and funding commitments are scaled up to address mounting levels of threat, lions may disappear from most of Africa.

It seems that public opinion, in many places, is strongly against trophy hunting, particularly of threatened species (Macdonald et al. 2016a). This creates pressure for a ban on trophy hunting, but also risks unintended consequences for lion conservation. This report acknowledges that where there is evidence of scientifically-based regulation that is strictly enforced, lion hunting can contribute to lion conservation, and that this constitutes a good reason to tolerate it at least on land that might otherwise be lost to the lion estate. However, societal pressure may stop this recreation; were this to happen before some alternative means of giving lions monetary value were in place (where photo-tourism cannot do so), there are grounds to be fearful of serious detriment to the lions' already deteriorating conservation status. In this regard, Macdonald et al. (2016a)

contrast the consequences of a jump versus a journey: a precipitate jump to ending lion trophy hunting might risk grave unintended consequences for the species' conservation, consequences that could be avoided by a carefully planned journey to that end. An obvious, and perhaps the only plausible, mechanism to achieve this would be some form of international payment to encourage coexistence with lions; to the nearest order of magnitude, and considering only the costs of substituting other land uses for trophy hunting, this could cost as much as the US$1.25 billion estimates by Panthera et al. (2016) adequately to safeguard current protected areas for lions. For perspective, and while mindful that society may face parallel expenses in funding custody of other global commons, the amount needed seems less daunting when we realise that US$12 billion is spent annually in Europe and the US on perfume alone[35]. Until such a mechanism is in place, the risk to lion conservation of a complete ban on trophy hunting is too great to take, but in the meantime the establishment of strictly enforced regulations to ensure that trophy hunting does benefit lion conservation is a priority.

[35] http://www.worldwatch.org/node/764