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# A SCIENTIFIC OVERVIEW OF THE CONSERVATION STATUS OF AFRICAN LEOPARDS (*PANTHERA PARDUS PARDUS*), WITH A SPECIFIC FOCUS ON TROPHY HUNTING

This document was submitted by the Secretariat at the request of Panthera in relation to agenda item 15.*

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# A scientific overview of the conservation status of African leopards *Panthera pardus pardus*, with a specific focus on trophy hunting

## Background

Until recently, leopards were deemed to warrant low conservation priority. Their wide geographic distribution and ability to persist in regions where other large carnivores had been extirpated gave rise to a widespread assumption that their conservation status was assured. However, recent reviews (Jacobson et al. 2016, Stein et al. 2016) have shown that leopard range has contracted dramatically; it is estimated that leopards have disappeared from 48–67% of their historic African range and 83–87% of their former Asian range (Jacobson et al. 2016). Accordingly, the conservation status of leopards declined from Near Threatened to Vulnerable in the most recent update of The IUCN Red List of Threatened Species (Stein et al. 2016). A decision was also taken at the 17$^{th}$ meeting of the Conference of Parties (CoP) to the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) to assess quotas for leopard hunting trophies (Decision 17.114–17.117).

Although leopards are listed on Appendix I of CITES, 12 African countries are permitted to export a quota of leopard skins each year, as long as these skins are not used for commercial purposes. Most of these skins are procured through trophy hunting, with a combined annual quota for all countries of 2648 leopard skins. Population estimates used to determine the existing quotas were mainly derived from a modelling exercise that correlated leopard numbers with rainfall (Martin & de Meulenaer 1988). This model was widely criticised for omitting critical factors such as anthropogenic mortality and prey availability, and for relying upon questionable assumptions; e.g., that leopards occur at maximum densities in all available habitat. Consequently, the final estimate of 714,000 leopards in sub-Saharan Africa was considered an impossible overestimate (Jackson 1989, Norton 1990, Bailey 2005). Despite this, export quotas have not been reviewed or revised (unless to introduce new quotas or increase existing quotas) for almost 20 years. Against this backdrop, parties were directed at the 17$^{th}$ CoP to: "*consider whether these quotas are still set at levels which are non-detrimental to the survival of the species in the wild, and to share the outcomes of the review and the basis for the determination that the quota is not detrimental, with the Animals Committee at its 30th meeting*" (Decision 17.114). Here, we provide an overview of current scientific knowledge on leopard status, and more specifically the effect(s) of trophy hunting on leopard populations. We also provide recommendations on how best to mitigate detrimental impacts potentially arising from trophy hunting.

## Leopard population trends

Although our knowledge on leopard distribution, and the extent of leopard range loss, has improved markedly (Jacobson et al. 2016, Stein et al. 2016), our understanding of leopard population trends (i.e., how numbers have changed over time) remains limited. Indeed, in their recent assessment of leopard status for the IUCN Red List, Stein et al. (2016) commented that longitudinal data was only available for a single leopard population (in KwaZulu-Natal, South Africa; Balme et al. 2009) from the ~75 countries considered extant leopard range. Accordingly, there is an urgent need to collect rigorous data on leopard population trends, and at scales that can meaningfully inform conservation policy (including CITES Non-Detriment Findings; NDFs). To address this need, Panthera, in collaboration with the South African National Biodiversity Institute and other partners, developed a national leopard monitoring programme to determine how leopard populations were faring in South Africa. From 2013 to 2017, 94 camera-trap surveys were undertaken at 31 sites across the country. Sites comprised a combination of state and province-run protected areas, privately-owned wildlife conservancies and commercial game ranches, and community-run nature reserves. Leopard densities were estimated using spatial capture-recapture models (Royle et al. 2009) and ranged from 0–12 leopards/100 km$^2$. Annual population growth (lambda) averaged across all sites with longitudinal data (n = 23), and weighted by baseline population size, was 0.92 ± 0.05 (or an 8% population decline per year; Mann et al. 2018). While this represents the status of leopards in only a single country, it is still cause for major concern. It is the only robust data currently available on leopard population trends, and there is no scientific evidence to suggest that leopard populations elsewhere, and specifically in the 11 other countries that permit trophy hunting, are faring any better.

**Threats to leopards**

Like most large carnivores, leopards suffer from multiple threats, including loss and fragmentation of their habitat (Swanepoel et al. 2013, Jacobson et al. 2016), depletion of natural prey (Henschel et al. 2011, Rosenblatt et al. 2011), retaliatory killing due the real and perceived threat that leopards pose to livestock and game (Kissui 2008, St John et al. 2011, Thorn et al. 2013, Pitman et al. 2015, 2017), and poaching for their body parts (Stein et al. 2016). The latter, in particular, has emerged as a key threat to leopard populations in southern Africa. Several ethnic groups use leopard skins for ceremonial wear. Chief among these is the Nazareth Baptist "Shembe" Church in South Africa; followers of which wear leopard skins as symbols of prestige. Mark-resight and questionnaire surveys undertaken at Shembe gatherings suggest that there are 15,747 ± 946 leopard skins currently in circulation among Shembe followers, and that 879 ± 53 leopards are killed each year to fuel the demand for skins (Balme et al. unpubl. data). Indeed, more than 1000 leopard skins can frequently be seen at a single gathering. Preliminary results from genetic assignment tests show that most (~85%) of these skins originate outside South Africa, from countries as far afield as Angola and Zambia (Naude et al. unpubl. data). The demand for skins by the Shembe Church is thus likely having a regional impact on leopards in southern Africa, and the Shembe are only one of several ethnic groups using leopard skins for cultural purposes (others include the Swazi from Swaziland, and the Lozi and Ngoni from Zambia).

Several peer-reviewed studies, undertaken at scales that range from a single study site (Balme et al. 2009, 2010) to provincial (Pitman et al. 2015) and national (Packer et al. 2009, 2011, Swanepoel et al. 2014) scales, have demonstrated that poorly-managed trophy hunting may also cause, or at least contribute towards leopard population declines. While the numbers of leopards killed illegally (e.g., because of conflict or poaching for skins) likely eclipses the numbers of leopards trophy hunted each year, research has shown that hunting almost always constitutes additive rather than compensatory mortality (Robinson et al. 2014, Creel et al. 2015, Wolfe et al. 2015). There is also little evidence that trophy hunting fosters increased tolerance of leopards (Balme et al. 2009, Pitman et al. 2015) or other large carnivores (Peebles et al. 2013, Chapron & Treves 2016). Hence, offtake by trophy hunting likely compounds, rather than relaxes, pressures on local leopard populations.

Large carnivores are especially susceptible to overhunting due to their complex social systems that depend on long-term stability (Milner et al. 2007, Packer et al. 2009, Bischof et al. 2018). An artificial increase in turnover and immigration rates can increase contact between unfamiliar individuals and promote intraspecific strife. Unnaturally high turnover among adult males may also increase infanticide, potentially to unsustainable levels (Whitman et al. 2004, Balme et al. 2009). Solitary species such as leopards appear particularly sensitive to infanticide as females cannot rely on cooperative defence against incoming males (Balme & Hunter 2013). These biological considerations, as well as levels of other human-mediated mortality, must be taken into account when deciding upon leopard quotas.

**Recommendations**

*1. Move away from fixed national quotas based on arbitrary population estimates to adaptive quotas informed by robust estimates of leopard population trend.*

Estimating leopard population size at a national scale is near meaningless for management, given the inaccuracy and imprecision of estimates. For example, Swanepoel et al. (2014) used all survey data available, along with a habitat suitability model (Swanepoel et al. 2013), to estimate the size of South Africa's leopard population. Even though research effort is considerably higher in South Africa than in other range states (Balme et al. 2014), the 95% confidence interval of their estimate ranged from 2813 to 11,632 leopards (Swanepoel et al. 2014). Such imprecise estimates, that extend over almost an order of magnitude, should not be used to set hunting quotas. Rather, quotas should be managed adaptively based on robust estimates of population trend. Long-term monitoring sites can be established in designated Leopard Hunting Zones (LHZs; Pitman et al. 2015), with quotas allocated to LHZs based on the status of local leopard populations. This will not only reduce the risk of overhunting, but also ensure that the effects of other forms of offtake are considered in quota setting. The ultimate yardstick of whether trophy hunting is sustainable must be the health of leopard populations; quotas can be awarded to LHZs with stable or increasing leopard populations and withheld from LHZs with decreasing populations. Such an approach relies on reliable and regular monitoring. A combination of intensive monitoring (e.g., annual camera-trap surveys coupled with spatial capture-recapture sampling to estimate leopard population density; Royle et al. 2009) and extensive monitoring (e.g., change in leopard occupancy based on spoor counts or questionnaires; Karanth et al. 2011, Zeller et al. 2011) can be used to track populations in LHZs. Importantly, detection probability must be accounted for when assessing trends (e.g., by using statistical approaches such as capture-recapture or occupancy modelling); otherwise, it is impossible to gauge whether estimates truly reflect population status (Hayward et al. 2015). The use of biased information, typically derived from proxy-based approaches such experiential knowledge or unvalidated indices of relative abundance, can severely compromise decision-making, to the extent that admitting that no information is available may be less harmful than using incorrect information (Karanth et al. 2003, Katzner et al. 2011).

Frameworks that use a combination of intensive and extensive monitoring can be rolled out relatively cheaply and at scales needed to inform quota setting; this type of approach has been implemented successfully in several countries to regulate large carnivore hunting, and is currently being trialled in South Africa to adaptively manage leopard quotas. Information on local leopard population status, and hence the sustainability of hunting, can be captured and updated easily in NDFs (given the robust, standardised method of data collection), and can be provided on a trophy-by-trophy basis to import countries if such detail is required.

*2. Restrict trophy hunting to male leopards ≥7 years only.*

Establishing reliable monitoring frameworks within the range states to enable adaptive quota-setting will take time, and likely require external financial assistance. It is critical that other safeguards that limit the detrimental impacts of hunting on leopards be introduced in the interim. Key amongst these is regulating the sex and age of leopards that are hunted. Packer et al. (2009), and more recently Pitman (2017), demonstrated that restricting trophy hunting to male leopards ≥7 years old minimised harmful impacts on populations. By this age, male leopards have held tenure for long enough to allow at least one litter to reach independence, which can be sufficient to maintain population stability. Implementing a strict 7-year age minimum for trophy leopards would dramatically reduce the risk of overharvesting despite uncertainties in population sizes. It should also ease pressure from other forms of offtake as local population recruitment will improve (Balme et al. 2009).

An age-based approach can only be considered if hunters are able to identify suitably-aged leopards in the field. Using a 35-year dataset of known-age individual leopards from South Africa, it was shown that dewlap size is an accurate indicator of male leopards ≥7 years old (Balme et al. 2012). Discriminant models revealed that there was a 91–100% likelihood of discerning males ≥7 years correctly based on dewlap size alone. Most leopards are hunted over baits at distances of 50–80 m. The dewlap is easily distinguished at this distance. The increasing use of remotely-triggered cameras deployed near baits to assess trophy quality prior to shooting further facilitates accurate aging. Detailed leopard aging guides and online educational material (including a trophy selection exam) are also available to assist hunters. While the relationship between leopard age and dewlap size was based on empirical data from only a single population, correlative evidence suggested that it applied to other leopard populations in East and southern Africa (Balme et al. 2012).

The implementation of a minimum 7-year trophy age will not necessarily disadvantage leopard hunters. Provided age-limits are strictly adhered to, the number of animals available to hunt exceeds that proposed for sustainable population-based quotas (male leopards ≥7 years old typically comprise 8–18% of leopard populations at capacity (Balme et al. 2018), compared to a maximum sustainable offtake of 4% recommended by Caro et al. 2009). The system is also self-regulating in that old male leopards are generally only present, and thus available to hunt, in healthy leopard populations.

The same criteria used by hunters to estimate leopard age (i.e., the presence of a well-developed dewlap) can be used by authorities to evaluate trophies (with the addition of tooth wear; Stander 1997). Detailed high-resolution photographs – taken before the animal is skinned, as well as of the cleaned skull – should be submitted with each trophy for assessment. Data on the effort expended on hunts (e.g., the duration of the hunt, the number of baits deployed, the number of baits fed on by leopards) should also be collected after every hunt (both successful and unsuccessful), as this may (but not always; Creel et al. 2016) share a relationship with leopard abundance (Edwards et al. 2014).

Currently, only South Africa has proposed that the export of leopard trophies be restricted to males ≥7 years. Other restrictions imposed on trophies (e.g., in Zimbabwe, hunters are encouraged to target "mature" males, while in Tanzania, minimum size limits are in place for leopard trophies; but see Spong et al. 2000) have little scientific justification. Simulation models (Packer et al. 2009, Pitman 2017) show that populations will still decline if trophy hunting is limited to only mature males (i.e., those ≥4 years), particularly if other forms of offtake continue, while body (and skull) size is a poor indicator of male leopard age once they have reached maturity (Balme et al. 2012).

**Conclusion**

As an Appendix I species, leopards are offered the highest level of protection possible under CITES. Indeed, trade in species listed on Appendix I should only occur if it can be demonstrated to be of benefit to that species. Where robust scientific evidence exists, it suggests that leopard populations are in decline. At a range-wide scale, leopards have disappeared from many areas they formerly occupied (leading to the recent uplisting to Vulnerable on the IUCN Red List; Stein et al. 2016), while in South Africa, the only African country with reliable information on population trends, leopard numbers have decreased dramatically (Williams et al. 2017, Mann et al. 2018). Several peer-reviewed studies have further shown that trophy hunting has contributed towards leopard population declines (Balme et al. 2009, 2010, Packer et al. 2009, 2011, Swanepoel et al. 2014, Pitman et al. 2015). Urgent reforms are required to current leopard hunting practices; otherwise, it hard to justify that legal trade in skins through a CITES-sanctioned export quota will not be detrimental to the survival of the species in the wild, let alone benefit its conservation.

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